UNIVERSITI PUTRA MALAYSIA

EXPOSURE TO SECONDHAND SMOKE AND ACADEMIC PERFORMANCE AMONG PRIMARY SCHOOL CHILDREN IN SERDANG, SELANGOR

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BY

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

ACKNOWLEDGEMENT

Alhamdulillah, thanks to Allah SWT with HIS blessing and wisdom for guidance me to complete this final year project and to ease everything and make things possible for me. Without HIS permission and blessing, this thesis would not have been completed with successfully. I would like to express my sincere appreciation and gratitude to my supportive supervisor, Dr. Emilia Zainal Abidin for her advices, ideas, patience, and valuable comments throughout this final year project thesis. Without her advices and motivation, this thesis could not have been completed. Thousand of thanks I wish to my co-supervisor, Dr. Irniza Rasdi for her guidance and valuable comments in improving my writing skills.

My deepest gratitude goes to the Laboratory of Pathology Faculty of Medicine and Health Sciences for the use of their facilities as well as for their assistance, especially to Pn. Safarina for helping me in ELISA analysis and not forgetting *Makmal Perkembangan Kanak-kanak*, UPM for letting me use the Wechsler Nonverbal (WNV) Scale of Ability tools.

I would like to thank the headmaster and teachers of Sekolah Kebangsaan Serdang for their co-operation in helping me for data and sample collection. Finally, deepest and undivided appreciation to my lovely parents En. Saliman bin Salleh and Pn. Fatimah bt. Ahmad for their supports and motivation. Finally, I would like to wish thousand thanks to all people that involved in this study whether directly or indirectly to the compilation of this thesis.

ABSTRACT

EXPOSURE TO SECONDHAND SMOKE AND ACADEMIC PERFORMANCE AMONG PRIMARY SCHOOL CHILDREN IN SERDANG, SELANGOR

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Introduction: Majority of children are involuntarily exposed to tobacco smoke mainly by adults, in the places where children live, work and play. There has been recent evidence of a relationship between poor cognitive performances and Secondhand smoke (SHS) exposure. Cotinine has been commonly used as a biomarker in researches for children's study on exposure to tobacco smoke. **Objective:** The overall aim of this study was to determine the association between exposure to SHS with academic and cognitive performance among primary school children. **Methodology:** This cross-sectional study was conducted at one of the primary school in Serdang. All students in year 5 of the primary school were invited to take part in this study. Parental- administered questionnaire was distributed with the consent form. 72 of the students obtained the permission to participate from n=127 (57% response rate). 68 of students were valid to take part in this study. Methods used to measure the distribution data of exposure to SHS were by the questionnaire and cotinine measurement from saliva samples. Cotinine were analysed using Salimetrics Cotinine ELISA (Enzyme Immunoassay kit). Academic performance which is student's latest examination result was obtained from the school, while cognitive ability was measured using Wechsler Nonverbal Scale of Ability (WNV) test. **Results:** This study found that 39.7% of respondents lived with a father that smoke and 27.7% of them had a salivary cotinine level exceeding 0.1 ng/ml. There was a significant association between children's daily SHS exposure and salivary cotinine concentration ($p<0.05$). No significant relationship was found between SHS exposure and academic performance and cognitive ability ($P>0.05$). **Conclusion:** This study was a preliminary study, which contributed as baseline data on exposure to secondhand smoke and academic performance as well as cognitive ability among schoolchildren in Malaysia. There was no association between SHS exposure with academic performance and cognitive ability, however, there were clear patterns of higher SHS exposure and poorer academic performance and cognitive ability. This study suggests a further research on exposure to SHS and academic performance in other future study with a larger sample size among a higher sample size population.

Keywords: Secondhand smoke, Salivary cotinine, Schoolchildren, Cognitive, Academic performance

ABSTRAK

PENDEDAHAN KEPADA ASAP ROKOK PASIF DAN PRESTASI AKADEMIK DALAM KALANGAN KANAK-KANAK SEKOLAH RENDAH DI SERDANG, SELANGOR

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Pengenalan: Kebanyakan kanak-kanak terdedah kepada asap rokok secara tidak sukarela terutamanya daripada orang dewasa, di tempat-tempat di mana kanak-kanak hidup, bekerja dan bermain. Terdapat bukti terkini mengenai hubungan antara keupayaan kognitif dan pendedahan asap rokok pasif. Kotinin telah biasa digunakan sebagai penanda bio dalam penyelidikan untuk kajian ke atas kanak-kanak dan pendedahan asap rokok. **Objektif**: Matlamat keseluruhan kajian ini adalah untuk menentukan hubungan antara pendedahan kepada asap rokok pasif dengan prestasi akademik dan kognitif di kalangan kanak-kanak sekolah rendah. **Metodologi**: Kajian keratan rentas telah dijalankan di salah sebuah sekolah rendah di Serdang. Semua pelajar tahun 5 sekolah rendah ini telah dijemput untuk mengambil bahagian dalam kajian ini. Borang soal selidik telah diedarkan bersama borang persetujuan. 72 pelajar mendapat kebenaran untuk mengambil bahagian dalam kajian ini dari n = 127 (57% kadar respons). 68 pelajar layak untuk menyertai kajian ini. Kaedah yang digunakan untuk mengukur taburan data terhadap pendedahan kepada asap rokok pasif adalah dengan borang soal selidik dan pengukuran tahap kotinin daripada pengumpulan sampel air liur. Kotinin dianalisa dengan menggunakan Salimetrics cotinine ELISA (Enzyme Immunoassay kit). Prestasi akademik iaitu keputusan peperiksaan terkini pelajar telah diperoleh dari sekolah, manakala keupayaan kognitif diukur dengan menggunakan ujian Wechsler Nonverbal Scale of Ability (WNV). **Keputusan:** Kajian ini mendapati bahawa 39.7% daripada responden tinggal bersama bapa yang merokok dan 27.7% daripada mereka mempunyai tahap Kotinin air liur melebihi 0.1 ng / ml. Terdapat hubungan yang signifikan antara pendedahan asap rokok pasif harian keatas kanak-kanak dan kepekatan Kotinin air liur ($p<0.05$). Tiada hubungan yang signifikan didapati antara pendedahan asap rokok pasif dan prestasi akademik serta keupayaan kognitif ($p>0.05$). **Kesimpulan:** Kajian ini adalah kajian awal yang menyumbang sebagai data asas mengenai pendedahan kepada asap rokok pasif dan prestasi akademik serta keupayaan kognitif di kalangan pelajar sekolah di Malaysia. Tiada hubungan antara pendedahan asap rokok pasif dengan prestasi akademik serta keupayaan kognitif walau bagaimanapun, terdapat corak yang jelas antara pendedahan asap rokok pasif yang lebih tinggi dan prestasi akademik serta keupayaan kognitif yang rendah. Kajian ini mencadangkan kajian lanjut mengenai pendedahan kepada asap rokok pasif dan prestasi akademik dalam kajian masa depan dengan saiz sampel yang lebih besar di kalangan populasi yang lebih besar.

