UNIVERSITI PUTRA MALAYSIA

THE EFFECTS OF AIR QUALITY FEEDBACK AND HEALTH PROMOTION TO REDUCE SECOND-HAND SMOKE EXPOSURE AMONG INDIAN PRIMARY SCHOOLCHILDREN IN SELANGOR

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BY

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

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ABSTRACT

THE EFFECTS OF AIR QUALITY FEEDBACK AND HEALTH PROMOTION TO REDUCE SECOND-HAND SMOKE EXPOSURE AMONG INDIAN PRIMARY SCHOOLCHILDREN IN SELANGOR

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Introduction: Exposure of second-hand smoke (SHS) to schoolchildren due to parental smoking at home is a main public health concern as children are vulnerable to ill-health effects arising from chemicals from tobacco. Approximately half of Malaysian schoolchildren are exposed to SHS due to their parental smoking at home. Therefore, by providing feedback of air quality in homes coupled with health promotion to smoking parents may be able to encourage parents to not smoke around their children at home. **Objectives:** This study aims to determine the effects of intervention which is air quality feedback and health promotion to reduce SHS exposure among Indian primary schoolchildren in Selangor. Besides, to determine and compare the knowledge of smoking parents before and after intervention. **Methods:** This is an intervention study conducted among seven households of Indian ethnic group. The air quality was measured using Dylos DC1700 for 8-h in homes. Dylos DC1700 is specifically able to measure and differentiate $PM_{2.5}$ released from cigarette smoke using laser based particle counter. From Dylos DC1700 measurements, the graph of $PM_{2.5}$ was illustrated by AFRESH Software in which for every peak exceeds 25$\mu g/m^3$ with slow decay shows the SHS coming from cigarette. The measurement was conducted twice in which the post measurement one day gap after the pre measurement. Health promotion was coupled with air quality feedback of the first measurement as a tool to increase the knowledge of smoking parents on SHS and its effects on children's health. After both air quality feedback and health promotion were conducted, the post knowledge of smoking parents on SHS and its effects was assessed. **Results:** The result showed that the average of $PM_{2.5}$ in each house is 34.96 (19.26) $\mu g/m^3$ exceeding the 24-h guidance limit by WHO which is 25 $\mu g/m^3$. The highest $PM_{2.5}$ recorded was 71 $\mu g/m^3$. In the post-measurement, the average decreased to 19.76 (9.92) $\mu g/m^3$. However the differences was not significant. The knowledge on SHS among smoking parents also showed significant increase with the median of 42.86 (71.43) to 91.84 (14.29). **Conclusion:** The knowledge among smoking parents has been found to increase in this study after air quality feedback and health promotion were conducted. This study will be able to encourage smoking parents not to smoke around their children with a larger sample population. This study suggests to carry out measurement for 24 h to obtain accurate results that can be compared with existing standards. The intervention should involve other family members such as wives as they will be able to give motivational supports to the smoking fathers to at least not to smoke in house.

Keywords: Second-hand smoke, parental smoking, schoolchildren, air quality feedback, health promotion, $PM_{2.5}$

ABSTRAK

KESAN-KESAN MAKLUM BALAS KUALITI UDARA DAN PROMOSI KESIHATAN DALAM MENGURANGKAN PENDEDAHAN KEPADA ASAP ROKOK PASIF DALAM KALANGAN PELAJAR SEKOLAH RENDAH TAMIL DI SELANGOR

NADHIRAH BALKIST IHSAN

Pengenalan: Pendedahan kepada asap rokok pasif dalam kalangan pelajar sekolah rendah disebabkan tabiat merokok ibu bapa di rumah telah menjadi kebimbangan kesihatan awam. Ini disebabkan oleh kanak-kanak mudah mendapat kesan kesihatan boleh membahayakan nyawa berikutan dari pendedahan kepada bahan kimia produk tembakau. Oleh itu, dengan menyediakan maklum balas kualiti udara bersama promosi kesihatan mungkin mampu menggalakkan ibu bapa perokok untuk tidak merokok apabila berdekatan dengan kanak-kanak di rumah. **Objektif:** Kajian ini bertujuan untuk menentukan kesan-kesan intervensi iaitu maklum balas kualiti udara dan promosi kesihatan untuk mengurangkan pendedahan kepada asap rokok pasif dalam kalangan pelajar sekolah rendah Tamil di Selangor. Selain itu, untuk menentukan dan membandingkan pengetahuan ibu bapa merokok sebelum dan selepas intervensi. **Kaedah:** Kajian intervensi ini dijalankan di dalam tujuh buah rumah etnik India. Kualiti udara diukur menggunakan *Dylos DC1700* selama lapan jam di rumah. *Dylos DC1700* secara spesifiknya mampu mengukur dan membezakan $PM_{2.5}$ dilepaskan dari asap rokok menggunakan zarah balas berasaskan laser. Kemudian, melalui *AFRESH software* graf tahap $PM_{2.5}$ yang melebihi 25μg/m^3 dengan penurunan yang perlahan menunjukkan asap rokok pasif datang daripada asap rokok. Pengukuran telah dijalankan sebanyak dua kali dengan jarak satu hari dari pengukuran pertama. Maklum balas kualiti udara dan promosi kesihatan adalah sebagai alat untuk meningkatkan tahap pengetahuan ibu bapa perokok berkaitan asap rokok pasif dan kesan-kesannya kepada kesihatan kanak-kanak. Selepas itu, tahap pengetahuan ibu bapa perokok dinilai melalui soal kaji selidik. **Keputusan:** Secara purata, tahap $PM_{2.5}$ di setiap rumah perokok adalah 34.96 (19.26) μg/m^3 melebihi had yang ditetapkan WHO untuk 24 jam iaitu 25μg/m^3. Tahap yang paling tinggi direkod adalah 71 μg/m^3. Selepas pengukuran pos, purata $PM_{2.5}$ berkurangan kepada 19.76 (9.92) μg/m^3 tetapi perbezaan adalah tidak signifikan. Tahap pengetahuan bapa perokok adalah signifikan dengan median skor 42.86 (71.43) kepada 91.84 (14.29). **Kesimpulan:** Tahap pengetahuan bapa perokok didapati meningkat selepas intervensi dijalankan. Kajian ini boleh menggalakkan ibu bapa perokok untuk tidak meroko apabila berdekatan kanak-kanak dengan sampel populasi lebih besar. Melalui kajian ini, dicadangkan untuk membuat pengukuran 24 jam agar dapatan kajian dapat dibezakan dengan had yang telah ditetapkan. Intervensi ini bukan sahaja melibatkan perokok, malahan seluruh ahli keluarga seperti para isteri sebagai sokongan motivasi kepada bapa perokok.

Kata kunci: Asap rokok pasif, ibu bapa perokok, kanak-kanak sekolah, maklum balas kualiti udara, promosi kesihatan, PM_2

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LIST OF ABBREVIATIONS

AFRESH	Finding Ways to Reduce Second-hand Smoke Exposure in Homes
API	Air Pollutant Index
CDC	Control of Communicable Disease
DALYs	Disability-Adjusted Life-Years
ETS	Environmental tobacco smoke
FCTC	Framework Convention on Tobacco Control
GATS	Global Adult Tobacco Survey
GM	Geometric mean
GWLs	Graphic warning labels
KAP	Knowledge, attitude and practice
PM	Particulate matter
PM_{10}	Particles have the diameters of 10 μm
$PM_{2.5}$	Particulate matter with aerodynamic diameter of 2.5 μm or smaller
REFRESH	Reducing families' exposure to second-hand smoke in the home
SFL	Smoke free legislation
SHS	Second-hand smoke
SJKT	Sekolah Jenis Kebangsaan Tamil
US EPA	United States Environmental Protection Agency
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Study Background

Second-hand smoke (SHS) or also known as environmental tobacco smoke (ETS) is the combination of smoke released by the smoker through exhalation and the smoke that is produced from the burning of the tip of cigarette (Zahid Naeem, 2015). The exposure to SHS has the same impact as being exposed to main stream smoke in which as reported by World Health Organization (WHO) (2014) that mostly of about 4,000 of chemicals known in tobacco smoke are dangerous and 40 from the chemicals are considered to be cancerous. Even though the harmful impacts of SHS have been reported since 1928, SHS still remain as the common pollutant in indoor environments in many regions (Öberg et al., 2011). Therefore, many people including the adults and children are exposed to the harmful effects of SHS corresponding to the death of world's population in which 47% and 28% of women and children; respectively (WHO, 2014).

Asia is found to have the highest nicotine concentration in hair of children living with smokers compared to Europe, Middle East and Latin America (Wipfli et al., 2008). Similarly, Öberg et al. (2011) concluded that half of the population of Western Pacific Region B that includes Malaysia have highest proportion of exposure

to SHS together with those in Europe and Southeast Asia which are Indonesia, Sri Lanka and Thailand. There were 603 000 premature deaths and 10.9 million loss of disability-adjusted life-years (DALYs) in 2004 making children to be at 61% of DALYs. It is also found that there were high death cases among adults due to ischemic heart disease, lower respiratory infections in children and followed by the asthma in adults.

SHS exposure to children is a concern as children are vulnerable to diseases that can harm their life such as ischemic heart disease, lower respiratory infections, asthma and lung cancer (Öberg et al., 2011). This is because due to the facts that children have less developed immune system and smaller lungs making their demand for oxygen is greater, hence having higher respiratory rates. Moreover, children usually have no power to defend themselves against unhealthy exposure to SHS especially at home. It is found that 40% of the global children population is exposed to SHS, compared to 33% adult male and 35% adult female; both non-smokers.

Global Adult Tobacco Survey (GATS) (2011) has found that 43.9% of men and 1% of women in Malaysia smoked tobacco. It is also reported that adults aged 25 years old to 44 years old have the highest number of smoking any tobacco product. The urban residents of adults have higher number of smokers as for any smoked tobacco product compared to rural residents.

1.2 Problem Statement and Study Justification

Current smokers reported by Institute for Public Health (2015) in National Health and Morbidity Survey 2015 is the highest among Bumiputras (25.8%), Malay (24.7%), Indians (16.5%) and Chinese (14.2%). There have been several smoking cessation initiation studies as well as programme have been conducted among adults such as an intervention study by Zulkifley et al. (2017) that found Ramadan can be a month to initiate quit smoking among Malay adults. In fact, Ministry of Health in Malaysia provide quit smoking clinic called "mQuit" that offer services on customizing quit smoking plan, give advice on quitting smoking, comprehensive follow-up sessions by healthcare professionals and also nicotine replacement therapy to facilitate smoking cessation. Health promotion also have been incorporated to initiate smoking cessation such as a study carried out by Fathelrahman et al. (2010). The study has found that through new pictorial warnings on packaging of cigarette can increase the interest in quitting smoking among male adults. Unfortunately, the prevalence of smoking among adults aged 15 years above is still high which is 22.8% compared to the target that has been set up in End Game in National Strategic Plan for Non Communicable Diseases (2016-2025) by Ministry of Health (2016) to reduce the prevalence of smoking among adults aged 15 years above to less than 15% in 2025.

SHS exposures among children is a significant problem in Malaysia. In a survey conducted, it shows that 52.9% of school children in Malaysia were exposed to SHS at home due to at least one parental smoking (Abidin et al., 2011). Considering the fact of prevalence of smoking among adults is high, children at risk of getting

greater exposure to SHS. Moreover, SHS exposure to children aged 10 to 11 years is significantly associated with asthma symptoms such as wheezing during exercise (Abidin et al., 2014).

Children in western pacific region of region B including Malaysia were found to expose to SHS with the percentage of 67% (Öberg et al., 2011). However, there is no exact percentage of school children expose to SHS is established except for Malay students. This is because most of the studies conducted focusing on national schools in Malaysia that dominated by Malay instead of Indian school children. A study conducted by Abidin et al. (2014) stated that their study under-represent the other ethnic groups compared to Malay population. Similarly to a survey conducted in Malaysia, selection of schools were done among national schools causing the Indian school children was less-represented in the research (Abidin et al., 2011). Najihah et al. (2014) also found that Malay students dominated their study. Thus, there is no study primarily focusing on SHS exposure among Indian school children even though according to GATS (2011) that approximately 2.4% Indian adults have the highest percentage of smoking occasionally and approximately 17.2% were daily smokers.

In Malaysia, numerous studies and health promotion have been conducted to initiate smoking cessation among adults. One of it is the *Tak Nak* (Say No) anti-smoking campaign by Ministry of Health Malaysia that is channelled through various mass media including television, radio, newspaper, billboards and cinema. However, the target is still not yet to be achieved as stated in to End Game in National Strategic Plan for Non Communicable Diseases (2016-2025) by Ministry of Health (2016)

which is to reduce adults smoking to 15% in 2025. The health promotion in this study is in accordance with Article 8 Protection from exposure to tobacco smoke of WHO Framework Convention on Tobacco Control (FCTC) and Article 12 that is to promote and strengthen the public awareness of tobacco control issue by using available communication tool. Air quality feedback has proven to change smoking behaviors of mothers when they were able to get information on the level of secondhand smoke they exposed to their children at home (Wilson et al., 2012). Thus, this study will be the first study that incorporates air quality feedback in home and health promotion to help in changing smoking behavior instead of initiating smoking cessation among smoking parents and at the same time reducing the SHS exposure among school children.

Children at greater risk when it comes to exposure to SHS at home. It is very important to change smoking behavioral among parents since exposure to SHS mainly comes from home (Abidin et al., 2011). Moreover, it is significant to conduct a study especially among Indian school children that one of the least being studied in SHS exposure. Thus, this study will involve Indian school children coming from two Tamil primary schools to best represent the population exposure to SHS at home.

There is no air quality feedback has been done in Malaysia yet to reduce SHS exposure. A successful study called REFRESH stands for Reducing families' exposure to second-hand smoke in the home by Wilson et al. (2012) has incorporated air quality feedback in the homes of smoking mothers with at least one child younger than 6 years old. Rather than emphasizing on smoking cessation among the smoking mothers, this

study focused on to change smoking behaviour of the smoking mothers when they are around their children. The personalized results of the indoor air quality together with motivational interview have improved the indoor air quality. This study also shows that with the knowledge and information shared to the smoking mother can help into reducing children to second-hand smoke at home.

1.3 Study Objectives

Generally, this study aims to determine the effects of air quality feedback and health promotion to reduce SHS exposure among Indian primary schoolchildren in Selangor.

The specific objectives are as follow.

i. To determine the socio-demographic distribution of smoking parents.

ii. To determine the level of $PM_{2.5}$ in households with smoking parents before and after they receive air quality feedback.

iii. To determine the knowledge of smoking parents before and after health promotion is given.

iv. To compare the level of $PM_{2.5}$ in households before and after receive air quality feedback.

v. To compare the knowledge of smoking parents before and after health promotion is given.

1.4 Study Hypotheses

This study hypothesized that there is significant different of level of $PM_{2.5}$ before and after smoking parents receive air quality feedback. There is also significant different of knowledge before and after health promotion is given.

1.5 Study Variables

The independent variable for this study is the parental smoking habit at home meanwhile the dependent variables are the concentration of $PM_{2.5}$ at home and the knowledge of parent on second-hand exposure to children.

1.6 Definition of Term

1.6.1 Operational Definition

1.6.1.1 Air Quality Feedback

The measurement of $PM_{2.5}$ is by Dylos DC1700 in the households with smoking parents. This Dylos DC1700 will provide a real-time measurement of concentration of $PM_{2.5}$ ($\mu g/m^3$) released from the smoke of cigarette. The concentration of $PM_{2.5}$ will be illustrated in graph in which the reading of $PM_{2.5}$ can be compared to the air quality standard by WHO primarily. The air quality measurement will be conducted in the first visit at the house of respondent and after one day gap of the first visit to determine the change of level $PM_{2.5}$ after air quality feedback is given together

with health promotion. For each measurement, the level of $PM_{2.5}$ in the respondent's house will be explained.

1.6.1.2 Health Promotion

Health promotion will be conducted in this study by giving knowledge on the meaning of second-hand smoke, the harmful chemicals in cigarette, the harmful effects of second-hand smoke exposure to children and the solution to protect children from second-hand smoke. This information will be in brochure in which the contents are adapted from Ministry of Health entitled "The Harmful Effects of Second-hand Smoke". This brochure aimed to increase the knowledge particularly smoking parents on the harmful effect of second-hand smoke and reduce the exposure of second-hand smoke to their children at home. Health promotion will be conducted once after the first visit at the respondent's home.

1.6.1.3 Particulate Matter ($PM_{2.5}$)

This study focused on the source of $PM_{2.5}$ coming from cigarette smoke.

1.6.2 Conceptual Definition

1.6.2.1 Air Quality

Air quality is the measurement of how clean or polluted the air is. Often it is measured with Air Quality Index that shows the trend of changes of amount of air pollution as described by National Oceanic and Atmospheric Administration meanwhile in Malaysia it is measured by Air Pollutant Index (API) as described by Department of Environment (n.d.).

1.6.2.2 Feedback

Cambridge Dictionary (2019) defined feedback as information or statements of opinion about something, that can tell whether it is successful or liked.

1.6.2.3 Health Promotion

WHO (1998) defined health promotion as the process of enabling people to increase control over and to improve their health.

1.6.2.4 Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ is particulate matter with aerodynamic diameter of 2.5 μm or smaller. It is called fine inhalable particles that can be breathed deep into lungs and affected

people will be impacted with the ill-health effects. The source of $PM_{2.5}$ can be from construction sites, smokestacks or even fires (US EPA, 2018).

1.6.3 Conceptual Framework

The following conceptual framework shows this study highlights on the exposure of SHS among schoolchildren due to smoking habit of parents in which includes the measurement of the level of $PM_{2.5}$. The level of $PM_{2.5}$ conducted before and after conducting air quality feedback and health promotion to the smoking parents. The measurement took place in the households with children of smoking parents as majority of schoolchildren in Malaysia exposed to SHS at homes due to parental smoking (Abidin et al., 2011). The exposure to SHS due to parental smoking was illustrated by providing the level of $PM_{2.5}$ instead of level of cotinine as the measurement of $PM_{2.5}$ was easier to conduct rather than level of cotinine. There is also no reported literature regarding the use of air quality feedback in Malaysia.

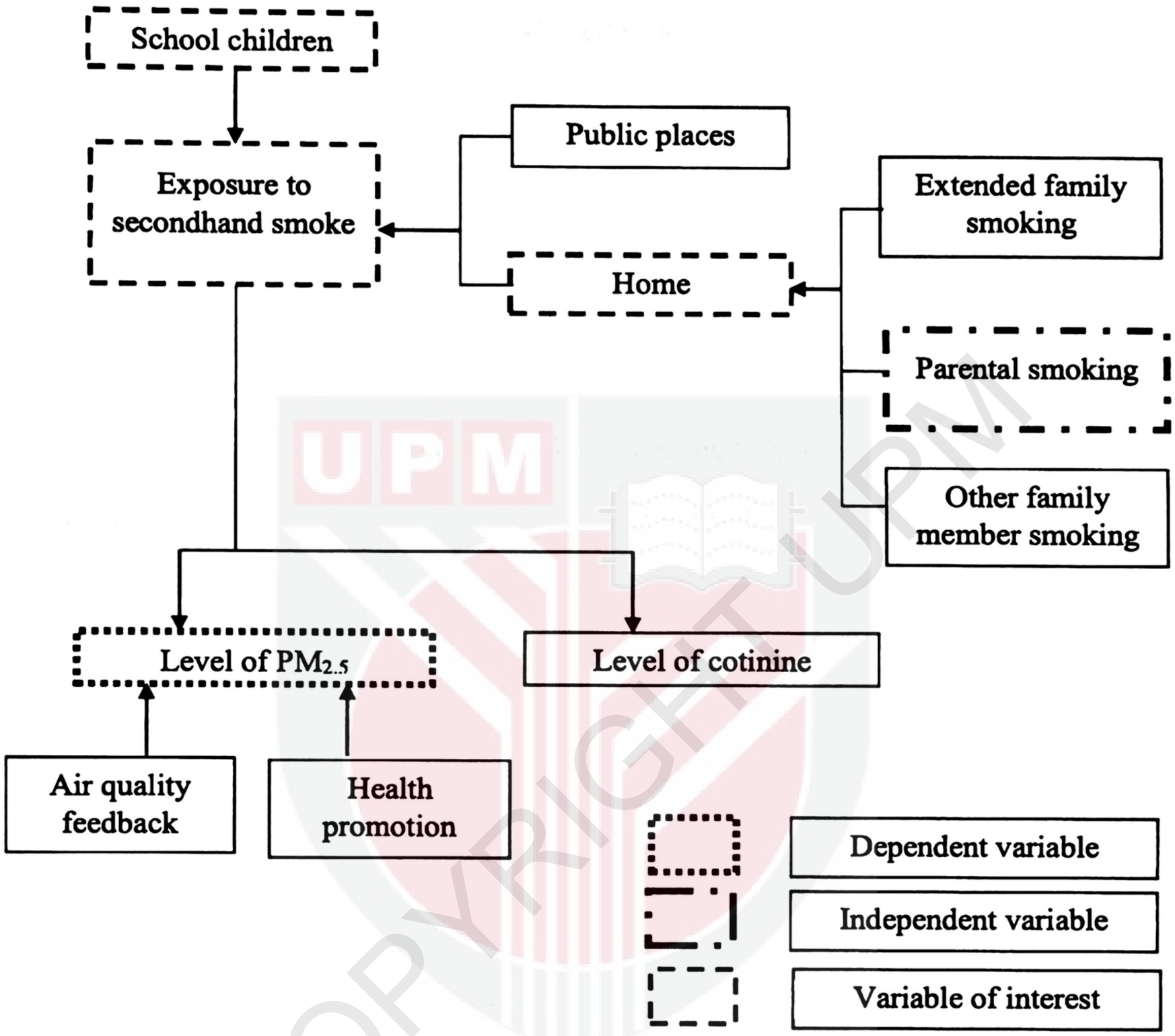

Figure 1.6.3: The conceptual framework of this study

CHAPTER 2

LITERATURE REVIEW

2.1 Particulate Matter (PM)

According to United States Environmental Protection Agency (US EPA) (2018), particulate matter (PM) is the term used for the mixture of solid particles and droplets of liquid found in the air. Large and dark particles such as smoke, dirt, dust or soot can be seen through the naked eyes. On the other hand, some of the particles are small that need electron microscope to be detected. The sources of these particles can be variety from construction sites, fires or unpaved roads, power plants and industries emission.

US EPA (2018) states that PM includes PM_{10} and $PM_{2.5}$. The difference between these two particles are in terms of their size. PM_{10} is defined as the particles have the diameters of 10 micrometers (μm) and it is an inhalable particle. $PM_{2.5}$ has diameters of 2.5 μm and smaller which is known as a fine inhalable particle. The difference is PM_{10} can be inhaled deep into the lungs or even the bloodstream which can cause harmful effects to the health and $PM_{2.5}$ pose a greater risk to the health. The small size of $PM_{2.5}$ can be described as the 70 μm of the diameter human hair is 30 times larger than those largest fine particles. The following Figure 2.1 shows the size comparison for PM particles.

