UNIVERSITI PUTRA MALAYSIA

COMPARISON OF KNOWLEDGE, ATTITUDE AND PRACTICE ON HAZE AMONG FIRST AND FINAL YEAR MEDICAL STUDENTS IN UNIVERSITI PUTRA MALAYSIA, SERDANG

NUR HAZWANI MOHD NASIR

COMPARISON OF KNOWLEDGE, ATTITUDE AND PRACTICE ON HAZE AMONG FIRST AND FINAL YEAR MEDICAL STUDENTS IN UNIVERSITI PUTRA MALAYSIA, SERDANG

BY

NUR HAZWANI BINTI MOHD NASIR

Thesis submitted in fulfilment of the requirement for the degree of Bachelor Science (Environmental and Occupational Health) from the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

ACKNOWLEDGEMENTS

First of all, I would like to say Alhamdulillah, for giving me strength and good health to finish up my final year project report. I would like to express my sincere gratitude to my project supervisor, Assoc. Prof Dr Haliza Abdul Rahman on her support, guidance and advices in my project. I am very fortunate to have her as my supervisor that had helped me a lot in improving and completing this project in time.

I also would like to thank Dr Ho Yu Bin as the coordinator for my final year project. Her invaluable guidance and sharing had helped to finish this project successfully. Other than that, I would like to thank to all lecturers and supporting staffs of the Department of Environmental and Occupational Health who had contributed directly or indirectly in making this project.

Last but not least, I would like to express my sincere thanks to first and final year of medical students in Universiti Putra Malaysia who had participated in this survey and make this project successful. Last but not least, I really appreciate my family for their support and encouragement throughout this project.

ABSTRACT

COMPARISON OF KNOWLEDGE, ATTITUDE AND PRACTICE ON HAZE AMONG FIRST AND FINAL YEAR OF MEDICAL STUDENTS IN UNIVERSITI PUTRA MALAYSIA, SERDANG

NUR HAZWANI MOHD NASIR

Introduction: Haze is defined as an atmospheric phenomenon where pollutant particles particulate in the air and obscure the normal clarity of the sky. Haze is one example of atmospheric pollution that has occurred in Malaysia several years back and getting worse until now. Most of the haze episodes occurred in conjunction with period of prolonged drought associated with the El Nino phenomenon. Haze gives great negative impacts in terms of health, social and the economy. Although awareness and concern about the problem of haze are constantly increasing, many previous studies showed that the students' practices on the environment including air pollution were still low among university students. **Objective:** To study the knowledge, attitude and practice on haze among first and final year of medical students in Universiti Putra Malaysia (UPM). **Methodology:** A cross sectional study was conducted at Faculty of Medicine and Health Sciences, UPM with first and final year of medical students as respondents. A total of 244 students were selected. Questionnaires were administered to determine the socio-demographic, information knowledge, attitude and practice on haze among them. Data was analysed by using "Statistical Package for Social Sciences (SPSS) Version 22.0. The level of knowledge, attitude and practice on haze was evaluated using the scoring method. **Result and Discussion:** The level of knowledge for first and final year of medical students was moderate which was 40(41.9%) and 59(39.1%) respectively. The level of attitude for both groups were also moderate, which was 54(57.0%) and 97(64.2%) respectively. For the practice level, both groups showed bad practice during haze, which was 64(68.8%) and 107(70.9%) respectively. The findings also indicated that there were no significant difference of mean knowledge, attitude and practice on haze between these two groups ($Z=0.555$, $p>0.05$; $t= -1.573$, $p>0.05$; $Z= -0.720$, $p>0.05$). Malay and Chinese students were associated with knowledge level with odd ratio (OR) 5.22 and 2.98 respectively. In addition, there was an association between knowledge and practice ($p=0.003$, $p<0.005$). The attitude level was associated with practice level in which moderate attitude tend to have poor practice on haze ($p=0.024$, $p<0.05$). **Conclusion:** The medical students perceived moderate knowledge and attitude, but low in practice. They are recommended to take environmental course and the schedule should be restructured to determine the suitability of time and syllabus that should be taught to them.

Keywords: Knowledge, Attitude, Practice, Haze, Medical Students

ABSTRAK

PERBEZAAN PENGETAHUAN, SIKAP DAN AMALAN TERHADAP JEREBU DI KALANGAN PELAJAR PERUBATAN TAHUN PERTAMA DAN AKHIR DI UNIVERSITI PUTRA MALAYSIA, SERDANG

NUR HAZWANI MOHD NASIR

Pengenalan: Jerebu ditakrifkan sebagai fenomena atmosfera di mana zarah pencemar terampai di udara dan mengurangkan kualiti kejelasan langit. Jerebu ialah satu contoh pencemaran udara yang berlaku di Malaysia sejak beberapa tahun yang lalu dan semakin teruk sehingga kini. Kebanyakan episod jerebu berlaku akibat tempoh kemarau yang berpanjangan dikaitkan dengan fenomena El Nino. Jerebu memberi kesan negatif dari segi kesihatan, sosial dan ekonomi. Walaupun kesedaran dan kebimbangan mengenai masalah jerebu sentiasa meningkat, banyak kajian sebelum ini menunjukkan bahawa amalan pelajar terhadap alam sekitar termasuk pencemaran udara masih rendah dalam kalangan pelajar universiti. **Objektif:** Untuk mengkaji pengetahuan, sikap dan amalan mengenai jerebu antara pelajar-pelajar perubatan tahun pertama dan akhir di Universiti Putra Malaysia (UPM). **Metodologi:** Kajian irisan lintang telah dijalankan di Fakulti Perubatan dan Sains Kesihatan, UPM dengan pelajar perubatan tahun pertama dan akhir sebagai responden. Sejumlah 244 orang telah dipilih. Borang soal selidik telah diedarkan untuk menentukan sosio-demografi, pengetahuan,sikap dan amalan terhadap jerebu. Data analisis telah dilakukan dengan menggunakan "Statistical Package For Social Science (SPSS) Versi 22.0. Tahap pengetahuan, sikap dan amalan mengenai jerebu dinilai menggunakan kaedah pemarkahan. **Keputusan dan Perbincangan:** Tahap pengetahuan untuk pelajar perubatan tahun pertama dan akhir ialah sederhana, iaitu 40(41.9%) dan 59(39.1%). Tahap sikap untuk kedua-dua kumpulan juga sederhana, iaitu 54(57.0%) dan 97(64.2%). Untuk tahap amalan, kedua-dua kumpulan menunjukkan amalan buruk semasa jerebu, iaitu 64(68.8%) dan 107(70.9%). Dapatan kajian juga menunjukkan tiada perbezaan yang ketara antara purata pengetahuan, sikap dan amalan mengenai jerebu di antara kedua-dua kumpulan ($Z = 0{,}555$, $p>0.05$; $t = -1{,}573$, $p>0.05$; $Z = -0{,}720$, $p>0.05$. Pelajar Melayu dan Cina berkait dengan tahap pengetahuan dengan nisbah ganjil 5.22 dan 2.98. Di samping itu, terdapat perkaitan antara pengetahuan dan amalan ($p=0.003$, $p<0.005$). Tahap sikap berkait dengan amalan yang mana sikap yang sederhana cenderung kepada amalan yang rendah terhadap jerebu. **Kesimpulan:** Pelajar-pelajar perubatan mempunyai pengetahuan dan sikap yang sederhana, tetapi rendah dalam amalan. Mereka dicadangkan untuk mengambil kursus persekitaran dan jadual perlu distrukturkan semula untuk menentukan kesesuaian masa dan silibus yang perlu diajar kepada mereka.

Kata kunci: Pengetahuan, Sikap, Amalan, Jerebu, Pelajar Perubatan

TABLE OF CONTENTS

CHAPTER 3 : METHODOLOGY

CHAPTER 4: RESULTS AND DISCUSSION

CAHPTER 5: CONCLUSION AND RECOMMENDATION FOR FUTURE RESEARCH

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

SEA	Southeast Asian
USEPA	United States Environmental Protection Agency
COPD	Coronary Obstructive Pulmonary Disease
PSI	Pollutant Standard Index
ASEAN	Association of Southeast Asian Nations
IL-6	Interleukin-6
UFP	Ultrafine Particles
TNF-α	Tumor Necrosis Factor-Alpha
NOAA	National Oceanic and Atmospheric Administration
AQP	Air Quality Plan
LEZ	Low Emission Zone

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Air pollution is a major issue that affect human health and life satisfaction. In Malaysia, haze phenomenon is not a new phenomenon and had occurred several years back and getting worse until now. Previously, haze had occurred in 1982-83, 1987, 1994, 1997-98, 2002, 2004, 2005, 2006, 2009, 2013 and the latest in 2015. Haze can be defined as an atmospheric phenomenon where pollutant particles particulate in the air and obscure the normal clarity of the sky (Khoo, 2006). Haze also is defined as weather phenomenon that leads to an atmospheric visibility of less that 10km due to the amount of suspended solid or liquid particles, smoke and vapour in the atmosphere (Xiao *et al.*, 2011). According to the Department of Environment (2016a), haze is the presence of fine particles (0.1-1.0 μm in diameter) in the air that dispersed at high concentrations which diminish the horizontal visibility. The increment of carbonaceous $PM_{2.5}$ during haze had been studied by observing the changes in the concentration of pyrolyzed organic carbon (OP), levoglucosan (LG), mannosan (MN), galactosan, syringaldehyde, vanillic acid (VA) and cholesterol (Fujii *et al.*, 2015).

Almost every year the Southeast Asian (SEA) haze events affect Malaysia, Brunei, Singapore, Indonesia and Southern Thailand due to the large scale of forest burning in Sumatra and Kalimantan, Indonesia. The southwest monsoon winds blow the thick smoke towards Southeast Asian region. For southwest monsoon, it happens between May to August in which it dominates the wind pattern and cause the climate hotter and drier (Tangang *et al.*, 2012). Another type of monsoon is northeast monsoon that happens between November to February in which more rainfall occurs to east coast. The prolonged haze events are influenced by El Nino phenomenon.

The amount of particulate matter (<10mm) keep increasing during haze episode due to biomass burning. The particulate matter with an aerodynamic diameter of 2.5 micrometre or less or also known as $PM_{2.5}$, is recognised as the main health hazard during haze weather (Kai *et al*, 2013). Besides particulate matter, haze also contains inorganic gases such as sulphur dioxide (SO_2) and nitrogen dioxide (NO_2), hydrocarbons, aldehydes and polycyclic aromatic hydrocarbons. Haze also contains aerosol which is small particles and water vapour.

Air Pollution Index (API) is an index that closely follows United States Environmental Protection Agency (USEPA) Pollution Standard Index in giving understandable information regarding air pollution level. There are six major pollutants that are measured in Malaysia's API include NO_2, SO_2,CO, ozone (O_3) and particulate matter with diameter of 10 micrometre or less (PM_{10}) and the latest one is particulate matter with diameter of 2.5 micrometre or less ($PM_{2.5}$). The API values give an indication of the air quality as shown in Table 1.1.

Table 1.1: Air Pollution Index (API)

API Reading	Status
Below 50	**Good** (low pollution without any bad effect on health)
51-100	**Moderate** (moderate pollution that does not pose any bad effect on health)
101-200	**Unhealthy** (worsen the health condition of high risk people who is the people with heart and lung complication)
201-300	**Very unhealthy** (worsen the health condition and low tolerance of physical exercises to people with heart and lung complications. Affect public health)
More than 300	**Hazardous** (hazardous to high risk people and public health)

(Source: Department of Environment (DOE) Malaysia)

Ambient Air Quality Guidelines Malaysia has been updated and improved to Ambient Air Quality Standards Malaysia in 2014 (UKM News, 2015). The improvements to the existing guidelines shall include the following: -

1) Adding parameter fine mist of suspended particulate matter 2.5 micrometre or less in size (PM2.5).
2) Setting new concentration limits for air pollutants such as PM_{10}, SO_2, CO, NO_2, and O_3. Conformity concentration limits will be implemented in stages according to the three stages of the interim which are interim 1 (IT - 1) in 2015 , interim 2 (IT - 2) in 2018 and fully standard usage in 2020 .
3) Objective Review of the IPU in line with the Malaysian Ambient Air Quality Standard 2013, which is developing a new methodology of calculation of the API , making a comparison between the existing API to the new API , and suggest categories for the status of air quality based on the new IPU.

There are several factors that contribute to haze. The main factor is the widespread of biomass burning from the large scale of forest fires in Sumatra and Kalimantan, Indonesia. To cut the budget, the oil palm companies use method of slash-and-burn to clear the site before replanting the oil palm. According to Haliza (2013), the factors that contribute to haze can be domestic or transboundary. For domestic factor, open burning, industrial activities and transportation enhance the hazy situations. A previous study revealed that 57.58% of the total variance and 70.20 of PM2.5 mass has been identified as motor vehicle emission, followed by soil dust, industrial, sea-salt and the rest was undefined.

Haze pollutants affect all inhabitants in the Earth especially human. The effects of haze are depending on individual health, attitude and practice during haze crisis. People who are vulnerable, immunocompromised person like elderly or children, those with chronic lung or heart diseases are more susceptible to get sick during haze. It was supported by study done by Brook *et al.* (2004) that suggested elderly and less than high school education (low socioeconomic status) were the susceptible population. The impacts can be short-term or long-term. Among short-term effects of haze are coughing, wheezing, asthma, skin and eye irritation. Meanwhile, for long-term effects, the person might get coronary obstructive pulmonary disease (COPD), heart diseases and cancer.

A study by Mott *et al.* (2005) proved that there were significant fire-related increases in respiratory hospitalizations, especially those for COPD and asthma (Mott *et al.*, 2005). The exposure to PM 2.5 also caused adverse health effects and premature death in humans (Bertha *et al.*, 2014). Environmental expert had proved that haze event was associated with the morbidity and mortality (Brook *et al.*, 2004; Kai *et al*, 2013; Mazrura *et al.*, 2014). Besides impacts to health, haze also affects the social and economy aspects. For salesman, the exposure to air pollution was an economic choice between losses in sales or production from shutdown of business during worst haze and affecting personal health or employees, where the person needed to pay for the treatment (Odihi, 2003).

1.2 PROBLEM STATEMENT

This study was conducted because of a few factors which were haze as annually event occurred in Malaysia, health effects of haze especially among medical students, and the socioeconomic impact that had forced the school and institutions to be closed as the API reading reached unhealthy level. In addition, the haze crisis also affected the aspect of economy and environment.

Haze pollution has become worsened in Malaysia that had forced the government to close the schools. During October 2015, as example many schools were forced to be closed due to worsening haze and the API readings were in unhealthy level which is above 100. According to Ministry of Education Malaysia (MOE) (2015a), the total schools that were closed on Oct 21 were 2,528 and affected 1,734,668 students. Meanwhile, 4,778 schools were closed on Oct 22 where the API reading was indicated as unhealthy category with 2,696,110 students affected (MOE, 2015b).

Besides that, some of the universities in Selangor were forced to be closed as the API reading increased from time to time. One of the universities that involved was Universiti Putra Malaysia (UPM). Furthermore, Vice Chancellor of UPM, Prof Dato' Dr Mohd Fauzi b. Haji Ramlan had taken out a statement to cancel all the classes or curriculum activities in the university from Oct 19 at 2.00pm until Oct 20 2015 (**Appendix 1**). According to University Health Centre of UPM, the reading of API on that day reached the reading 250 and was estimated to increase again. The

reading was categorized as very unhealthy. The students were prohibited to do outside activities and advised to stay at their homes. Other than that, on Oct 5 2015, Universiti Teknologi Mara (UiTM) Selangor was forced to cancel all classes due to worsening haze condition with the API reading of 308 (New Straits Times, 2015). Other universities involved were International Islamic University of Malaysia (IIUM) Gombak and Islamic Science University of Malaysia (USIM) Nilai.

Furthermore, the haze episode gave negative impacts to communities to perform their everyday activities. They were instructed to stay in their homes. Sporting and other outdoor activities needed to be postponed due to hazy situation as reported in media (Forsyth, 2014).

In addition, there was increasing of health problems among UPM students during haze episode especially infection of upper respiratory tract by 69.0% in August, 79.4% in September and 76.6% in October. Other diseases that were experienced by them included infection of lower respiratory, asthma, skin problem and infection of eye irritation. The statistics of the diseases covered from August until October 2015 obtained from University Health Centre (UHC) was shown in Table 1.2.

Table 1.2: Haze-related diseases in UHC, UPM from August to October 2015

Types of Diseases	Month		
	August	**September**	**October**
Infection of upper respiratory tract	846	1,618	1,535
Infection of lower respiratory tract	87	67	69
Asthma	71	88	108
Skin problem	213	249	257
Infection of eye irritation	9	15	34

(Sources: Universiti Health Centre, UPM (2015))

The aggregation of fine particulate matters in the surrounding would obstruct the respiratory system as proved by previous studies. Respirable disease, lung cancer, atherosclerosis, ischemic heart disease and stroke were possible diseases that might get due to exposure to haze (Khoo, 2006). The presence of the PM2.5 makes it worst as they could enter deeply into the lungs and decreased the efficiency of gaseous exchange in the alveoli. The combination of $PM_{2.5}$ with toxic compound such as heavy metal, benzene, toluene and xylene would disturb the structure of chromosome and DNA, and might cause cancer (Kai *et al.*, 2013). According to National Environmental Agency (2014), due to the great impact contributed by $PM_{2.5}$, it would be incorporated into current Pollutant Standard Index (PSI) as sixth pollutant parameter.

1.3 STUDY JUSTIFICATION

The previous study had reported that haze contributed to various negative health impacts. High proportion of respiratory problems during haze appeared due to lack of knowledge, unsafe attitude and dangerous practice. The usefulness of knowledge, attitude and practice (KAP) questions was in highlighting the lack of KAP with respect to safe practice during haze. In addition, this study could contribute beneficial information about the level of knowledge, attitude and practice during haze among the respondents.