Kata Kunci: Asap rokok pasif, Kotinin air liur, Kanak-kanak sekolah, Kognitif, Prestasi Akademik

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LIST OF ACRONYMS & ABBREVIATIONS

<	Less than
>	More than
%	Percentage
ng/ml	Nanograms per Mililiter
x^2	Chi Square
WHO	World Health organization
FCTC	Framework Convention on Tobacco Control
USEPA	US Environmental Protection Agency
SHS	Secondhand Smoke
WNV	Wechsler Nonverbal Scale of Ability
GC-MS	Gas-Chromatography Mass-Spectrophotometry

CHAPTER 1

INTRODUCTION

1.1 Background

Tobacco smoke is the smoke produced when a smoker lit a cigarette which consists of particles and gaseous phases when a smoker burns the tobacco. Tobacco has long history of usages which begin in early Americas (World Health Organization, 2002 The Tobacco Atlas). Smoking is the most common method to consume tobacco. Following the industrial revolution, cigarettes had been promoted and became popularized. Over the years, scientists had discovered the chemicals in the tobacco as well as the dangerous health effect it may cause.

Previous research also found that tobacco leaves used in making cigarettes, these leaves contain radioactive material, particularly lead-210 and polonium-210 (Muggli *et al.,* 2008). According to Papastefanou and colleague (2000), the radionuclide contents depend on the soil condition and fertilizer use. The radioactive particles stick on both sides of tobacco leaves as it has sticky hair- likes structures. This particles remains along the process until it is manufactured into cigarettes. Small amounts of radioactive particles could accumulate in the lung tissue as smokers inhaled the cigarette smokes and may contribute to huge radiation dose over the time. Radioactivity may be one of the causes in lung cancer to the smoker (United States Environmental Protection Agencies or USEPA, 2012).

As finding found the dangerous health effect of tobacco smoke to the smoker, Secondhand smoke (SHS) is considered as dangerous as or more dangerous than firsthand smoke. Firsthand smoke or the smoker has the benefit of filter in the cigarettes compared to SHS which does not have the benefits of filter. Due to this factor, non smokers inhale the smoke and other substances directly from the air.

SHS is a mixture of the smoke given off by the burning end of a cigarette, pipe, or cigar, and the smoke exhaled by smokers. It is also called environmental tobacco smoke (ETS) and exposure to SHS is sometimes called involuntary or

passive smoking. SHS contains more than 4,000 substances, several of it known to cause cancer in humans or animals (USEPA, 2011). The chemicals contained in firsthand smoke such as carbon monoxide, formaldehyde, nicotine and benzene are also present in secondhand smoke. This shows that exposure to SHS also results in many of the same health consequences as being an active smoker.

Long term exposure to SHS has been associated with chronic health effects to non- smokers (IARC Handbooks of Cancer Prevention: Evaluating the effectiveness of smoke-free policies, 2009). The adverse health effects are well known to occur among smoker, but SHS exposure is more harmful than smoking itself. This is due to directly inhale the smoke and the poisonous substances in it without any filter compare to smokers itself as primary purpose of the cigarette filter is to reduce the tar inhale through tobacco smoke (Cummings *et al.*, 2001).

Majority of children exposed to tobacco smoke are involuntarily exposed due to their natural child behavior which were mainly by adults, in the places where children live, work and play (A Report of the Surgeon General, 2007). They are often not able to remove themselves or choose whether or not to be in the smoky environment. World Health Organization (WHO) estimates that around 700 million, or almost half of the world's children, breathe air

polluted by tobacco smoke, particularly at home. With this large number, SHS causes illness in children (WHO, 1999).

As children's bodies are developing, they are the most susceptible group for SHS exposure because their bronchial tubes are smaller and their immune systems are less developed. Children have higher breathing rate compared to adult, this make them more susceptible to develop respiratory and aural consequences if exposed to cigarette smoke (Delpisheh, 2005).

1.2 Problem Statement

The adverse health effect of tobacco smoke had been well described. Smoking causes about four million deaths annually, mainly related to cardiovascular disease, lung cancer and other cancers and chronic lung disease (WHO, 1999). Tobacco smoke is also an important source of indoor air pollution, contributing to a noxious environment, eye irritation, and unpleasant odour (Nandasena *et al.*, 2011).

Tobacco smoke exposure consists of mainstream smoke and sidestream smoke. Mainstream smoke is a smoke which inhaled directly through the tobacco product and exhaled by the smoker. Sidestream smoke is a smoke from the burning end of the cigarette, cigar or smoking pipe that passes into the

surrounding air, rather than into the smoker's lungs. Mixture of sidestream and mainstream smoke also called SHS. Previous studies showed that sidestream smoke is more harmful than mainstream smoke (Schick & Glantz, 2005). Exposure to sidestream smoke especially to children has been associated with poorer neurocognitive performance (Swan *et al.*,2007). Due to children's physical build, the small combustion particles make their way into the body's cells more easily when compared to adults and it is made worst with the greater lung surface in children.

In the guidelines of Article 8 of the WHO Framework Convention on Tobacco Control (FCTC), it has been stated that there is "no safe level of exposure to tobacco smoke" (WHO FCTC, 2005). Furthermore on the average, there are more children exposed to SHS compared to adults due to their nature of being involuntarily exposed. It proves that this issue has to be taken seriously into account since children are the most susceptible group which has the highest possibility to be exposed to the noxious SHS.

The WHO also has identified parental or household smoking as the major source of children's exposure to SHS. In 2004, WHO reported that there were 40% of children, 33% of male non-smokers and 35% of female non-smokers who were involuntarily exposed to SHS worldwide (WHO, 2004).

These numbers again strongly indicates the importance issue of children's exposure.

Naturally, younger children prone to spend more time in closer proximity to their parents, albeit smoking or otherwise and these children may spend most of their time indoors (Delpisheh *et. al*, 2004). With the presence of smoking parents, children continuously will be exposed to SHS if smoking are performed indoors. Furthermore, considering the Asian's common family arrangements, sometimes there will be a member of an extended family living together in a home. In the situation that members of the family is also a smoker, the child is exposed to more than one smoker while at home. As they growing up, the cumulative effect because of early exposure and long life exposure to SHS may affect their physiology and health condition.

1.3 Research Justification

This research has been conducted among primary school children at a primary school in Serdang as a preliminary study. It is to find the association between SHS exposure from household members, and its ability to the affect children's cognitive performance.

There were many researches on exposure to SHS to children and the health effect they might have due to the exposure. However, there are limited studies on SHS related to the cognitive abilities, intelligent quotient and neurobehavioral of the children in Malaysia and internationally.