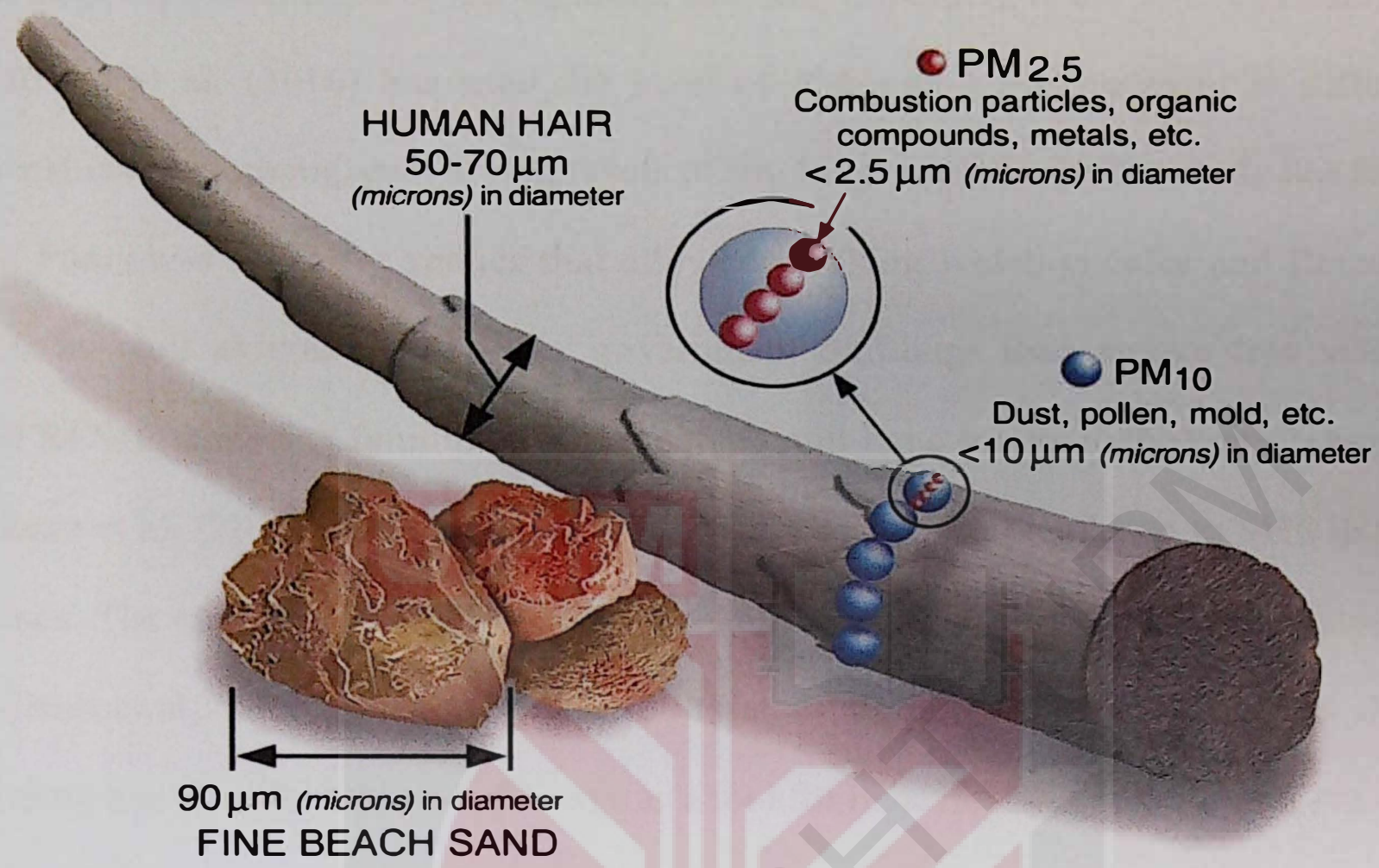

Figure 2.1: Size comparison of PM
Source: US EPA (2018). Retrieved from https://www.epa.gov/pm-pollution/particulate-matter-pm-basics

2.2 Secondhand Smoke (SHS)

Second-hand smoke (SHS) is the mixture of thousands of components that are known to be toxic and cancerous that are exhaled through the mainstream smoke and side stream smoke (Apelberg et al., 2012). SHS can be found both outside and indoor environments. As for the indoor SHS exposure mainly depends on the number of cigarettes smoked in a particular time, the volume of the room and the ventilation rate.

The measurement of SHS can be done by measuring the airborne particulate matter (PM) that emitted by the cigarette smoking (Apelberg et al., 2012). A study by Loffredo et al. (2016) has used the level of $PM_{2.5}$ as a measurement at different intensities of smoking and varying levels of smoking restrictions. The study has found that $PM_{2.5}$ was higher at venues that allowed smoking which is cafes and Ramadan tents as well as courts and other government buildings than smoke free venues. REFRESH (Reducing families' exposure to second-hand smoke in the home) study by Wilson et al. (2012) also used $PM_{2.5}$ to measure exposure of children to SHS in their homes. The measurement of $PM_{2.5}$ can be done by using equipments such as SidePak (Wilson et al., 2012) and Dylos DC1700 (Han et al., 2016). However, the use Dylos recently has been found to be effective as a tool for behaviour modification of smokers in homes (Semple et al., 2013) as it produces barely audible noise as it is made up of small fan and larger air inlet. It is also easier to use with only one button needed to operate it and cost one-tenth less than SidePak. The use of SidePak can cause it to be stolen, lost or even damaged making a barrier to use it. SidePak also produces loud noise caused by the internal pump in it. The selections of menu cause a burden to the users that at the end can results in lost or invalid data.

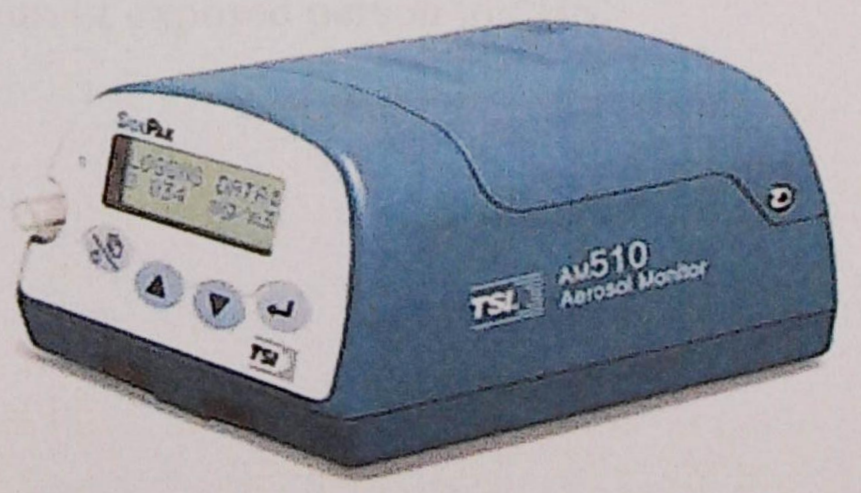

Figure 2.2.1: SidePak AM510

Source: TSI Incorporated. (n.d.). Retrieved from https://www.tsi.com/discontinued-products/sidepak-personal-aerosol-monitor-am510/#gallery

Figure 2.2.2: Dylos DC1700 Air Quality Monitor

Source: Dylos Corporation. (n.d.). Retrieved from http://www.dylosproducts.com/dc1700.html

Besides, the exposure to SHS can also be measured by using cotinine level. Aylward (2018) described the predominant metabolite and active metabolite (Punyadeera & Slowey, 2013) of nicotine is cotinine. The cotinine is the biomarker for the exposure to tobacco products such cigarette smoke which is SHS. This biomarker can be detected in the serum of exposed person to SHS.

2.3 Tobacco Control

Globalization of tobacco epidemic has caused the development of World Health Organization Framework Convention on Tobacco Control (WHO FCTC). The

WHO FCTC develops a regulatory strategy in order to address addictive substances. Article 8 of WHO FCTC emphasized on the protection from exposure to tobacco smoke in indoor workplaces as well as protection of children from SHS meanwhile Article 12 that is to promote and strengthen the public awareness of tobacco control issue by using available communication tool. In 2005, Malaysia became a party to World Health Organization's (WHO) Framework Convention on Tobacco Control (FCTC).

According to Malaysia Food Act 1983, there are 24 places where smoking is prohibited under Control of Tobacco Product Regulations (Amendment) 2017. It includes public places such as airport and shopping complex. Apart from that, government premises, educational institutions, air-conditioned places, service counters and health facilities including hospital or clinic. In addition, National Service Training Centres (PLKN) and areas that have been gazetted by Ministry of Health in Melaka including Melaka Raya, World Heritage City of Melaka, Melaka International Trade Centre (MITC) and Alor Gajah and Jasin town centres. Recently in January 2019, Ministry of Health has enforced the smoking banning in all restaurants, coffee shops and hawker centers including open-air eateries. Even so, the smokers are permitted to smoke three metres away from the establishments. However, those caught against the banning by smoking in the prohibited areas will be fined up to RM10,000 or imprisonment for two years while the premises that allow smokers to light up will be fined to a maximum fine RM2,500. The owner of premises needs to display poster "No Smoking" and ashtrays and smoking room are no longer allowed.

2.4 Air Quality Feedback

Air quality feedback includes the measurement of air and feedback on air quality. This method is used in an intervention study by Wilson et al. (2012) which is Reducing families' exposure to second-hand smoke in the home (REFRESH) conducted in United Kingdom is a feasibility study that involved air quality feedback for behavioral changes of smoking mothers. It is found that smoking mothers were shocked that their smoking habits at home around their children had exposed their children to unhealthy levels of $PM_{2.5}$. The level of $PM_{2.5}$ was measured on the 4^{th} visit after motivational interview has been done to the mother shows decreasing in trend. The study shows that air quality feedback together with motivational interview in households can be an effective tool in order to reduce SHS exposure among children. Even though there was possible of temporary behavior modifications of the smoking mothers, the results show significant reduction of nicotine levels over 24 hours of air sampling. Thus, it is proven that the smoking behavior can be reduced even only for a short time.

The standards available for $PM_{2.5}$ are from WHO which is 25 $\mu g/m^3$ for 24-hour, United States Environmental Protection Agency (US EPA) and also the new Malaysia Ambient Air Quality Standard is 35 $\mu g/m^3$ for 24-hour. Ruaraidh et al. (2017) conducted AFRESH that stands for Finding Ways to Reduce Second-hand Smoke Exposure in Homes study where the measurements from personalized air quality

feedback in the deprive households with children were compared with WHO guidance level.

Apart from that, air quality feedback has been used in reducing SHS exposure in homes in Scotland. Ruaraidh et al. (2017) has recently conducted air quality feedback with aim to promote smoke-free homes. This intervention incorporates theory- and evidence-based behavioural intervention together with air quality feedback as the main component of changing the behaviour to reduce second-hand smoke in deprived households with children. This study has shown changing in smoking behaviour of parents where one had started to smoke outside, and the other participant had smoke indoor with window open. It is also concluded that air quality feedback as shown in Figure 2.4 has reduced second-hand smoke exposure to children at home can be carried out as the participants can easily understand and interpret the results of air monitoring.

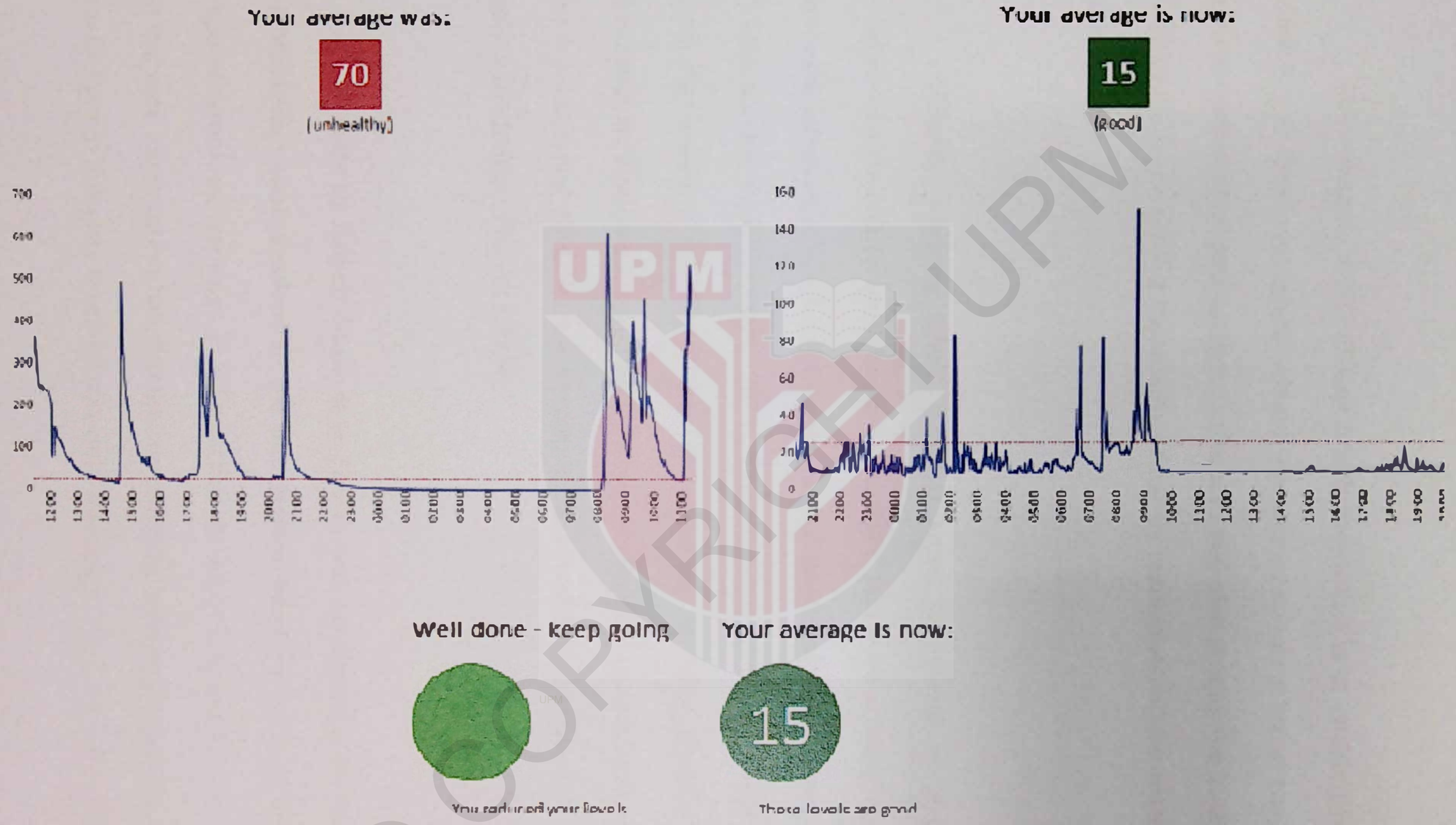

Figure 2.4: The example of graphs used in the AFRESH report.

Source: Retrieved from Ruaraidh et al. (2017).

2.5 Health Promotion to Initiate Smoking Cessation

According to WHO (2016) health promotion is to enable people to increase control over their own health. Health promotion covers a broad range of social and environmental interventions that can benefit and also protect the health of individual. In addition, it can protect the quality of life by managing and preventing the causes of ill health.

Graphic warning labels (GWLs) were introduced in Article 11 of the Framework Convention on Tobacco Control (FCTC) to the cover of cigarette products. Since the adoption of GWLs in Canada, half of smokers had motivated to quit smoking (Vathesatogkit & Charoenca, 2011; Cunningham, 2009) meanwhile in Australia, smoking cessation motivation has increased up to 60% (Borland et al., 2009). Similarly, in Thailand the smoking cessation attempts have increased among half of the smoker since the GWLs is introduced as stated by International Tobacco Control Policy Evaluation Project (2009).

A study by Fathelrahman et al. (2010) was conducted to compare the response of Malaysian adult smokers to the intervention newly introduced which is pictorial cigarette smoking warnings. It is found that the intervention group that was introduced to the new intervention has stronger response in smoking cessation compared to the control group that only received text-only warnings. Thus, it is proven that intervention

that promote better health such as initiating smoking cessation can improve their smoking behavioral.

2.6 Physiological and Anatomical Development of Children's Lung

Respiratory system consists of major organs with primary function to provide oxygen to body tissues for cellular respiration and removal of carbon dioxide (Gordon et al., n.d.). The respiratory system is shown in Figure 2.6.1 and Figure 2.6.2.

Human respiratory system can be divided into two; a conducting zone and a respiratory zone. Conducting zone consists of organs and structures that do not involve in gas exchange directly compared to respiratory zone. Conducting zone have functions to provide route for air inhaled and exhaled air. Besides, it removes debris and pathogens coming from the inhaled and exhaled air and also to warm and humidify the incoming air. The conducting zone consists of nose, pharynx, larynx, trachea and bronchial tree.

The structures of respiratory zone involved directly in gas exchange. Respiratory zone begins with terminal bronchioles that join a respiratory bronchiole that eventually lead to an alveolar duct. The composition of alveolar duct are smooth muscle and connective tissue which then opens into a cluster of alveoli. Alveolus is the one of many small and grape-like sacs attached to the alveolar ducts as shown in Figure 2.6.2.

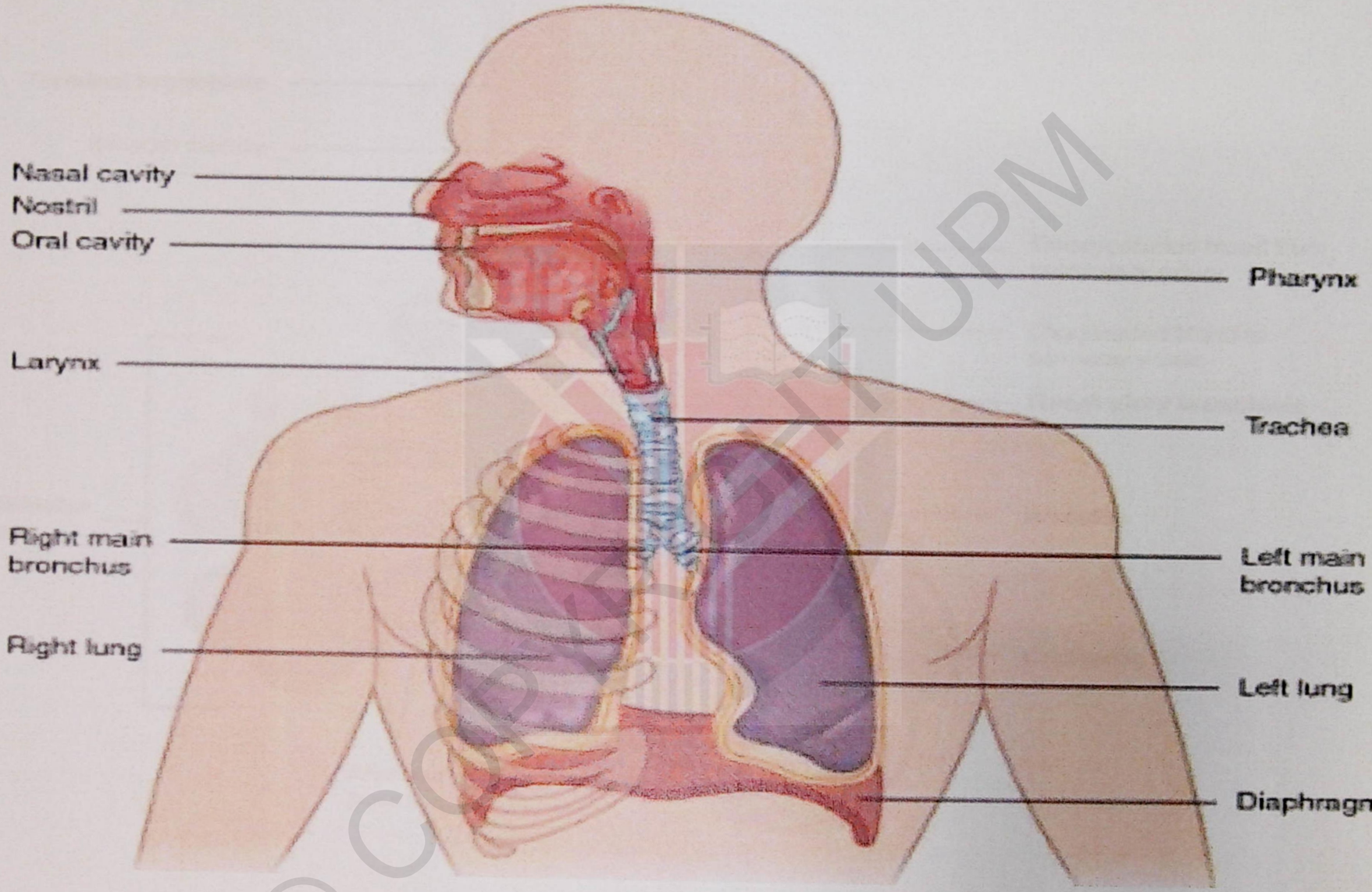

Figure 2.6.1: Major respiratory structures
Source: Betts at al. (n.d.). Retrieved from https://opentextbc.ca/anatomyandphysiology/chapter/22-1-organs-and-structures-of-the-respiratory-system/

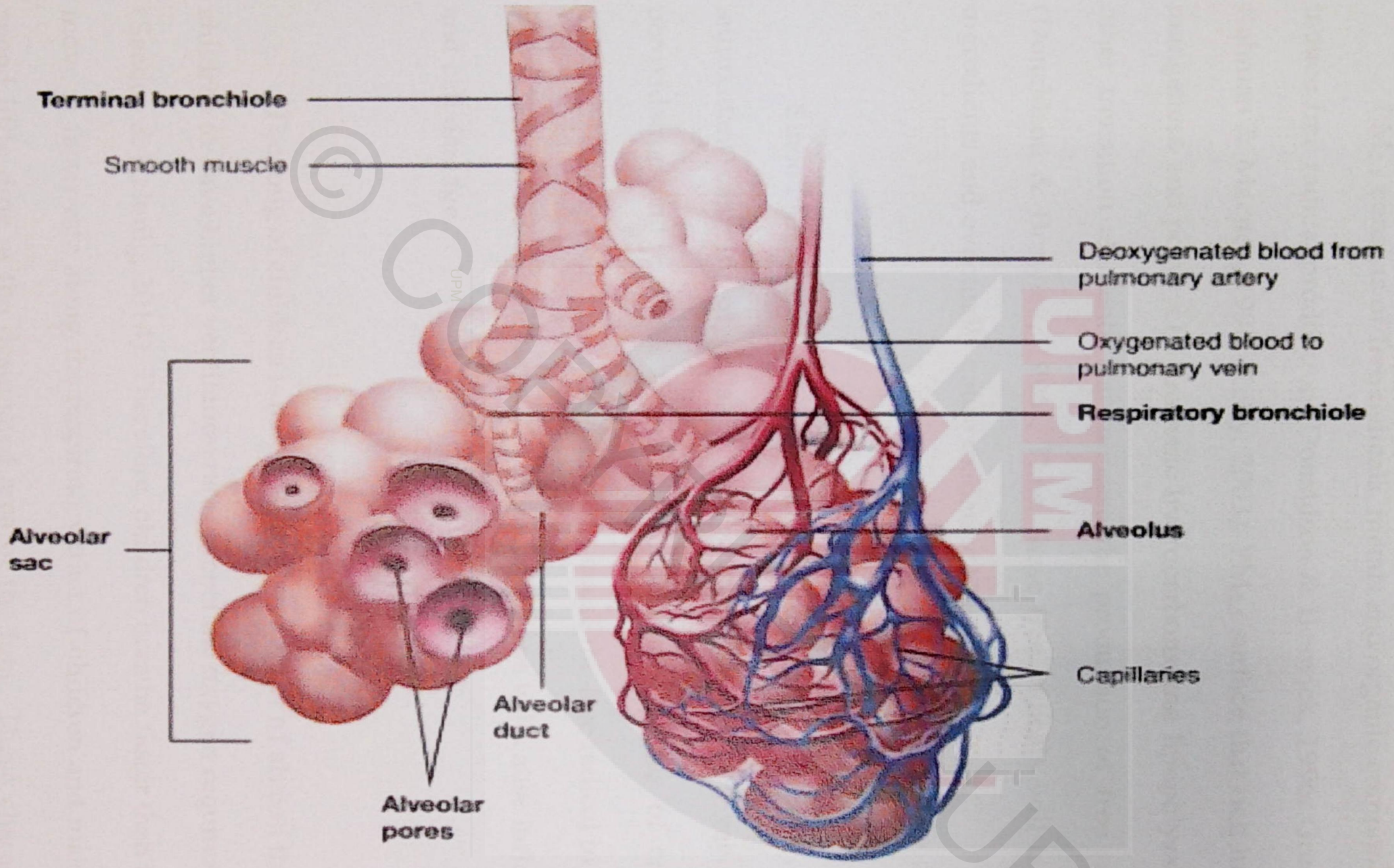

Figure 2.6.2: The structure of bronchiole in respiratory zone
Source: Betts at al. (n.d.). Retrieved from https://opentextbc.ca/anatomyandphysiology/chapter/22-1-organs-and-structures-of-the-respiratory-system/

2.7 Mechanism of Damaging Effects of $PM_{2.5}$ In Respiratory System

$PM_{2.5}$ consists of free radicals, metals and organic components that are able to induce free radical production (Donaldson & Beswick, 1996; Greenwell et al., 2002; Rahman & Macnee, 1996; Kelly, 2003). $PM_{2.5}$ surface that rich in iron, copper, zinc, manganese and polycyclic aromatic hydrocarbons and lipopolysaccharide as well as other transition elements can increase the production of free radicals in the lung (Donaldson & Beswick, 1996). Thus, these free radicals will consume antioxidant ingredients and eventually cause oxidative stress.