This study was conducted at Universiti Putra Malaysia because it was one of the institutions that was affected by haze and were forced to close due to worsening haze, as example on 19th to 20th October 2105. Other universities involved were Universiti Technology Mara (UiTM), International Islamic University of Malaysia (IIUM) and Islamic Science University of Malaysia (ISUM).

The chosen respondents were medical students because they study about anatomy and impacts of pollutants to human body. In addition, this study was conducted to medical students to know whether they are aware with this breaking news since they are exposed to health issues. The haze consists of particulate matters which can give detrimental effects to the body. In future, these medical doctors have to deal with the patients and educate them about the best practice that they should do during haze to avoid any adverse impacts on their health. Furthermore, the medical students will be future health care providers for community. They will play a

significant role to the community in guiding them to have good lifestyle and avoid from getting health problems especially during haze. Since the medical students are more sensitive with the health issues, it could facilitate their adoption of healthy lifestyle.

This study also was conducted among first year and final year of medical students because there was a gap of knowledge between them. The final year students had already learnt many topics about health meanwhile the first year of medical students are still new in this field. To increase the awareness regarding haze, adolescence was the best stage to deliver the knowledge and apply safe practice during haze. Most of the adolescences were going through the learning process and developing their critical thinking. They also delivered the information to their family when they go home.

This study also focused on university students as youth because they were currently dominated the higher institution, consisted of 45% of the whole population, and high chance to be assigned as future leader (Bernama, 2012). As defined in the 1997 National Youth Development Policy, youth range between the ages of 15 – 40. However, the policy also specifies that youth development programs and activities shall be focused on youth aged 18 – 25 (Youthpolicy.org, 2014). In order to achieve sustainable development, the public institutions make efforts to enhance students' potential through the environmental education, policy and programme (Bernama, 2012; Foo, 2013). Hence, medical students were suitable target group in conducting this study.

Another reason to do this study was based on references, less study on environmental topics especially haze among medical students in Malaysia was done. Therefore, this study was conducted to study the knowledge, attitude and practice on haze among first and final year of medical students.

1.4 CONCEPTUAL FRAMEWORK

Figure 1.1 showed the conceptual framework of this study. It was general but clearer view of this research. The coloured boxes represented the factors in concern in his study.

Environmental issues were categorized into several categories which were geosphere, hydrosphere, biosphere and atmosphere. However, it focused on atmosphere. Haze was one of examples of atmospheric pollution due to anthropogenic causes such as open burning, vehicles emission, and industry activities. To study the knowledge, attitude and practice, they were fall under social part instead of environment, health and economy. The study subjects were first and final year of medical students in UPM, which was one of the public universities in Malaysia. It focused on practice of haze which was dependent variable between first and final year medical students in UPM that are influenced by the independent factors such as social demographic, knowledge about haze and attitude towards haze.

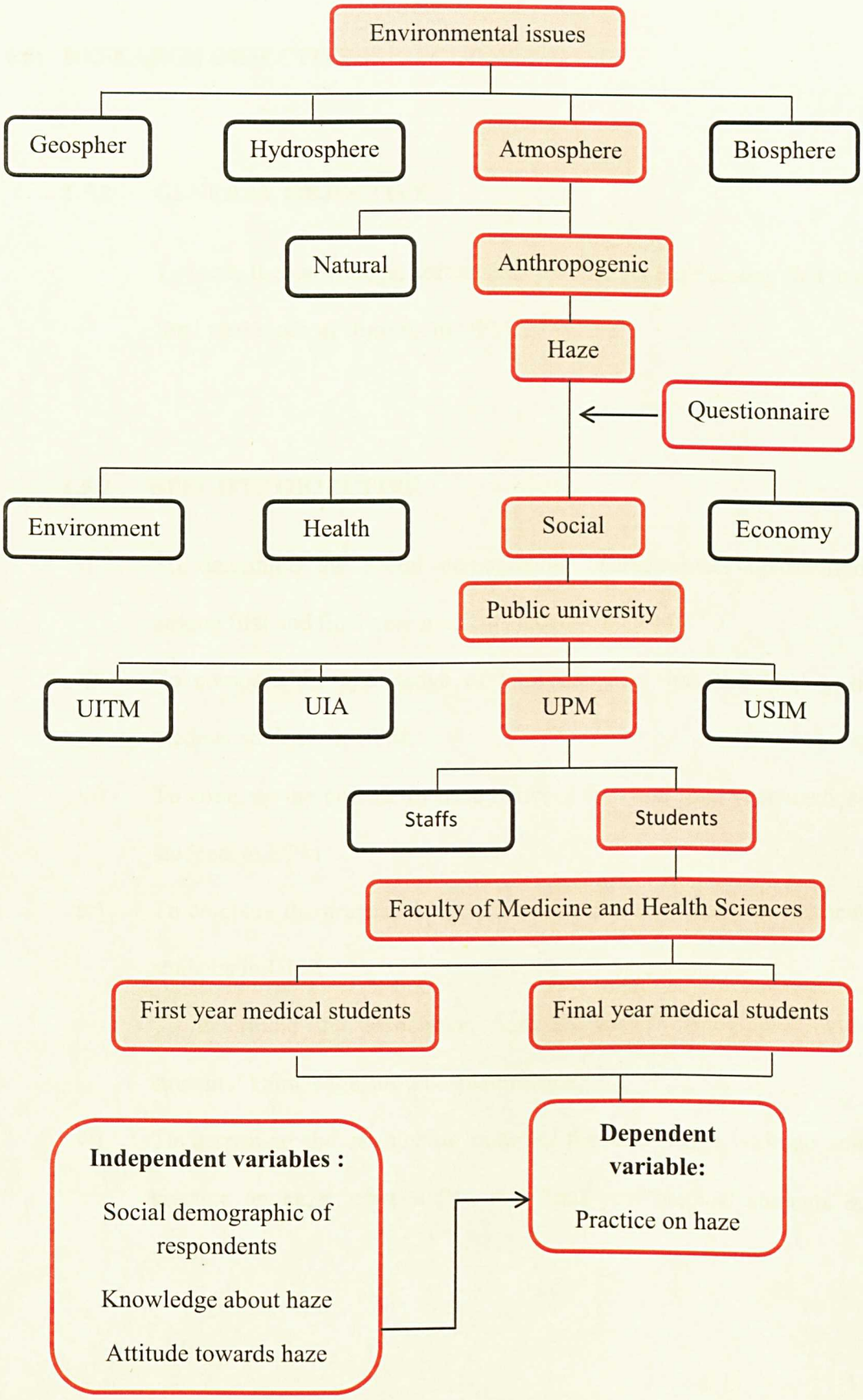

Figure 1.1: Conceptual framework

1.5 RESEARCH OBJECTIVE

1.5.1 GENERAL OBJECTIVE

To study the knowledge, attitude and practice on haze among first and final year medical students in UPM.

1.5.2 SPECIFIC OBJECTIVE

i) To determine the social demographic characteristics distribution among first and final year medical students in UPM.

ii) To compare the knowledge of haze between first and final year medical students in UPM.

iii) To compare the attitude of haze between first and final year medical students in UPM.

iv) To compare the practice of haze between first and final year medical students in UPM.

v) To determine the association between social demographic with students' knowledge, attitude and practice.

vi) To determine the association between the knowledge, attitude and practice on haze between first and final year medical students in UPM.

1.6 HYPOTHESIS

i. There is a significant difference on knowledge's score of haze between first and final year medical students in UPM.

ii. There is a significant difference on attitude's score of haze between first and final year medical students in UPM.

iii. There is a significant difference on practice's score of haze between first and final year medical students in UPM.

iv. There is an association between socio-demographic with students' knowledge, attitude and practice.

v. There is an association between the knowledge, attitude and practice on haze between first and final year medical students in UPM.

1.7 DEFINITION OF TERMS

1.7.1 Conceptual Definition

- Haze

Haze is defined as weather phenomenon that leads to an atmospheric visibility of less than 10 km due to the amount of suspended solid or liquid particles, smoke and vapour in the atmosphere (Xiao *et al.*, 2011).

- Air Pollution

Air pollution is the presence of solid, liquid or gaseous particles in the atmosphere, which are not generally present, or are present in higher concentration and have no beneficial effect (Palanissamy, 2013).

- First and Final Year Medical students

Students aged between 19-21 years for first year and 24-25 years for final year.

- Knowledge

Knowledge is the storage of events, concepts, principles, information etc. which the human mind gets through experience (Behera & Samal, 2015).

- Attitude

Attitude is defined as manner, disposition, feeling, position with regard to a person or thing, tendency or orientation, especially of the mind a negative attitude. Attitudes can be in form of likes and dislikes, biases, views, feelings concerning a situation or issue (Sammut, 2013).

- Practice

Practice is defined as perform (an activity) or exercise (a skill) repeatedly or regularly in order to improve or maintain one's proficiency (Dictionary.com, 2015).

1.7.2 Operational Definition

- Haze

Haze was a recurrent phenomenon happened in Malaysia since several years back due to domestic and transboundary factors. The modernisation and development of the country make the environment changed and decrease the life satisfaction of public.

- Air Pollution

Haze was one of air pollutions that occurred in Malaysia and being a great concern to public health. The awareness of people regarding environmental issues was important to maintain their health.

- First and final year medical students

The first and final year of medical students were selected to participate in this study. They were required to answer set of questionnaire about general information, knowledge, attitude and practice during haze.

- Knowledge

The knowledge about haze is measured by using self-administered questionnaire regarding the general information of haze situation, the sources and impacts of haze. It was rated into three categories which are good, moderate and poor knowledge. The knowledge will influence their practice whether they have good or bad practice.

- Attitude

It is evaluated by using self-administered questionnaire. The questions are close-ended question regarding the practice that they should applied during haze and rated to three categories which are good, moderate and bad.

- Practice

It is measured by using self-administered questionnaire that consist of questions regarding practice that they need to do during haze. It is divided into three categories which are good, moderate and bad practice.

CHAPTER 2

LITERATURE REVIEW

Literature review discussed about previous studies by other researchers regarding the haze phenomenon. This chapter explained about the definition, sources, impact of haze from the aspects of health, economy and social, haze phenomenon in Malaysia and mitigating measures to reduce haze-related problems.

2.1 Definition

The atmosphere, or air, comprised of NO (79%),O_2 (20%) and mixture of CO^2, water vapour, and small quantities of several other gases (1%) (Mabahwi *et al.*, 2014). Air pollution was any substance emitted into the air from an anthropogenic, biogenic or geogenic source, that is either not part of natural atmosphere or is present in higher concentrations than the natural atmosphere, and may cause a short-term or long-term adverse effect (Daly & Zannetti, 2007). The release of large amount of smoke and other pollutants into the atmosphere induced unhealthy environment because the absorption of the pollutants were faster than they could be absorbed (Enger & Smith, 2000). The decreasing in air quality could harm the human health, environment and also cause property damage.

Haze was defined as an atmospheric phenomenon where pollutant particles particulate in the air and obscure the normal clarity of the sky (Khoo, 2006). The particles are so small that they cannot be seen individually, but are still effective in scene distortion and visual range restriction. Besides, haze is a weather phenomenon that leads to an atmospheric visibility of less that 10km due to the amount of suspended solid or liquid particles, smoke and vapour in the atmosphere (Xiao *et al.*, 2011). Haze is the presence of the fine particles (0.1-1.0 μm in diameter) dispersed at a high concentration through a portion of the atmosphere that diminishes the horizontal visibility, giving the atmosphere a characteristic opalescent appearance (MMS, 1995). Furthermore, haze means an atmospheric phenomenon where pollutant particles particulate in the air and obscure the normal clarity of the sky (Khoo, 2006).

Haze events contributed to large amount of particulate matters in the atmosphere. Atmospheric fine particles (PM2.5, dP $\leq$2.5μm), a mixture of many inorganic and organic components, reside for a long time in the atmosphere and can go deeper into the lungs (Khan *et al.*, 2015).

Visibility was defined as the clarity or transparency of the atmosphere and the associated ability to see distant object (Hyslop, 2009). Visibility impairment was the result of light scattering and absorption by particles and gases in the atmosphere (Davidson *et al.*, 2001).

2.2 Sources of haze

Palanissamy (2013) stated that forest fire in Indonesia was one of the major sources of haze pollution in ASEAN (Association of Southeast Asian Nations) region. The particulate matter and CO_2 were emitted with high level in Indonesia (Heriyanto *et al.*, 2015). The smoke from peat and forest fires becomes transboundary and travels towards eastward and affected ASEAN countries. To get basic understanding about the source of particulate matter, it could be obtained from the bulk chemical measurements of particulate matter that covered elemental organic carbon (ECOC); secondary inorganic ions such as sulphate, nitrate and ammonia; sea spray in coastal areas; crustal elements likes silicon, aluminium, magnesium, potassium, titanium and iron (Schauer, 2013).

The haze also was caused by domestic factors such as smoke from the transportation, industries and open burning that make the haze getting worst. The pollutants such as carbon monoxide, sulphur dioxide, carbon dioxide, ozone and particulate matter were released. Meteorological condition affected the air quality, for example, higher level of ozone in the atmosphere was caused by higher temperature that fastened the chemical reaction (Afzali *et al.*, 2016). A study done by Abdullah *et al.* (2016) indicated that the level of SO_2 and NO_2 were higher during haze days compared to non-haze days. The elevated NO_2 was contributed by the development of motorways with complete combustion of vehicles (Dominick *et al*, 2012). A few previous studies stated that primary sources of particles were vehicle emissions, industrial emissions, large quantities of rod dust and domestic biomass

burning, contributed to haze (Afroz *et al.*2003; Keywood *et al.*, 2003; Ghazali *et al.*, 2010; Juneng *et al.*, 2011). The urban-industrialized areas and the restrictive nature of the atmosphere to emit the pollutants were the reasons behind haze, with the increment number of sources (Haliza, 2013).

The high level of particles or pollutants in the atmosphere that caused haze could be natural or anthropogenic. For natural sources, they included the oceans, forest and ground surface. Meanwhile, for anthropogenic, human activities contribute to emit the pollutants to the environment that include open burning, land clearing, vehicular use and combustion of fossil fuels. Brook *et al.* (2004) revealed that there were numerous natural and man-made sources of PM included motor vehicle emissions, tire fragmentation and resuspension of road dust, power generation and other industrial combustion, smelting and other metal processing, agriculture, construction and demolition activities, residential wood burning, windblown soil, pollens and molds, forest fires and combustion of agricultural debris, volcanic emissions, and sea spray.

A previous study done by Ahmad Jamhari *et al.*, (2004) showed that the presence of benzo[g,h,i]perylene (BgP) with high concentration indicated a source indicator for traffic emission at Klang Valley, Kuala Lumpur (urban, KL) and Petaling Jaya (industrial, PJ), and one site outside the Klang Valley, Bangi (semi-urban, BG). The contributing sectors of haze were residential combustion, industry and traffic with higher concentrations in urban and traffic (Duque *et al.*, 2016). High level of particulate matter in smoke came from biomass burning and proved by the

presence of levoglucosan and other minor monosaccharide derivatives in the aerosol, which were sugar anhydrides formed during the combustion of cellulose and hemicellulose (Abas *et al.*, 2004a).

2.3 Impacts of haze

2.3.1 Health

Haze condition gave greater impact to human if it was not treated early. Dust and smoke particles were the main component of haze. As it contained fine particulate matter which was $PM_{2.5}$, the particles could absorb deeper into the lungs and blood circulation and also disturbed the respiratory system. The abnormal lung function would result as coughs, wheezes, respiratory disorders and other symptoms, and increased the risks of bronchial asthma, chronic obstructive pulmonary disease (COPD), emphysema and other respiratory disease (Kai *et al.*, 2013). The exposure to $PM_{2.5}$ also caused adverse health effects and premature death in humans (Bertha *et al.*, 2014). In addition, the traffic and industrialized areas lead to poor indoor air quality (IAQ) and directly influenced the increasing report the respiratory problems (Choo *et al.*, 2015).

The haze pollution was believed could cause cancer via the adherence of large amount of toxic compound such as heavy metals, monoaromatic hydrocarbon (benzene, toluene, ethylbenzene and xylene (BTEX)) to $PM_{2.5}$ and increased the toxicity and disturbed the chromosome, DNA and genetic material (Kai *et al.*, 2013). The toxic chemicals in $PM_{2.5}$ contributed to cancer risk which was three to four in 1,000,000 people in Southeast Asia (Khan *et al.*, 2015).

The presence of CO, SO_2, NO_2 and O_3 during haze could affect the human health. Previous studies had proved that these components could cause serious respiratory problems. A study stated that NO_2 was associated with respiratory mortality by 7.53% (Wan Mahiyuddin *et al.*, 2013). NO_2 was a mainly secondary pollution and formed from NO through photochemical process. The exposure of NO_2 for short or term-term could induce the health effects to human, act as precursor to form other pollutants.

CO would reduce the oxygen-carrying capacity in the blood by combining with the haemoglobin and formed carboxyhaemoglobin. Due to lack of the oxygen in the body tissue, it caused tissue hypoxia (Tao *et al.*,2011). Then, it caused health effects such as impaired vision and coordination, headaches, dizziness, confusion and nausea at low exposure and death if high exposure (Raub & Benignus, 2002).

According to Kay (2006), respirable particulate matter was being increasingly recognised as an important and independent risk factor not only for respirable diseases and lung cancer, but also for atherosclerosis, ischemic heart disease and stroke. It shows that the particulate matter is very harmful as it disturbs the systems in the human body. Last but not least, a quasi-experimental Chinese study revealed that air pollution increased cardiorespiratory mortality and decreased the life expectancy among the public who exposed to the air pollution (Chen *et al.*, 2013). Interleukin-6 (IL-6) which was contributed by the exposure to PM_{10}, $PM_{2.5}$ and ultrafine particles (UFP) meanwhile Tumor necrosis factor-alpha (TNF-α) was contributed by $PM_{2.5}$ and UFP, were the main cytokines involved in the inflammation of the lungs and lead to respiratory problems (Kavitha *et al.*, 2010; Kavitha, *et al.*, 2011).