Academic performance of children in school is a key indicator to know whether they are in a good mental and physical condition. Apart from the established evidence of SHS and respiratory effects among children, there were previous research suggesting of exposure to SHS may be associated with poor academic performance among children (Yolton *et al.*, 2005).

The author share the link between deteriorated child development such as their intelligence, reasoning, achievement, perceptual skills, reading, language and verbal comprehension with prolonged exposure to SHS (Yolton *et al.*, 2005). Naturally, poor cognitive performance of children will lead to poor academic performance in school. Academic performance depends heavily on good cognitive ability and uninterrupted brain development of the child.

1.4 Conceptual Framework

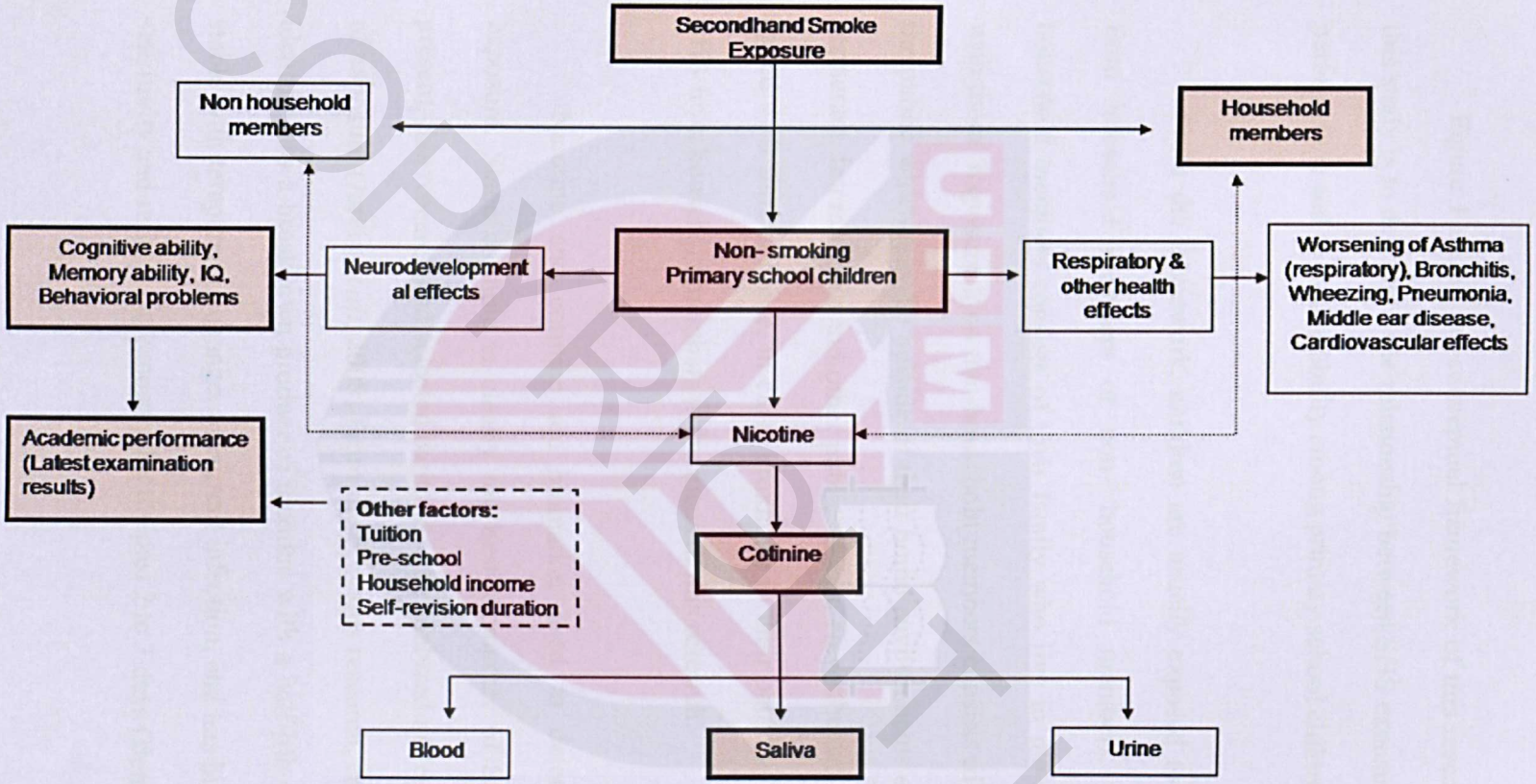

Figure 1.1: The conceptual framework for the research

Figure 1 shows the conceptual framework of this research. The aim of this study is to determine the relationship between SHS exposure and academic performance and cognitive ability among primary school children.

From the framework, children are usually exposed to the SHS either from household members or non- household members. Exposure from household members consists of their family who live in the same household with them. Exposure from non-household members consists of exposures from the public which may be outside of their home environments such as in a bus, restaurant, internet cafe and other public spaces. Nevertheless, children mostly spend their time at home, in close proximity to their parents. The exposure to SHS from household members is the focus of this research.

Nicotine and cotinine are biomarker used to determine the SHS exposure. Since cotinine is clearly the best biomarker of SHS exposure at present, this research had selected cotinine to be analyzed to determine the level of exposure (Jarvis *et.al.*, 2008) From the previous research, cotinine had been identified as a breakdown product of nicotine with a half-life of 20 hour. It is stable with temperature change, or current infection, and has high specifity and sensitivity and reflects on exposure for the past 2 to 3 days (Benowitz, 1996).

Cotinine can be detected from blood, urine and saliva. This research aims to analyze cotinine concentration from saliva as it is a non invasive method for children. Although exposure of SHS will give adverse health effect to children's respiratory system and also neurodevelopmental system, this research only focused on the effect to neurodevelopmental system. The neurodevelopmental system is related to the cognitive ability as well as children's academic performance in school. Difficulty with cognitive processes contributes to the increased risk of school problems seen among children (Aylward, 2002).