Since $PM_{2.5}$ induces the formation of free radicals excessively and reduces the antioxidant capacity of cells, it causes the lipids on cell membrane to undergo peroxidation and elevates the intracellular concentrations of calcium (Ca^{2+}). The increased of intracellular Ca^{2+} will further cause the free radical to elevate (Kim et al., 1997). Therefore, the increased Ca^{2+} concentrations will cause inflammatory reactions and cell damage.

The lung of children is made of smaller number of alveoli than in adults making children to have higher ventilation rate to meet the oxygen requirement of their bodies (Saaden & Kalunig, 2014). Therefore, children breathe faster than the adults. Particles move at faster rate along the respiratory tract of children and making the particles to spend little time at the designated area of the lung. These characteristics make the particles to penetrate deeper in the lung of children and the concentration of the

particles will be high in alveolar blood (Ginsberg et al., 2005). The deeper penetration making the dose absorbed to be high. Saaden and Kalunig (2014) state that the different development of nasal structural among children affect their rate of inhalation and deposition of particles. Children have lower nasal filtration and higher nasal airways resistance due to the nasal structure. These two factors affect the increase of mouth to nose breathing ratio and making the particles to further penetrate deeper in the lower respiratory tracts (Becquemin et al., 1999; James et al., 1997).

CHAPTER 3

METHODOLOGY

3.1 Research Design

This is a quantitative study that determined the level of $PM_{2.5}$ before and after air quality feedback and health promotion.

This is an intervention study in which to recruit the households with smoking parents as respondents, the recruitment made through finding the schoolchildren of smoking parents at schools. The Tamil primary schools selected purposively around Selangor. Permission has been obtained from the Ministry of Education prior to the conduction of the study. This study was conducted in period of 4 months.

3.2 Study Location

The selection of study locations was determined from the list available in Selangor Education Department in the district of Hulu Langat and Petaling. The sampling in the households were taken in the area of these two districts.

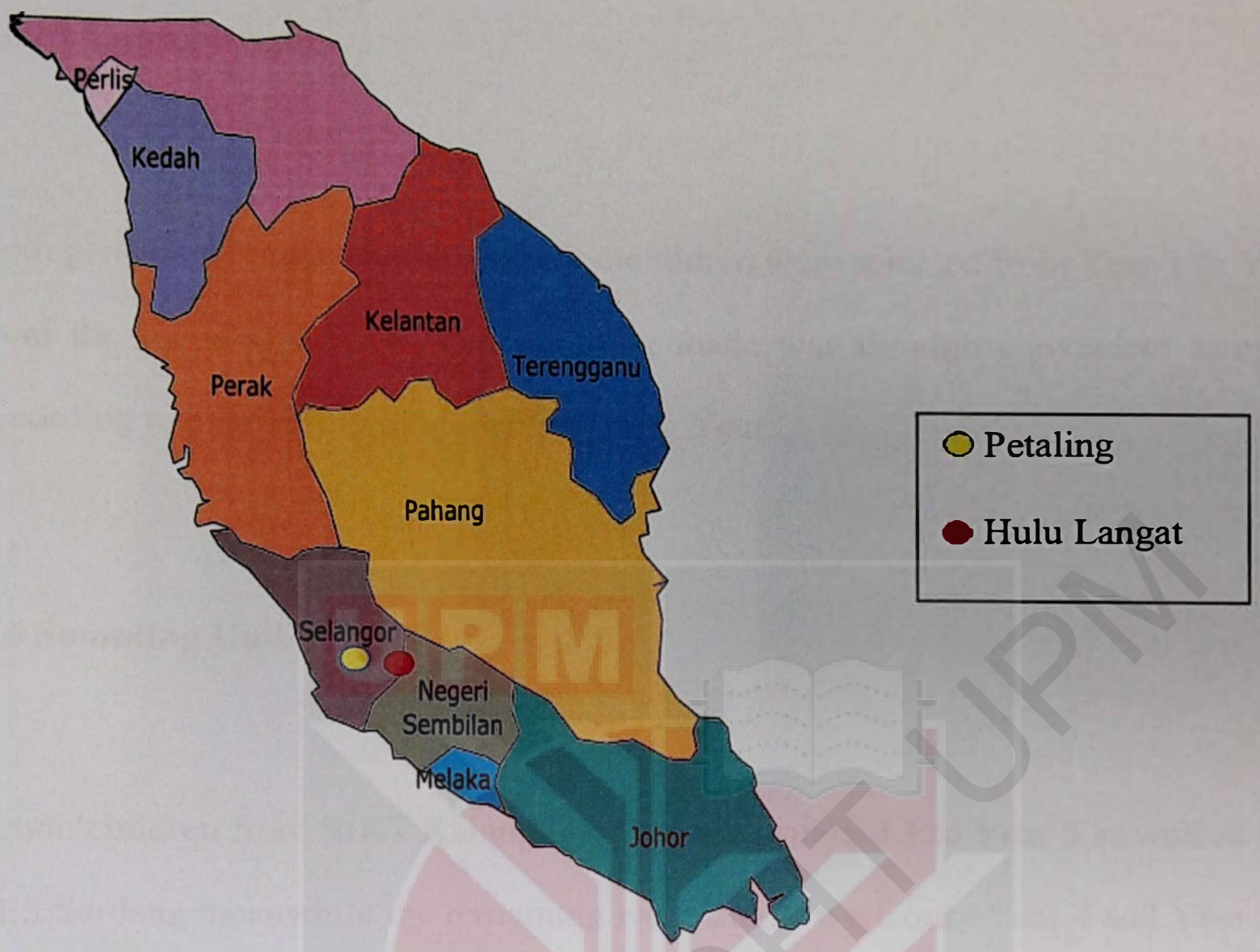

Figure 3.2: Map of study locations in Selangor

3.3 Study Population

Study population was the households with smoking parents that have schoolchildren lived in the house. School children were from four Tamil primary schools which are SJKT Ladang West Country Barat, SJKT Ladang West Country Timur, SJKT FES Serdang and SJKT Kajang. The selection was random to avoid selection bias. The inclusion criteria are schoolchildren currently living in the same house with at least one parental smoking and smoking parents smoke in house and available at home every day. The exclusion criteria are those who smoke outside of house and do not give consent to conduct intervention at home.

3.4 Sampling Frame

Both genders of female and male schoolchildren were selected from Year 1 to Year 5 from the schools selected. The sampling made was through convenient sampling, according to availability of students of each Year.

3.5 Sampling Unit

Schoolchildren from SJKT Kajang involved are standard 1 to Year 5 as well as SJKT FES Serdang meanwhile the remaining two schools were only Year 4 and Year 5.

3.6 Sampling Size

The sample size of this study calculated based on Equation 3.6 (Lemeshow, 1990) formula for one group cross-sectional study. The formula and calculation are shown as below:

$$n = \frac{Z^2_{1-\alpha/2}\, P\,(1-P)}{d^2} \qquad \text{Eq. 3.6.1}$$

Where

$Z_{1-\alpha/2}$ = z-score (1.96 for 95% confident interval)

P = Anticipated population proportion of smokers smoked in homes (78% according to Wipfli et al., 2008)

d = Absolute precision required on either side of the proportion (Margin of error is ± 10% or 0.1)

The calculation of estimated sample size:

$n = (1.96^2)*0.78*(1-0.78)/ (0.1^2)$

$= 3.8416*0.78*(0.22)/ (0.01)$

$= 0.65921856/ 0.01$

$= 65.9 \approx$ 66 households of respondents

Finite population correction factor:

$$n_a = \frac{n_r}{1+\frac{n_r-1}{N}} \quad \text{Eq. 3.6.2}$$

Where

n_a = The adjusted sample size

n_r = The original required sample size

N = Population size

n_a = $65.9/\ 1 + [(65.9 - 1)/\ (0.2*65.9 + 65.9)]$

= $36.19511043 \approx 37$

The number of household respondents needed was 37. However, after taking into consideration the additional 10% recovery to counter non-responsive respondents, missing data and errors, the number of household respondents will be 41 that recruited through both female and male students of schoolchildren.

3.7 Study Flowchart

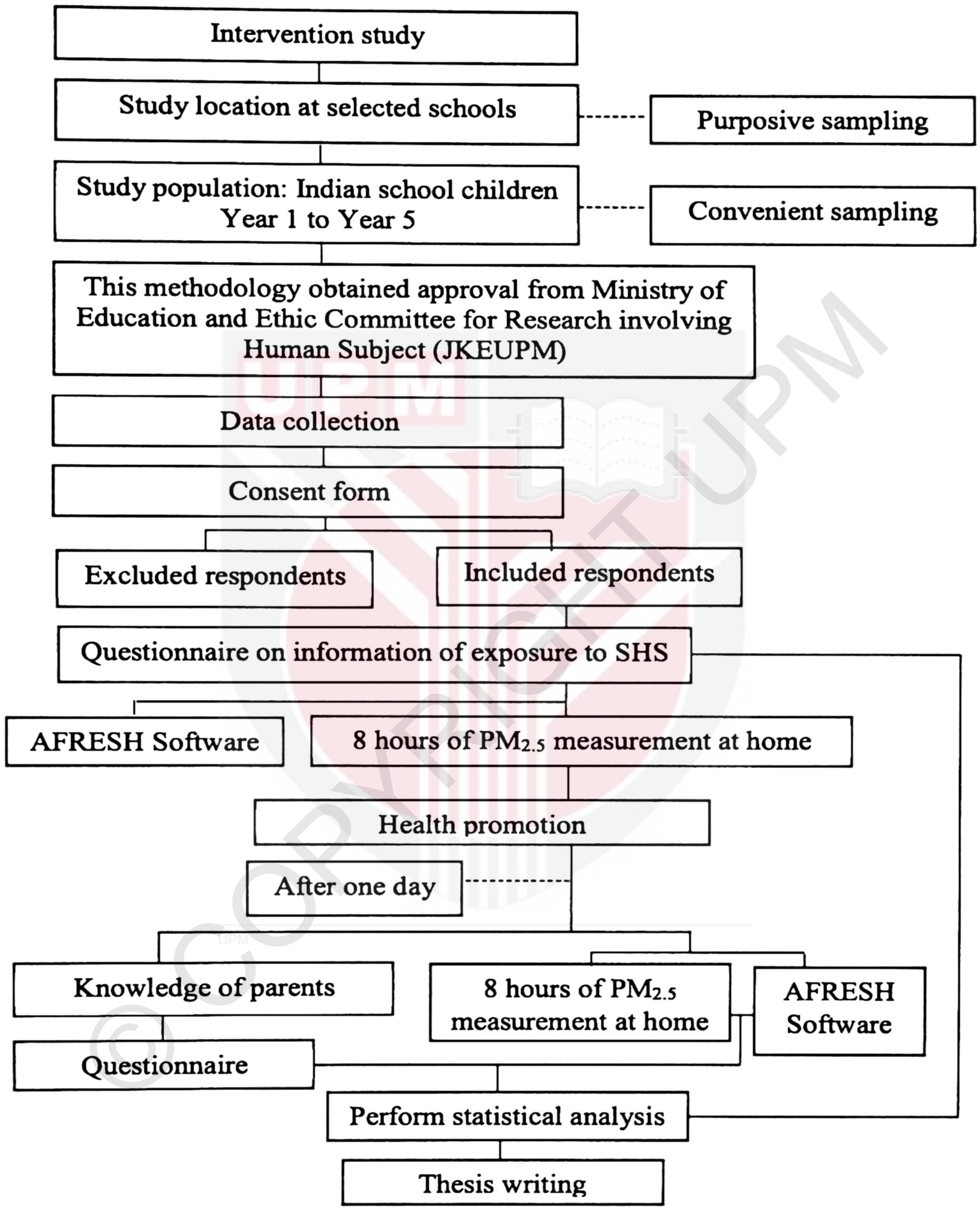

Figure 3.7.1: Study Flowchart

3.8 Study Instrumentation

3.8.1 Dylos DC1700 Air Quality Monitor

Dylos DC1700 is a True Laser Particle Counter that counts individual particles not more than 2.5µm with a dynamic bar graph showing instantaneous particle activity. It operates in continuous and monitoring mode. The flow rate of this equipment is 0.038 cfm (cubic feet per minute). Besides, PC Interface will be included that the data output in a format ready to load into a spreadsheet program for graphing or further analysis. DC1700 is shielded against Electro-Magnetic Interference in which it will count accurately even in close proximity to sources of interference, such as industrial machinery, fluorescent lights, and high voltage power supplies found in some air purifiers. Sampling duration in each house was eight hours. In order to minimize other sources that could contribute to the detection of this indoor air pollutions, all of these measurements will be carried out away from any source of use of coal or wood. The instrument placed at an elevated place of a meter that is unachievable and in the living room and one metre away from windows or doors as possible (Gaofeng et al., 2017). It is specifically identify SHS coming from cigarette smoke as there is an application of algorithm.

3.8.2 Brochure

Brochure as a tool of health promotion was distributed to the smoking parents in which the content is adapted from Ministry of Health on second-hand smoke entitled "The Harmful Effects of Second-hand Smoke". The content of the brochure has included the definition of second-hand smoke, the harmful chemicals in cigarette, the statistics of children exposed to second-hand smoke at home, the health effects of exposure to second-hand smoke and the solution to reduce second-hand smoke exposure at home to children. The content was written in English as in Appendix A.

Figure 3.8.2: Front page of health promotion brochure

3.8.3 Questionnaire

Questionnaire were distributed to the school children and filled by their smoking parents, Part A consists of six items of socio-demographic information to be filled including age, gender, occupation, salary, educational level and religion. Part B was on the cigarette use adapted from Global Adult Tobacco Survey (GATS) with eight items. The knowledge of parents were assessed through questionnaire in which the questions are formulated from brochure that had be given to the parents as the instrument for health promotion. The brochure is adapted from Ministry of Health brochure entitled "The Harmful Effects of Second-hand Smoke" that aims to increase the knowledge particularly smoking parents on the harmful effect of second-hand smoke and to reduce the exposure of second-hand smoke to their children at home. This Part C was made up of seven questions that test the knowledge of parents on the toxic chemicals in cigarette, the health effect of second-hand smoke exposure to children and the definition of second-hand smoke. There were positive and negative statements. For every correct answer, respondent was given (1) mark meanwhile zero (0) mark for wrong answer. All questionnaires were in Malay and Tamil language. Questionnaire as in Appendix B.

3.8.4 AFRESH Software

AFRESH Software version 0.40 04052016 was used to produce the SHS report by using data from Dylos DC 1700. The data was downloaded by plugged in the USB

cable into the port and launched the software. After data is downloaded in the software, it will automatically produce report in PDF and data in excel format. REFRESH study has found that by using this evidence based behavioural intervention has succeeded in reducing the average concentrations of $PM_{2.5}$ (Ruaraidh et al., 2017).

3.9 Quality Control

3.9.1 Dylos DC1700 Air Quality Monitor

The maintenance of Dylos DC1700 is by cleaning it with compressed air periodically (Semple, n.d.).

3.9.2 Questionnaire

Pre-test was carried out to identify any problems such as unclear instructions or questions in the questionnaire. The questionnaire tested first on 10% which is four of the total respondents to ensure the contents of the questionnaire are understandable for the smoking parents to fill in. This pre-test conducted among the same socio-demographic of desired respondents. Time taken for the respondents to answer the questionnaire estimated through this pre-testing was 15 minutes. Through the pre-test, majority of the respondents preferred the questionnaire to be in Tamil language thus the questionnaire was translated into Tamil together with Malay translation. The

translated questionnaire was reviewed by expert and pre test was carried out among desired respondents.

3.10 STATISTICAL ANALYSIS

In this study, Statistical Package for Social Science (SPSS) Version 20 used to perform statistical analysis. Descriptive data for continuous variables presented in range values with means and standard deviation (SD) for the socio-demographic distribution and the level of $PM_{2.5}$ before and after the intervention and also the knowledge of smoking parents. Paired t-test was used in comparing the level of $PM_{2.5}$ before and after the intervention. Wilcoxon signed rank test was used in comparing the level of knowledge of smoking parents before and after the health promotion.

3.11 Token of Appreciation

All of the students involved were given stationaries as an appreciation meanwhile the participating households were given food token.

3.12 ETHICAL CONSIDERATION

This study has obtained ethical approval from University Research Ethics Committee of Universiti Putra Malaysia, Selangor, Malaysia (JKEUPM) with reference number of JKEUPM-2018-352 and Ministry of Education, Malaysia with reference number KPM.600-3/2/3-eras(2540). Respondents were briefed on the purpose of study and written inform consent obtained from respondents are confidential and used for study purposes only.

CHAPTER 4

RESULTS

4.1 Response rates

Questionnaires were distributed to 579 school children of 20 classes in 4 schools consists of students from Year 1 to Year 5. A total of 14.34% (n=83) responded questionnaires were returned. However, 46.99% (n=39) of questionnaires were returned incomplete meanwhile 53.01% (n=44) questionnaires positively respond to participate in this study. Among the number, 65.91% (n=29) respondents of households were not eligible and making 34.09% (n=15) respondents of households enrolled in this study. Nevertheless, there were 53.3% (n=8) drop outs from this study. Therefore, 46.7% (n=7) respondents of households participated in this study.

4.2 Socio-demographic data

A total of 7 households were enrolled in this study. The age of the participated respondents ranged from 31 to 54 years old, with a mean of 39.29 years (7.319). All of the respondents were males (100%) and consists of Indian ethnicity (100%) with Hindu religion (100%). Majority of the respondents' educational level was up to primary school level (42.9%) and up to secondary school level (42.9%). More than half of the respondents (57.1%) were non-government employees and the least was government employee (14.3%). 100% of the respondents were categorized in low

income. 37 non-participating households have a mean age of 41.05 years (5.637). The age ranged from 32 years old to 58 years old. This households consist of female and male respondents, 35.1% and 64.9% respectively and 100% of them are Indian ethnicity. Majority are Hindu and 2.7% for each Christian and Buddha. The educational level of non-participating households comprised of no education as the least which is 2.7% meanwhile 54.1% are secondary level. Apart from that, the occupation that made up the most in this households are non-government staffs which is 48.6% and 2.7% retiree as the lowest number. Furthermore, 10.8% are not working making 10.8% of them have no income. All of the participating households are smokers meanwhile majority of non- participating households are non-smokers. Data for the socio-demographic distribution is as shown in Table 4.2.1 and Table 4.2.2.

Table 4.2.1: Socio-demographic distribution of participating (n=7) and non-participating households (n=37)

Variables		Non-participating households	Participating households
Total		n=37	n=7
Mean age			
Mean (SD)		41.05 (5.637)	39.29 (7.319)
Gender			
	Male	24 (64.9)	7 (100)
	Female	13 (35.1)	-
Ethnicity			
	Indian	37 (100)	7 (100)
Religion			
	Hindu	35 (94.6)	7 (100)
	Christian	1 (2.7)	-
	Buddha	1 (2.7)	-
Educational level			
	No formal education	1 (2.7)	-
	Primary	2 (5.4)	3 (42.9)
	Secondary	20 (54.1)	3 (42.9)
	Tertiary	14 (37.8)	1 (14.3)
Occupation			
	Government	5 (13.5)	1 (14.3)
	Non-government	18 (48.6)	4 (57.1)
	Self-employed	9 (24.3)	2 (28.6)
	Retiree	1 (2.7)	-
	Not working	4 (10.8)	-
Income*			
	Low	19 (51.4)	7 (100)
	Medium	14 (37.8)	-
	High	-	-
	No income	4 (10.8)	-
Smoking status			
	Yes	9 (24.3)	7 (100)
	No	28 (75.7)	-

Values are in numbers (percentages)
SD: Standard Deviation
*: The three categories was derived from Department of Statistics for 2017 findings. Household income not more than RM3,000 is categorized as low income, medium ranged from RM3,000 to RM6,275 and high for those with household income more than RM13,148.