2.3.2 Economy

The haze also affected communities from the aspects of economy. The haze episode that reported in Malaysia from 1997 until 2015 had brought big losses reaching billions of dollars to the government generally. Lost tourism and lost workdays because of the respiratory illness elevated the total economic losses. The sellers tend to increase the price of fresh products during hazy conditions. A previous study conducted by Jamal *et al.*,(2014) stated that there was increasing in inpatient cases associated with haze by 2.4 per 10,000 populations from 2005 until 2009, which means an increase of 31 percent from normal days and it covered average annual economic loss at MYR273,000 ($91,000 USD).

In 2013, Singapore has suffered economic losses estimated at $1 billion per week (Palanissamy, 2013). Some airlines company also were being affected by haze. Haze had decreased the visibility and efficiency of air traffic in the airports. The normal visibility day (7—10 statute miles (SM) had reduced to less than 3SM (Robert *et al.,* 2009). It was difficult for the pilots to see the runway during the haze day and can lead to crush between the aircrafts.

In Thailand, the haze conditions in 2015 were the worst condition compare to previous haze crisis. According to Asia-Pacific Chief Economist, Rajiv Biswas, December was an important peak season for Thai tourism industry. However, if the haze condition continue worsening, it can affect the tourism booking because the tourist likely to avoid haze-affected country in Southeast Asia (DW, 2015).

A previous study showed that the estimation of economic loss during haze was MYR273,000 ($91,000 USD) annually or MYR23,000 ($7700 USD) per month or MYR766 ($256 USD) per day or an average of MYR14,368 ($4789 USD) per hazy day (transboundary). For Malaysia, the loss due to incremental of inpatient rates using COI was estimated MYR0.273 million (USD91,000) (Jamal *et al.*, 2014).

2.3.3 Social

The haze also affected the community in the aspects of socials. According to MOE (2015a), the closure of schools affected 1,734,668 students in 2,528 schools nationwide. The public were advised to limit their outside activity and wear mask if they went outside. All this could increase emotional and behaviour problems on human (Haliza, 2013).

A study showed that there were association between haze and mild to moderate psychological stress with the recurrent thought, mental images and feeling about haze. A study revealed that physical symptoms such as headache, eye irritation and coughing can lead to mild psychological stress during haze episode (Ho *et al.*, 2014). Hence, reducing physical symptoms can reduce the mild psychological symptoms among healthy people.

Besides, the haze phenomenon decreased the visibility and reduced the quality of images, resulted in a lot of bad impacts on computer vision applications, likes outdoor surveillance, object recognition and tracking, unmanned vehicle system and alleviated the performance of these vision application due to alteration of radiance from a scene point (Zhai & Ji, 2015). In addition, haze might cause traffic disruption and accidents, that might result in loss of life and economy loss (Pentamwa & Oanh, 2008).

2.4 Haze phenomenon

(a) Malaysia

There were several haze episode occurred in Malaysia. The issue has become a recurring phenomenon since 1980s, the worst one in 1997 (Alfroz *et al.*, 2003; Abas *et al.*, 2004b). The particulate matter was transported by south-westerly winds (between June and September) to Malaysia. The haze episode become worsening with the presence of heavy load of vehicular emissions and biomass activities. It leads to serious prolonged haze events being recorded on the Peninsular of Malaysia and at Sabah and Sarawak (Alfroz *et al.*, 2003; Abas *et al.*, 2004b). The chronology of haze episode in Malaysia is shown in Table 2.1.

Table 2.1: The chronology of haze episode in Malaysia

No.	Year	Situation
1	1994	After haze episode in 1991, Malaysia was reported again with haze issues in September 1994. It meant that there were lapses of three years. This time of haze episode was more than previous year. The main cause identified was forest fire in Kalimantan and Southern Sumatra. Other than that, drought, lower wind conditions and emissions from industries and transports elevated the condition.

2	1997	It occurred in September to November 1997. El Nino phenomenon increases the haze situation. Air quality become worsened at Sarawak between 19 September to 28 September (10 days) and Sarawak was declared as Haze Emergency as the Air Pollution Index above 500. Then, the situation back to normal coinciding the monsoon season in November.
3	2005	By August 2005, the haze is considered the most serious because Klang Valley and its surrounding areas were badly affected. Pelabuhan Klang and Kuala Selangor were declared as Haze Emergency on 11 August 2005 as the Air Pollution Index (API) exceeds 500. The haze situation became normal after two days with the reading below hazardous level (301). The haze shifted to northern states of Perlis, Kedah and Penang. The reading recorded as unhealthy in Langkawi, Alor Setar, Kangar, Pulau Pinang, Prai and Seberang Jaya between 13 August until 114 August 2005. The air quality back to normal on 16 August 2005.
4	2006	Slight to moderate haze episodes happened in mid-July, mid-August and late September to October 2006. In July, Seberang Prai, Port Klang and Sri Mahjong recorded unhealthy reading of API on 17,18 and 19 July 2006. Few areas in Sarawak such as Kuching, Sibu, Sarikei, Samarahan, Sri Aman, Petra Jaya and Bintulu obtained unhealthy air quality level in mid-August 2006.

		Sri Aman in Sarawak was recorded the highest Air Pollution Index (API) with the reading 221 which considered as unhealthy air quality level on 6 October 2006. Meanwhile, on 7 October 2006, twenty stations in Peninsular Malaysia were noted as unhealthy air quality status.
5	2010	Muar, Johor experienced short haze episode from 19 to 23 October 2010 in which the reading of Air Pollution Index (API) reached unhealthy to hazardous level. It was because of transboundary haze pollution. The highest recorded reading of API in Muar was 432 and 170 schools in Muar District of Johore were forced to be closed on 21 October 2010.
6	2011	From May to September 2011, transboundary haze pollution resulted in short period of haze episode in Malaysia. Slight deterioration of overall air quality was recorded in 2011.
7	2012	Dry period of June to August had resulted in forest fire from Central and Nouthern Sumatra, Indonesia which reported in slight deterioration of overall air quality in 2012. Institut Latihan Perindustrian (ILP) in Miri Station, Sarawak has resulted in high level of PM_{10} between June to August 2012.
8	2013	Haze occurred in Malaysia from 15 to 27 June 2013. It was caused by transboundary haze. Unhealthy and hazardous level was recorded. Johor, Melaka and Negeri Sembilan were seriously affected. On 23 June 2013, Haze Emergency was declared by Hon. Prime Minister in Muar and Ledang

		Districts, Johor on 23 June 2013. The Haze Emergency was lifted on 24 June 2013.
9	2014	From February and Mac 2014, several states in Peninsular Malaysia were affected which were Klang Valley, Perak, Melaka, Negeri Sembilan and Johor. It was caused by forest and peatland fires in Selangor, Perak, Pahang, Johor, Kedah, Kelantan and Terengganu. It became worsened on 14 March 2014 as the reading reached more than 300 in Port Klang and Banting, Selangor. 230 schools in the Klang and Kuala Langat Districts in Selangor were forced to be closed as the API reading reported more than 200 which was unhealthy level of air quality. From June to October, during Southwest monsoon, transboundary haze pollution happened. Highest Air Pollutant Index (API) reported was 260 (very unhealthy), in Seri Manjung, Perak on 22 July 2014. From 25 July to 117 September 2014, several areas in Sarawak reported unhealthy air quality status with the highest API (very unhealthy), in Sibu, Sarawak on 28 July 2014. From 17 Sept to 12 Oct 2014, west coast and northern parts of Peninsular Malaysia experienced unhealthy air quality status with the highest API recorded was 129, in Nilai, Negeri Sembilan on 10 Oct 2014.

10	2015	Malaysia had reported deterioration of air quality from August to September 2015 because of large scale of forest fire in Sumatra and Kalimantan, Indonesia. On 15 September 2015, 34 areas in the country recorded unhealthy air quality status the first time in Malaysia's history since 1997. All schools in Putrajaya, Kuala Lumpur and Melaka were closed on 15 September 2015 and all schools in Kuching and Samarahan Divisions, Sarawak were forced to be closed on 18 September 2015.

(Sources: DOE Malaysia)

A study conducted by Mazrura *et al.*, (2014) at Klang Valley stated that there were significant differences between haze days and non-haze days, except relating to humidity and visibility. The mean concentration of PM_{10} for haze days was 134.5 $\mu g/m^3$ and the highest result of concentration of PM_{10} was 481.1 $\mu g/m^3$ recorded on 11^{th} August 2005 as shown in Table 2.2.

Table 2.2: Descriptive results of the environmental data for haze and non-haze days in Klang Valley region during 2000-2007

Parameters	Mean (SD)			Difference in mean (95% CI)
	All days (N = 2922 days)	Haze days (N = 88 days)	Non-haze days (N = 2834 days)	
PM_{10} ($\mu g/m^3$)	55.5 (23.0)	134.5 (59.1)	53.1 (15.4)	81.4 (68.9–94.0)
NO_2 (ppb)	21.0 (4.4)	26.8 (3.8)	20.8 (4.4)	5.9 (5.1–6.9)
SO_2 (ppb)	4.5 (1.4)	5.2 (1.3)	4.5 (1.4)	0.7 (0.4–1.0)
CO (ppm)	0.8 (0.3)	1.5 (0.7)	0.8 (0.2)	0.7 (0.6–0.8)
O_3 (ppb)	54.3 (17.4)	70.6 (24.8)	53.8 (16.9)	16.8 (11.5–22.0)
Temperature (C)	27.4 (1.0)	28.0 (0.8)	27.4 (1.1)	0.7 (0.5–0.8)
Humidity (%)	77.6 (6.5)	74.2 (5.1)	77.7 (6.5)	-3.6 (-4.9 to -0.2)
Visibility (km)	11.02 (1.6)	7.0 (2.6)	11.1 (1.4)	-4.1 (-4.7 to -3.6)

Sources: Mazrura *et al.* (2014)

In early 1990s, three severe haze episodes were recorded in Klang Valley: August 1990, October 1991 and August-October 1994, with the major sources of urban-industrial pollutants that trapping in the atmosphere, supported by dry weather during southwest monsoon season that unfavourable for efficient dispersion of the pollutants through convective mixing by heavy rain (Soleiman *et al.*, 2003). Thus, meteorological variables such as temperature had strong correlation with the total suspended solid (TSP) that influenced the haze episodes.

(b) Worldwide

Other than Malaysia, there were several Southeast Asia regions that were badly affected by haze such as Singapore, Brunei, and Southern Thailand. From July to October 1997, haze was recorded as the most damaging in history and recurrent in August 2005 and affected these Southeast Asia regions. During the most severe haze of 1997, the large and uncontrolled fires occurred in the peat areas of Sumatra Island (Qadri, 2001).

Air quality monitoring network of the Pollution Control Department (PCD) of Thailand recorded a high concentration of potential harmful small particles in some areas (PCD, 2005). The haze phenomenon with elevated particulate matter (PM_{10}) often occurs in Thailand during June-August period in which the PM_{10} level reached 92 $\mu g/m^3$ in Songkhla and 108 $\mu g/m^3$ in Phuket compared to normal period which were 32 $\mu g/m^3$ in Songkhla and 56 $\mu g/m^3$ in Phuket, interpreted as not exceeding the National Ambient Air Quality Standard of 120 $\mu g/m^3$ (Pentamwa & Oanh, 2008).

The Pollutant Standard Index (PSI), an air pollution measurement index in Singapore, reached highest level of 401 on 21st June 2013 compared to worst level of 226 occurred in 1997,which was exceeded the 'hazardous' level of 300. Thus, Singapore's new Transboundary Haze Pollution Act was introduced on 25th September 2014 to combat this haze issue (Khee & Tan, 2015). In addition,

Singapore government minimised its occurrence by applying several ways such as pressuring Indonesia to ratify the Haze Agreement, legal action against the culprit, and coasian solution (Gill & Bin, 2013).

2.5 Hotspot of haze

In 12 September, Sumatra, Indonesia had reported 328 hotspots. They were detected by National Oceanic and Atmospheric Administration (NOAA) 18 based on Asean Specialised Meteorological Centre (ASMC) in Singapore (Borneo Post, 2015). The numbers of hotspots increased rapidly on 14 September with the number of hotspots nearly 1000 as haze thickens (Channel NewAsia, 2015). The air quality had reached hazardous level with the reading of Pollutant Standard Index above 301.

Figures 2.1 and 2.2 showed the annual and monthly hotspots count reported in Peninsular Malaysia, Sabah& Sarawak, Sumatra and Kalimantan from ASEAN Specialised Meteorological Centre (ASMC).

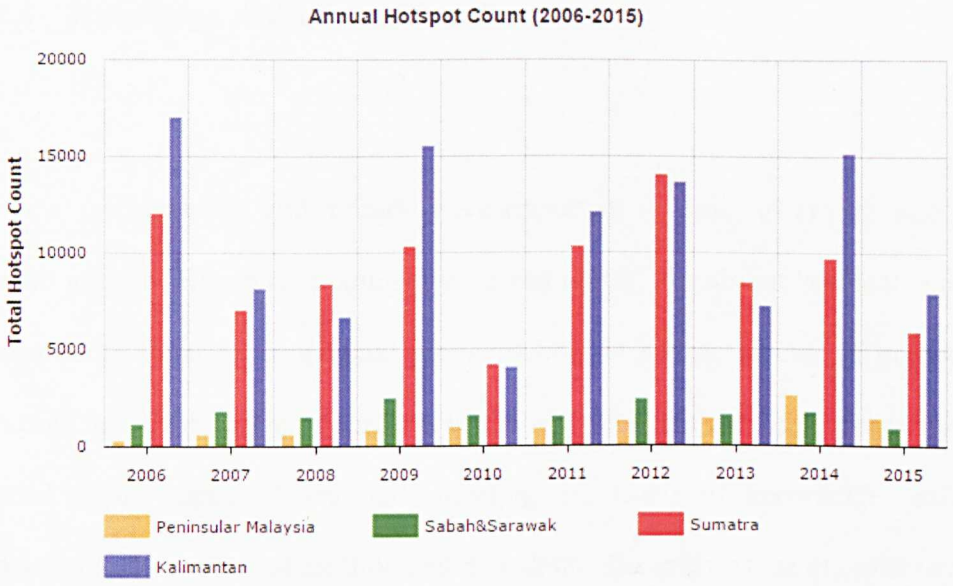

Figure 2.1: Annual hotspot count

(Source:ASMC)

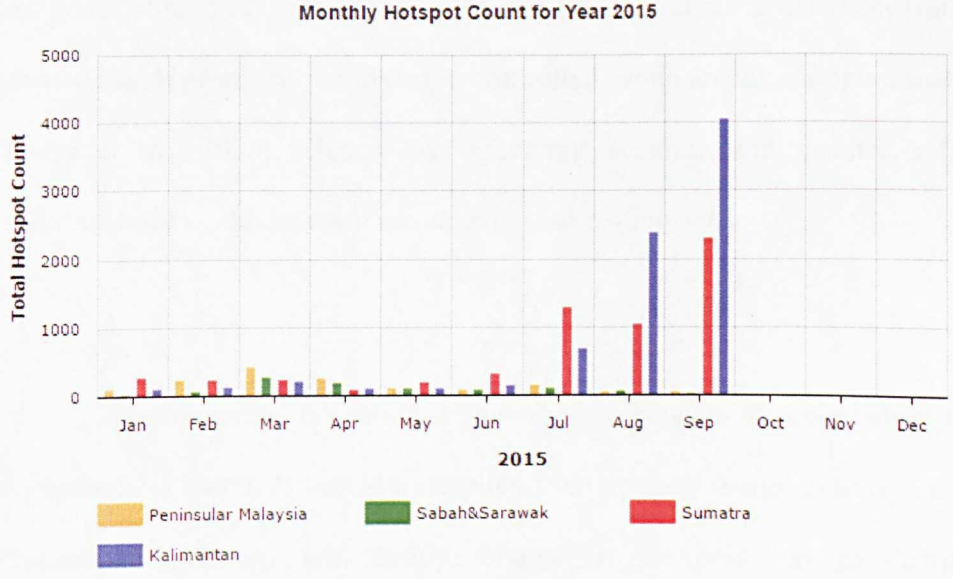

Figure 2.2: Monthly hotspot count

(Source: ASMC)

2.6 Knowledge, Attitude and Practice

Knowledge and attitude were important in order to ensure safe practices were applied. However, findings by Azizan (2008) stated that "students had a good awareness about environmental problems but yet had no change in practice". This means the involvement of students in the activities that can protect the environment need to be improved. By understanding the levels of knowledge, attitude and practice, any awareness creation could be done efficiently as the organiser could plan the program more appropriately to the needs of community (Kaliyaperumal, 2004).

People who exposed a greater risk to health and greater disturbance to their lifestyle, such as duathletes, were more knowledgeable about transboundary haze, had good attitude towards it and apply practice that could avoid them from getting adverse health problems compared to controlled group among shopping mall visitors (Pretto *et al.*, 2015). Hence, by delivering accurate and updated information regarding haze could decrease the negative human impacts.

Environmental education is important to educate the community about the environmental issues. It should be applied from primary school to university. Beside educational institution and family, internet is the best way to distribute the information regarding environment health as it is the students preferred choice of media (Ahmad *et al.*, 2015).

Youth is the suitable generation in ensuring the sustainable development of the country. It is because young generation today will be the leader in the future. The government's emphasis on youth's involvement in promoting sustainable development in conjunction with the concept in the country's education system at all education levels (Foo, 2013).