1.5 Definition of Term

1.5.1 Conceptual Definition

i) Secondhand Smoke

Involuntary or passive smoking is the exposure to SHS which is a mixture of exhaled mainstream smoke and sidestream smoke released from a smouldering cigarette or other smoking device (cigar, pipe, etc.) and diluted with ambient air. SHS is also sometimes referred to as "environmental tobacco smoke" (ETS). Involuntary smoking involves inhaling carcinogens and other toxic components that are present in secondhand smoke (WHO, 2012).

ii) Primary School Children

Primary education takes six years. In Malaysia, children usually start primary education at the age of seven. Primary education is a continuation of pre-school education. In addition to reading, writing and arithmetic, children will be exposed to other subjects such as science, physical education, islamic and moral education. At the end of their studies in year 6, they will sit for the Primary School Achievement Test (UPSR). This is to test their mastery on comprehension, writing and oral for Malay and English, mastery of mathematical skills and mastery of science concepts (Ministry of Education, 2012).

iii) Cotinine Concentration

Cotinine is a breakdown product of nicotine with a half-life of 20 hour. It is stable with temperature change, or current infection, and has high specifity, 95.9% and sensitivity, 92.3% (Etter *et. al*, 2000). Cotinine concentrations in biologic fluids such as saliva have been used by many scientists to evaluate SHS exposure because cotinine reflects exposure to nicotine, which indicates the exposure to the smoke of tobacco products (Benowitz, 1996).

iv) Academic Performance

A metric that is frequently calculated based on standardized test scores. Factors such as attendance and graduation rates may be considered as well. Factors included for measurement are vary by state (EPA, 2010).

v) Cognitive ability

Cognitive abilities are the brain based skills or mental functions in carrying any task from the simplest to the most complex. It is the mechanisms of learning, remembering, problem solving, and pay attention rather than with any actual knowledge (Michelon, 2006).

1.5.2 Operational Definition

i) Secondhand Smoke Exposure

Secondhand smoke exposure can be obtained through questionnaire by parental reported about smoking behavior of household members. Household members include father, mother, siblings or anyone living in the same house with the respondents.

ii) Primary School Children

All of the students in year 5 of Sekolah Kebangsaan Serdang, Selangor. The name list of students in year 5 obtained from the school administration.

iii) Cotinine Concentration

Cotinine concentration as biomarker to measure the secondhand smoke exposure acquires from the saliva sample collection and analyzed using the Salivary Cotinine Quantitative Enzyme Immunoassay Kit. For a person who are exposed to SHS, the cotinine level indicate significant exposure when >1 ng/ml while < 1ng/ml indicate minor exposure (Salimetrics, 2011).

iv) Academic Performance

The latest examination result of respondents which consists of 13 subjects (*Bahasa Melayu kefahaman dan penulisan*, *Bahasa Arab, Bahasa Inggeris, Kemahiran Hidup, Kajian Tempatan, Pendidikan Jasmani, Pendidikan islam atau moral, Pendidikan Muzik, Pendidikan Sivik*, *Pendidikan seni*, Mathematics and Sciences) in percentage obtained from student's school record.

v) Cognitive Ability

The cognitive ability score can be obtained by using the Wechsler Nonverbal Scale of Ability (WNV) assessment tools. There are six subtests in WNV which are Matrices, Coding, Object Assembly, Recognition, Spatial Span and Picture Arrangement. The subtest was conducted based on examinee ages and goal of assessment.

1.6 Research Objectives

1.6.1 General Objective

To determine the association between SHS exposure with academic performance among primary school children.

1.6.2 Specific objectives

I) To determine distribution of exposure to SHS among primary school children

II) To determine association between frequency of exposure to SHS and cotinine concentration in saliva

III) To determine the relationship between SHS exposure and academic performance among primary school children

IV) To determine the relationship between SHS exposure and cognitive ability of primary school children

1.7 Study Hypothesis

I) Children from households with smoking family members have higher SHS exposure compared to children from non smoking households members

II) There is a relationship between higher frequency of exposure to SHS and higher cotinine concentrations

III) There is a relationship between SHS exposure and academic performance among primary school children

IV) There is a relationship between SHS exposure and cognitive ability among primary school children

CHAPTER 2

LITERATURE REVIEW

2.1 Secondhand Smoke Exposure

Secondhand smoke (SHS) or environmental tobacco smoke (ETS) is a mixture of two form of tobacco smoke which is mainstream smoke and sidestream smoke. Mainstream smoke are the smoke inhaled directly by the smoker from the cigarettes and also the smoke exhaled from the smoker. Sidestream smoke is the smoke that comes from the end of burning cigarette, pipe or cigar which then goes into the air. Sidestream smoke is also known as main component of secondhand smoke. Sidestream smoke combine with mainstream smoke results in higher concentration of carboxyhemoglobin, nicotine and cotinine in blood than exposure to equal quantities of mainstream smoke (Swan & Lessov-Schlaggar, 2007). The gas or vapour phase of

sidestream smoke is responsible for most of the sensory irritation and respiratory tract epithelium damage (Schick & Glantz, 2005).

2.2 Health Effect of Secondhand Smoke Exposure to Children

SHS exposures among children have been linked with outcomes such as respiratory diseases, sudden infant death syndrome and also middle ear diseases (Tutka et. al, 2002). Exposure to secondhand smoke may also be associated with an increased risk of cardiovascular disease and it may in turn be associated with an increased risk of cognitive impairment and dementia (Chen, 2011).

2.2.1 Respiratory health

There were study have shown evidence of the significant association between SHS exposure and respiratory symptoms among children (Sharina *et al.*, 2007). Exposure to SHS has been shown to be associated with increased prevalence of upper respiratory tract infections, wheeze, asthma and lower respiratory tract infections (Cheraghi *et al.*, 2011). Lower respiratory tract illnesses consist of bronchitis, brochiolitis and pneumonia is an important cause of respiratory health effect due to parental smoking. Asthma is the most common chronic disease of childhood, and environmental factors play an important role in determining both onset and severity. Respiratory health problems occur due to

destruction of the alveoli (air sacs) in the lungs. Alveoli are essential for the exchange of oxygen in the blood. When they break down, the lung loses its elasticity to absorb oxygen. The onset of the disease is very gradual and breathlessness only becomes troublesome when about half of the lung has been destroyed (British Lung Foundation, 2011). The lung grows as height increases during childhood. Damage to the lung during its development will cause lasting effects and reduce the lung's capacity. It is difficult to distinguish between residual effects of maternal smoking during pregnancy and childhood SHS exposure (WHO, 1999).

2.2.2 Middle ear disease

Middle ear disease is also called Otitis media. Due to the shorter Eustachian tubes, which are at a more horizontal angle than in the adult ear, Children especially younger than seven are much more prone to otitis media. This is because they have not completely developed the same resistance to viruses and bacteria as adults. Early childhood exposure to SHS is causally associated with a major child health burden: acute and chronic middle ear disease (WHO, 1999).

Previous studies have shown that children exposed to cigarette smoke in their homes were at increased risk for middle-ear disease. Both acute otitis media

and persistent middle-ear effusions have been associated with involuntary smoking (Samet *et al.*, 1995). Therefore, passive smoking as well as sidestream smoke increases the risk of otitis media with effusion and recurrent otitis media (Ilicali, 2001).

2.2.3 Neurodevelopmental effects

Neurodevelopmental disabilities may lead to disorders of central nervous system function such as language disorders, learning disabilities, attention deficit-hyperactivity disorder (ADHD), developmental coordination disorders and behavioral problems (Behrman & Butler, 2007).