Table 4.2.2: Socio-demographic distribution of non-participating households based on smoking status

Variables		Non- participating households (n=37)	
Smoking status		Yes (n=9)	No (n=28)
Gender			
	Male	9 (100)	15 (53.6)
	Female	-	13 (46.4)
Religion			
	Hindu	9 (100)	26 (92.9)
	Christian	-	1 (3.6)
	Buddha	-	1 (3.6)
Educational level			
	No formal education	1 (11.1)	-
	Primary	1 (11.1)	1 (3.6)
	Secondary	6 (66.7)	14 (50.0)
	Tertiary	1 (11.1)	13 (46.4)
Occupation			
	Government	-	5 (17.9)
	Non-government	5 (55.6)	13 (46.4)
	Self-employed	3 (33.3)	6 (21.4)
	Retiree	-	1 (3.6)
	Not working	1 (11.1)	3 (10.7)
Income*			
	Low	7 (77.8)	12 (42.9)
	Middle	1 (11.1)	13 (46.4)
	High	-	-
	No income	1 (11.1)	3 (10.7)

Values are in numbers (percentages)

*: The three categories was derived from Department of Statistics for 2017 findings. Household income not more than RM3,000 is categorized as low income, medium ranged from RM3,000 to RM6,275 and high for those with household income more than RM13,148.

The highest number of smokers are at the age of 39 years old and 47 years old for participating and non- participating households, respectively. It is also found that both households have the same number of smokers at the age of 41 years old. The frequency of smoking among the male participants in both participating and non-participating households are shown in Figure 4.2.3.

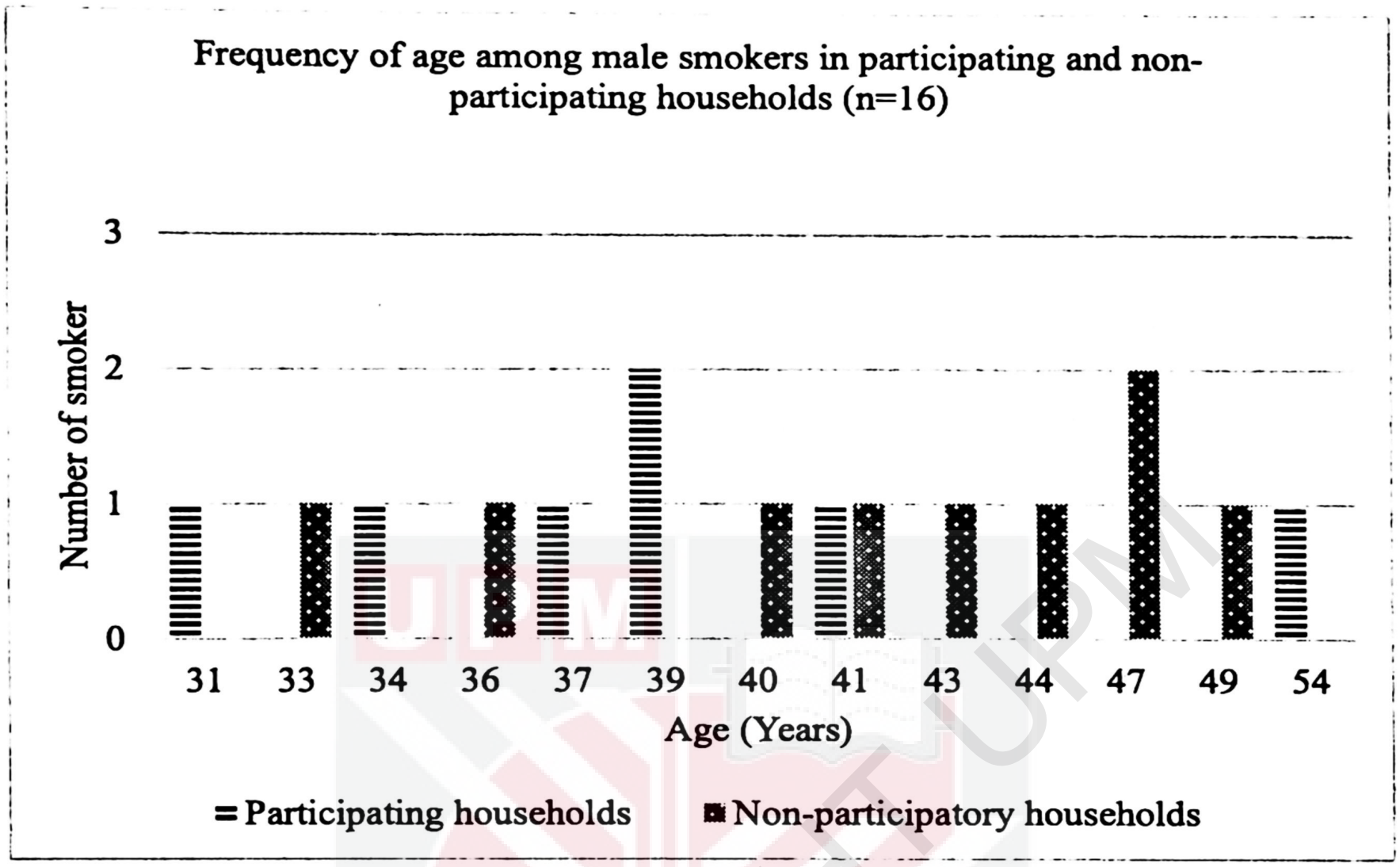

Figure 4.2.3: Frequency of age of smokers among participating households and non-participating households

4.3 Smoking history

The highest average number of cigarettes smoked daily among participating households is 6 cigarettes which is 28.6% from the total number of 7 compared with non-participating households is 0 cigarettes (75.7%). Approximately 57.1% of participating households smoked for 7 days with the presence of their children for the past week meanwhile only 10.8% of non-participating households. Lastly, the frequency of smoking in house among respondents of participating households is the highest for sometimes (42.9%) and among the non- participating households is never smoke in house (78.4%). The smoking history among smokers are shown in Table 4.3.1.

Table 4.3.1: Smoking history of smokers in participating and non- participating households

Variables		Non-participating households	Participating households
Total		n=9	n=7
Average number of cigarettes smoked daily			
	4	-	1 (14.3)
	5	3 (33.3)	1 (14.3)
	6	-	2 (28.6)
	7	1 (11.1)	-
	10	1 (11.1)	1 (14.3)
	20	3 (33.3)	1 (14.3)
	40	1 (11.1)	1 (14.3)
Frequency of smoking in house with the presence of children			
	0 Days	1 (11.1)	-
	1-2 Days	4 (44.4)	2 (28.6)
	3-4 Days	-	1 (14.3)
	5-6 Days	-	-
	7 Days	4 (44.4)	4 (57.1)
Frequency of smoking in house			
	Never	1 (11.1)	2 (28.6)
	Sometimes	4 (44.4)	3 (42.9)
	Everyday	4 (44.4)	2 (28.6)

Values are in numbers (percentages)

4.4 Number of cigarette smoked, smoking person, type of ventilation and volume of living room of participating households.

Among the seven households, the highest number cigarette smoked before air quality feedback is carried out is eight and the lowest number is two. However, the highest number of cigarette smoked after the intervention is eight and the lowest is one. Among the seven households, only household 1, household 5 and household 7 did

not have reduction in terms of number of cigarette smoked. All households only have natural ventilation such as windows. The highest volume of the living room recorded is 134.87 m^3. Data on the frequency of cigarette smoked, number of smoking people in house, type of ventilation and the volume of living room are as shown in Table 4.4.1.

Table 4.4.1: The number of cigarette smoked, number of people smoking in each household, type of ventilation and volume of living room

Variables	Number of cigarette smoked		Number of other people smoking in house	Type of ventilation	Volume of living room (m^3)
	Before intervention	After intervention			
Household 1	3	5	-	Natural	134.87
Household 2	8	1	-	Natural	43.41
Household 3	4	1	-	Natural	43.46
Household 4	7	3	-	Natural	45.50
Household 5	2	8	-	Natural	41.30
Household 6	5	1	-	Natural	40.93
Household 7	4	8	-	Natural	59.79

Values are in numbers
Natural ventilation such as windows

4.5 Level of $PM_{2.5}$ in each participating households

The following figures are the graphs produced in each household (n=7) before and after measurement.