2.7 Mitigating measures

The health effects during haze episode could be reduced by applying the mitigating measures. People with immunocompromised such as older people, children and people with chronic disease were more susceptible to get haze-related disease. People with chronic disease such as asthma, chronic obstructive pulmonary disease (COPD), diabetes and hypertension were advised to wear face mask, drink a lot of water and stay inside their homes, until the API reading was below 100.

Besides, legislation was one of the ways to prevent the occurrence of haze. ASEAN organizations should enforce the policies to avoid illegal burning in the future to clear the land for agriculture by using slash-and-burn method (Ho *et al.*, 2014). The restriction of open burning in hotspots areas has been issued by Department of Environment. Anyone who carried out the open burning can be fined of not more than RM500,000 or imprisonment of five years or both as stipulated in Section 29A(2) of the Environmental Quality (Amendment) Act 2001. The enforcement of policies to reduce the emission of road vehicles and their impacts

should be informed by different contributors and efficacy of technical (standard and specific control technologies) and institutional (inspection and maintenance program) approaches (Grieshop, 2013).

The implementation of Air Quality Plan (AQP) by the Directive on Ambient Air Quality and Cleaner Air for Europe (Directive 2008/50/EC) suggested four scenarios to decrease the release of PM10 and NO2 (Duque *et al.*, 2016). They included :

Scenario 1 : Replacement of 10% of vehicles below EUR03 class (diesel and gasoline) by hybrid model vehicles

Scenario 2 : Introduction of a Low Emission Zone (LEZ) on a specific polluted area of Porto city, with the restriction for vehicles below EUR03

Scenario 3 : Replacement / conversion of 50% of the conventional fireplaces by more efficient equipment (residential construction)

Scenario 4 : Application of clean technologies that allow a reduction of 10% in PM10 emissions from production processes and industrial combustion.

The deterioration of community health during haze such as asthmatic disease, eye and skin irritation were widely known. Thus, the distribution of information regarding smoke dispersion should be taken to provide early warning system to community and institutions to prepare themselves to anticipate fire haze disaster (Heriyanto *et al.*, 2015). Besides, in order to tackle the haze issue,

environmental regimes and organisation should use financial incentives to reduce the causes in term of cross-border collaboration and discussed what might be done to improve environmental haze problem (Tacconi *et al.*, 2008).

CHAPTER 3

METHODOLOGY

This chapter discussed about the method and instrument used in the study. This chapter also explained about the study design, study location, sampling and method used in choosing the respondents, data collection and data analysis.

3.1 STUDY DESIGN

The study was a cross-sectional comparative study which focused to determine the knowledge, attitude and practice on haze among first and final year of medical students in UPM.

3.2 STUDY LOCATION

The study was conducted at Faculty of Medicine and Health Sciences (FMHS), Universiti Putra Malaysia (UPM), Serdang, Selangor. The location of the study was illustrated in Figure 3.1.

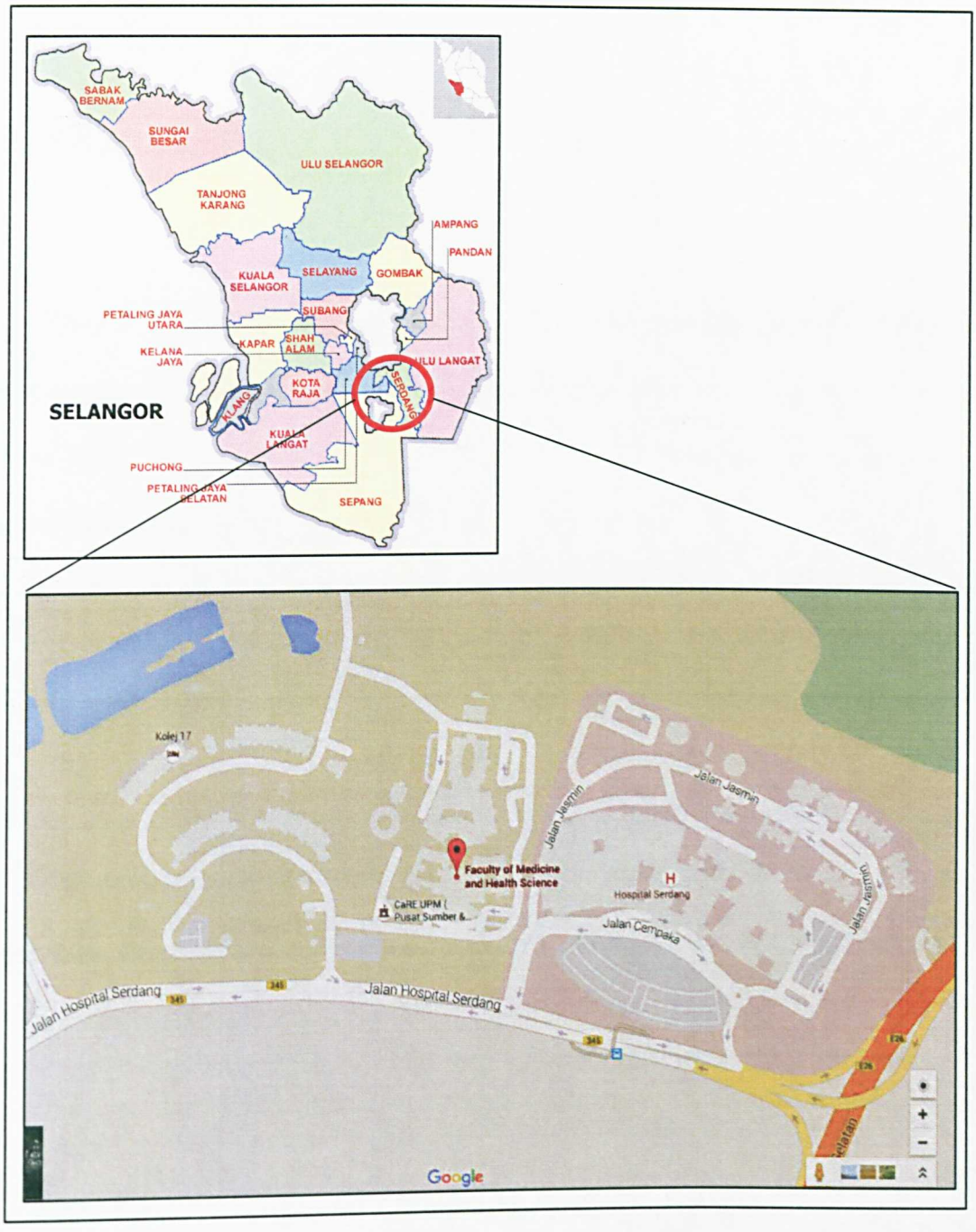

Figure 3.1 : Study location

(Sources: Google Map)

3.3 SAMPLING

3.3.1 Sampling Population

The total population from both groups of medical students were 244. For irst year of medical students, the total numbers of students were 93. Meanwhile, for final year students, the total numbers of students were 151. All first and final year of medical students were selected to participate in this study.

3.3.2 Sampling Frame

The updated name list of first year and final year of medical students were obtained from the Academic Division, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

3.3.3 Study Sample

The samples of the respondents selected were first year and final year of medical students at Faculty of Medicine and Health Sciences, Universiti Putra Malaysia.

3.3.4 Sampling Method

All respondents from first and final year of medical students were selected.

3.35 Sampling Size

All respondents from first and final year of medical students were chosen to participate in the study. The numbers of first year medical students were 93 while the numbers of final year students were 151. Hence, total respondents were 244.

3.4 STUDY OF INSTRUMENT

Questionnaire

The level of knowledge, attitude and practice on haze among first and final year of medical students were evaluated by using self-administered questionnaire. The questionnaire comprised of four sections. Section A was about the social demographic of the respondents such as age, gender and races. For section B, the questions were about general information regarding haze phenomena. Meanwhile, Section C comprised of three subtopics which were knowledge about haze, attitude

towards haze and practice during haze. Other than that, questions in Section D were about the suggestion to reduce the haze.

The questionnaire was modified from previous study according to the suitability of the topic of the study. Some of the questions were modified from a study done by Nur Atiqah (2015). The questionnaire was shown in **Appendix 2.**

3.5 VARIABLES

3.5..1 Independent Variables

The independent variables were social demographic of respondents, knowledge about haze and attitude towards haze.

3.5.2 Dependent Variable

The dependent variable was practice on haze such as wearing mask, drinking a lot of water and participating in environmental program.

3.6 DATA COLLECTION

Before distributing the questionnaire, the respondents were briefly explained about the purpose and importance of the study. Their personal information and responses were kept confidential by the study researcher. They were required to fill in the consent form to take part in this study (**Appendix 3**). The respondents were given a self-administered questionnaire to be answered and collected at the end of the survey. The information gained from the questionnaire was used to measure the level of knowledge, attitude and practice on haze between the first and final year of medical students.

3.7 DATA ANALYSIS

The data was analysed by using "Statistical Package for Social Sciences (SPSS) Version 22.0.

The level of knowledge, attitude and practice on haze was evaluated using scoring method as follow:

i) The scoring method for knowledge

Right answer : 1 point

Wrong answer : 0 point

The score calculated was converted in term of score level which was good, moderate and low level. A mean score and standard deviation of the group were used to identify the subject into three groups as follow (Ajit, 2011):

Good level : score > Mean +SD

Moderate level : score = Mean +/ - SD

Poor level : score <Mean – SD

ii) The scoring method for attitude

Strongly agree : 5 points

Agree : 4 points

Not certain answer : 3 points

Disagree : 2 points

Strongly disagree : 1 points

The score calculated was converted in term of score level which was high, medium and low attitude. A mean score and standard deviation of the group were used to identify the subject into three groups as follow (Ajit, 2011):

Good attitude : score > Mean +SD

Moderate attitude : score = Mean +/ - SD

Poor attitude : score <Mean – SD

iii) The scoring method for practice

Right answer : 1 point

Wrong answer : 0 point

The score calculated was converted in term of score level which was good, and bad. A mean score and standard deviation of the group were used to identify the subject into three groups as follow (Ajit, 2011):

Good level : score > Mean

Poor level : score <Mean

Descriptive statistical was used to determine the mean and standard deviation. To determine the association between two different groups, Chi square was used. Meanwhile, Independent t-test and Mann U-Whitney were used to compare two groups of respondents. To determine the relationship between two variables, logistic regression was used.

3.8 QUALITY CONTROL

To ensure the reliability of the questionnaire, a pilot study was conducted among 25 respondents from second year of medical students who had similar characteristics with the sample subject. They were excluded in the study. The purpose of pre-test was to ensure that the respondents could understand the questions well and found any difficulties during answering the questions. The questionnaire were analysed by using statistic Package for the SPSS version 22.0 to arrive at

Cronbach alpha to test the internal reliability and consistency of the questions. The value of Cronbach alpha obtained from the pilot study was 0.796. The questions were considered reliable.

3.9 ETHICAL CONSIDERATION

Before conducting the study, the approval from the Ethical Committee for Universiti Putra Malaysia (JKEUPM) was gained with the JKEUPM Ref No. of FPSK(EXP15-OSH)U048 (**Appendix 4**). The respondents also were given brief explanation on how to conduct this study. Other than that, written permission by using consent form was filled in by the respondents. To respect the privacy of the subjects, their personal information and responses were kept confidential.

3.10 STUDY LIMITATION

The outcome of study was measured based on the answer of the respondents from self-administered questionnaire. It was based entirely on respondents' honesty as the respondents may be reluctant to give information about their knowledge, attitude and practice during haze. The respondents also needed to recall back their attitude and practice during haze as this study was conducted after haze episode. Thus, it could lead to recall bias. The data analyses were done based on a cross-sectional data; thus the causal interpretation of the results cannot be done.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter included descriptive and analytical findings on demographic, knowledge, attitude and practice. The general information represented descriptive finding followed by descriptive characteristics on general knowledge, knowledge about haze, attitude towards haze and practice during haze event. For analytical findings, comparison between groups and association between all independent variables were presented in this section.

To carry out this study, 244 sets of questionnaire were distributed among first and final year of medical students. There were four sections in the questionnaire, which were Section A (social demographic), Section B (general information), Section C (knowledge, attitude and practice), and Section D (suggestion). Out of 244 respondents, 244 (100% response rate) copies were completed and returned to the researcher.

4.1 General Socio-Demographic Characteristics

This part showed about the frequency distributions of socio-demographic of the respondents. It included the age, gender and races of the respondents. The data of the socio-demographic characteristics were tabulated in Figure 4.1.

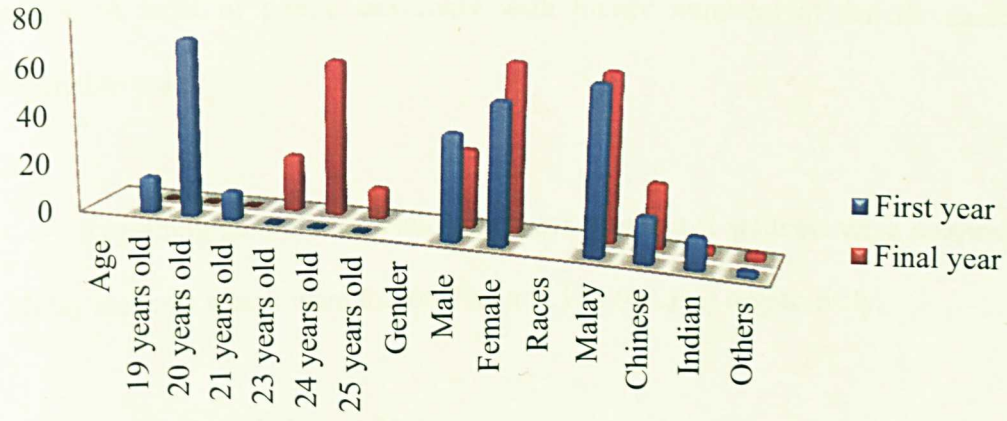

Figure 4.1: Socio-demographic Characteristics

Regarding age, for first year of medical students, the range of age was 19-21 years old. Majority of the first year of medical students were 20 years old, which were 68 (73.1%). Meanwhile, for final year of medical students, their age ranged from 23 to 25 years old. There were 96 (63.6%) of the final year students aged 24 years. The mean and standard deviation (SD) for the first year were 19.97 $\pm$ 0.52 while for the final year, the mean and SD was 23.90 $\pm$ 0.59. It was the common age of undergraduate level after matriculation or pre-university including STPM and diploma at the age of 10-21 years old. Adolescence was the best stage to deliver information as they could understand and accept what being told to them.

For gender, the study population comprised of 40 (43%) males and 53 (57%) females for first year of medical students. For final year students, the numbers of male participants were 48 (32%) and female participants were 103 (68%). The ratio was opposite with the current distribution of general population in the whole Malaysia. According to Department of Statistic Malaysia (2011), at the age of 19 to 25 years old, male was outnumbered female with sex ratio of 106. However, it was common in most of public university with higher numbers of female students compared to male.

Regarding race, the first and final year of medical students were dominated by Malay students which were 62 (66.7%) and 102 (67.5%) respectively.

4.2 General Knowledge on Haze

This part showed the frequency of general knowledge on haze for supporting the information about haze phenomenon among respondents. Table 4.1 revealed information such as knowing about the terms of "haze", notice about haze phenomenon in Malaysia, knowing about the reading of Air Pollutant Index, knowing about components of air pollutants in haze, about El Nino phenomenon that make haze become worse, N95 mask adequate protection against haze or not.

Hearing about terms of "haze"

Regarding the questions, 241 (98.8%) of students heard about term of "haze" while 3 (1.2%) has not heard about it.

Notice about haze phenomenon in Malaysia

There were 242 (99.2%) students notice about haze phenomenon in Malaysia while 2 (0.8%) did not notice about it.

Sources of information

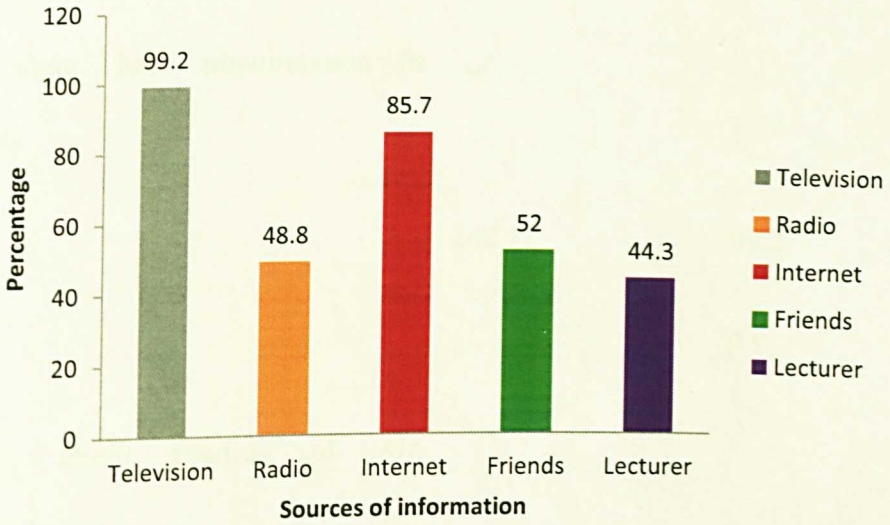

Figure 4.2: Sources of information

Figure 4.2 showed sources of information about haze. Majority of the students got information via television which was 212 (99.2%), followed by internet 209 (85.7%). Other information got from friend 127 (52%), radio 119 (48.8) and lecturer 108 (44.3). As the haze issue become breaking news in 2015 and make the schools closed, the information was updated in television frequently. Other than that, the medical students spent their precious times in the library and they might easily access to Internet and follow the current news about haze.