When compared to children of non-smokers, children of smokers perform more poorly in school (Yolton *et al.*, 2005). They also have lower scores in cognitive functioning tests in particular, language and auditory processing and have more behavioural problems, including conduct disorders, hyperactivity, and decreased attention spans (WHO, 1999).

Previous research has also shown that even low level exposure to ETS has a negative effect on the cognitive abilities of children (Yolton *et al.*, 2005).

The mechanisms by which SHS may effects on cognitive function are unknown. However, carbon monoxide in SHS can be the reason of depleting oxygen supply to the brain, and adversely affect mental performance (Bauman *et al.*, 1991).

2.2.4 Cardiovascular effects

Active and passive smoking have been shown to be associated with cardiovascular diseases (Kalio, 2009). In children, adolescents, and young adults, there is some evidence that SHS exposure may accelerate the development of cardiovascular disease. This is because of deleterious effects on oxygen transport, high-density lipoprotein (HDL) cholesterol, and possibly endothelial function (WHO, 1999).

One of mechanism among multiple cardiovascular effects of SHS is endothelial dysfunction. One study in Finland showed endothelial function, a measure of arterial health, was reduced in children who had been chronically exposed to low level of SHS from their smoking parents compared to children who lives with a non-smoker (Kallio *et al.*, 2007). The SHS exposure was assessed objectively via cotinine in serum samples from children age 11 years old.

2.3 Secondhand smoke and children

World Health Organization (WHO) consultation report concludes that the evidence of SHS harm to children is consistent and robust. This involuntary and harmful exposure can also be seen as a human rights violation for the children (WHO, 1999). As they unable to avoid the poisonous environment, continuous exposure to it may lead to several health effects without their own willingness.

Children are susceptible to the risks of SHS because of their underdeveloped immune system; they have higher breathing rates and cannot control their environments as well as adults (EPA, 2010). Younger children spend more time in closer proximity to their smoking parents, and these children may spend most of their time indoors (Delpisheh *et. al*, 2004). In 1999, WHO estimated that almost half of the world's children are involuntarily exposed to tobacco smoke (WHO, 1999). This shows that children are more likely than adults to suffer health effects from SHS exposure (Ashley, 1998).

2.4 Cotinine as biomarker

Cotinine levels have proved to be a useful marker of general levels of exposure to secondhand smoke (Jarvis, 1991). Cotinine is a breakdown product of nicotine with a half-life of 20 hour (Benowitz, 1996). Since cotinine has a longer half-life than nicotine, it is retained in the body for a considerable period of time (Coultas *et al.*, 1987). Thus, cotinine can be detected in various body fluids, and is used to assess an individual's exposure to tobacco or tobacco smoke (Etter *et al.*, 1999).

Previous research on exposure to secondhand smoke and academic performance suggested, cotinine should be used as biomarkers to establish the validity of self-reported SHS exposure (Ho *et al.*, 2010).

2.5 Tobacco smoke exposure and academic performance of children

Tobacco smoke exposure link to child development such as their intelligence, reasoning, achievement, perceptual skills, reading, language and verbal comprehension (Yolton *et al.,* 2005). It has been suggested that exposure to SHS can cause neurobehavioral and neurodevelopmental deficits, including hyperactivity, decreased attention span, reduced general intellectual ability,

skills in language and auditory tasks, and academic achievement (Tutka *et. al,* 2002).

Previous research stated that parental smoking was associated with lower mean scores on 'theoretical subjects based on school reports.' (Weitzman, 2001). This evidence is further compounded by the fact that among Otitis media children also may lead to sustained middle ear effusion and hearing loss which in turn could result in language difficulties and academic problems (Md Daud *et al*., 2010).

As the cognitive abilities and mental health decrease, it may affect the intelligent quotient of children, thus interfere their learning process which then may result in poor academic performance in school.

CHAPTER 3

METHODOLOGY

3.1 Study Design

This research had been implemented with a cross-sectional study design to determine the relationship and distribution of SHS exposure on the academic performance among respondents from January 2013 to March 2013.

3.2 Study Location

This research had been conducted in a primary school in Serdang Selangor. This school was chosen because of the location which is close to the (within 1 km) laboratory of Universiti Putra Malaysia, Serdang where the sample was analyzed. As the saliva sample needed to be refrigerated within 30 minutes and freezed at or below -20°C within four hours after collection for long term storage, this study location was judged to be the most suitable as it is the nearest to the laboratory. Moreover, previously there is no research related to SHS done in this school.

3.3 Sampling

3.3.1 Sampling Population

The population of the respondents consists of students in year 5 of a primary school in Serdang, Selangor.

3.3.2 Sampling Frame

The sampling frame of this research was obtained from the name list of students in year 5 registered in a primary school of Serdang, Selangor.

3.3.3 Study Sample

The study sample consists of all students who were exposed to tobacco smoke or not exposed to tobacco smoke from their household members.

Inclusion criteria in this study were students who were studying in year 5. While **exclusion criteria** in this study were students who were not in year 5 and also not studying in this selected primary school in Serdang. Besides, student who were just enrolled into this school were also excluded since there were no latest examination results could be obtained from the school.

3.3.4 Sampling unit

The sampling unit for this study was the student who fulfilled the selection criteria and studying in year 5 of Sekolah Kebangsaan Serdang, Selangor.

3.3.5 Sampling method

Purposive sampling method had been used in this study.

3.3.6 Sample size

In epidemiological studies, sample size of the study is very important. The sample size taken must be adequate so that the results obtained will be precise. Based on the previous research, the prevalence of exposure to secondhand smoke and academic performance among students was 20% (Ho *et al.,* 2010). The study sample had been calculated based on the formula of Kirkwood, 1988 as the following:-

$$N = \frac{p(1-p)}{e^2}$$

Where, N : Sample size

P : 20% prevalence of exposure to secondhand smoke and academic performance among students.

e^2 = standard error (5%)

$$N = \frac{0.20(1-0.20)}{0.05^2}$$

= **64** respondents

Based on the calculation done above, the minimum sample size for this study is 64 respondents. For the purpose of this study, an addition of 20% was added to the sample size to overcome the problem of non-responses. The total of non-responses sample size was 13. Hence, the sample size was **77** respondents.

3.4 Study Instrumentation

3.4.1 Questionnaire

Questionnaires were disseminated at school to parents via the children. The questionnaires were used to obtain the respondent's background information, socio-demographic, socio-economic, household members smoking behavior and children's school performance. This questionnaire had been divided into three sections. Section A was required for background information about parents and their children. Section B enquired about the exposure to tobacco smoke and section C enquired about school performance of their children. The questionnaire was provided in *Bahasa Melayu* as the national language.

3.4.2 Student's school record

Previous research on exposure to SHS and academic performance suggested that school records can be used to establish the validity of academic performance (Ho *et al.*, 2010).