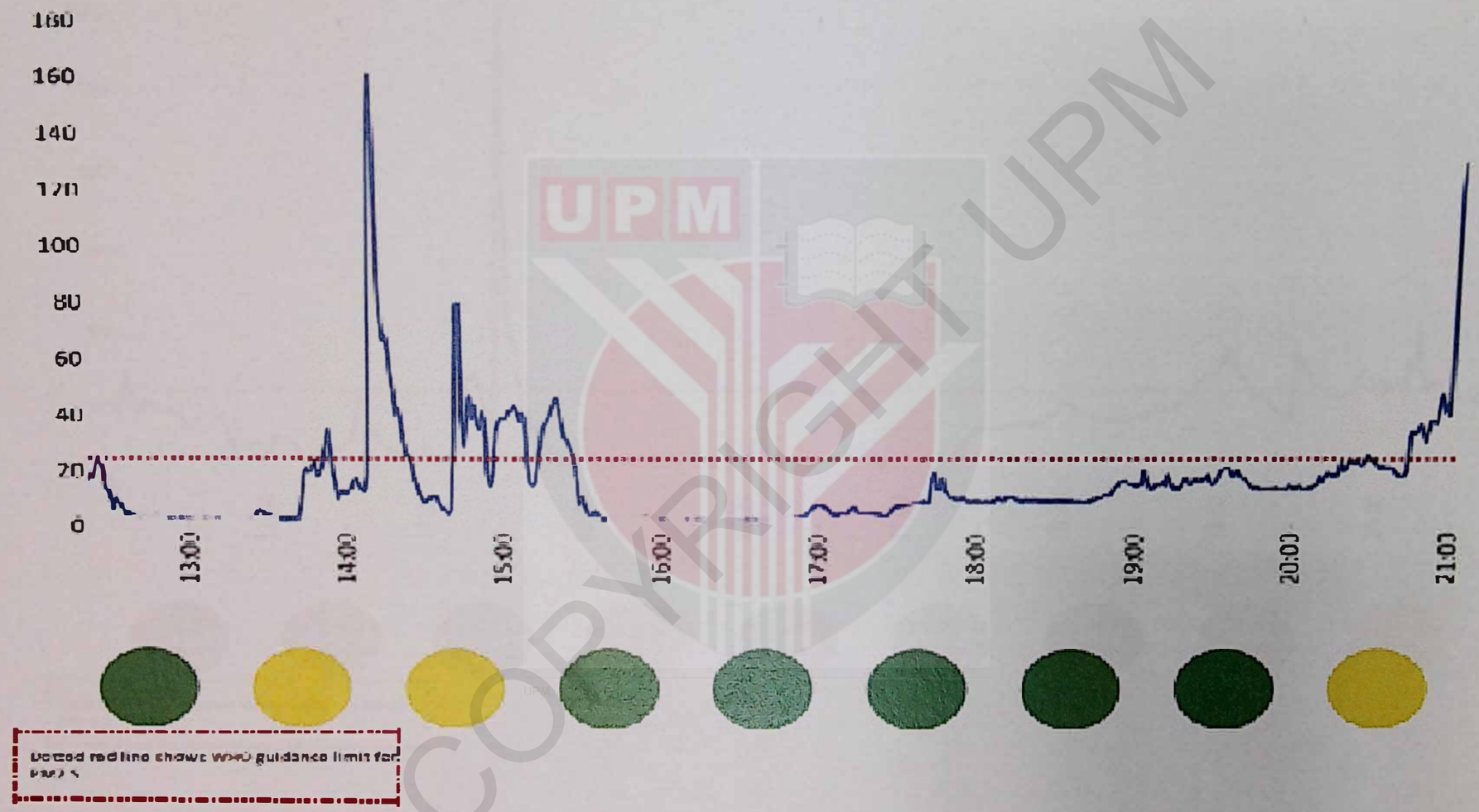

Figure 4.5.1: Graph of $PM_{2.5}$ in household 1 before the intervention

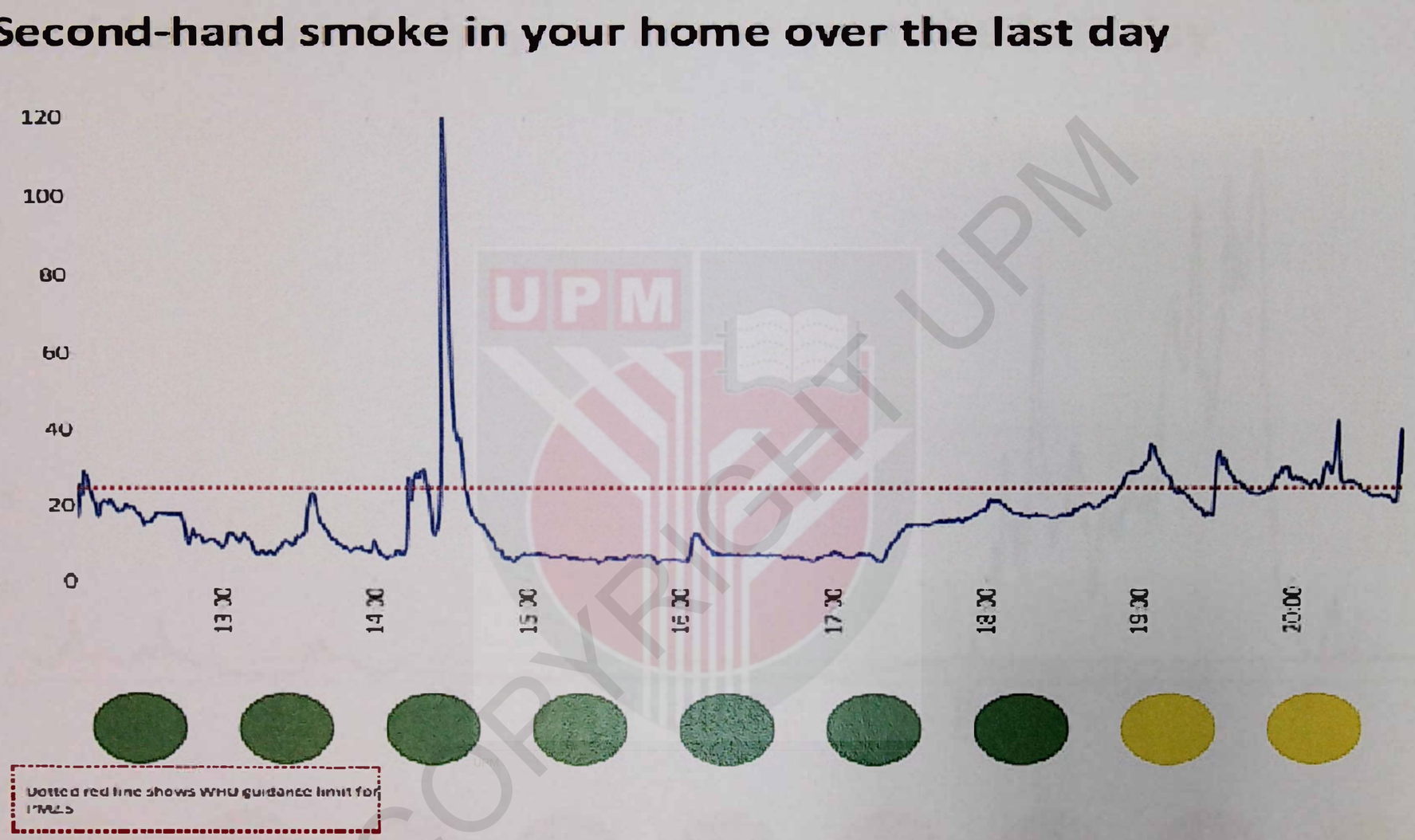

Figure 4.5.2: Graph of $PM_{2.5}$ in household 1 after the intervention

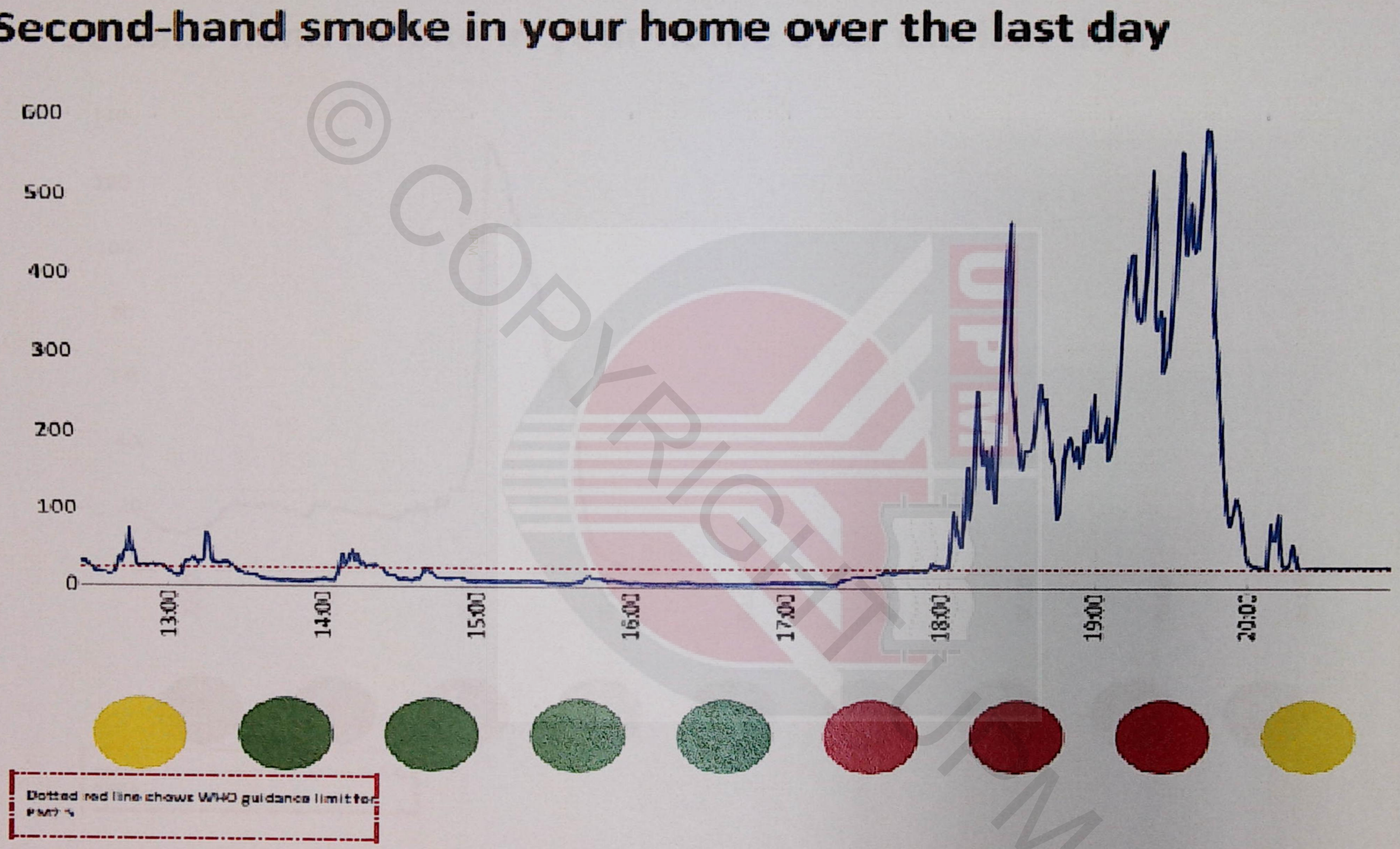

Figure 4.5.3: Graph of $PM_{2.5}$ in household 2 before the intervention

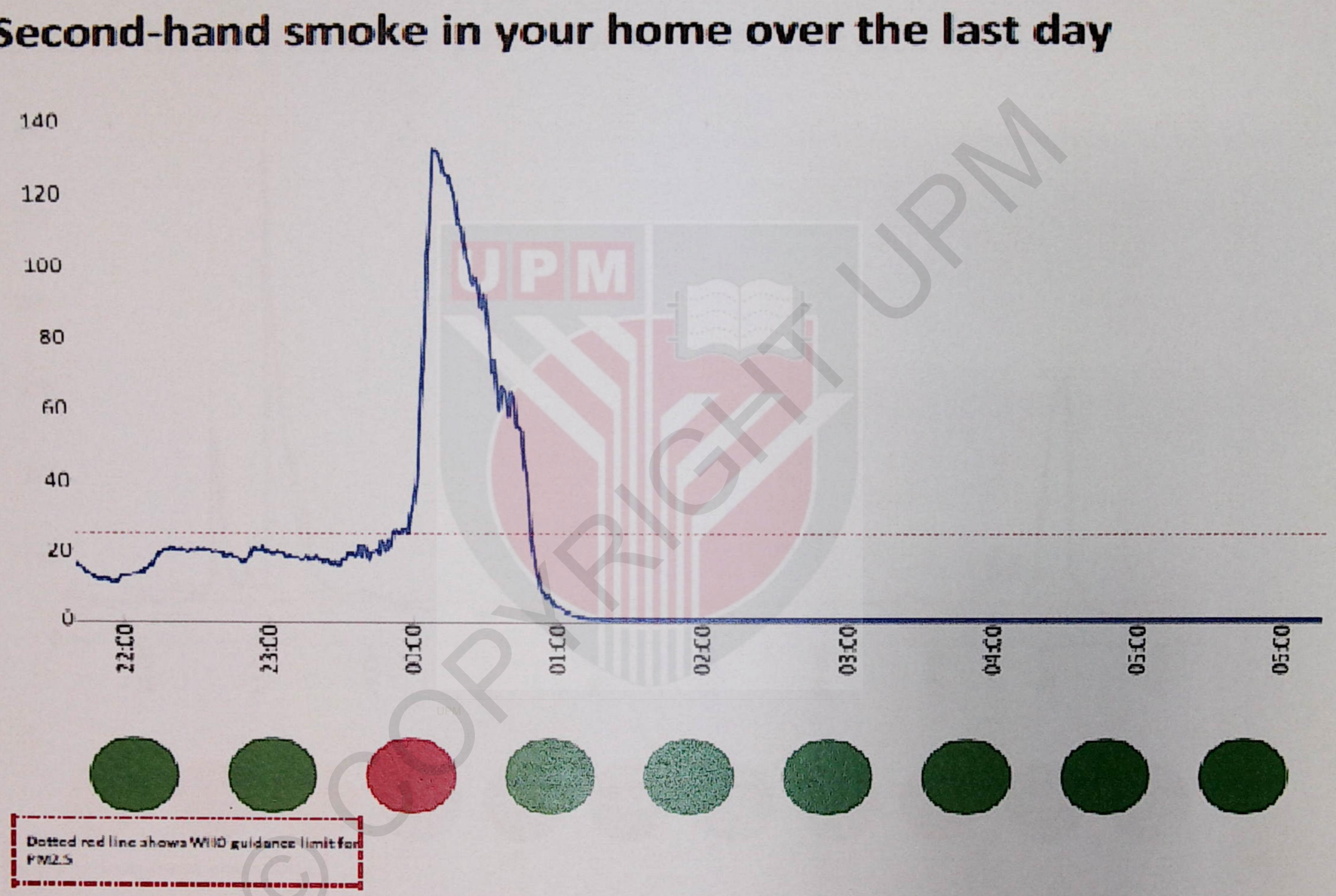

Figure 4.5.4: Graph of $PM_{2.5}$ in household 2 after the intervention

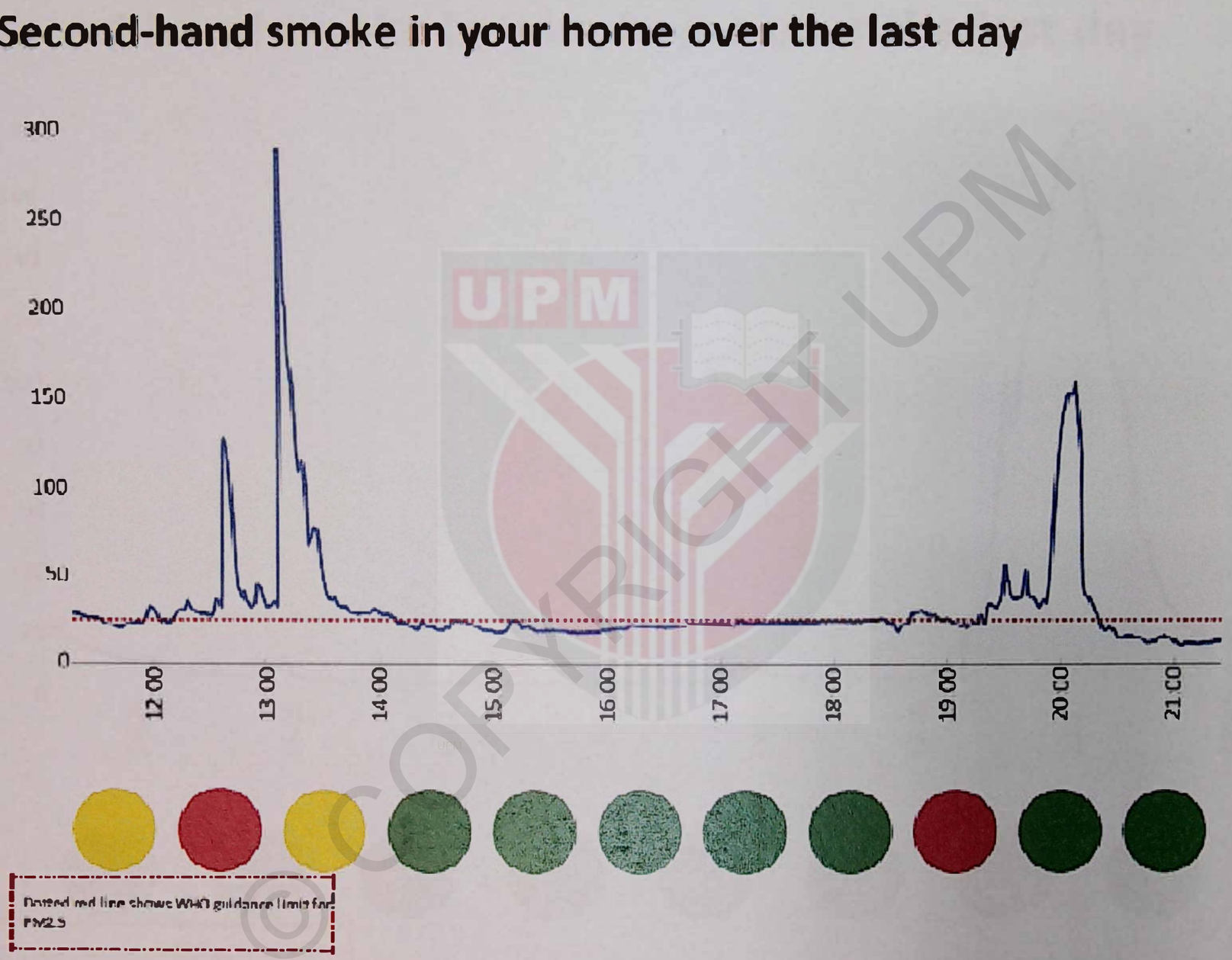

Figure 4.5.5: Graph of $PM_{2.5}$ in household 3 before the intervention

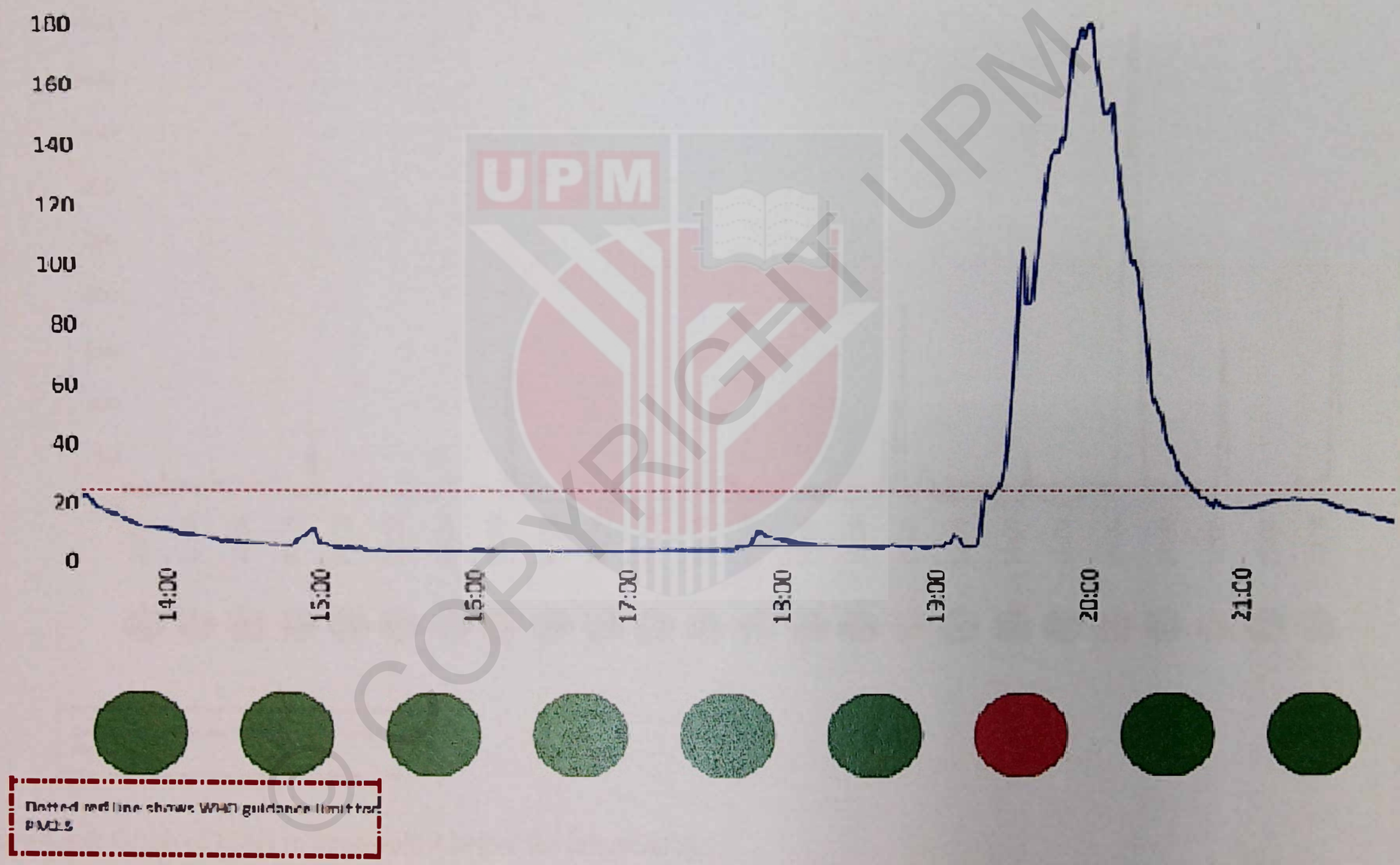

Figure 4.5.6: Graph of $PM_{2.5}$ in household 3 after the intervention

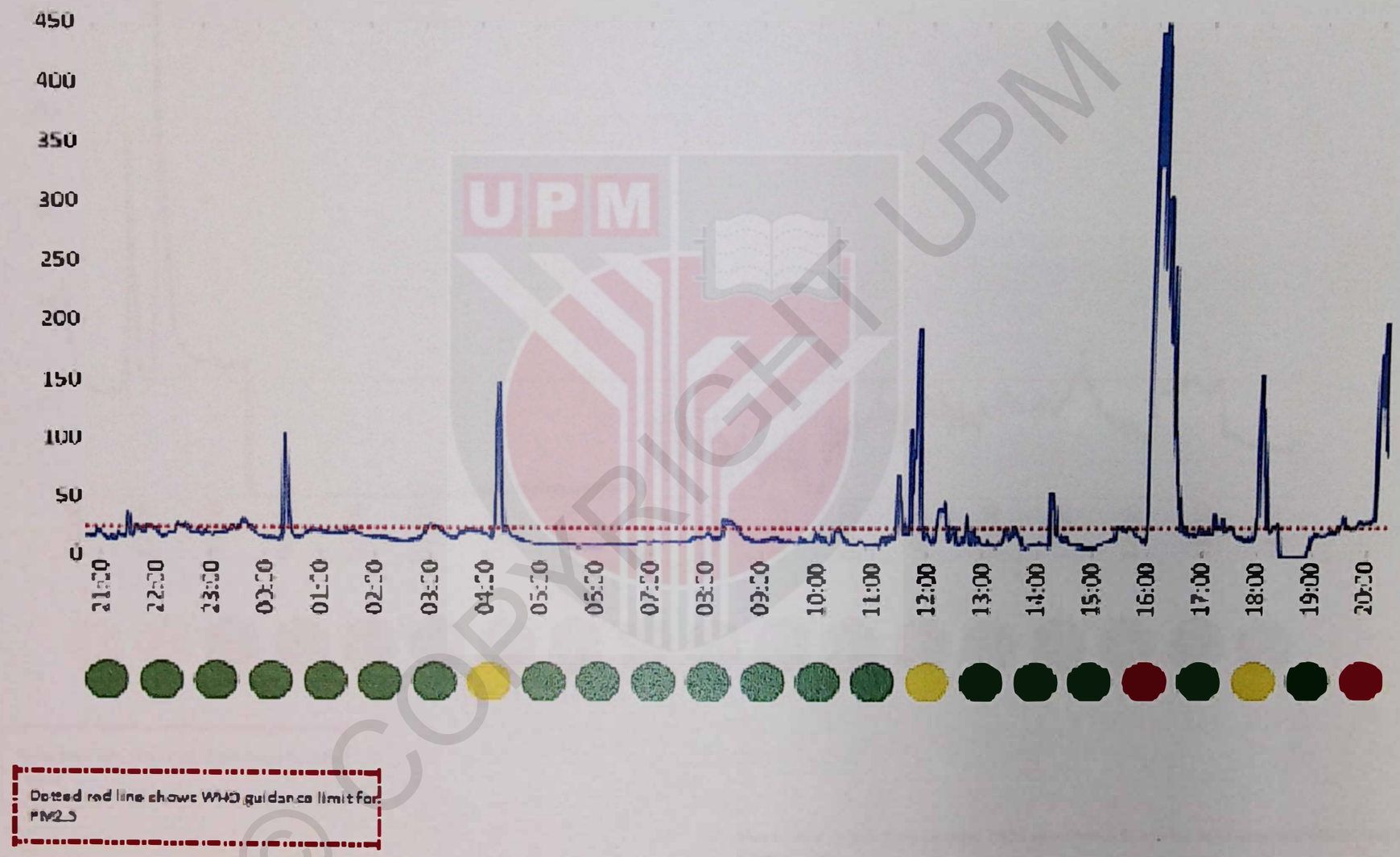

Figure 4.5.7: Graph of $PM_{2.5}$ in household 4 before the intervention

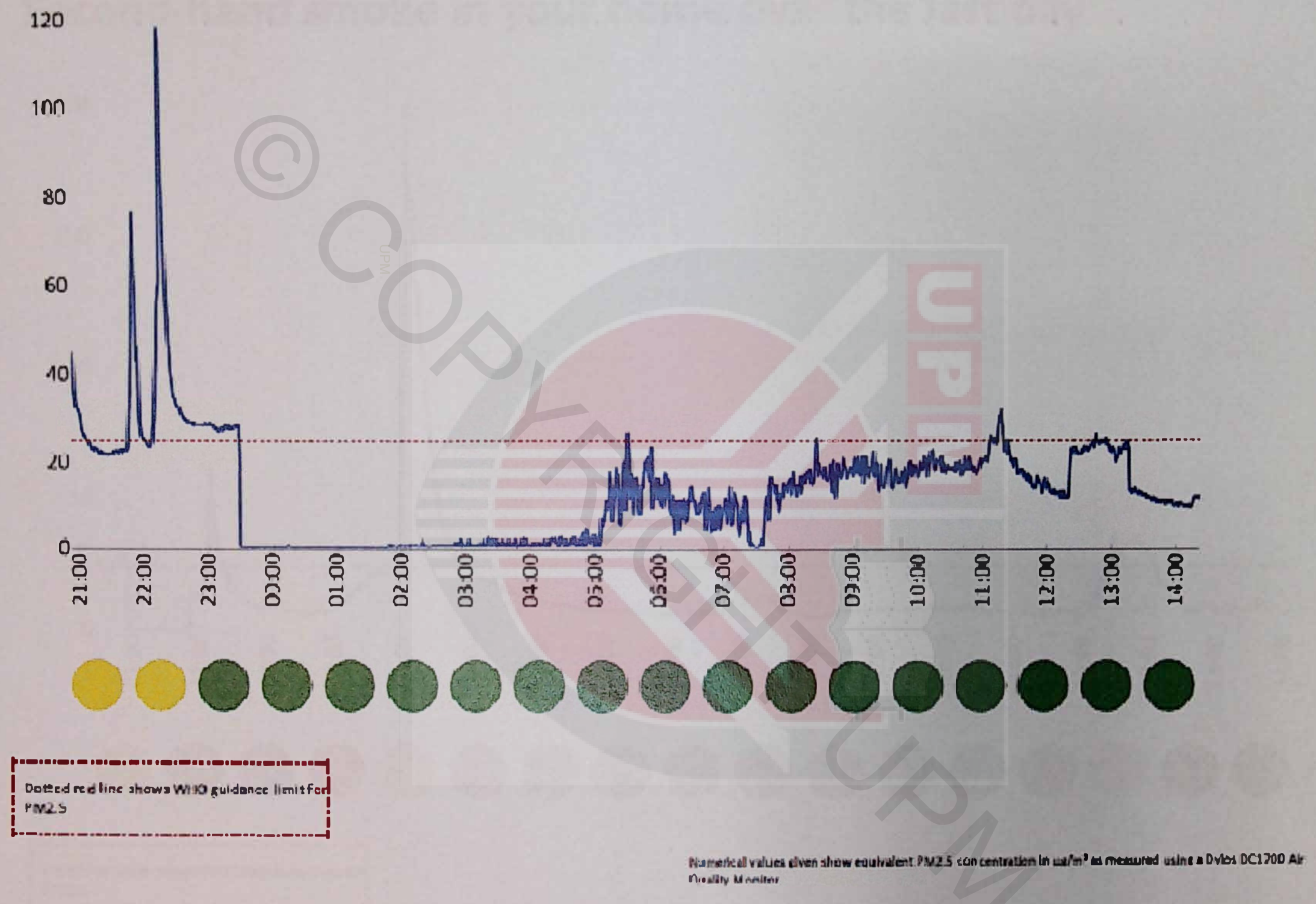

Figure 4.5.8: Graph of $PM_{2.5}$ in household 4 after the intervention

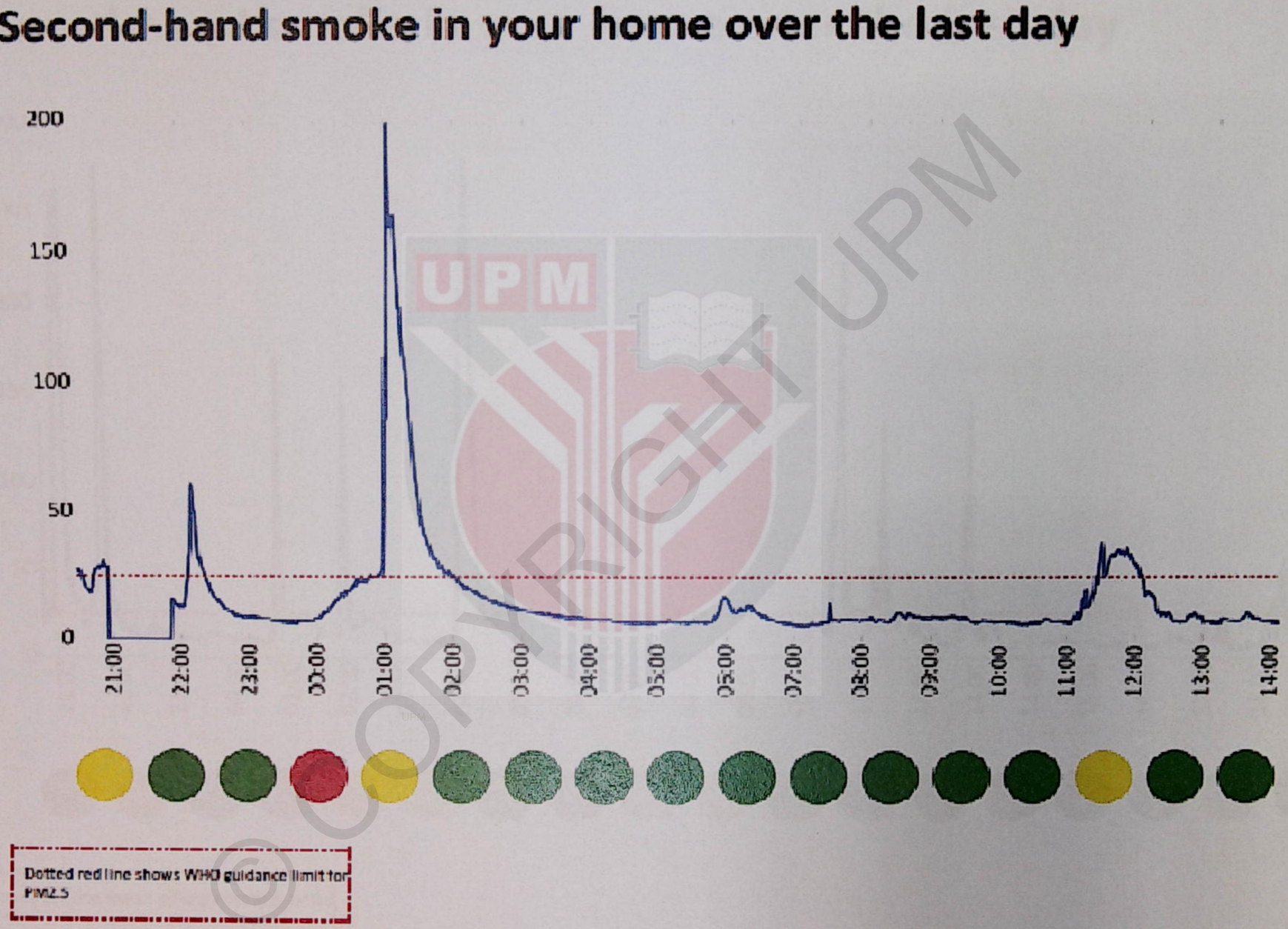

Figure 4.5.9: Graph of $PM_{2.5}$ in household 5 before the intervention

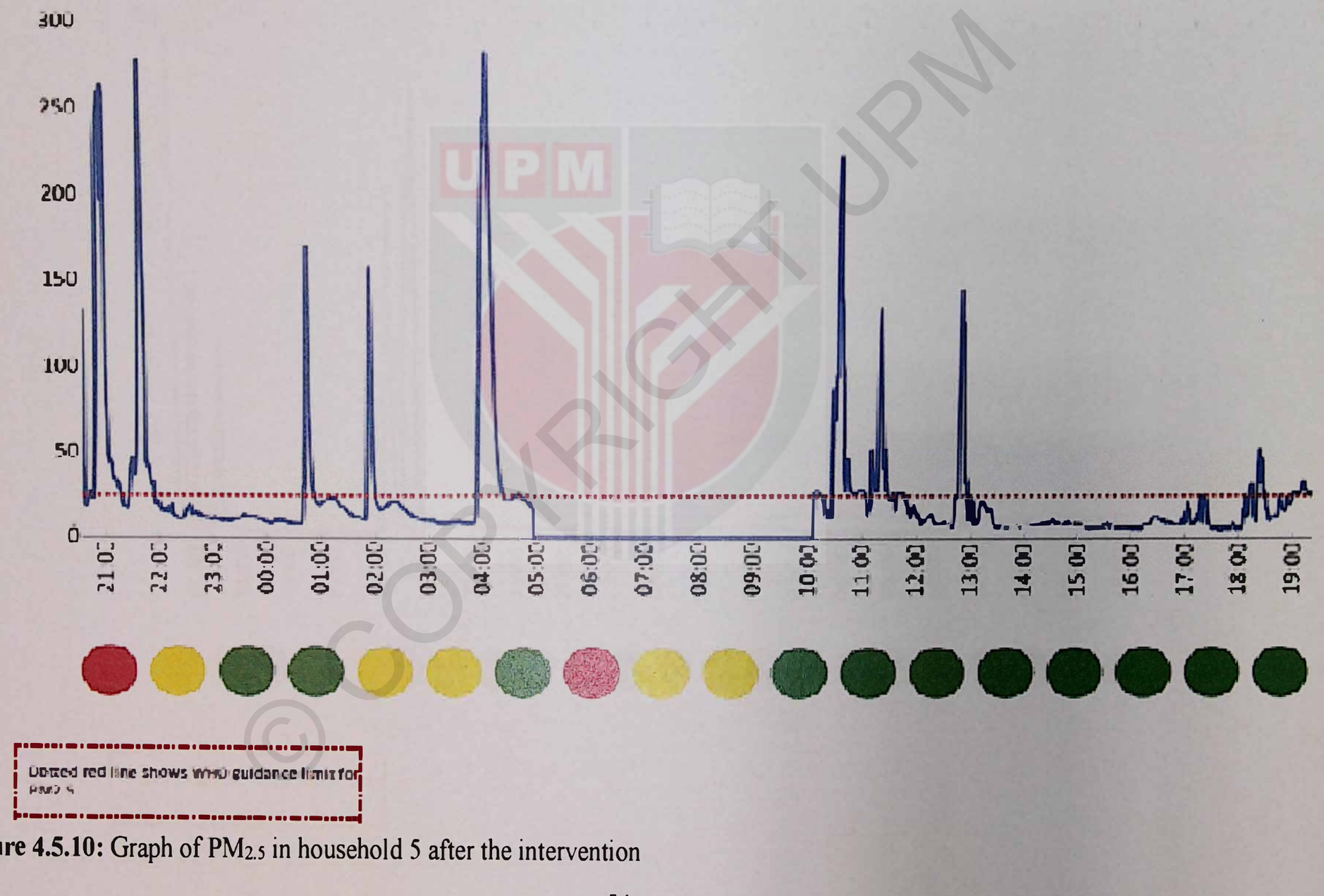

Figure 4.5.10: Graph of $PM_{2.5}$ in household 5 after the intervention

Second-hand smoke in your home over the last day

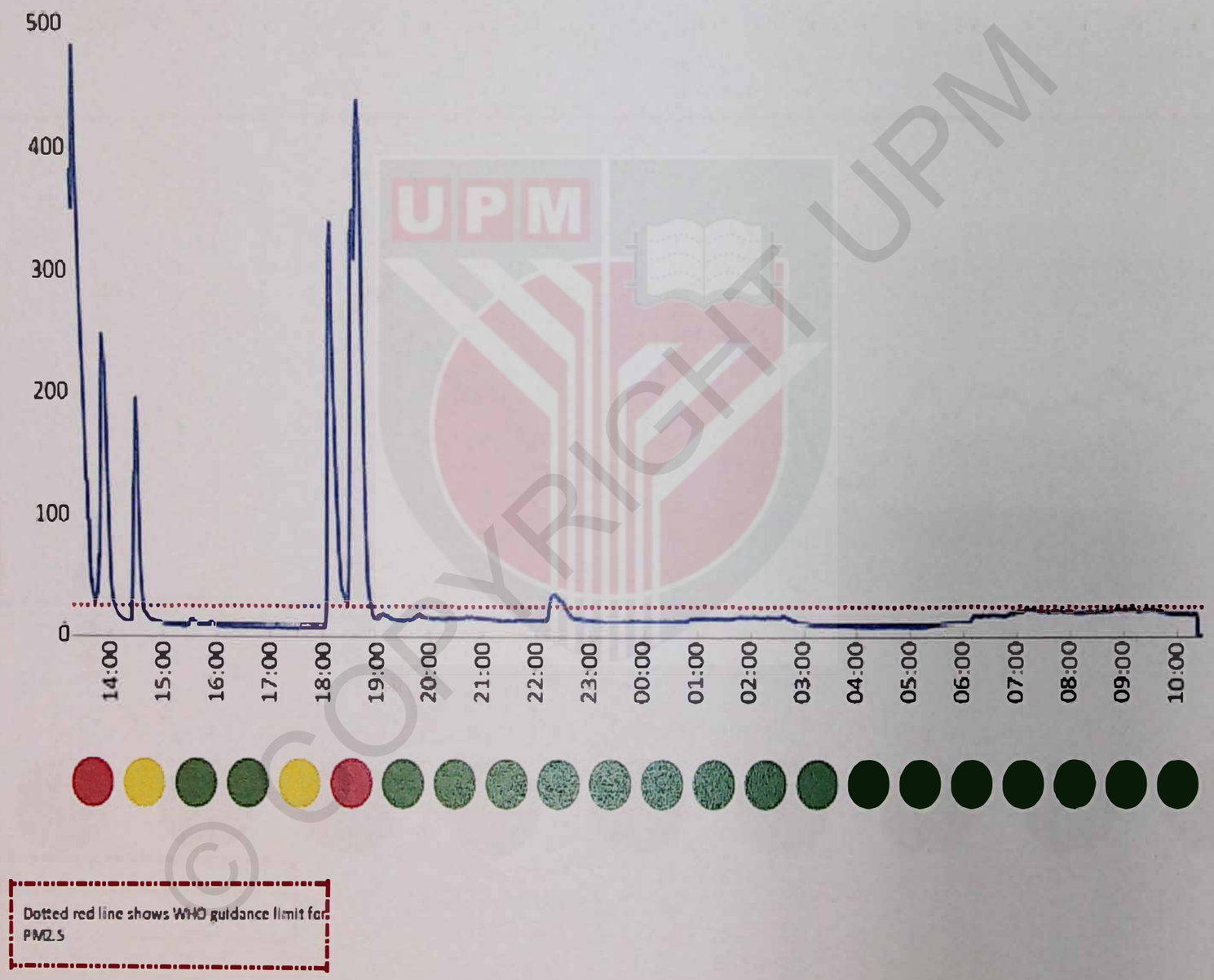

Figure 4.5.11: Graph of $PM_{2.5}$ in household 6 before the intervention

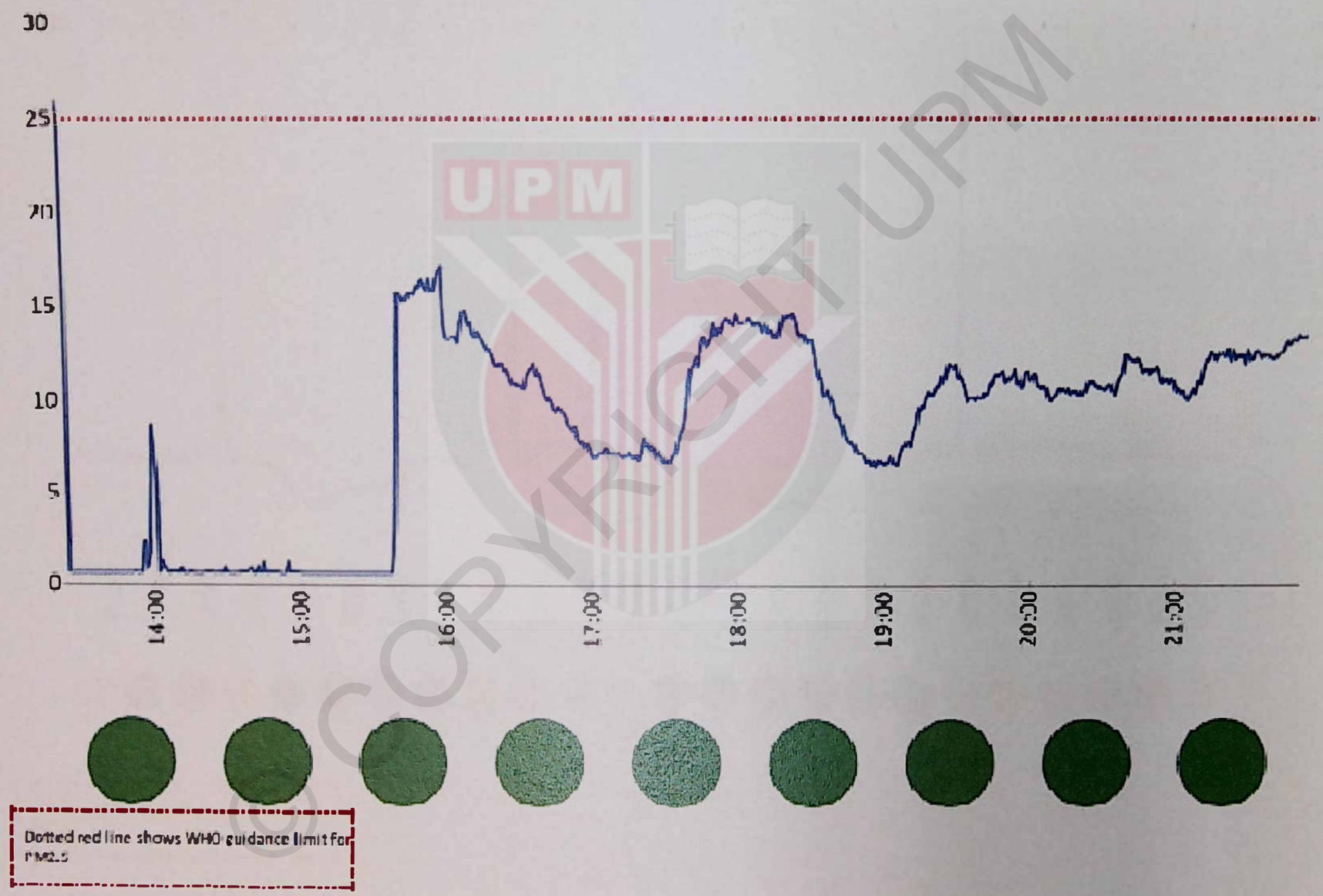