Table 4.1: General knowledge on haze

General knowledge	Number (n)	Percentage (%)
Hearing about the terms of "haze"		
Yes	241	98.8
No	3	1.2
Notice about haze phenomenon in Malaysia		
Yes	242	99.2
No	2	0.8
Knowing about reading of Air Pollution Index		
Yes	205	84
No	39	16
Knowing about components of air pollutants in haze		
Yes	137	56.1
No	107	43.9

Components of haze		
Particulate matter	92	37.7
Sulphur dioxide	81	33.2
Nitrogen dioxide	59	24.2
Carbon dioxide	79	32.4
Ozone	25	10.2
Carbon monoxide	107	43.9
El Nino phenomenon make haze become worsening	193	79.1
N95 mask an adequate protection against haze	206	84.4

Knowing about reading of Air Pollution Index

About 205 (84%) students knew about Air Pollution Index while 39 (16%) students did not know about it.

Knowing about components of haze

There were 137 (56.1%) of students knew about components of haze. Meanwhile, 107 (43.9%) of students did not know about it.

Components of haze

Regarding the question, 92 (37.7%) of students chose particulate matter as components of haze, followed by sulphur dioxide 81 (33.2%) and carbon dioxide 79 (32.4%). For nitrogen dioxide, 59 (24.2%) respondents chose it as their answer and 25 (10.2%) chose ozone as components of haze. It indicated that the students were unaware of the fact that ozone was one of the components of haze. Considering the students' background which were from undergraduate level, it was quite worrisome because even they have higher education level, majority of them were still lacking in knowledge regarding haze.

El Nino phenomenon makes haze become worsening

There were 193 (79.1%) of students agreed that El Nino phenomenon makes haze become worsening.

N95 mask an adequate protection against haze

There 206 (84.4%) of the respondents knew that N95 mask an adequate protection against haze.

Regional sources of haze

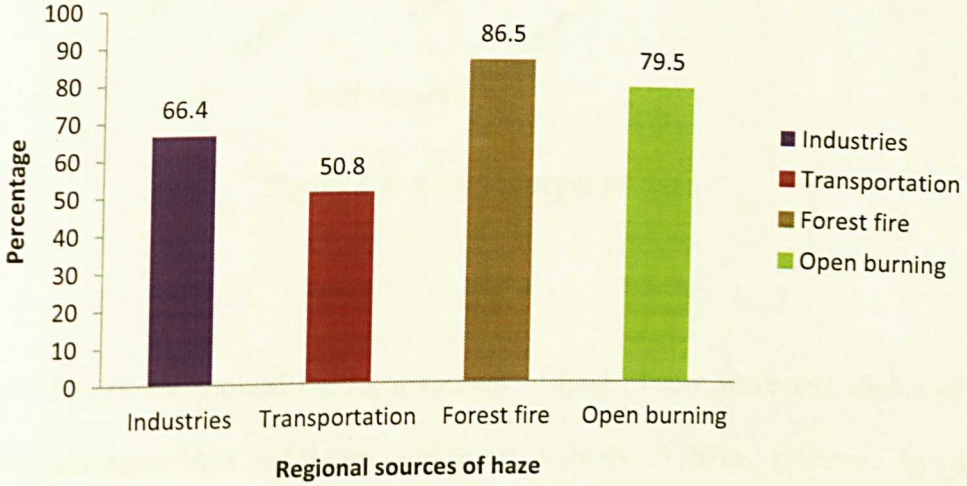

Figure 4.3: Regional sources of haze

Figure 4.3 showed the regional sources of haze. Most of the respondents chose forest fire as the regional sources of haze which was 211 (86.5%), followed by open burning 194 (79.5%), industries 162 (66.4%) and transportation 124 (50.8).

Local sources of haze

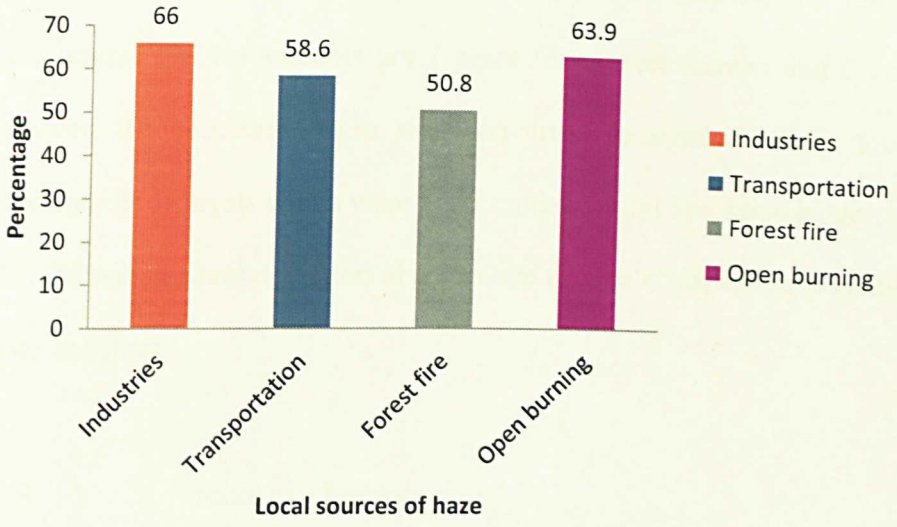

Figure 4.4: Local sources of haze

Figure 4.4 showed the local sources of haze. There were 161 (66%) of the respondents knew that industries was local sources of haze, followed by open burning 156 (63.9%). The rest answers were transportation 143 (58.6%) and forest fire 124 (50.8%).

4.3 Knowledge about haze

There were 15 questions being asked to know the respondents' knowledge about haze issues. The respondents got 1 point for correct answer and 0 point for wrong answer. The obtained score was converted in term of score level and categorized into three levels which were high, moderate and low knowledge. A mean score of 11.78 and standard deviation of 1.70 were used to classified respondents into three group as follow:

Good level : score of 13 or more

Moderate level : score between 11-12

Poor level : score of 10 or below

In order sum up the knowledge level of the respondents, the distributions of knowledge level were shown in Figure 4.5. Final year of medical students had good level of knowledge which was 59 (39.1%) compared to first year of medical students which was 29 (31.2%). For moderate level of knowledge, final year had 59 (39.1%) while first year had 40 (41.9%). There were 33 (21.9%) for final year students and 24 (26.9%) for first year students who had poor level of knowledge.

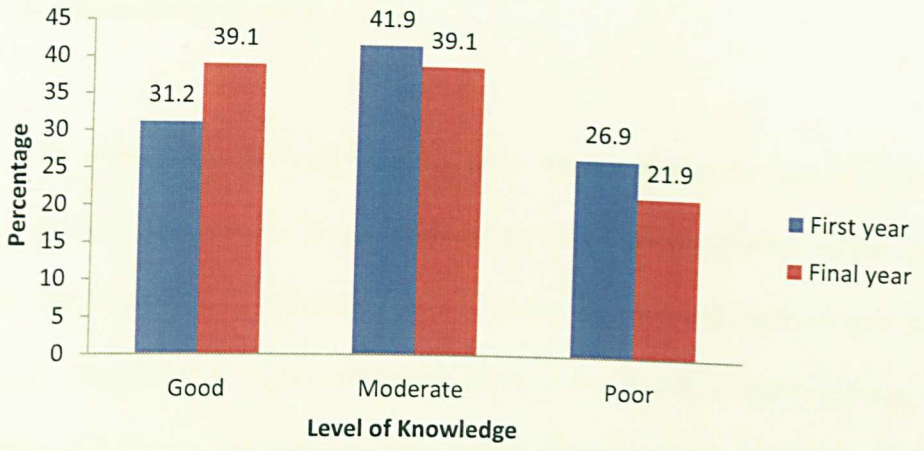

Figure 4.5: Level of Knowledge

Since haze was recurrent issues, the knowledge on haze was an important for the university students to have good practice during haze. Without appropriate knowledge, they might have tendency to adopt bad practice that could lead to increment of outpatient in the hospital due to haze-related disease such as asthma, cough, fever and others.

With the advanced technology, any information could be reached easily at the tip of their fingers in a single point of access. As the hazy situation occurred around the respondents, they might hear, know or read about this issue. However, due to limited information delivered to them especially from formal education, their knowledge on haze was slightly moderate. Many studies had shown that knowledge was a prerequisite for environmental behaviour, that influenced whether ecologically or environmentally responsible public behaviour (Ahmad *et al.*, 2010). By delivering knowledge to students, it was believed to enhance awareness and lead to positive attitudes towards environment (Arbaat *et al.*, 2009).

4.4 Attitude towards haze

To explore the attitude towards haze among first year and final year of medical students, there were 15 questions being asked about opinion either agree or not with the statements for attitude towards haze. The scoring method was used to classify the attitude level. The score was given 5 for strongly agree answer, 4 for agree answer, 3 for not sure answer, 2 for disagree answer and 1 for strongly disagree answer.

The score obtained was sum up and classified into three levels which were high, moderate and low level of attitude. A mean score of 60.81 and standard deviation of 6.91 were used to classified the subjects into three levels as follow:

Good level	: score of 67 or more
Moderate level	: score between 55-66
Poor level	: score of 54 or below

To sum up the attitude towards haze, the distributions were tabulated in Figure 4.6. Most of the respondents from first and final year of medical students had moderate attitude which were 54 (57%) and 97 (64.2%). Meanwhile, 21 (22.6%) and 38 (25.2%) from first and final year perceived good level of attitude. About 18 (20.4%) and 16 (10.6%) of the respondents from first and final year had poor level of attitude.

Figure 4.6: Level of Attitude

The attitude towards haze influenced the practice of the students during haze whether good or bad. Having good knowledge and attitude must come along to encourage people to apply good practice. It was revealed by a previous study that showed attitude towards the environment was influenced by their level of knowledge about the environment (Rosta *et al.*, 2011).

Attitude is a complex mental construct (perception) which emerges out of an integration of an individual's belief and values system (Boershing & de Young, 1993). Hence, it was quite challenging to ensure application of good attitude among the youth generation as their attitude already accumulated and formed throughout the upbringing process and the attitude involved what they believed about and what positive value they got by practicing good attitude during haze (Awang *et al.*, 2013).

4.5 Practice during haze

For practice during haze, there were 15 questions being asked to the respondents to know their practice during haze. The respondents got 1 scores for correct answer and 0 mark for wrong answer. The obtained practice score was converted in term of score level and classified into two groups which were good and bad practice. A mean score of 11.53 and standard deviation of 2.74 were used to classify the subjects into two groups as follow:

Good practice : score of 12 or more

Bad practice : score below 11

Figure 4.7 showed the distribution of level of practice among first and final year of medical students. Majority of the students for both groups had bad practice which were 64(68.8%) and 107 (70.9%). Meanwhile, there were 29 (31.2%) and 44 (29.1%) of the first and final year who applied good practice during haze.

Figure 4.7: Level of Practice

Practice was an indicator to know the successful or failure of any environmental programmes. If the person could apply good practice right after the end of the programmes, it showed that the programmes were effective and successful. But for the present study, majority of the students were categorized as bad practice. The result was similar to a study done by Wang *et al.* (2015), and come out with two possible reasons that contribute to low practice, which were the respondents could not answer the questions properly as the "practice" part was created at the end of the questionnaire, resulting in some missing value and the other reason was the lack of air pollution good self-protection guidance. Hence, the medical students were unaware about the most appropriate protective measure that they should apply.

4.6 Comparison of the Knowledge, Attitude and Practice of Haze Among First and Final Year of Medical Students

Table 4.2, 4.3 and 4.4 showed the difference in knowledge, attitude and practice' score between first and final year students.

The p-value of Kolmogorov-Smirnov (KS) for knowledge score was 0.000. It was not normally distributed, hence Mann-Whitney test was used. For the knowledge score, the mean rank of first year was 119.17, while the mean rank of final year was 124.55. Based on Mann-Whitney test, the Z statistics is -0.590 and *p* value is 0.555 which is >0.05. Therefore, null hypothesis was not rejected and the result was not significant. There was no significant difference of median knowledge between first and final year groups.

Table 4.2: Comparison of the knowledge about haze between first and final year of medical students

	Group	N	Median (IQR)	Mean rank	Z-statistics	p-value
Score knowledge	First year	93	12.00 (2)	119.17	-0.590	0.555
	Final year	151	12.00 (2)	124.55		

N=244, Mann-Whitney test

The curriculum structure for medical students was full with medical subjects and lack of environmental subject. For first year of medical students, they were not exposed yet with the environmental subject in their class schedule, hence they did not know deeply about environmental terms and facts. Meanwhile, for the final year of medical students, they had learnt the environmental subject during second year and already left the subjects for almost two years, so the chances for them to forget the content of the specific environmental terms were high. In addition, they already have many subjects to do revision and limited time to access to environment issues.

The skewness/standard error for knowledge score was -2.44. It was normally distributed, hence Independent T-test was used. The mean of attitude among final year students was higher compared to first year students. The 95% confident interval for mean difference was between -3.282 and 0.371. Based on Independent T-test, the T- statistics is -0.573 and *p* value is 0.118 which is >0.05. Therefore, null hypothesis was not rejected and the result was not significant. There was no significant difference of mean attitude between first and final year groups.

Table 4.3: Comparison of the attitude during haze between first and final year of medical students

	Group	N	Mean	SD	Mean difference (95%CI)	T-statistics	p-value
Score attitude	First year	93	60.02	7.475	-1.455 (3.282,0.371)	-1.573	0.118
	Final year	151	61.48	6.208			

N=244, Independent T-test

Better-educated individuals were more aware about air pollution, which meant they ensured themselves updated with the current issues (Wang *et al.*, 2015). However, due to lack of knowledge, the medical students from both groups tend to get poor attitude. In addition, they might focus on their examination only that held frequently in a month for the purpose to enhance their knowledge in medical field.

The p-value of Kolmogorov-Smirnov (KS) for practice score was 0.000. It was not normally distributed, hence Mann-Whitney test was used. For the practice score, the mean rank of first year was 126.61, while the mean rank of final year was 119.55. Based on Mann-Whitney test, the Z statistics is -0.720 and *p* value is 0.472 which is >0.05. Therefore, null hypothesis was not rejected and the result was not significant. There was no significant difference of median practice between first and final year groups.

Table 4.4: Comparison of the practice during haze between first and final year of medical students

	Group	N	Median (IQR)	Mean Rank	Z-statistics	p-value
Score practice	First year	93	12.00 (4)	126.61	-0.720	0.472
	Final year	151	12.00 (4)	119.55		

N=244, Mann-Whitney test

Even the medical students might know about haze-related diseases, but they did not put the knowledge into practice that could prevent the negative impacts on their health during haze. The first year of medical students spent most of their times in air-conditioned lecture hall listening to sharing session from the expertise in medical field while the final year of medical students spent most of their times doing practical in the hospital. A study indicated that Malaysian public were concerned about environment, but they did not turn them into practice (Haliza, 2011).

4.7 Association between Social Demographic with Students' Knowledge, Attitude and Practice

The association between social demographic (age, gender and race) with students' knowledge, attitude and practice were analysed by using Chi-square test and were tabulated in Table 4.5, 4.6, 4.7, 4.8, 4.9 and 4.10. The Chi-Square test was conducted to determine the relationship between two categorical variables. To determine the relationship between two variables, logistic regression was used.

There were no association between social demographic (age, gender and race) with the knowledge, attitude and practice among first and final year of medical students. The p-value for all selected variables was more than 0.05. There were no significant difference between social demographic with the knowledge, attitude and practice during haze among first and final year of medical students.