The respondent's school record was obtained from the school via their teacher. The average marks for all subjects had been calculated and results of mathematics, science, *Bahasa Melayu (kefahaman)* and *Bahasa Melayu (penulisan*) was used to represents academic performances. These subjects

were chosen as the natural brain hemisphere function is separated into two kind of different field which are science and arts. This selection was done to obtain the stability on this research for both fields which mean some of the students may achieved more in sciences (mathematics and science) compared to art (writing and comprehension) or vice versa.

For all subjects chosen, total higher mark was 100 marks and the lowest is 0 marks. As overall, the average marks calculated was the final academic score of respondents.

3.4.3 Saliva sample collection

The advantage of salivary cotinine measurements is that it is a relatively non-invasive matrix and the collection procedures are relatively simple and well tolerated (Avila-Tang *et al.*, 2012). Saliva samples were collected using Salimetrics Oral Swab (SOS) from Salimetrics Ltd. Children were requested to produce saliva by saturating a sterile oral swab in their mouth for two minutes in order to produce an adequate volume of saliva for analysis later. The collected samples were then placed in test tubes and stored at -20°C in the freezer before analyzing it using ELISA (Enzyme Linked Immuno Sorbent Assay) specific for cotinine as shown in Figure 3.1 and Figure 3.2. The procedure on sample collection was provided in testing protocol given by the Salimetrics Company.

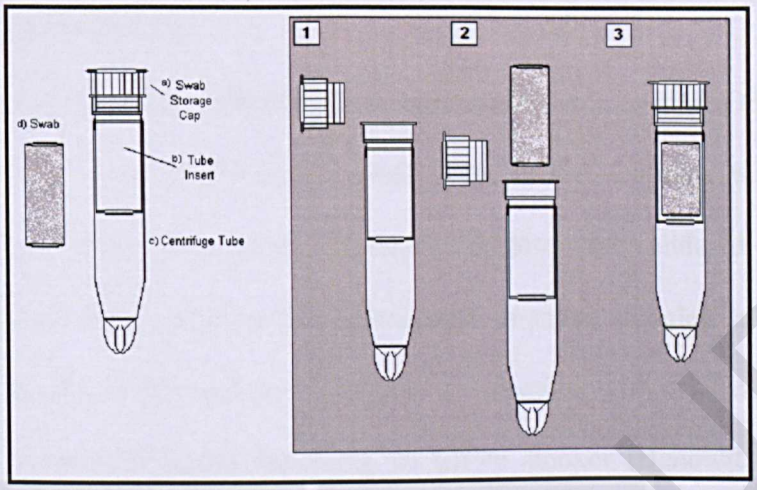

Figure 3.1: Steps to store oral swab in the storage tube

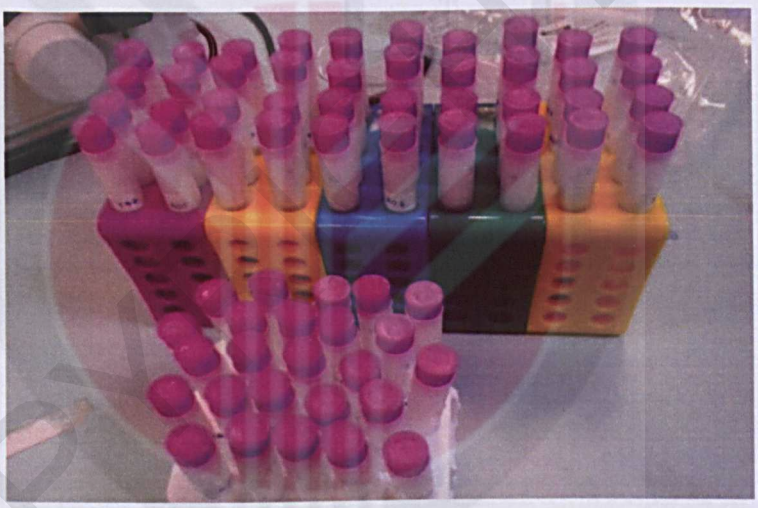

Figure 3.2: Oral swab was placed in test tube after saliva collection

3.4.4 ELISA Cotinine Kit

Saliva samples were collected using Salimetrics Oral Swab (SOS) from Salimetrics Ltd. The analysis was performed using ELISA Cotinine Kit as in Figure 3.3 below. This kit is an immunoassay designed and validated for the quantitative measurement of cotinine concentration in saliva samples. It is used to measure primary or secondhand exposure to nicotine with >15 ng/ml of Cotinine in saliva as cut-point indicating an active smoker (Benowitz *et al.*, 2002). This is the rapid enzyme immunoassay method for analyzing cotinine concentration in the saliva.

Figure 3.3: ELISA Cotinine Kit

The concentrations of salivary cotinine were obtained by extrapolating optical density values from standard curves graphs obtained from analysis of standard concentrations of the standard cotinine. It was expressed in ng/ml. (Abidin *et al*., 2011). To determine the concentration of unknowns (sample), 4-parameter curve fit by software from Readerfit.com (curve fitting tool for ELISA analysis) was used to interpolate the data.

Test Principle

Standards, unknowns (samples) and control along with rabbit antibodies to cotinine and cotinine linked to horseradish peroxidase (conjugate) were added to the 96- well microtiter plate. The cotinine in standards, unknowns and conjugate competes for the antibody binding sites. Unbound components are washed away after incubation process. Reactions of peroxidase enzyme on substrate tetramethylbenzidine (TMB) were used to measured bound conjugate. Blue colour was formed due to this reaction. Yellow colour was formed after stopping the solution with 2 molar sulphuric acid. Optical density was read on standard plate reader at 450 nm (Salimetrics, 2011).

3.4.5 Wechsler Nonverbal Scale of Ability (WNV)

The Wechsler Nonverbal Scale of Ability (WNV) is an individually administered clinical instrument designed to measure the general cognitive ability of examinees ages 4 years 0 months through 21 years 11 months (4:0 – 21:11). This instrument particularly useful for examinees who are diverse in terms of linguistic, cultural, educational and socioeconomic backgrounds, as well as those who have language disabilities, Autistic Disorder or are deaf or hard of hearing. This instrument is suitable for people whose first language is not English because the pictorial directions and stimuli do not require knowledge of English and the test does not require any verbal response.

From the previous test review, the reliability across age ranges and full scale score Fisher's z reliability coefficient ranged from 0.64 (Full Score ages 4 years 0 months to 7 years 11 months; two-subtest) to 0.85 (Full Score ages 13 years 0 months to 21 years 11 months; four-subtest) (Massa & Rivera, 2009).