Figure 4.5.12: Graph of $PM_{2.5}$ in household 6 after the intervention

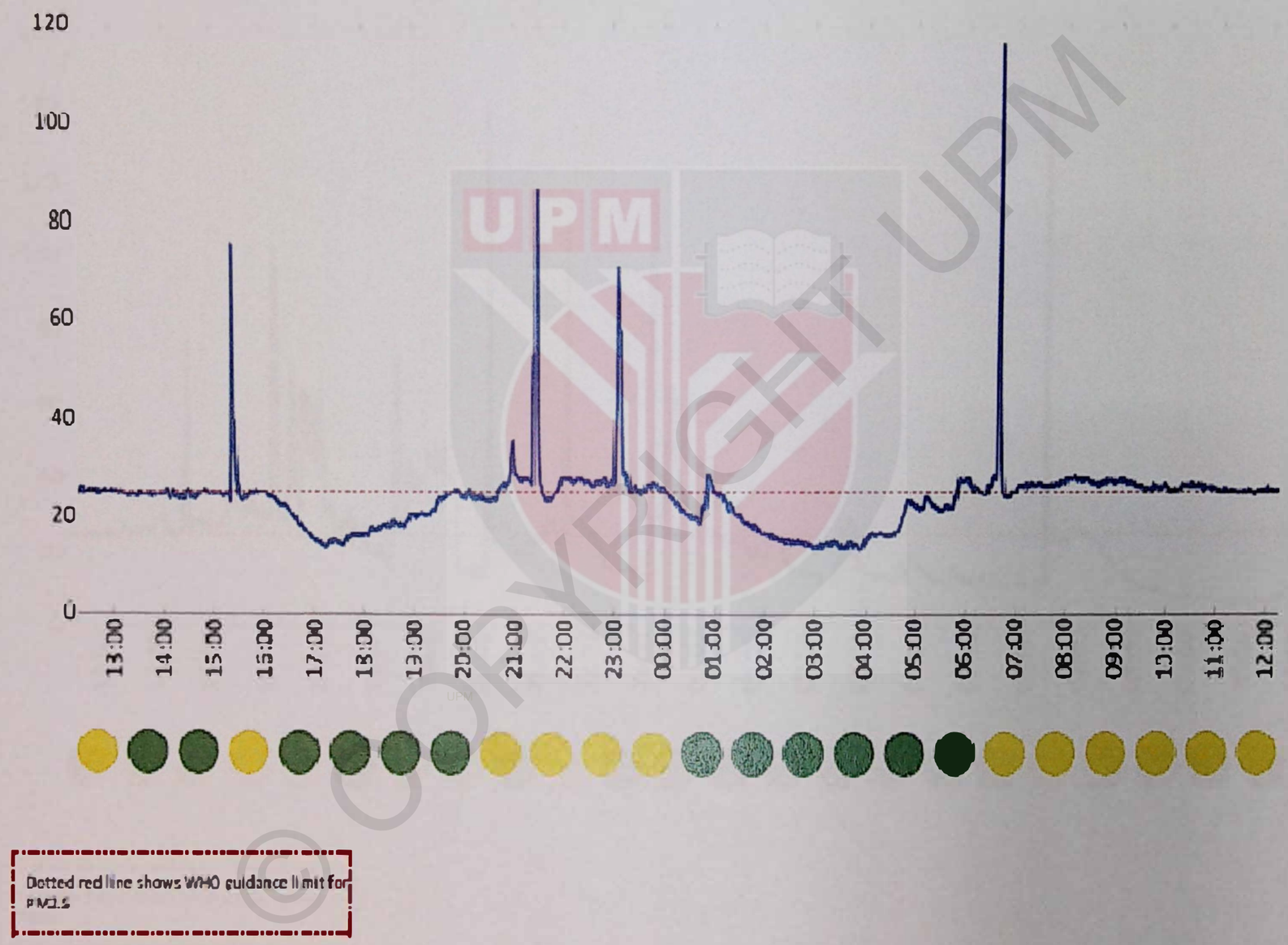

Figure 4.5.13: Graph of $PM_{2.5}$ in household 7 before the intervention

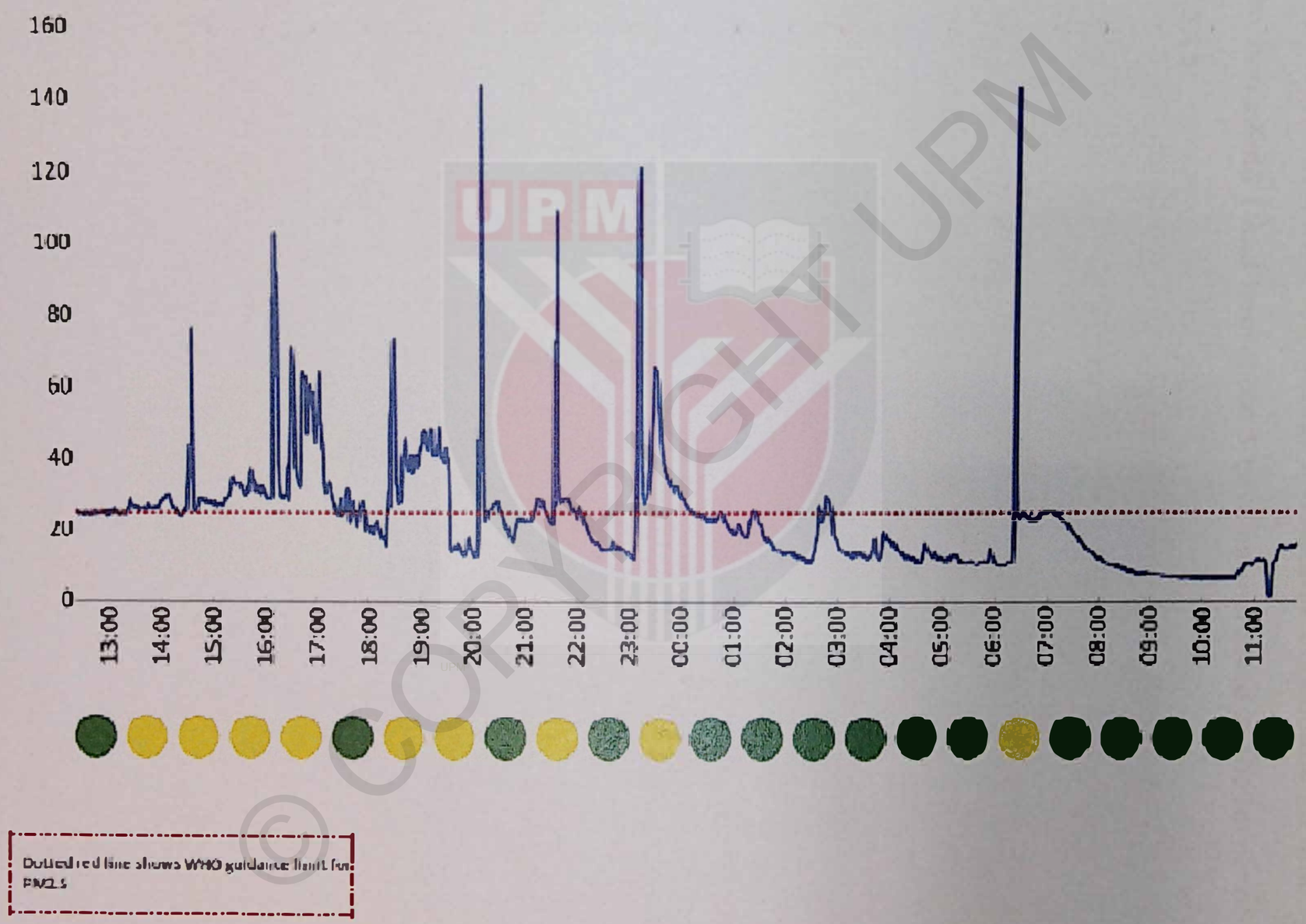

Figure 4.5.14: Graph of $PM_{2.5}$ in household 7 after the intervention

The level of $PM_{2.5}$ in household 2, household 3, household 4 and household 6 have decreased compared to the average level before conducting air quality feedback. However, household 1 and household 5 have an increased in the levels of $PM_{2.5}$ as in Table 4.5.15.

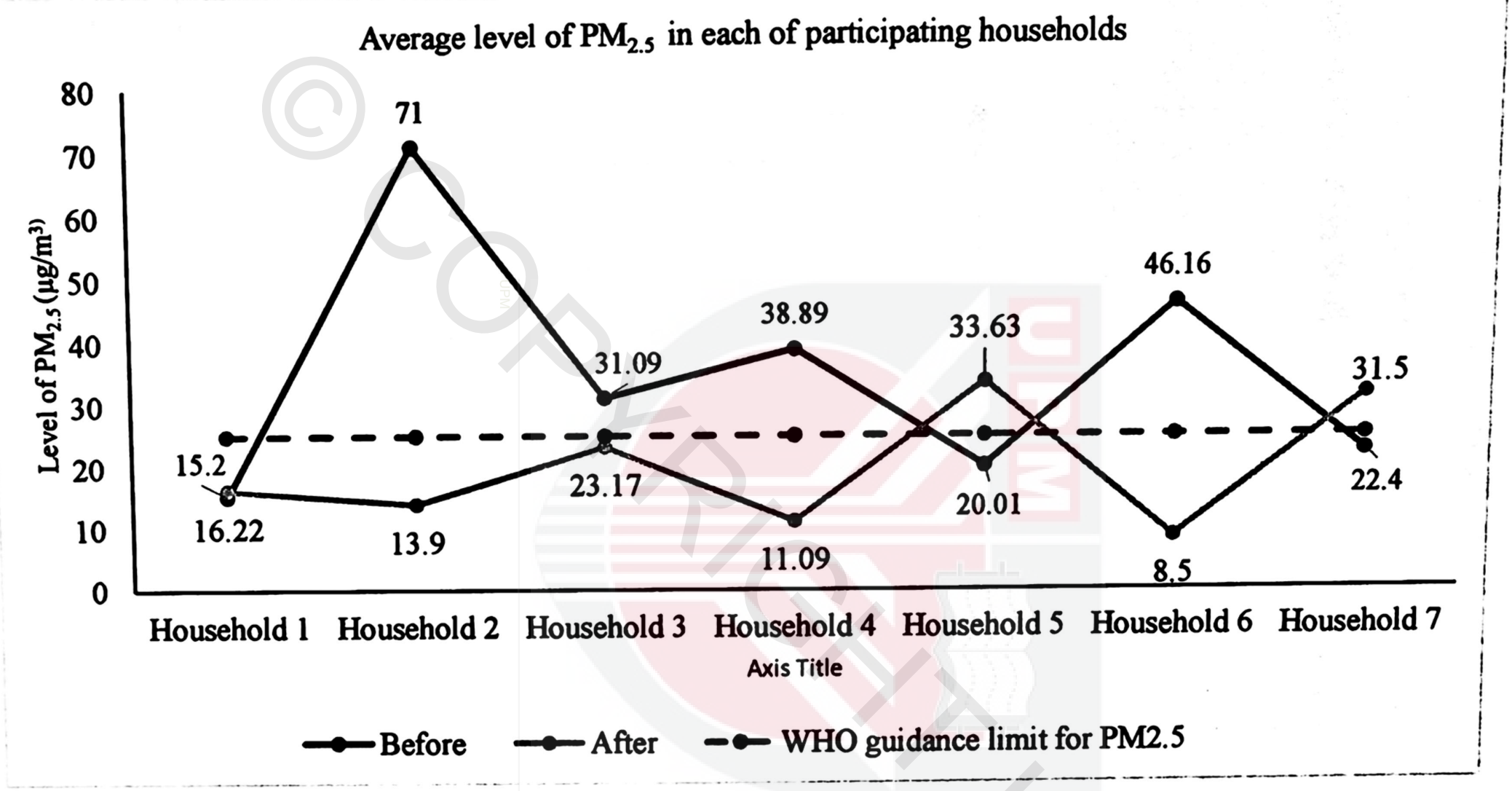

Figure 4.5.15: Line graph comparing level of $PM_{2.5}$ before and after air quality feedback in each household.

4.6 Level $PM_{2.5}$ in participating households

The comparison in mean level of $PM_{2.5}$ before and after air quality feedback has been given for 8 hours and 30 minutes. It is found that there is reduction of mean level of $PM_{2.5}$ from 34.96 (19.26) to 19.76 (9.92) $\mu g/m^3$ as in Figure 4.6.1.

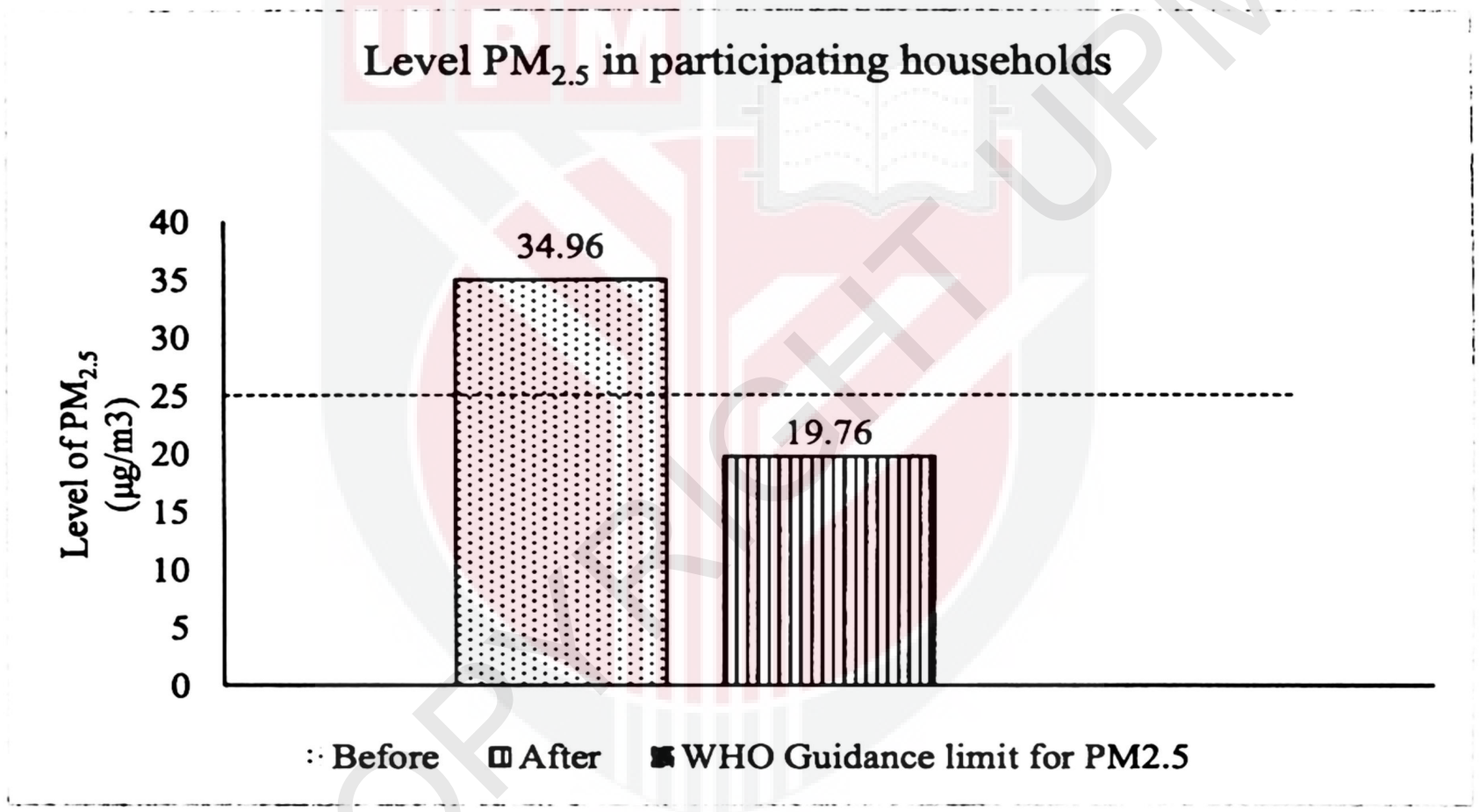

Figure 4.6.1: Comparison of level of $PM_{2.5}$ in participating households before and after air quality feedback

Paired t –test was performed to compare the mean level of $PM_{2.5}$ before and after air quality feedback. The *t*-value for the comparison made is 1.533 with *p*-value of 0.176.