Table 4.5: Association between socio-demographic with knowledge among first year medical students

		Knowledge level, n(%)				
Age		**Good**	**Moderate**	**Low**	**X^2(df)**	**p-value**
	19	5(35.7)	7(50.0)	2(14.3)	5.366(4)	0.252
	20	18(26.5)	29(42.6)	21(30.9)		
	21	6(54.5)	4(36.4)	1(9.1)		
Gender						
	Male	13(32.5)	19(47.5)	8(20.0)	1.285(2)	0.526
	Female	16(30.2)	21(39.6)	16(30.2)		
Race						
	Malay	17(27.4)	29(46.8)	16(25.8)	5.422(6)	0.491
	Chinese	6(35.3)	5(29.4)	6(35.3)		
	Indian	5(41.7)	6(50.0)	1(8.3)		
	Others	1(50.0)	0(0.0)	1(50.0)		

N=93, Chi square test

Table 4.6: Association between socio-demographic with attitude among first year medical students

		Attitude level, n(%)				
Age		**Good**	**Moderate**	**Low**	**X^2**	**p-value**
	19	6(42.9)	4(28.6)	4(28.6)	8.990(4)	0.061
	20	15(22.1)	41(60.3)	12(17.6)		
	21	0(0.0)	9(81.8)	2(18.2)		
Gender						
	Male	9(22.5)	22(55.0)	9(22.5)	0.472(2)	0.790
	Female	12(22.6)	32(60.4)	9(17.0)		
Race						
	Malay	14(22.6)	33(53.2)	15(24.2)	11.173(6)	0.083
	Chinese	2(11.8)	13(76.5)	2(11.8)		
	Indian	3(25.0)	8(66.7)	1(8.3)		
	Others	2(100.0)	0(0.0)	0(0.0)		

N=93, Chi square test

Table 4.7: Association between socio-demographic with practice among first year medical students

		Practice level, n(%)			
		Good	**Bad**	**X^2**	**p-value**
Age					
	19	5(35.7)	9(64.3)	0.371	0.831
	20	20(29.4)	48(70.6)		
	21	4(36.4)	7(63.6)		
Gender					
	Male	14(35.0)	26(65.0)	0.477(1)	0.490
	Female	15(28.3)	38(71.7)		
Race					
	Malay	22(35.5)	40(64.5)	2.530(3)	0.470
	Chinese	3(17.6)	14(82.4)		
	Indian	3(25.0)	9(75.0)		
	Others	1(50.0)	1(50.0)		

N=93, Chi square test

Table 4.8: Association between socio-demographic with knowledge among final year medical students

		Knowledge level, n(%)				
		Good	**Moderate**	**Low**	**X^2(df)**	**p-value**
Age						
	23	13(37.1)	14(40.0)	8(22.9)	4.729(4)	0.316
	24	38(39.6)	34(35.4)	24(25.0)		
	25	8(40.0)	11(55.0)	1(5.0)		
Gender						
	Male	20(41.7)	18(37.5)	10(20.8)	0.199(2)	0.905
	Female	39(37.9)	41(39.8)	23(22.3)		
Race						
	Malay	41(40.2)	41(40.2)	20(19.6)	3.813(6)	0.702
	Chinese	13(33.3)	14(35.9)	12(30.8)		
	Indian	2(40.0)	2(40.0)	1(20.0)		
	Others	3(60.0)	2(40.0)	0(0.0)		

N=151, Chi square test

Table 4.9: Association between socio-demographic with attitude among final year medical students

		Attitude level, n(%)				
		Good	**Moderate**	**Low**	**X^2**	**p-value**
Age						
	23	9(25.7)	21(60.0)	5(14.3)	2.926(4)	0.570
	24	26(27.1)	60(62.5)	10(10.4)		
	25	3(15.0)	16(80.0)	1(5.0)		
Gender						
	Male	10(20.8)	34(70.8)	4(8.3)	1.341(2)	0.511
	Female	28(27.2)	63(61.2)	12(11.7)		
Race						
	Malay	26(25.5)	66(64.7)	10(9.8)	6.388(6)	0.381
	Chinese	11(28.2)	24(61.5)	4(10.3)		
	Indian	0(0.0)	3(60.0)	2(40.0)		
	Others	1(20.0)	4(80.0)	0(0.0)		

N=151, Chi square test

Table 4.10: Association between socio-demographic with practice among final year medical students

		Practice level, n(%)			
		Good	**Bad**	**X^2**	**p-value**
Age					
	23	11(31.4)	24(68.6)	2.232(2)	0.328
	24	30(31.3)	66(68.8)		
	25	3(15.0)	17(85.0)		
Gender					
	Male	19(39.6)	29(60.4)	3.718(1)	0.054
	Female	25(24.3)	107(70.9)		
Race					
	Malay	35(34.3)	67(65.7)	4.092(3)	0.252
	Chinese	7(17.9)	32(82.1)		
	Indian	1(20.0)	4(80.0)		
	Others	1(20.0)	4(80.0)		

N=151, Chi square test

From the findings, there were no significant difference between social demographic (age, gender and race) with the knowledge, attitude and practice among first and final year of medical students. It was similar with the previous study that showed no association between social demographic with students' knowledge, attitude and practice, but there were two factors that affecting the level of knowledge which were respondents' educational level and average annual household income (AAHI) (Wang *et al.*, 2015). Besides, a study by Afiff *et al.* (2016) also found there were no significant difference between sociodemographic factors and attitude.

However, this result was opposite with the finding obtained from study by Pretto *et al.* (2015). All these result may because inadequate environmental training programme held at the faculty especially during haze. The medical students also might not have time to join the environmental event as they had full schedule and examination. They also rarely exposed to outdoor activities as the final year students quite busy with their practical at the hospital whereas the first year students used most of their times to do revision because they must strengthened their theory about medical terms and facts before attending practical session. A study done by Pretto *et al.* (2015) showed that people who always expose to air pollution like duathletes were more knowledgeable than people who do not expose like shopping mall visitors.

The association between social demographic with students' knowledge, attitude and practice were further analysed by using Simple Logistic Regression test and were tabulated in Table 4.11. The test was used to obtain an equation to predict an outcome from one or more independent variables in order to test their relationship. From the findings, there were no factors associated with the attitude and practice on haze among first and final year of medical students. However, for knowledge, there was predictor associated with it for final year medical students, which was race. The p-value obtained was <0.001 for final year group. Malay and Chinese students were associated with knowledge level with odd ratio (OR) 5.22 and 2.98 respectively. It showed that Malay and Chinese students had better knowledge about haze compared to Indian and others.

Table 4.11: Logistic regression analysis for predictor of association between knowledge and race

Year	Variables		Odd Ratio (OR)	95% of Confidence Interval		p-value
				Lower	Upper	
Final year	**Race**	Malay	5.22	4.47	6.11	**<0.001***
		Chinese	2.98	2.39	3.70	**<0.001***
		Indian & Others	1.00	-	-	-

N=151, Simple logistic regression, *significant at p<0.05

1.00 as reference indicator

4.8 Association between Knowledge, Attitude and Practice during Haze

To analyse the association between knowledge and attitude on practice during haze, Chi-square test was used. The data obtained was tabulated in Table 4.12 and Table 4.13.

About 45 (78.9%) students had poor knowledge and poor practice during haze. Only 38 (43.2%) students had good knowledge and good practice during haze.

The Chi-square test obtained was 11.631 and the p-value of test was 0.003. Therefore, there was an association between knowledge and practice during haze.

Table 4.12: Association between knowledge and practice

Knowledge		Practice level				
		Count	Good	Poor	X^2	p-value
	Good	88	38 (43.2%)	50 (56.8%)	11.631	**0.003***
	Moderate	99	23 (23.2%)	76 (76.8%)		
	Poor	57	12 (21.1%)	45 (78.9%)		

N=244, Chi square test * significant at $p<0.05$

About 115 (76.2%) students had moderate attitude and poor practice during haze. Meanwhile, only 24 (42.4%) students who had good attitude and good practice. The Chi-square test obtained was 7.493 and the p-value of test was 0.024. Therefore, there was an association between attitude and practice during haze.

Table 4.13: Association between attitude and practice

Attitude		Practice level				
		Count	Good	Poor	X^2	p-value
	Good	59	25 (42.4%)	34 (57.6%)	7.493	**0.024***
	Moderate	151	36 (23.8%)	115 (76.2%)		

Poor	34	12 (35.3%)	22 (64.7%)

N=244, Chi square test * significant at $p<0.05$

Even the knowledge of health behaviour was useful, it did not automatically intent that this behaviour would be followed (Wang *et al.*, 2015). The finding of previous study showed that UKM students had high level of knowledge, awareness and attitude but low level of environmental practice (Arbaat *et al.*, 2011). In order to improve haze practice, the medical students should being told about the specific guidance on how to protect themselves during haze. In the meantime, the attitude of the student must be strengthened to increase their environmental awareness especially during haze and to influence them in practicing good practice.

4.9 Suggestion

The suggestion was proposed in Section D of the questionnaire distributed to first and final year medical students.

Question 1

In your opinion, what is the ways in which the government can help the public/private organisation adapt to haze problem?

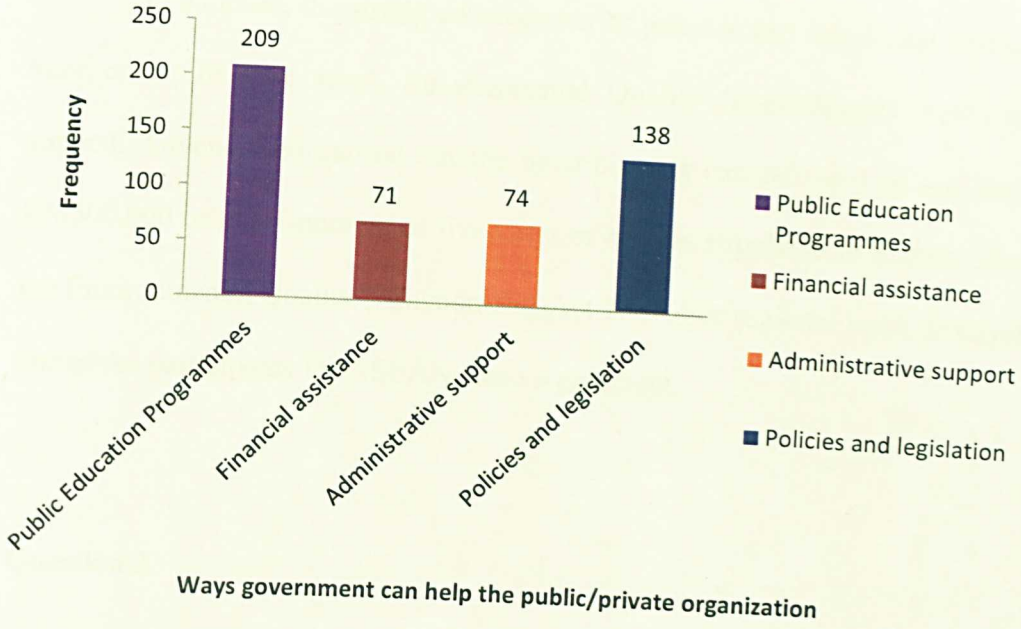

Figure 4.8: Ways government can help the public/private organization

Based on Figure 4.8, the 209 of the respondents chose public education programme as one of the ways in which government can help public/private organisation adapt to haze problem, followed by policies and legislation (138 respondents) and administrative support (74 respondents). The least choice was financial assistance (71 respondents).

From previous study, it was stated that formal education was the best method to deliver environmental information and promote the right environmental values in youth especially students (Rosta *et al.*, 2011). The youth generation will become the future leader for the nation. Hence, they must be well-prepared to face the challenges in environmental issues such as haze. Furthermore, the transboundary haze phenomenon involved other countries to deal with.

In addition, the strong enforcement of policies and legislation could reduce haze crisis. In state level, Environmental Quality (Amendment) Act 2001 was applied. Anyone who carried out the open burning can be fined of not more than RM500,000 or imprisonment of five years or both as stipulated in Section 29A(2) of the Environmental Quality (Amendment) Act 2001. For regional level, Malaysia was one of the participants for ASEAN Haze Agreement.

Question 2

In your opinion, what are the requirements for improving public/private sectors' ability to participate in haze adaptation/mitigation activities?

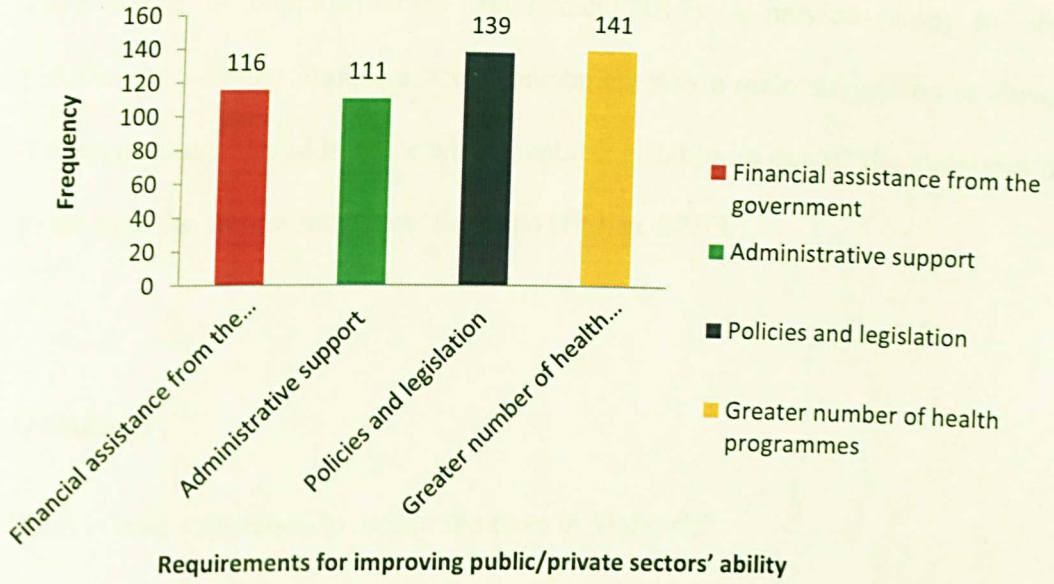

Figure 4.9: Requirements for improving public/private sectors' ability

Figure 4.9 showed the frequency of requirements for improving public/private sectors' ability to participate in haze adaptation/mitigation activities. Majority of the students chose greater number of health programmes with 141 respondents, followed by policies and legislation with 139 respondents and financial assistance from the government with 116 respondents. The least preference answer was administrative support, in which 111 respondents chose it.

With greater number of health programmes, the knowledge of the individuals also will be increased. Then, high level of knowledge will create positive attitude towards environment (Rosta *et al.*, 2011). The enforcement of policies and legislation also played important role in haze adaptation/mitigation activities. By enforcing strict laws and policies, it was one of methods that develop cost effectiveness of implementation (Suchindah, 2015). A previous study by Haliza (2010a) showed that impose a strict punishment was a main suggestion to conserve the environment. In addition, environmental legislation is one of the strategies used to manage the environment long time ago (Haliza, 2010b).

Question 3

What is your suggestion to reduce the haze in Malaysia?

About 55 students suggested that reduce open burning as one of the ways to reduce haze. Law enforcement and health awareness also were suggested by them with frequency of 44 and 24 respondents respectively. Other ways to reduce haze were

using public transport, carpool, cloud seeding, reduce industrialisation, attitude of civilliants, better technologies, conserve forest and political involvement. The suggestion to reduce haze was tabulated in Table 4.15.

Table 4.15: Suggestion to reduce haze.

Suggestion	Frequency (N)	Percent (%)
Attitude of civilliants	1	0.4
Better technologies	1	0.4
Carpool	5	2.0
Cloud seeding	2	0.8
Conserve forest	2	0.8
Health awareness	24	9.8
Law enforcement	44	18.0
Political involvement	1	0.4
Public transport	13	5.3
Reduce industrialisation	7	2.8
Reduce open burning	55	22.5
Summont or compensation	1	0.4

To control the haze, the sources that contributed to haze must be identified. By eliminating the sources of haze, it will definitely could reduce the haze episode. Since the open burning was one of the sources of haze, the respondents' suggestion to reduce the open burning was the right decision. People would behave if they were blackmailed with fine or summon for wrong doing. So, law enforcement was

appropriate way to reduce haze in Malaysia. The pollutants such as carbon monoxide, sulphur dioxide, carbon dioxide and particulate matter were released. Afroz *et al.*(2003) stated that motor vehicles were the main source that contribute to air pollution in Klang Valley. So, the suggestion to reduce haze due to these sources were using public transport and practicing carpool. Health education such as organizing health awareness campaign, distributing health brochure and advertisement, were believed could reduce haze. Other way suggested was reducing industrialisation. From survey conducted by previous study, 47.5% of the respondents agreed that industries and developers were the main contributors in destructing the environment (Haliza, 2011).

Question 4

Do you think the environmental health course should be taught to all university students regarding mitigation and strategy to tackle haze issue?

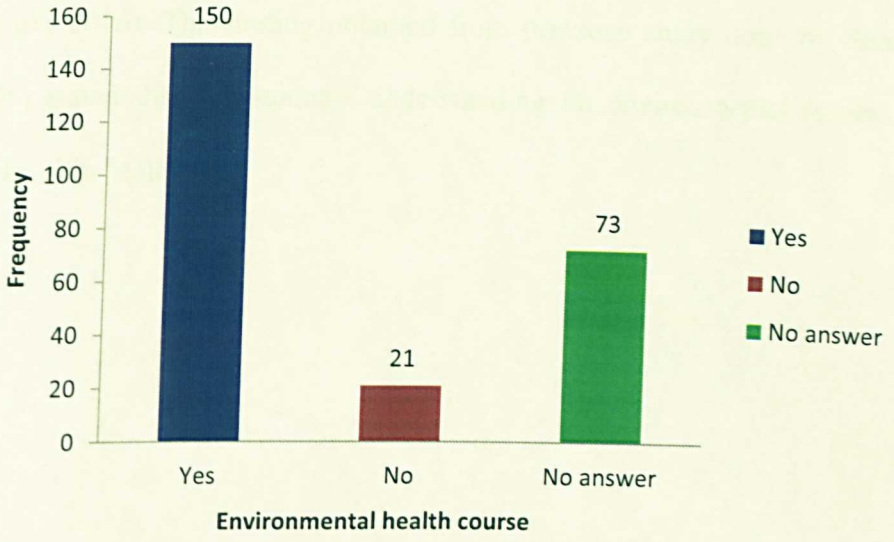

Figure 4.10: Environmental health course should be taught to all university students

From Figure 4.10, about 150 of the students agreed that environmental health course should be taught to all university students and 21 respondents did not agree.

From the result obtained, the level of knowledge and attitude were moderate while the level of practice of the first and final year of medical students was poor. Hence, they were highly recommended to take environmental health course. The courses also should be taught to other university students. Education is the least expensive and most effective way to deliver information regarding environmental issues as they could save and mitigate themselves safely (Haliza, 2014). To create effective environmental education system, more investment on the teachers that teach related topics should be done as they play important role in creating awareness among the students (Aminrad *et al.*, 2012). The fully involvement of the teachers on environment issues should be applied as a study reported that they had fair knowledge but the practice on environmental practices did correspond with it (Mat Said *et al.*, 2016). The finding obtained from previous study done by Sharifah *et al.*,(2005) stated that the students understanding on environmental issues was in surface level in Malaysia.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS FOR FUTURE RESEARCH

5.1 CONCLUSION

The present study showed that the medical students have moderate level of knowledge and attitude during haze. However, the level of practice was poor. They considered television as their source of information. However, limited specific terms or facts that they could get because these kinds of information were available in Internet or any formal environmental education.

When comparing the level of knowledge, attitude and practice on haze among first and final year of medical students, there were no significant difference between them. This result revealed that it was important to provide formal environmental education and environmental protection campaign to improve awareness linked to air quality especially haze among the medical students.

In applying good practice, it must be supported by having good knowledge and attitude. The finding of this study showed that there were association between knowledge - practice and attitude – practice.

Haze was recurrent issues that affect the human health and disturb the ecosystem in the environment. It was an important issue that everyone should know and kept updated as the information could be easily accessed. Atmospheric pollutants were hard to control as they dispersed in the atmosphere. Improving the quality of air was the responsibility of all people, not only the government. The government and citizens should cooperate to combat this issue effectively as it currently being recognised as serious problem.