There are six types of tests in WNV which are Matrices, Coding, Object Assembly, Recognition, Spatial Span and Picture Arrangement as shown in Figure 3.4. The version consists of a 4 and a 2-subtest battery for each age band. The 4-subtest battery for ages 8:0-21:11consists of Matrices, Coding, Spatial Span and Picture Arrangement. The 2-subtest battery consists of Matrices and

Spatial Span. Matrices subtest are used to measures perceptual reasoning, while spatial span measures working memory with visual spatial stimuli.

It was stated in WNV manual, when time is critical, the 2-subtest battery can be completed in about 20 minutes and may be preferable to the 4-subtest battery, which takes about 45 minutes. Since this study had time limitation, 2-subtest battery (Matrices and Spatial Span) such as in Figure 3.5, had been selected to complete the assessment (Wechsler & Naglieri, 2006).

Description on how were matrices and spatial span test had been conducted was in table 3.1. Figure 3.6 described the position during the test was being conducted.

Figure 3.4: Wechsler Nonverbal Scale of Ability (WNV) Kit

Figure 3.5: 2-subtest battery (Matrices and Spatial Span)

Table 3.1: Description of 2-Subtest Battery (For age 8:0-21:11)

Subtest	Description
Matrices	The examinee looks at an incomplete figural matrix and selects the missing portion from four or five response options.
Spatial Span	The examinee taps a series of blocks as demonstrated by the examiner. For Spatial Span Forward, the examinee repeats a sequence of tapped blocks in the same order as demonstrated by the examiner. For Spatial Span Backward, the examinee repeats a sequence of tapped blocks in the reverse order of that demonstrated by the examiner.

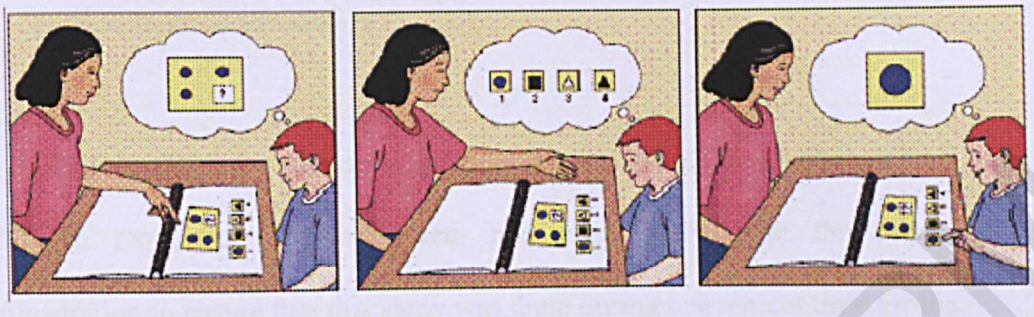

Figure 3.6: Innovative Pictorial Directions of WNV

3.5 Variables

3.5.1 Dependent variables

1) Academic performance of the students (year 5) in Sekolah Kebangsaan Serdang, Selangor.

2) Wechsler Nonverbal Scale of Ability (WNV) score

3.5.2 Independent variables

Secondhand smoke exposure and cotinine concentration in saliva

3.6 Data collection procedure

Prior to start the data and sample collection the approval from school had been requested. The agreement had been made with the school administration to ensure that this study was done during convenient time for the school since this data collection might disturb their teaching and learning time.

Permission letter had been forwarded to the parents of student in year 5 to get the consent for participates in this study. The questionnaires were then distributed to the parents of children who agreed to be involved in this study. This questionnaire consists of questions about background information, socio-demographic, socio-economic, household smoking behavior, and children's academic status. Besides, student's school record of latest examination result was obtained from school to measure the academic performance.

Saliva samples were collected on students who are allowed by their parents to be in this study to measure exposure of secondhand smoke. Before collecting the samples, the students were required to rinse their mouth thoroughly with water for 10 minutes. This is because the acidic or high sugar foods can compromise assay performance by lowering sample pH and influencing bacterial growth. As in Figure 3.7 below, during the sample collection, children need to place the cotton roll in their mouth (under the front

of the tounge) for two minutes in order to produce an adequate volume of saliva for later analysis. Samples was kept in the cool box within 2 minutes of collection before being transport to the laboratory within 2 hours and stored in a -20°C freezer.

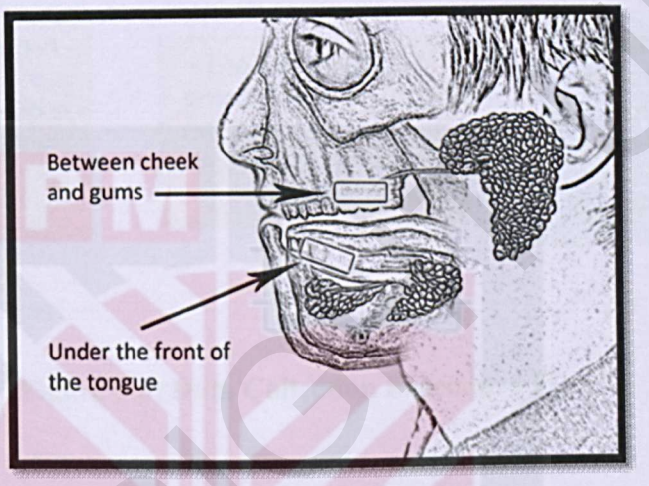

Figure 3.7: Location of oral swab in mouth

As for cognitive test, WNV test was conducted among respondents in about 20 minutes for each person. The two tests were Matrices and Spatial span. Data collection procedures are summarized in Figure 3.7 below.

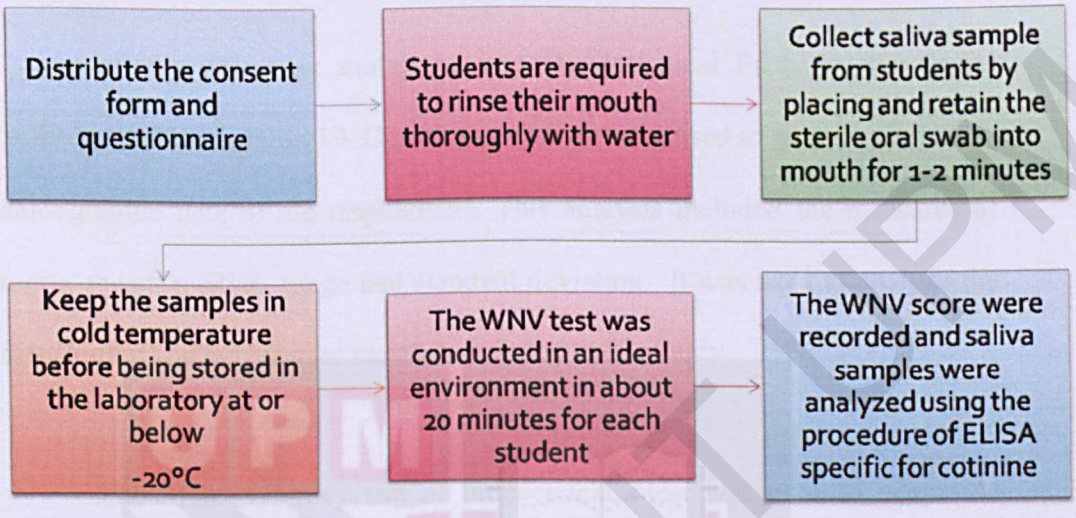

Figure 3.8: Data Collection Procedure Flow

3.7 Data Analysis

All the data was analyzed using the Statistical Packages for Social Sciences (SPSS) version 19. Descriptive statistic was used to analyze the socio-demographic data of the respondents. This analysis included the measures of mode, mean, median, range and standard deviation. It was used to analyze the distribution and summarize variable included in this study.