Table 4.6.2: Comparison of level of $PM_{2.5}$ before and after air quality feedback (n=7)

Variable		Before	After	*t*-value	*p*-value
Level of $PM_{2.5}$ ($\mu g/m^3$)	M (SD)	34.96 (19.26)	19.76 (9.92)	1.533	0.176

M: Mean
SD: Standard Deviation
Paired *t*-test was performed

4.7 Algorithm to differentiate $PM_{2.5}$ coming from cigarette smoke

Semple (n.d) has stated the algorithm used in differentiating the SHS coming from cigarette smoke, the large particles obtained from Dylos DC1700 measurement must be less than 2% from the total of small and large particles. The formula below was used.

$$x = \frac{large\ particles}{all\ particles} \times 100 \qquad \text{Eq. 4.7.1}$$

Where

$$x = proportion\ of\ big\ particles\ to\ small\ particles$$

Table 4.7.1: The percentage of big particles in each participating households (n=7)

Household	Proportion of big particles (%)	
	Before intervention	After intervention
1	5.00	5.28
2	3.22	0.00
3	3.72	2.36
4	6.35	8.63
5	4.80	2.95
6	3.57	5.46
7	2.45	5.58

Values are in percentage

4.8 Knowledge level before and after health promotion

Part C of the questionnaire is regarding the knowledge on SHS for the smokers of participating households. There are seven questions and comprised of three positive and four negative questions. For each correct answer, one mark will be rewarded meanwhile zero for wrong and "don't know" answer. Question 1 asked on the definition of SHS. Majority answered wrong during the pre-health promotion. However, all of them scored correct after the health promotion. Question 2 was about the substances in cigarettes smoke can cause cancer in which majority of the smokers answered correctly. Third question touched on the nicotine cannot cause addiction in which half of the smokers answered wrong. Next, the negative type question asked on the exposure of cigarette smoke to children will not increase the risk of getting asthma and lung inflammation. 57.1% (n=4) answered correctly. All of the smokers answered correctly on the small amount of exposure of cigarette smoke to children can cause cancer compared to only 71.4% (n=5) answered correctly before the health promotion. 42.9% (n=3) of the smokers of participating households did not know that one of the SHS exposure coming from cigarette smoke released at home. Last question was the exposure to cigarette smoke at short duration is safe compared to long duration. Even though after the intervention, 42.9% (n=3) answered false as in Table 4.8.1.

Table 4.8.1: Knowledge level before and after health promotion

Variables	Knowledge Score			
	Before intervention		After intervention	
Q1: Secondhand smoke is the mixture of sidestream smoke coming from the end lighted cigarette and smoke that is exhaled by smoker.	Answered right	Answered wrong	Answered right	Answered wrong
Q2: The harmful chemicals hiding in a cigarette smoke known as carcinogens.	3 (42.9)	4 (57.2)	7 (100)	-
Q3: Nicotine in cigarette cannot cause addiction.	5 (71.4)	2 (28.6)	6 (85.7)	1 (14.3)
Q4: Exposing an infant/kid to secondhand smoke will not increase the child's risk to asthma and lung inflammation.	3 (42.9)	4 (57.1)	7 (100)	-
Q5: Even small amount of exposure to cigarette smoke to children can cause cancer.	4 (57.1)	3 (42.9)	6 (85.7)	1 (14.3)
Q6: Cigarette smoke released in house is the source of exposure to passive smoking among children	5 (71.4)	2 (28.6)	7 (100)	-
Q7: There is safe level of exposure to cigarette smoke.	4 (57.1)	3 (42.9)	7 (100)	-

Q1: Question 1
Values are in numbers (percentage)

Health promotion was conducted in order to educate the smokers of participating households on matter related to SHS. Based on Table 4.6 the knowledge after conducting health promotion has increased to 91.84 from 42.86 as median score. The z is -2.371 and *p*-value is 0.018 as shown in Table 4.8.2.

Table 4.8.2: Comparison of smokers' knowledge before and after health promotion was conducted among participating households (n=7)

Variable		Before	After	z	*p*-value
Knowledge level[+]	Median (IQR)	42.86 (71.43)	91.84 (14.29)	-2.371	0.018*
Knowledge level[++]	Mean	57.14 (30.30)	-	-	-
Knowledge level[+++]	Mean	62.07 (25.69)	-	-	-

IQR: Interquartile Range
[+]Wilcoxon Signed Ranks Test was performed for smokers of participating households
[++]Knowledge of smokers of non- participating households
[+++]Knowledge of non-smokers of non- participating households
*p<0.005 is statistically significant

CHAPTER 5

DISCUSSION

5.1 Dylos DC1700

Dylos DC1700 (Dylos Corporation, Riverside, California, USA) is a low-cost, laser particle counter. It measures the particle number concentrations for particles larger than 0.5 μm and particles larger than 2.5 μm. Dylos DC1700 produces low and barely audible noise (Steinle et al., 2014). The participants can use this Dylos with ease as it reduces the burden of carrying it without interfering their normal daily routine. Dylos DC1700's battery is rechargeable, and they are provided with serial port for to enable data download. According to Semple et al. (2013) Dylos is preferred as it costs only one-tenth of the cost of SidePak. SidePak produced noisy noise and heavy to be carried by participant. The benefits of using Dylos are it uses laser to measure the particle numbers in the air for every one second and able to show us how the levels of SHS change over time. Moreover, Dylos has the ability of taking data for more than six days (9056 minutes) and the data will be stored even when switched off. Dylos DC1700 also able to over-write oldest data thus it captures the most recent 9056 minutes. This Dylos DC1700 has no ability of recording sound but instead it just has the function of measuring particle number concentrations. Apart from using Dylos DC1700, the software used is AFRESH Software. The use AFRESH Software will provide text file containing time, $PM_{2.5}$ equivalent ($\mu g/m^3$), small particles per cubic

foot, large particles, large particles per cubic foot, date and small-large particles per cubic foot. This software has the function of downloading and prepare feedback report regarding the level of $PM_{2.5}$ in the house as shown in Figure 5.1.1, Figure 5.1.2, and Figure 5.1.3.

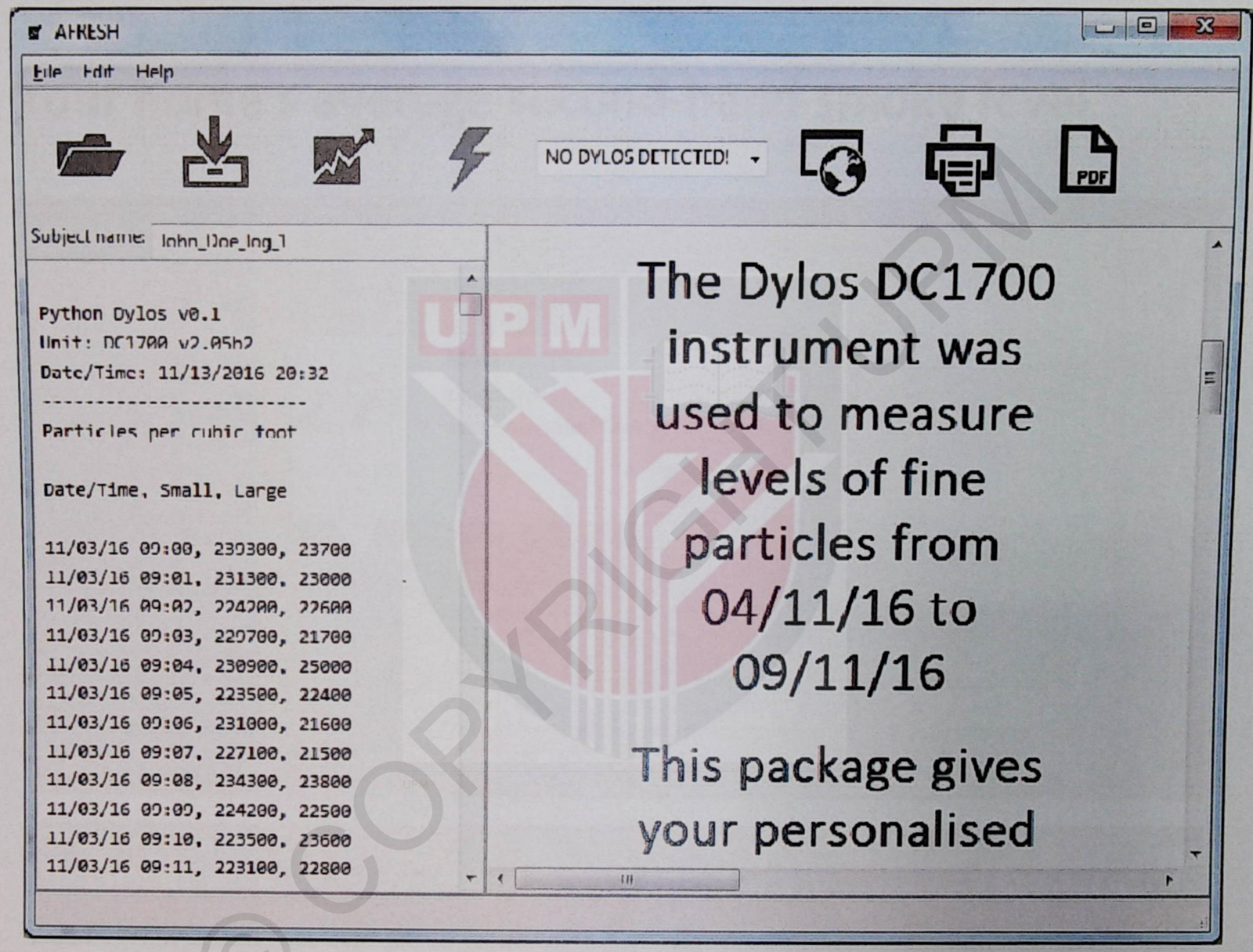

Figure 5.1.1: The interface shown when data is downloaded through AFRESH Software Retrieved from Semple (n.d.).

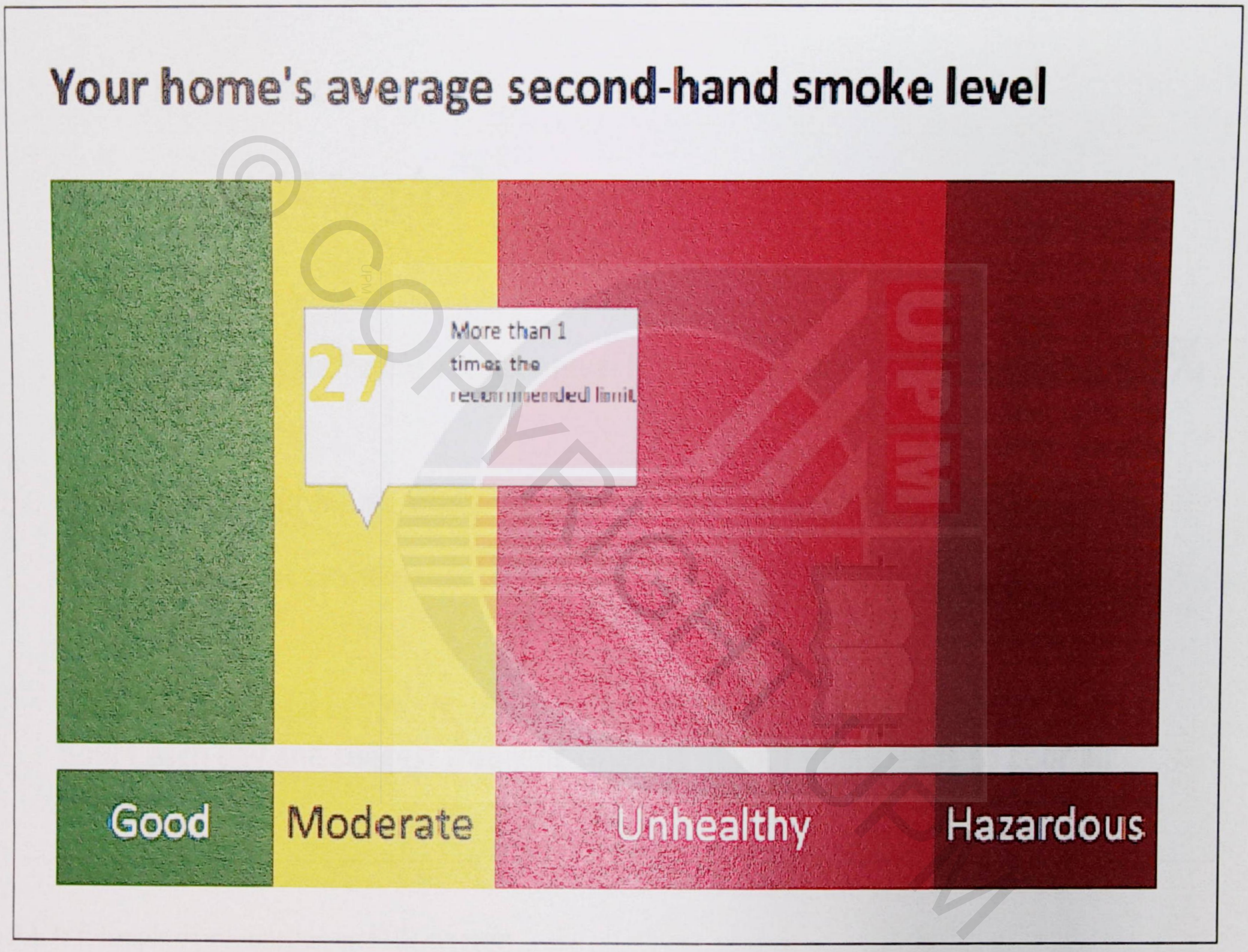

Figure 5.1.2: Example of respondent's average second-hand smoke level

More information

Highest value: $447\mu g/m^3$

Total time that your home's smoke level is above the WHO guidance value: 19%

Total time in your house when smoke levels were above those in Scottish bars before they went smoke-free: 1%

Fine particle levels in your home are above the WHO guidance limit for about 5 hours each day and suggest frequent smoking in your home leads to poor air quality

Figure 5.1.3: Example of information on SHS in report

Measuring particle matter can be a problem as all the instruments do not specify the $PM_{2.5}$ to SHS. The $PM_{2.5}$ can be from SHS, traffic emission, cooking fume and also air freshener. However, application of algorithm has made the $PM_{2.5}$ measured by Dylos DC1700 enable the user to differentiate the $PM_{2.5}$ coming from SHS or not. The smoking activity can be identified through the graph as shown in Figure 5.1.4. For every sudden and sharp increase of reading, together with peak more than 25µg/m^3 indicate one cigarette smoked. It also can be identified with short lived peak followed by long slow decay.

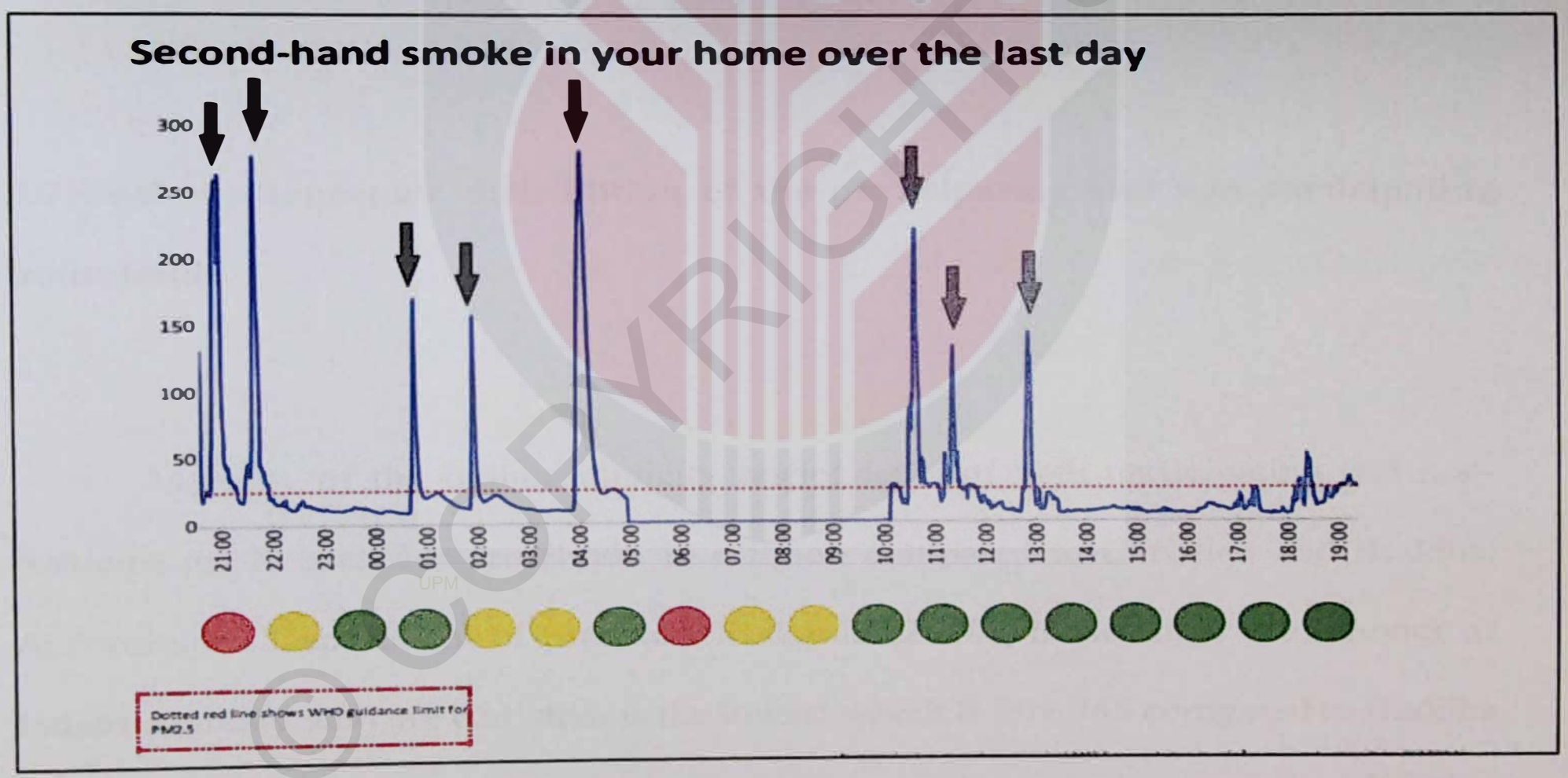

Figure 5.1.4: The peaks that indicate SHS

Initially, there were 15 households were eligible for this study. However due to some limitations, they were not able to enrol in this study. This is because, some of the respondents have long working hours and were not able at home thus making measurement was not possible. Moreover, there was also due to chronic sickness

making them need to be hospitalized during the data collection period. There were also sudden drop-outs as the smokers were not interested in joining even though have agreed to enrol in this study. Apart from that, some mothers of the households had the interest of participating in this study as they were worried about the smoking habit of the husbands as well as the SHS exposure to the children, however the fathers disagreed from participating. Unfortunately, due to the facts that fathers are the one whom have the power of making decision, they were not enrolled in this study. From this study, it has been found that some of the smokers smoke outside of the house. They practice smoke-free home and therefore they were not eligible for this study. Therefore, seven households enrolled in this study.

5.2 Socio-demographic distribution of the participating and non-participating households

Majority of the Indian ethnicity respondents of both participating and non-participating households are Hindu in religion compared to Christian and Buddha. According to Department of Statistics Malaysia (2010), in Selangor the number of Indian ethnicity who are Christian is the lowest which is 209,745 compared to Buddha 1,330,989 and Hindu 631,980. However, based on this total, the number of Buddha outnumbered those who are Hindu to be compared with this study findings. This is due to the small number of respondents that cannot be as representatives of the whole people.

All of the participating households are comprised of male smokers. This is correspondent to the smokers of non-participating households that made up of 100% of male. National Health and Morbidity Survey 2015 shows that 43% of male are current smokers compared to only 1.4% of female smokers in Malaysia.

The educational level among smokers of participating households are mostly with primary and secondary educational level. Comparing to tertiary educational level, there is only 14.3% (n=1) of smokers among participating households. According to National Health and Morbidity Survey 2015 reported smokers are the lowest among tertiary education (14.9%) compared to secondary (25.2%) and primary education (25.8%). This phenomenon is seen among non-smokers of non-participating households which most of them have secondary and tertiary background. Abidin et al. (2011) has found that among schoolchildren in urban areas, the geometric mean (GM) of cotinine concentrations was high among fathers with middle school (0.84 ng/ml) followed by high school (0.59 ng/ml) educational level in which generally are secondary level. Meanwhile among smoking fathers with tertiary educational level, the SHS exposure was the highest among children with fathers who had Diploma or Technical certificate (0.54 ng/ml) education due paternal smoking to be compared with fathers with higher educational attainment (0.38 ng/ml). However, the GM cotinine level among secondary school fathers was higher than those in tertiary level.

Global Adult Tobacco Survey 2011 reported that daily smokers among Malaysians adults aged more than 15 years old are the highest among secondary education level meanwhile the lowest among adults that had education level of college

and above. Similarly, CDC (2018) stated that people with lower levels of education attainment have higher rates of cigarettes smoking. There is only 2.7% (n=1) of the smokers of non-participating households has obtained no formal education in comparison with non-smoker that has none respondents with no formal education. This is because people with lower education have the tendency to be persistent smoker as coping mechanism to stress. Stress is raised due to lower occupational status and financial problems (Siahpush, Heller & Singh, 2005; Sorensen, Gupta & Pednekar, 2005). In conclusion, smoking fathers with tertiary education attainment tend to have lower SHS exposure towards their children at home.

As reported, half of smokers in the participating households are working in non-government sector compared to only 14.3% from government sector. In National Health and Morbidity Survey 2015 has stated that private sector had the highest proportion of current smokers. Similarly, self-employed also among the highest proportion of smokers. In this study, a slight difference among self-employed smokers of participating households had 28.6%, as the second highest in percentage. However, it is still can be considered as among the highest to be compared with government sector. The number of smokers are less than those in private sector and self-employed can be due to the smoking prohibition in any government premises as stated in Control of Tobacco Product Regulations 2004. According to the data among smokers of non-participating households, 48.6% (n=18) are working in non-government sector. In contrast, half of the non-smokers among non-participating households are non-government sector. This situation can be related to the knowledge they have which the

highest compared to smokers of participating and non-participating households through the questionnaire given.