5.2 RECOMMENDATIONS

Based on this research, there were few suggestions made to increase environmental knowledge among the medical students. The medical students were recommended to take environmental subject in their schedule as they had moderate level of knowledge, attitude and poor practice. They should be exposed to scientific terms and facts in environment just like how deeply they learnt medical subjects. The schedule should be restructured to determine the suitability of time and syllabus that should be taught to them. The lecturers that will teach them must come from environmental background as they more experts in this field.

The media should advertise more beneficial information especially during haze crisis to encourage the public to adapt good practice and take good care of their health as the vulnerable people easily affected by the pollutants. The artist or any influential people may involve in the advertisement to make it interesting and influence the public to learn or get some inputs from it.

Environmental programmes should be held at the faculty that required the involvement of the medical students. Hence, there were no more excuses for them to not attend the environmental programmes. Their roles as doctors not limited to treat the patients only, but they must advise the patients to engage with positive attitude and good practice as the environment and health were interrelated. The air pollution

especially during haze created various haze-related diseases that decrease the productivity of the individuals.

To improve this research in the future, this study was recommended to be assessed among medical and health sciences students or science and non-science students. Besides, more participants should be involved in this study. Further extensive studies that explored about the reasons for having environmental education among the medical students were also highly recommended because formal education was the best method to share information and encourage people to apply good practice during haze crisis in the future.

ACKNOWLEDGMENT

I would like to express my sincere gratitude to all respondents from first and final year of medical students, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia who had participated in this study.

REFERENCES

Abas, M. R., Oros, D. R., & Simoneit, B. R. T. (2004a). Biomass burning as the main source of organic aerosol particulate matter in Malaysia during haze episodes. *Chemosphere*, *55*(8): 1089–1095.

Abas, M. R., Rahman, N., Omar, N. Y., Maah, M. J., Samah, A. A., Oros, D. R., Otto, A. & Simoneit, B. R. (2004b). Organic composition of aerosol particulate matter during a haze episode in Kuala Lumpur, Malaysia. *Atmospheric Environment*, *38*(25): 4223–4241.

Abdullah, N.S., Kamarudin, L.M., Zakaria, A. & Md Shakaff, A.Y. (2016). Impact of Haze on Air Quality: So2 and No2 Levels During 2015 Malaysian Haze Episode.Unpublished paper presented at International Conference on Environmental and Occupational Health 2016, 1-6.

Afiff, K., Dharchaini, K., Huda, B.Z & Hayati. (2016). Knowledge and Attitude on Prevention of Occupational Hazards among Medical Students in a Public University, Malaysia. Unpublished paper presented at International Conference on Environmental and Occupational Health 2016, 1-6

Afroz, R., Mohd Nasir, H. & Noor Akma, I. (2003).Review of air pollution and health impacts in Malaysia. *Environmental Research,* 92: 71-77.

Afzali, A., Afzali, M., Rashid, M., Sabariah, B. & Faghihi-Zarandi, A. (2016). Prediction of Ozone Concentration Based on Temperature in an Urban Area Using Artificial Neural Network Approach. Unpublished paper presented at International Conference on Environmental and Occupational Health 2016, 1-9.

Ahmad Jamhari, A.,Mazrura, S.,Latip. M.T. *et al.*, (2004). Concentration and Source Identification of Polycyclic Aromatic Hydrocarbons (Pahs) in PM10 of Urban Industrial and Semi-Urban Areas in Malaysia. *Elsevier,* 86: 16-27.

Ahmad, J., Noor, S. M., & Ismail, N. (2015). Investigating Students' Environmental Knowledge, Attitude, Practice and Communication. *Asian Social Science*, 11(16): 284-293.

Ahmad, S. N. B., Juhdi, N., & Shaikh Awadz, A. (2010). Examination of Environmental Knowledge and Perceived Pro- Environmental Behavior among Students of University Tun Abdul Razak, Malaysia. *International Journal of Multidisciplinary Thought*, 1(1): 328–342.

Ajit, P.S. & Robert, S.C. (2011). Knowledge, Attitude and Practice on Disposal of Sharp Waste, used for Home Management of Type-2 Diebetes Mellitus in New Delhi, India. *J Health Res*, 25: 135-140.

Aminrad, Z., Sayed Zakariya, S.Z., Hadi, A.S. & Sakari, M. (2012). Environmental Education in Malaysia, Progresses and Challenges Ahead (Review). *Life Science Journal*, 9(2): 1149-1154.

Arbaat, H., Norshariani, A.R. & Sharifah Intan Sharina, S.Y. (2011). The Level Of Environmental Knowledge, Awareness, Attitudes and Practices among Ukm Students, presented at 3rd Regional Conference on Engineering Education, Sarawak, 2010.Johor Bahru, JB: Centre for Engineering Education.

Awang, T. B., Salleh, H. H., & Jusang, B. R. (2013). Exploring the Levels of Knowledge , Attitudes and Environment- Friendly Practices Among Young Civil Servants in Malaysia. *Social Sciences & Humanities*, 21: 21–38.

Azizan A.S. (2008). Kita Hanya Menumpang. Pemanasan Global. *Estidotmy*, 76: 16-17.

Behera, J. & Samal, R. M. (2015). Environmental Knowledge of Secondary School Students : A Topographical Analysis. *International Journal of Social Science and Humanities Research*, 3(2): 252–261.

Bernama. (2012, May 14). Youths Have a Big Role in Determining Nation's Future-Najib. Bernama.

Bertha, R., Behera, S.N. & Balasubramanian, R.(2014). 2013 Southeast Asian Smoke Haze: Frac_15tionation of Particulate-Bound Elements and Associated Health Risk. *Environ. Sci. Technol.*, 48: 4327-4335.

Boershing, S. and de Young, R. (1993). Evaluation of between Advocate Environmental Preservation and of Selected Recycling Curricular: Educating The Green Local Environmental Protection should be Further Citizen. *J. Environmental Education*, 18(3): 7-13.

Borneo Post (2015) 328 Haze Hotspot Detected in Sumatra. Retrieved from http://www.theborneopost.com/2015/09/12/328-haze-hotspots-detected-in-sumatra/. [Accessed on 30 October 2015].

Brook, R.D., Franklin, B., Cascio, W., Hong, Y., Howard, G., Lipsett, M., Leupker, R., Mittleman, M., Samet, J., Smith, S.C. & Tager, I. (2004). Air Pollution and Cardiovascular Disease: A Statement for Healthcare Professionals From the Expert Panel on Population and Prevention Science of the American Heart Association. *American Heart Association, Inc.*, 1: 2656-2671.

Channel Asia (2015): Nearly 1,000 Hotspots Detected in Sumatra as Haze Thickens. Retrieved from http://www.channelnewsasia.com/news/asiapacific/nearly-1-000-hotspots/ 2125114.html [Accessed on 30 October 2015].

Chen, Y., Ebenstein, A., Greenstone, M. & Li, H. (2013). Evidence on the Impact of Sustained Exposure to Air Pollution on Life Expectancy from China 's Huai River Policy. *Massachusetts Institute of Technology Department of Economics Working Paper Series*, 13(15): 1–53.

Choo, C. P., Juliana, J., Hamedon, T. R., & Adam, N. M. (2015). Preschools' Indoor Air Quality and Respiratory Health Symptoms among Preschoolers in Selangor. *Procedia Environmental Sciences*, 30: 303–308.

Daly, A., & Zannetti, P. (2007). An Introduction to Air Pollution – Definitions, Classifications and History. *Science And Technology*, 1: 1–14.

Davidson, K., Deck, L. & Houle, C. (2001). Assessing Public Opinions on Visibility Impairment due to Air Pollution: Summary Report. Abt Associates Inc. Retrieved from https://www.google.com/search?sclient=psyab&biw=1517&bih=741&noj=1&q=Assessing+Public+Opinions+on+Visibility+Impairment+due+to+Air+Pollution%3A+Summary+Report

Department of Environment Malaysia (DOE). (2016a). Haze Air Pollution Phenomena . Retrieved from: http://www.doe.gov.my/portalv1/info-umum/jerebu-fenomena-pencemaan-udara/128 [Accessed on May 2016].

Department of Environment Malaysia (DOE). (2016b). Chronology-of-Haze-Episodes-in-Malaysia. Retrieved from: http://www.doe.gov.my/portalv1/wp-content/uploads/2015/09/Chronology-of-Haze-Episodes-in-Malaysia. [Accessed on December 2015].

Department of Statistics Malaysia. (2011). Population Distribution and Basic Demographic Characteristic Report 2010. Retrieved from https://www.statistics.gov.my/index.php [Accessed on Februari 2016].

Dictionary.com. (2015). Retrieved from https://www.google.com/webhp?sourceid=chromeinstant&ion=1&espv=2&ie=UTF-8#q=practice+definition [Accessed on November 2015].

Dominick, D., Latif, M.T., Juahir, H., Aris, A.Z. & M.Zain, S. (2012). An Assessment of Influence of Meteorological Factors on PM_{10} and NO_2 at Selected Stations in Malaysia. *Sustain. Environ. Res.*, 22(5): 305-315.

Duque, L., Relvas, H., Silveira, C., Ferreira, J., Monteiro, A., Gama, C., Rafael, S., Freitas, S., Borrego, C. & Miranda, A. I. (2016). Evaluating Strategies to Reduce Urban Air Pollution. *Atmospheric Environment*, 127(2): 196–204.

DW (2015) Haze Affecting Thai Tourism Industry. Retrieved from http://www.dw.com/en/haze-affecting-thai-tourism-industry/a-18801663. [Accessed on 31 October 2015]

Enger, E. D., & Smith, B. F. (2000). Environmental Science: A Study of Interrelationships (7th ed.). Boston, Mass: *McGraw-Hill.*

Faculty of Medicine and Health Science UPM Serdang. (2015). Retrieved from https://www.google.com/search?q=daerah+selangor/@https://www.google.com/maps/place/Faculty+of+Medicine+and+Health+Science/. (Accessed on November 2015)

Foo, K. Y. (2013). A Vision on the Role of Environmental Higher Education Contributing to the Sustainable Development in Malaysia. *Journal of Cleaner Production*, 61: 6–12.

Forsyth, T. (2014). Public Concerns about Transboundary Haze: A Comparison of Indonesia, Singapore, and Malaysia. *Global Environmental Change*, *25*(1): 76–86.

Fujii, Y., Sohno, S., Amil, N., Latif, M.T., Oda, M., Matsumoto, J. & Mizohata, A. (2015). Annual Variations of Carbonaceous $PM_{2.5}$ in Malaysia: Influenced by Indonesian Peatland Fires. *Atmos. Chem. Phys.*, 15: 13319–13329.

Ghazali, N.A., Ramli, N.A., Yahaya, A.S., Md Yusof, N.F.F., Sansuddin, N. & Al Madhoun, W.A. (2010). Transformation of Nitrogen Dioxide into Ozone and Prediction of Ozone Concentrations Using Multiple Linear Regression Techniques. *Environ. Monit. Assess.*, 165(1-4): 475-489.

Gill, A., & Bin, T. S. (2013). Transboundary Haze: How Might The Singapore Government Minimise Its Occurrence? *The. LKY School of Public Policy*, 1: 1–15.

Grieshop, A. P. (2013). Motor Vehicle Contributions to Urban Air Pollution : Emission Measurements to Inform Effective Policy. *Proceedings of the U.S.-Iran Symposium on Air Pollution in Megacities*, 2: 76–86.

Haliza, A.R. (2010a). Indigenous Community Involvement in Environmental Issues: The Case of the Mah Meri Tribe Of Pulau Carey, Kuala Langat, Selangor. *Kemanusiaan*, 17: 111-134.

Haliza, A.R. (2010b). Human Rights to Environment in Malaysia. *Health and the Environment Journal*, 1(1): 59-64.

Haliza, A.R. (2011). Public Involvemnet on Environmental Issues in Malaysia with Reference to Alor Star, Kedah. *International Proceedings of Chemical, Biological and Environmental Engineering*, 16: 90-93.

Haliza, A.R. (2013). Haze Phenomenon in Malaysia : Domestic or Transboudry Factor ? *International Jurnal of Chemical, Environment and Biological Sciences*. 1(4): 597–599.

Haliza, A.R. (2014). An Overview of Environmental Disaster in Malaysia and Preparedness Strategies. *Iranian J Publ Health*, 43(3): 17-24.

Haze Annual Hotspots. (2015). Retrieved from http://asmc.asean.org/asmc-haze-hotspot-annual#Hotspot (Accessed on Dec 2015)

Haze Monthly Hotspots. (2015). Retrieved from http://asmc.asean.org/asmc-haze-hotspot-monthly#Hotspot (Accessed on Dec 2015)

Heriyanto, E., Syaufina, L., & Sobri, M. (2015). Forecasting Simulation of Smoke Dispersion from Forest and Land Fires in Indonesia, 24: 111–119.

Ho, R. C., Zhang, M. W., Ho, C. S., Pan, F., Lu, Y., & Sharma, V. K. (2014). Impact Of 2013 South Asian Haze Crisis: Study of Physical and Psychological Symptoms and Perceived Dangerousness of Pollution Level. *BMC Psychiatry*, 14(81): 1-8.

Hyslop, N. P. (2009). Impaired Visibility: The Air Pollution People See. *Atmospheric Environment*, *43*(1): 182–195.

Jamal, O., Mazrura, S., Mastura, M. & Md Khadzir, S.A. (2014). Transboundary Smoke Haze Pollution in Malaysia: Inpatient Health Impacts and Economic Evaluation. *Environmental Pollution*, 189: 194-201.

Juneng, L., Latif, M.T., Tangang, F. (2011). Factors Influencing the Variations of PM_{10} Aerosol Dust in Klang Valley, Malaysia during the Summer. *Atmos Environ.*, 45(26): 4370–4378.

Kai, L. U., Yu, Q. I. N., Xue, H. E. G., & Gao, G. F. (2013). The Impact of Haze Weather on Health : A view to Future. *Biomed Environ Sci.*, 26(12): 945–946.

Kaliyaperumal, K. (2004). Guideline for Conducting a Knowledge, Attitude and Practice (KAP) Study. *AECS Illumination*, 4(1): 7–9.

Kavitha, M., Jalaludin, J., Abdah Md, A., Zarida, H., Shamsul, B. M., & Syazwan, A. L. (2010). Human Sputum Interleukim-6 by Exposure to PM10 among Bus Drivers in Klang Valley. *Journal of Appliedd Sicences*, 10(4): 269–276.

Kavitha, M., Juliana, J., & Ma, A. (2011). Relationship Between Exposure To Particulate Matter And Biomarkers Among Bus Drivers In Klang Valley, Malaysia. *Health and the Environment Journal*, 2(2): 1–7.

Kay,. L.K (2006). The Haze and Health: A Blog about the Fog. *Annals Academy of Medicine*, 35(12): 909-910

Keywood, M.D., Ayers, G.P., Gras, J.L., Boers, R. & Leong, C.P. (2003). Haze in the Klang Valley of Malaysia. *Atmospheric Chemistry and Physics*. 3: 591-605.

Khan, M. F., Latif, M. T., Saw, W. H., Amil, N., Nadzir, M. S. M., Mazrura, S., Tahir, N.M. & Chung, J. X. (2015). Fine Particulate Matter Associated with Monsoonal Effect and the Responses of Biomass Fire Hotspots in the Tropical Environment. *Atmospheric Chemistry and Physics Discussions*, 15(16): 22215-22261.

Khee, A., & Tan, J. (2015). The " Haze " Crisis in Southeast Asia : Assessing Singapore's Transboundary Haze Pollution Act 2014. *National University of Singapore*, 1: 1–44.

Khoo, K. L. (2006). The Haze and Health : A Blog About the Fog. *Annals Academy of Medicine*, 35(12): 909–910.

Mabahwi, N. A. B., Leh, O. L. H., & Omar, D. (2014). Human Health and Wellbeing: Human Health Effect of Air Pollution. *Procedia - Social and Behavioral Sciences*, 153: 221–229.

Mat Said, A., Ahmadun, F., Hj. Paim, L. & Masud, J. (2016). Environmental Concerns, Knowledge and Practices Gap among Malaysian Teachers. *International Journal of Sustainability in Higher Education*, 4(4): 305 – 313.

Mazrura, S., Nurul Asyikin, Z., Wan Rozita, W.M., Mohd Talib, L., Rozita, H., Md Firoz, K., Norhayati, M.T. & Chan, C. (2014). A Case-Crossover Analysis Of Forest FiRe Haze Events and Mortality in Malaysia. *Atmospheric Environment*, 96: 257–265.

MOE.(2015a). Information on the Haze Issue in Schools. Retrieved from http://www.moe.gov.my/en/kenyataan-media-view?id=5030 [Accessed on 5 May 2016].

MOE.(2015b). Information on the Haze Issue in Schools. Retrieved from http://www.moe.gov.my/en/kenyataan-media-view?id=5032 [Accessed on 5 May 2016].

MMS. (1995). Report on Air Quality in Malaysia as Monitored by the Malaysian Meteorological Service 1994. Technical Note No. 55, Malaysian Meteorological Service. Jalan Sultan, 46667 Petaling Jaya, Selangor, Malaysia.

Mott, J.A., Mannino, D.M., Alverson, C.J., Kiyu, A., Hashim, J., Lee, T., Falter, K. & Redd, S.C. (2005). Cardiorespiratory Hospitalizations Associated with Smoke Exposure during the 1997 Southeast Asian Forest Fires. *International Journal of Hygiene and Environmental Health*, 208: 75-85.

National Environmental Agency. (2014). PSI (With effect from 1 April 2014). Retrieved from http://www.nea.gov.sg/anti-pollution-radiation-protection/air-pollution-control/psi/psi [Accessed on January 2016].

Nur Atiqah, Y. (2015) Knowledge, Attitude and Practice towards Recycling Activity Among Secondary School Students at Hulu Langat, Selangor, Malaysia. Unpublished degree's thesis for Bachelor of Science of Environmental and Occupational Health, Universiti Putra Malaysia.

New Straits Times (2015, Oct 4). No Lectures in Uitm Selangor Campuses on Monday. Retrieved from http://www.nst.com.my/news/2015/10/no-lectures-uitm-selangor-campuses-monday [Accessed on March 13 2015].

Odihi, J.O.(2003).Haze in Southeast Asia: Needed Local Actions for a Regional Problem. *Pure and Applied Geophysics*, 160: 205-220.

Palanissamy, A. (2013). Haze Free Air in Singapore and Malaysia – The Spirit of the Law in South East Asia. *International Journal of Education and Research, 1*(8): 1–8.

Pentamwa, P. & Oanh, N. T. K. (2008). Air Quality in Southern Thailand during Haze Episode in Relation to Air Mass Trajectory. *Songklanakarin Journal of Science and Technology, 30*(4): 539–546.

Pollution Control Department (PCD). (2005). Haze Transboundary Pollution. Retrieved from PCD Website: http://www.pcd.go.th/info_serv/air_haze [Accessed on January 2016].

Pretto, L.D., Acreman, S., Ashfold, M.J., Mohamkumar, S.K. & Campos-Arceiz, A. (2015). The Link between Knowledge, Attitudes and Practices in Relation to Atmospheric Haze Pollution in Peninsular Malaysia. *Plos One*. (Dec 8): 1-11.

Qadri, S.T. (2001). Fire, Smoke, and Haze: The ASEAN Response Strategy. Asian Development Bank, Philippines.

Raub, J. A. & Benignus, V. A. (2002). Carbon Monoxide and the Nervous System. *Neuroscience and Biobehavioral Reviews*, *26*(8): 925–940.

Robert, S.L., Craun, C., Robinson, M. & Phaneuf, M. (2009). Evaluating The Impacts of Haze on Air Traffic Operations. *AvMet Application Inc.*(Jun 27): 1-19

Rosta, H., Hock, L.K. & Fadhilah, O. (2011). Environmental Knowledge and Attitude among Student in Sabah. *World Applied Science Journal*, 14: 83–87.

Sammut, G. (2013). Measuring Attitudes and Points of View : Social Judgment of Proposals for the Revision of Student Stipends in Higher Education, *Psychology & Society*, *5*(1): 54–66.

Schauer, J. (2013). Strategies to Understand the Sources of Fine Particulate Matter in Polluted Urban Areas. *Proceedings of the U.S.-Iran Symposium on Air Pollution in Megacities*, 2: 35–39.

Soleiman, A., Othman, M., Samah, A. A., Sulaiman, N. M., & Radojevic, M. (2003). The Occurrence of Haze in Malaysia: A Case Study in an Urban Industrial Area. *Pure and Applied Geophysics*, 160: 221–238.

Sharifah A., Paim, H.L. & Yahaya, N. (2005). Towards Sustainable Consumption: An Examination of Environmental Knowledge among Malaysians. *International Journal of Consumer Studies*, 29(5): 426-436.

Suchindah, A. (2015). Transboundary Haze Pollution Problem in Southeast Asia: Reframing ASEAN's Response. *ERIA Discussion Paper Series*, 82: 1-21.

Sun, Y., Zhuang, G. & Tang, A. (2006). A Chemical Characteristics of PM2.5 and PM10 in Haze-fog Episodes in Beijing. *Environ. Sci. Technol.*, 40: 3148–3155

Tacconi, L., Jotzo, F., & Grafton, R. Q. (2008). Local Causes, Regional Co-Operation and Global Financing for Environmental Problems: The Case of Southeast Asian Haze Pollution. *International Environmental Agreements: Politics, Law and Economics*, 8(1): 1–16.

Tangang, F. ., Juneng, L., Salimun, E., Sei, K. M., Le, L. J., & Muhamad, H. (2012). Climate Change and Variability over Malaysia: Gaps in Science and Research Information. *Sains Malaysiana*, 41(11): 1355–1366.

Tao, Y., Zhong, L., Huang, X., Lu, S., Li, Y., Dai, L., Zhua, T. & Huang, W. (2011). Acute Mortality Effects of Carbon Monoxide in the Pearl River Delta of China. *Science of the Total Environment.*, 41: 34-40.

UKM News. (2015). UKM Consultants Revised Method of Air Quality. Retrieved from http://www.ukm.my/news/Latest_News/ukm-pakarunding-kajli-semula-cara-nilai-kualiti-udara/.[Accessed on 27 April 2016].

University Health Centre UPM (2015). Statistics of Haze-Related Diseases from August to October 2015. Universiti Putra Malaysia, 43400 Serdang, Selangor.

Wan Mahiyuddin, W. R., Mazrura, S., Aripin, R., Latif, M. T., Thach, T. Q. & Wong, C. M. (2013). Short-term Effects of Daily Air Pollution on Mortality. *Atmospheric Environment*, 65: 69–79.

Wang, R., Yang, Y., Chen, R., Kan, H. & Wu, J. (2015). Knowledge, Attitudes, and Practices (KAP) of the Relationship between Air Pollution and Children's Respiratory Health in Shanghai, China. *International Journal of Environmental Research and Public Health*, *12*(2): 1834–1848.

Xiao, Z. M., Zhang, Y. F., Hong, S. M., Bi, X. H., Jiao, L., Feng, Y. C. & Wang, Y. Q. (2011). Estimation of the Main Factors Influencing Haze, Based on a Long-Term Monitoring Campaign in Hangzhou, China. *Aerosol and Air Quality Research*, 11(7): 873–882.

Youthpolicy.org. (2014). Definition of Youth. Retrieved from http://www.youthpolicy.org/factsheets/country/malaysia/[Accessed on April 2016].

Zhai, Y. & Ji, D. (2015). Single Image Dehazing for Visibility Improvement. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XL-1/W4: 355–360.

JAWATANKUASA ETIKA UNIVERSITI UNTUK PENYELIDIKAN MELIBATKAN MANUSIA (JKEUPM)

UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR, MALAYSIA

FORM B1: RESPONDENT'S INFORMATION SHEET AND CONSENT

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

1. STUDY TITLE :

Comparison of Knowledge, Attitude And Practice on Haze Among First and Final Year Medical Students in Universiti Putra Malaysia, Serdang

2. INTRODUCTION:

In Malaysia, haze phenomenon is not a new issue. It had occurred several years back and getting worse until now. Previously, haze had occurred in 1982-83, 1987, 1994, 1997-98, 2002, 2004, 2005, 2006, 2009, 2013 and now in 2015. Haze is one of examples of atmospheric pollution. It is defined as an atmospheric phenomenon where pollutant particles particulate in the air and obscure the normal clarity of the sky (Kay, 2006). The haze affects several countries including Indonesia, Malaysia, Brunei, Singapore and Southern Thailand. Haze commonly occurred in the month of January to February and July to August. Most of the haze episode occurred in conjunction with period of prolonged drought associated with the El Nino phenomenon (Fredolin Tangang et al., 2009).

This study is conducted to study the knowledge, attitude and practice on haze among medical students in UPM. In addition, this study was conducted to increase awareness among medical students regarding the impacts of haze to human health and the environment..

3. WHAT WILL YOU HAVE TO DO?

You will be given and asked to answer a set of questionnaire. You are needed to sign a consent form (respondent) to indicate your interest in this study. Besides that, you need to return the consent form to the investigator when answering the questionnaire.

4. WHO SHOULD NOT PARTICIPATE IN THE STUDY?

All lecturers and supporting staffs who work at Faculty of Medicine and Health Sciences should not participate in this study.

9. CONSENT

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

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

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

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

* delete where necessary

Signature .....
(Respondent)

Date :.....

Signature .....
(Witness)

Name :.....

I/C No. :.....

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

Date .....

Signature .....
(Researcher)

UNIVERSITI PUTRA MALAYSIA

COMPARISON OF KNOWLEDGE, ATTITUDE AND PRACTICE ON HAZE AMONG FIRST AND FINAL YEAR MEDICAL STUDENTS IN UNIVERSITI PUTRA MALAYSIA, SERDANG

The purpose of this survey is to get opinion from you regarding knowledge, attitude and practice during haze among medical students. All information given will be processed using the computer and will be kept confidential. The individual answer will not be presented in any presentation. Hence, I would like to ask you to fill in this questionnaire honestly and correctly. Your cooperation is highly cooperated.

I have read the introduction of this questionnaire form and agree to answer according to the terms and conditions.	**Yes / No**

Signature :

Date :

.....

Matric number : .....

Confidential

The information given is for the research purpose only and will be kept confidential.
Instruction: Please answer all of the questions below and tick (/) in the given boxes.

A. RESPONDENT INFORMATION

1. Age: _____
2. Gender:

   Male ☐ Female ☐
3. Race:

   Malay ☐ Chinese ☐ Indian ☐ Others ☐
4. Year of study:

   First year ☐ Final year ☐

B.GENERAL QUESTIONS

1. Have you heard about the terms of "haze"?

   Yes ☐ No ☐
2. Do you notice about haze phenomenon occurred in Malaysia

   Yes ☐ No ☐
3. Where do you get information regarding haze phenomenon?

   Television ☐

   Radio ☐

   Internet ☐

   Friend ☐

   Lecturer ☐

   Others: state .....
4. Do you know about the reading of Air Pollution Index (API)?

   Yes ☐ No ☐
5. Do you know about the components of air pollutants in haze?

   Yes ☐ No ☐
6. If yes, please tick which are the components of haze. (can choose more than 1 answer)

   Particulate matter ☐ Sulphur dioxide ☐ Nitrogen dioxide ☐

   Carbon dioxide ☐ Ozone ☐ Carbon monoxide ☐

7. Is El Nino phenomenon making the haze in Malaysia become worsening?

   Yes ☐ No ☐

8. Is the N95 mask an adequate protection against haze?

9. Yes ☐ No ☐

10. What is the regional sources that contribute to haze? (can choose more than 1 answer)

    Industries ☐ Transportation ☐ Forest fire ☐ Open burning ☐

11. What is local sources that contribute to haze? (can choose more than 1 answer)

    Industries ☐ Transportation ☐ Forest fire ☐ Open burning ☐

C. KNOWLEDGE, ATTITUDE AND PRACTICE DURING HAZE

a) Knowledge about haze

No.	Statement	Yes	No
1	Department of Environment (DOE) Malaysia has Air Quality Monitoring station to monitor the 24 hours air quality.		
2	Particulate matter with size of 2.5 micrometre ($PM_{2.5}$) more dangerous than particulate matter with size of 10 micrometre (PM_{10}).		
3	Haze can cause respiratory related disease such as asthma, cough and sore throat.		
4	Do you know that haze can cause cardiovascular disease and other detrimental effects to your health?		
5	Do you think that government do something to tackle the haze issue in Malaysia?		
6	Do you know the action of the government to reduce haze in Malaysia?		
7	N95 mask is more effective compare to surgical mask.		
8	Do you think the increasing of industrial activities make haze phenomenon more serious?		
9	Large scale of forest fire in Sumatra, Indonesia is the major cause of haze.		
10	Air Pollution Index (API) range 51-100 is considered very unhealthy.		
11	Carbon dioxide is one of components that made up haze.		

12	Haze Emergency will be declared if the API reading above 500?		
13	Cloud seeding can control the haze phenomenon.		
14	Do haze can give impacts in term of social and economy?		
15	Do you know several episodes of haze that occurred in Malaysia?		

b) Attitude during haze

Scale: 1=strongly disagree, 2=disagree, 3=not sure, 4=agree, 5=strongly agree

No.	Statement	Scale				
		1	2	3	4	5
1	The reading of Air Pollution Index (API) in my area is above 100 and it does not make me worry.					
2	The haze management is the responsible of the government, not mine.					
3	I want to reduce the outdoor activities during haze.					
4	I think health education especially during haze is important to community.					
5	I feel comfortable when wearing mask during haze.					
6	The wearing of mask during haze does not give me any benefit.					
7	I think the taking of a lot of drinking water during haze is not important to me.					
8	I postpone my sport activity during haze.					
9	My family does not encourage me to stay outside during haze.					
10	I believe that the distribution of information regarding haze via media can help me getting more information.					
11	I think that the exposure about health issue should be taught to university students.					
12	Open burning can be done during haze.					
13	I think the usage of public transport can reduce haze by reducing the emission of pollutants.					

No.	Statement	Scale				
		1	2	3	4	5
14	I will seek the doctor if feeling sick.					
15	The factories should not emit the pollutants to the environment exceeding the standard limit.					

Scale: 1=strongly disagree, 2=disagree, 3=not sure, 4=agree, 5=strongly agree

c) Practice during haze

No.	Statement	Yes	No
1	I always take drinking water at least 8 glasses per day.		
2	I always wear mask during haze.		
3	I always turn on air-condition when driving.		
4	I always educate my family and friend to be aware during haze.		
5	I do not have interest in buying N95 mask because it wastes my money.		
6	I always clean my hand and face with soap and clear water after doing outside activities.		
7	I always ensure the air in the house is free from indoor contaminant such as cigarette smoke.		
8	I always reduce my outdoor activities during haze.		
9	I always get information regarding haze topic dan effect to the environment.		
10	I always participate in program related to atmospheric pollution such as haze.		
11	I will get early treatment if feeling unhealthy.		
12	I always recycle my things to reduce open burning.		
13	I always hangout at shopping complex or other closed building rather than open place during haze.		
14	I will avoid holding my pets during haze that can increase susceptibility in getting respiratory-related problems.		
15	I always clean my room from dust coming from outside.		

D. SUGGESTION

1.. In your opinion, what is the ways in which the government can help the public/private organization adapt to haze problem?

Public education programmes ☐

Financial Assistance ☐

Administrative support ☐

Policies and legislation ☐

Others : please state .....

2. In your opinion, what are the requirements for improving public/private sectors' ability to participate in haze adaptation/mitigation activities?

Financial assistance from the government ☐

Administrative support ☐

Policies and legislation ☐

Greater number of health programme ☐

Others: please state .....

3. What is your suggestion to reduce the haze in Malaysia?

_____

_____

4.Do you think the environmental health course should be taught to all university students regarding mitigation and strategy to tackle haze issue?

_____

_____

The questions end.

Thank you for answering the questionnaire.

JKEUPM Ref No. : FPSK(EXP15-OSH)U048

a) Members of the JKEUPM who reviewed the documents:
Prof Dr Lekhraj Rampal

b) Date of approval: 14/1/2016

Endorsed at JKEUPM Meeting on **27/1/2016**, attended by:

NAME	DESIGNATION	GENDER	TICK IF PRESENT
Prof. Dato' Dr. Abdul Jalil Nordin	Professor of Radiology& Dean, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr Zamberi Sekawi	Professor of Medical Microbiology & Deputy Dean (Research and Internationalization, Faculty of Medicine and Health Sciences	Male	√
Prof. Dato' Dr. Lye Munn Sann	Professor of Medical Statistics, Department of Community Health, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Tengku Aizan Abd Hamid	Professor Gerontology, Institute of Gerontology	Female	
Prof. Dr. Lekhraj Rampal	Professor of Medical Statistics, Department of Community Health, Faculty of Medicine and Health Sciences	Male	
Prof. Dr. Lim Thiam Aun	Professor of Anesthesiologist, Department of Surgery, Faculty of Medicine and Health Sciences	Male	
Prof. Dr. Patimah Ismail	Professor of Biomedicine, Department of Biomedical Sciences, Faculty of Medicine and Health Sciences	Female	√
Prof. Dr. Johnson Stanslas	Professor of Pharmacology, Department of Medicine, Faculty of Medicine and Health Sciences	Male	√
Prof. Dr. Sherina Mohd.Sidik	Professor of Medicine, Department of Psychiatry, Faculty of Medicine and Health Sciences	Female	√
Prof Dr. M. Iqbal Saripan	Professor of Biomedical Engineering, Department of Computer and Communication Systems, Faculty of Engineering	Male	√
Assoc. Prof. Dr. Mansor Abu Talib	Associate Professor of Guidance and Counseling, Department of Human Development and Family Studies, Faculty of Human Ecology	Male	
Assoc. Prof. Dr. Hejar Abd.Rahman	Associate Professor of Public Health / Head Of Unit, Department of Community Health, Faculty of Medicine and Health Sciences	Female	√
Assoc. Prof. Dr. Normala Ibrahim	Associate Professor of Psychiatry, Department of Psychiatry, Faculty of Medicine and Health Sciences	Female	√

Assoc Prof Dr Sharmala Paramasivam	Associate Professor of English Language, Department of English, Faculty of Modern Languages and Communication	Female	
Assoc Prof Dr Arshad Abdul Samad	Associate Prof of Teaching English as a Second Language(TESL), Department Language and Humanities Education, Faculty of Educational Studies	Male	
Assoc Prof Dr Muhamamd Najib Mohamad Alwi (Independent Member)	Associate Professor of Psychiatry and Psychiatric Consultant, Cyberjaya University College of Medical Sciences (CUCMS)	Male	
Dr. Salmiah Md. Said	Lecturer of Epidemiology, Medical Statistics, Department of Community Health, Faculty of Medicine and Health Sciences	Female	
Assoc. Prof. Dr. Noritah Omar (Lay Person)	Associate. Professor of English Language, Department of English Language, Faculty of Modern Languages and Communication	Female	
Dr. Rojanah Kahar (Lay Person)	Lecturer of Human Development and Family Studies, Faculty of Human Ecology	Female	
Tan Sri Dato' Napsiah Omar (Independent Member)	Chairman, Women's Institue of Management	Female	v
En John Posko Anthony (Lay Person)	Headmaster of Sekolah Jenis Kebangsaan (Tamil) Kajang	Male	v