Moreover, all of the smokers of participating households have salary less than RM3000.00 in a month making them to be categorized in low income. Similarly with the smokers of non-participating households. According to Abidin et al. (2011) GM cotinine was the highest among middle family income (0.57 ng/ml) but it was only differ slightly with low family income (0.55 ng/ml). As stated earlier, Siahpush, Heller & Singh (2005) and Sorensen, Gupta & Pednekar (2005) have found that the reason of smoking is due to financial problems. This explained the reason of majority people with low income in this study are smokers.

5.3 Frequency of age of smokers among participating households and non-participating households

National Health and Morbidity Survey 2015 has found that Malaysian aged from 35-39 years old have the highest prevalence (29.7%) of smoking meanwhile 30-34 years old are 29.3% of prevalence. This is can be clearly seen that there are highest number of smokers among 35-39 years age group compared with 30-34 years age group.

5.4 Average number of cigarettes smoked by smokers of participating and non-participating households

The average number of cigarettes smoked daily among smokers were obtained from both participating and non-participating households. Among participating households, majority of the smokers smoked 6 cigarettes daily. In comparison with non-participating households, majority of the smokers smoked 5 and 20 cigarettes daily. Since all of the smokers in this study are male, according to National Health and Morbidity Survey 2015 18.6% male in Malaysia smoke 10-14 cigarettes daily. 16.3% of male smokers smoked 5 to 9 cigarettes daily and 5.8% of less than 5 cigarettes. In Selangor, the highest prevalence of number of cigarettes smoked daily is form 5 to 9 daily. The number of smokers smoked cigarettes 5 to 9 cigarettes is the highest among both of participating and non-participating households. It is followed by more than 20 cigarettes daily, 10 to 14 cigarettes and the least is less than 5 cigarettes daily. This categories was adopted as in National Health and Morbidity Survey 2015. A study conducted by Wipfli et al. (2008) shows the mean of number of cigarettes smoked per day by Malaysians are 12. The findings in this study actually resembles that mostly of the smokers will smoke around 10-14 cigarettes daily.

5.5 Smoking history among smokers of participating and non-participating households

The finding from this study showed that the smokers among participating households smoked 7 days in house with the presence of their children for seven (7) days ago. Similarly, among smokers of non-participating households 44.4% of them smoked for 7 days with their children around. Wipfli et al. (2008) stated that 78% of Malaysians smoke in homes and 63% of them smoke near child.

Majority of smokers smoked for "sometimes" (42.9%) among participating households meanwhile majority of smokers of non-participating smoked for "sometimes" and "everyday". Global Adult Tobacco Survey (2011) found 20.9% Malaysian adults aged more than 15 years old smoked daily. The smokers of both participating and non-participating households in this study are mostly in their 30s and this can be seen in data of Global Adult Tobacco Survey (2011) that daily smokers are the highest among 25-44 years old.

5.6 Effects of Air Quality Feedback among Smokers of Participating Households

The number of cigarettes smoked before and after air quality feedback can be seen to reduce among smokers in household 2, household 3, household 4 and household 6. The trends of $PM_{2.5}$ concentrations can be seen to reduce in the graph shown in Figure 4.6. As stated by Wilson et al. (2012) and Ruaraidh et al. (2017)

through their studies which are REFRESH and AFRESH respectively, air quality feedback gave positive impacts to smokers to modify their smoking habit around children. Even though some households are not successful in reducing the level of $PM_{2.5}$, majority of households succeed and making the intervention possible. The reasons identified for households that were not successful in reducing their $PM_{2.5}$ are due to the negligence of the smokers on the harmful level of $PM_{2.5}$ as well as the harmful effects of SHS. AFRESH and REFRESH studies conducted the air quality feedback for approximately 5 days and 24-hours respectively. However, since this study is time-consuming and there is no study has been done yet in Malaysia, this is the trial and majority of the households succeed in reducing the level of $PM_{2.5}$. All of the households use windows as their natural ventilation with mechanical fan. According to CDC (2018) even though there is a usage of heating, ventilating and air-conditioning systems alone, the exposure to second-hand smoke still cannot be controlled. In fact, it will distribute throughout the building. Apart from that, partially exhausted and separately enclosed will still cause second-hand smoke to be distributed into adjacent areas.

The mean of $PM_{2.5}$ concentrations of smokers among participating households is found to have reduction from the first measurement using Dylos DC1700. Initially, the mean is 34.96 $\mu g/m^3$ reduced to 19.76 $\mu g/m^3$ which below the WHO guidance limit on $PM_{2.5}$ which is 25$\mu g/m^3$. US EPA existing standard for $PM_{2.5}$ is 35 $\mu g/m^3$ for 24-hour. Thus, the $PM_{2.5}$ after the air quality feedback is within safe limit Similarly, Department of Environment, the New Malaysia Ambient Air Quality Standard for $PM_{2.5}$ is 35 μg/m3 for 24-hour. This reduction is successful as the participating

households were explained about their house air quality when they smoked inside. Paired t-test was performed to compare for the mean concentrations of $PM_{2.5}$ before and after. The t-value is 1.533 indicates that there is greater evidence of having significant difference among the two measurement (Ogee et al., 2016). However, the p-value shows that only 0.176 meaning there is no significant difference. This can be caused by small number of samples and measurement. LaMorte (2016) said that p-value depends on the both magnitude of association and sample size.

This 8 hours and 30 minutes of measurement has found that the mean initially exceeded the guideline by WHO (2005) in which for 24-hour mean is only 25 $\mu g/m^3$ as well as EPA and the New Malaysia Ambient Air Quality Standard which are 35 $\mu g/m^3$. According to WHO (2008) the rationale of setting the guideline for $PM_{2.5}$ is to achieve the aim of protecting the health people with the lowest concentration of $PM_{2.5}$. This is because each person has variability in terms of exposure and their response towards $PM_{2.5}$. REFRESH study by Wilson et al. (2012) identified that through measurement of home air quality, the enhanced participants in which they were provided with the level of $PM_{2.5}$ in their home with the use of graph measured by SidePak made greater reduction of $PM_{2.5}$. It was also found among control group. This prove that by providing air quality feedback in home due to smoking can actually reduce the level of $PM_{2.5}$. AFRESH that conducted by Ruaraidh et al. (2017) that incorporated air quality feedback in the intervention has successfully proved that the smoking behaviour of parents changed where they started to smoke outside. Therefore, this study among smokers of participating households have succeed in reducing the exposure of $PM_{2.5}$ to children at home. The smokers of the participating households

changed their smoking behaviour in which they preferred to smoke outside rather than smoking in home especially with the presence of their children. Some of them also reduced the frequency of smoking inside home after air quality feedback was conducted. Although this is probably only temporary behaviour modification, long term behaviour modification can be achieved with longer measurement in home. However, during conducting the air quality feedback, it was found that in order to deliver the information regarding the level of $PM_{2.5}$ due to paternal smoking needed help from the mothers. Only a few of the smokers willingly to participate actively to obtain the measurement of $PM_{2.5}$ due to their smoking habits. Nevertheless, it was successful in delivering the exact concentrations of $PM_{2.5}$ coming from smoking activity. As reported by Wilson et al. (2012) in REFRESH, the smoking mothers were shocked when they were explained on the level of $PM_{2.5}$ exposed to their children. Similarly, some of the smokers and their wives found the level of $PM_{2.5}$ was shocking compared to level set by WHO which is 25 $\mu g/m^3$.

5.7 Algorithm to differentiate $PM_{2.5}$ coming from cigarette smoke in households

As suggested by Semple (n.d.) the proportion of big particles which is larger than 2.5μm should be less than 2% to consider the $PM_{2.5}$ coming from SHS source. However, majority of the results shows the percentage exceeding 2% which means there were other non-SHS sources were measured by the Dylos DC1700. The non-SHS sources could come from burning of solid fuels, cooking fumes and aerosols emissions from deodorants and also hair sprays (He et al., 2004).

5.8 Effects of Health Promotion

There were some of the respondents answered wrongly even though after health promotion in which giving education on SHS has been conducted to them. Some of the reasons are due to some of the smokers did not answer carefully and did not pay attention during the health promotion causing them to just select any answer to answer the questions even though the instructions has been given prior to the health promotion. As for making sure the health promotion can be done effectively, the health promotion should be conducted in the presence of their family members of the household especially the wives as they are able to convey and relate their husbands' smoking habit in the house.

The knowledge of smokers among participating households was found to increase after health promotion was given to them. There is significant difference of the median of the score. The purpose is to raise the knowledge among smokers on the danger of smoking habit and the harmful effects of SHS to children. This study has found that the knowledge of smokers among non-participating households is higher than the knowledge level of smokers among participating households. This explain why some of the smokers of non-participating households were not eligible in this study as they usually smoke outside of the house in which they practice smoke-free home. Some of them realized the harmful effects of smoking in home with the presence of other people especially their children. Similarly, the knowledge level of non-smokers is the highest compared to the smokers which is 62.07. Najihah Zainol Abidin et al. (2014) found that among respondents in state with partial smoke free legislation (SFL) and state with complete SFL, the knowledge level of respondents with partial

SFL is lower. Therefore, those who practice smoke free home for both smokers and non-smokers of non-participating households have higher knowledge level compared to smokers.

5.9 Strengths and Limitations

This study used Tamil questionnaire as to encourage participation from the Indian ethnic group. This study also the first study to use Dylos DC1700 as a tool for air quality feedback in reporting the exposure of SHS among Indian schoolchildren in Malaysia.

There are a few limitations found throughout this study. Firstly, the languages used initially in the questionnaires were English and Malay. However, after pre-test has been done, it was found that the desired respondents for this study preferred the questionnaires to be in Tamil language mainly. Thus, the translation has been done to convert the language into Tamil. The recruitment of participants was time-consuming as well as the process of conducting the intervention as it involved the availability of the respondents and their members of household. Thus, prior to measurement taking, confirmation on the presence of the smoker at home was taken into account. There was also problem where the Dylos DC1700 was turned off while it taking its measurement. Thus, reminder should be given to the members of households and several households have their measurement to be taken again. There were drop outs that were working outstation and for long hours making the intervention cannot be done as scheduled.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Overall, this study is feasible study for small scale population with several difficulties in conducting this intervention. The level of PM2.5 among the household generally are reduced to a safe level, below the guidance limit by WHO (25 $\mu g/m^3$) and both US EPA and the New Malaysia Ambient Air Quality Standard (35 $\mu g/m^3$). The knowledge among the smokers also increase as health promotion was conducted on SHS exposure. Air quality feedback using Dylos DC1700 has not been reported yet in literature in Malaysia. Thus, this study is the first study that incorporate the use of Dylos DC1700 together with health promotion in reducing the exposure of SHS among Indian primary schoolchildren. Apart from that, this study has found the air quality feedback has positive impacts among the smoking fathers of participating households even though some of them did not have reduction in level of $PM_{2.5}$. However, it can be seen through the knowledge level after the health promotion has increased compared to their level before the health promotion. Thus, even though there were no reduction in the level of $PM_{2.5}$, their knowledge at least has increased.

6.2 Recommendations

The recommendation for the future study is to incorporate interventions not only among smokers but also their other family members especially their partners, either husbands or wives. This is because interventions will be easily accepted when there is cooperation and involvement from their partners as a motivational support to reduce their smoking inside the house. Apart from that, to obtain more accurate result, it is suggested to carry out the measurement for 24-hour thus it will be comparable with existing standards or guidelines of $PM_{2.5}$ and to visualize the level of $PM_{2.5}$ more effectively to encourage behavioral change of smokers around children. Besides, in future, the study should incorporate more detailed question and include the knowledge, attitude and practice (KAP) on SHS exposure among children among smokers to understand their KAP on SHS. Thus, in future, studies can be done to increase the smokers' awareness on SHS and making intervention is conducted among them to be successful. Therefore, the targeted messages can be delivered and instilled in them and smoke-free home can be achieved especially those with children. This study also suggest to have an Indian translator during the intervention is carried out as language is a barrier in delivering the messages. All of the supplementary sources should be translated in Tamil as well as the questionnaire to encourage participation among them.

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APPENDIX A

It is estimated that half of all women and children are regularly exposed to secondhand smoke;

48.7%

STARTS AT HOME

64.1%

IN PUBLIC AREAS

*Global Youth Tobacco Survey 2009

Exposing an infant/kids to second-hand smoke greatly increases the child's risk of:

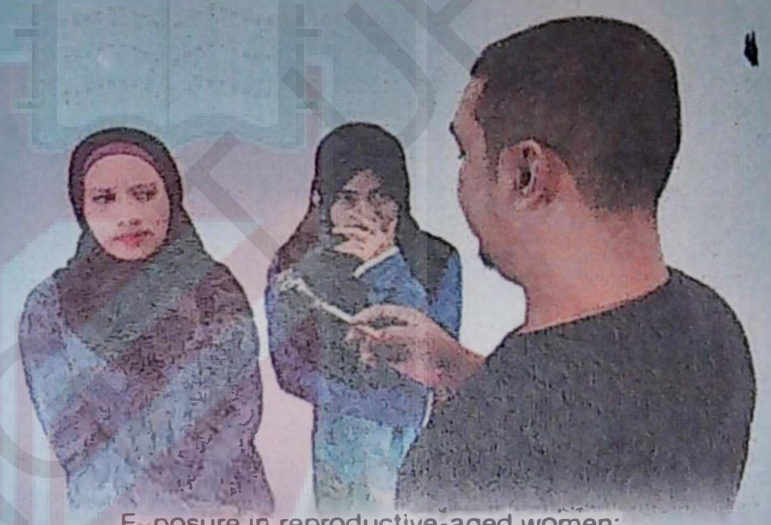
• Asthma • Pneumonia • Bronchitis • Fluid in the middle ear

Global Adults Tobacco Survey (GATS) Malaysia 2011

4 in 10 adults who work indoors (2.3 million adults) at the workplace

4 in 10 adults (7.6 million adults) are exposed to tobacco smoke at home

7 in 10 adults (8.6 million adults) who visited restaurants were exposed to tobacco smoke

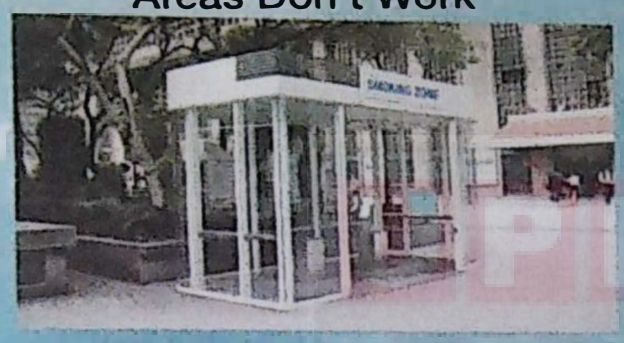


Exposure in reproductive-aged women:

• Pregnancy complications • Fetal growth restriction

• Preterm delivery • Still births • Sudden infant death syndrome

Smoking In Designated Areas Don't Work



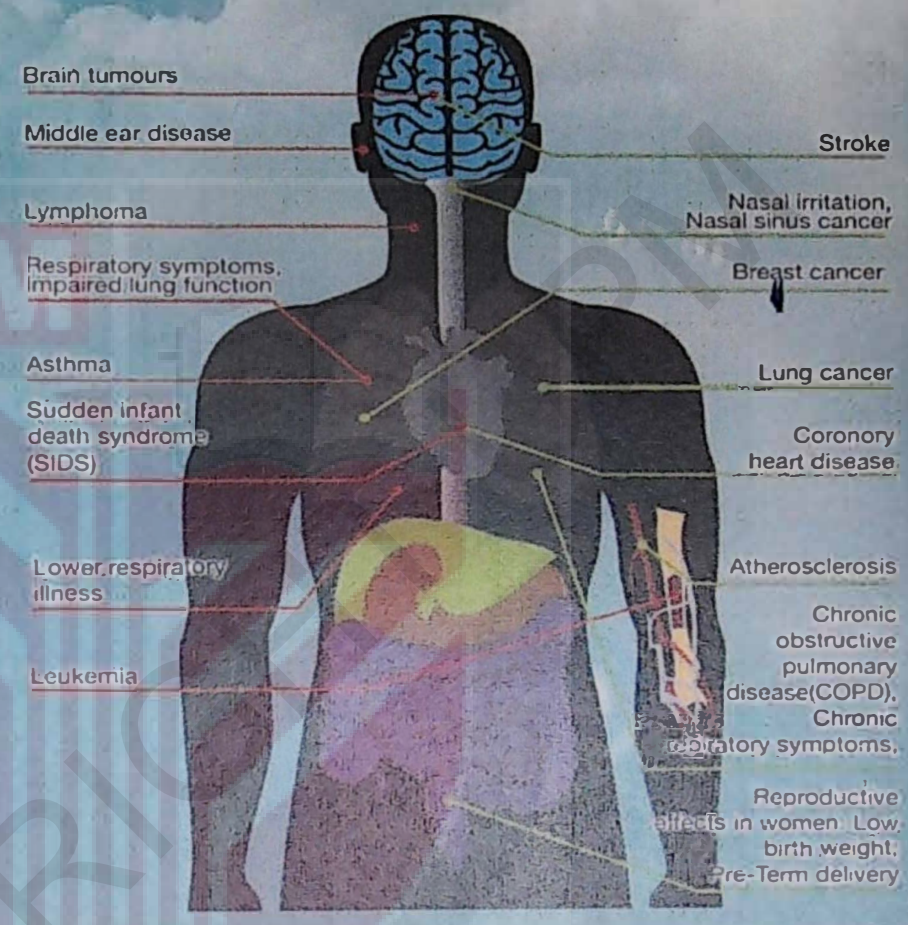
Ventilation Is Not Effective

Separation Does Not Work!

Bar tenders who work on 8 hour shift in a smoky bar inhale the same amount of cancer causing chemicals as if they smoked more than half a pack of cigarettes.

The Health Consequences of Involuntary Exposure to Secondhand Smoke

- When you inhale, chemicals in tobacco smoke can cause damage immediately
- Even the smallest amount of tobacco smoke can also damage your DNA which can lead to cancer
- Even brief exposure to SHS can cause cardiovascular disease and could trigger cardiac events, such as heart attack
- Tobacco smoke can quickly damage blood vessels and make blood more likely to clot



source: U.S Department of Health and Human Services

APPENDIX B

Tarikh: ID Responden: ☐☐☐

JABATAN KESIHATAN PERSEKITARAN DAN PEKERJAAN, FAKULTI PERUBATAN DAN SAINS KESIHATAN, UNIVERSITI PUTRA MALAYSIA, 43400 UPM SERDANG, SELANGOR MALAYSIA

BORANG SOAL SELIDIK

Bahagian C: Pengetahuan mengenai pendedahan asap rokok/ பகுதி C: சிகரெட் புகை வெளிப்பாடு அறிவு

Arahan: Sila tandakan (/) pada jawapan yang tepat. Hanya tandakan pada satu pilihan jawapan/ வழிமுறை: சரியான பதிலை (/) சரிபார். ஒரே ஒரு பதிலைத் தேர்ந்தெடுக்கவும்.

1. Asap rokok pasif adalah terhasil dari gabungan asap rokok yang menyala tapi tidak dihisap dan asap dihembus keluar oleh perokok/ செயலற்ற சிகரெட் புகை புகைத்தல் சிகரெட் முடிவில் இருந்து புகைபிடிப்பதும் புகைப்பதும் புகைபிடிப்பதும் ஆகும்.

☐ Ya/ ஆம் ☐ Tidak/ இல்லை ☐ Tidak tahu/ தெரியாது

2. Terdapat bahan-bahan kimia yang tersembunyi di dalam asap rokok yang boleh menyebabkan kanser/ சிகரெட் புகையில் மறைந்திருக்கும் இரசாயனங்கள் புற்றுநோயை ஏற்படுத்தும்.

☐ Ya/ ஆம் ☐ Tidak/ இல்லை ☐ Tidak tahu/ தெரியாது

3. Nikotin di dalam rokok tidak boleh menyebabkan ketagihan/ சிகரெட்டுகளில் நிகோடினால் அடிமையாதல் ஏற்படுவதில்லை.

☐ Ya/ ஆம் ☐ Tidak/ இல்லை ☐ Tidak tahu/ தெரியாது

4. Pendedahan asap rokok kepada kanak-kanak tidak meningkatkan risiko kanak-kanak untuk mendapat penyakit seperti asma dan radang paru-paru/ குழந்தைகளுக்கு சிகரெட் புகை வெளிப்பாடு குழந்தைகளுக்கு ஆஸ்துமா மற்றும் மூச்சுக்குழாய் அழற்சி ஏற்படுவதற்கான அபாயத்தை அதிகரிக்காது.

☐ Ya/ ஆம் ☐ Tidak/ இல்லை ☐ Tidak tahu/ தெரியாது

5. Pendedahan asap rokok kepada kanak-kanak dalam jumlah yang kecil mampu menyebabkan kanser/ சிகரெட் புகைப்பிற்கு சிறிய அளவிலான வெளிப்பாடு குழந்தைகள் மத்தியில் புற்றுநோய் ஏற்படலாம்.

☐ Ya/ ஆம் ☐ Tidak/ இல்லை ☐ Tidak tahu/ தெரியாது

6. Asap rokok yang dihembuskan di dalam rumah adalah sumber pendedahan asap rokok pasif kepada kanak-kanak di dalam rumah/ ஒரு வீட்டிற்குள் வெளியேற்றப்பட்ட சிகரெட் புகை குழந்தைகளுக்கு செயலற்ற புகைக்கு மூலமாகும்.

☐ Ya/ ஆம் ☐ Tidak/ இல்லை ☐ Tidak tahu/ தெரியாது

7. Pendedahan kepada asap rokok yang singkat masanya adalah selamat berbanding asap rokok yang lama kepada orang lain/ சிகரெட்டிற்கு புகைபிடிப்பதற்கான நேரம் குறுகிய காலத்திற்கு விட பாதுகாப்பானது.

☐ Ya/ ஆம் ☐ Tidak/ இல்லை ☐ Tidak tahu/ தெரியாது

APPENDIX C

APPENDIX D

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

Research title	:	**Effects of Air Quality Feedback and Health Promotion to Reduce Second-Hand Smoke Exposure Among Tamil Primary School Children In Hulu Langat**
Study Site	:	**Hulu Langat**
JKEUPM Ref No.	:	**JKEUPM-2018-352**
Researcher	:	**Nadhirah Balkist binti Ihsan**
Supervisor	:	**Assoc Prof. Dr. Emilia Zainal Abidin**

Documents received and reviewed with reference to the above study:

1. Ethics Application Form, Version 1 dated 29/10/2018
2. Respondent Information Sheet & Guardian's/Parent's Consent (English), Version 1 dated 29/10/2018
3. Respondent Information Sheet & Consent (English), Version 2 dated 28/11/2018
4. Proposal (English), Version 2 dated 5/12/2018
5. Questionnaires/ Interviews (English), Version 2 dated 5/12/2018
6. Curriculum Vitae of:
    a. Assoc Prof. Dr. Emilia Zainal Abidin

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

Decision by JKEUPM:

[X] Approved

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

[ ] Disapproved

Please note that the approval is **VALID UNTIL 31 DECEMBER 2019**

Researchers should comply with the following:

I. Complete a Study Final Report upon study completion (Form 3.2).

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