The Mann-Whitney test or Independent *t*-test was used to determine relationship of exposure to SHS among primary school children and academic performance. Chi-Square test was used for two categorical variables from questionnaire. To measure variables that more than three groups Kruskal Wallis test was used.

Correlation analysis was performed to determine relationship between continuous variables of respondents. Besides, this test was also used to determine the strength of relationship between variables. The association of the variables was considered significant at a value of $p < 0.05$. Multiple Linear Regression was used to determine the predictor factors which show statistically significant to variable based on the value of two or more other variables.

3.8 Quality Control

3.8.1 Questionnaires

Pre-test questionnaire were distributed to 10 respondents who have children studying in primary school. This is to get the feedback on the suitability of the questions given in the questionnaire. Based on the feedback given by the respondents, there had been some modification on the questions before conducting the actual test. Cronbach's alpha of this questionnaire was 0.60.

3.8.2 Saliva Sample collection

After sample collection, the samples were stored in cold temperature, in order to avoid bacterial growth in the specimen. The best practice is to refrigerate the samples within 30 minutes and freeze at or below -20°C within 4 hours of collection for long term storage (Salimetrics, 2011).

3.8.3 Wechsler Nonverbal Scale of Ability (WNV)

The WNV test was conducted in an ideal environment which was in a well-lit, quiet room that was free from distractions and interruptions. External distractions were minimized to focus the examinee's attention on the task presented.

3.9 Study Limitation

As the respondents in this study were children, the method of taking the saliva need to be conducted in interesting way to attract them on giving the cooperation. Otherwise, the sample collection will confront several problems such as vomiting, difficulty in breathing or mischievous behavior among childrens. Besides, there were not many studies which had been done following on tobacco smoke exposure and academic performance that used such method among children in Malaysia. Since the exposure to SHS and the frequency of exposure were obtained by the parental administrated questionnaires, there might be under-reporting of information especially among parents who were smokers.

Moreover, time constraints was also one of the limitation since this study was cross- sectional study which only determines the associations of risk factors and outcome at a specific period of time.

3.10 Ethical Consideration

First, the ethical clearance was obtained from the Medical Research Ethics Committee, Faculty of Medicine and Health Sciences, University Putra Malaysia (UPM). Permission to enter the school to conduct a research was obtained from the Educational Research Application System of Ministry of Education. Permission to conduct research was also obtained from *Jabatan Pelajaran Negeri Selangor*. Approval from respective schools was requested before the data collection begins. During the data collection period, the respondents were given some explanation about the whole study activities involved including some explanation about the saliva sample collection in term of the procedure and its purpose. Moreover, the approval letter was given to the parents or guardian to obtain the permission for their children to be involved in this study and they were also be informed that all information about the respondents were confidential.

CHAPTER 4

RESULT

4.1 Response Rate

There were 127 students in year 5 from 4 classes. The questionnaires, consent form and information sheet had been distributed to all of the students in year 5. A total of 72 (57% response rate) students agreed to take part in the study. However, from 72, four of the students were excluded from this study as they have recently enrolled into the school and do not have any academic results, thus leaving 68. In total, only 65 saliva samples were collected.

4.2 Socio Demographic Distributions

Based on inclusive and exclusive criteria, 68 of students were selected to be the respondents of this study. The respondents were selected among students in year 5 of the Sekolah Kebangsaan Serdang only.

Most of the respondents were Malay (95.6%). Since they were all in year 5, all of them were 11 years old. Among 68 of students, 52.9% of them were girls. There were 27.9% of respondent's mother had the highest educational level until colleges or universities compared to their father which are only 25% of them studied to the degree level. As for occupational types, 47.1% of their mothers were skilled worker, while for father's 50.0% and 6.2% of them were skilled workers and armed forces respectively. 36.8% of respondents were from family with low income, while 33.8% from family with total high income and 29.4% was from middle income. Table 4.1(a) and 4.1 (b) below summarize the respondent's background information.

Table 4.1(a): Distribution of socio-demographic among respondents (N=68)

Socio-Demographic characteristics	Frequency (n)	Percentage (%)
Gender		
Boy	32	47.1
Girl	36	52.9
Race		
Malay	65	95.6
Non-Malay	3	4.4
Educational Level		
Mother		
Primary School	2	2.9
High School	34	50.0
Diploma/Certificate	13	19.1
College/University	19	27.9
Father		
High School	38	55.9
Diploma/Certificate	10	14.7
College/University	17	25.0
Missing	3	4.4

Table 4.1(b): Distribution of socio-demographic among respondents (N=68)

Socio-Demographic Characteristics	Frequency	Percentage (%)
Occupation		
Mother		
Non-working	17	25.0
Unskilled worker	19	27.9
Skilled worker	32	47.1
Father		
Non-working	1	1.5
Unskilled worker	26	38.2
Skilled worker	34	50.0
Armed Forces	4	6.2
Missing	3	4.4
Total Family Income		
Low	25	36.8
Middle	20	29.4
High	23	33.8

Most of the respondents had three siblings (29.4%, n= 20) in their family and 39.7% (n= 27) of them were the first child in their family. Table 4.2 and 4.3 shows the distribution number of siblings and number among siblings of respondents.

Table 4.2: Distribution of number of siblings among respondents (N=68)

No. of siblings	Frequency	Percentage (%)
1	1	1.5
2	15	22.1
3	20	29.4
4	16	23.5
5	13	19.1
6	2	2.9
8	1	1.5
Total	68	100
Mean $\pm$ SD = 3.53 $\pm$ 1.287		

Table 4.3: Distribution of number among siblings of respondents (N=68)

No. among siblings	Frequency	Percentage (%)
1	27	39.7
2	15	22.1
3	12	17.6
4	10	14.7
5	2	2.9
6	1	1.5
7	1	1.5
Total	68	100
Mean $\pm$ SD = 2.29 $\pm$ 1.404		

4.3 Distribution of Secondhand Smoke Exposure

Based on the results, from 68 of schoolchildren, 39.7% (n= 27) of them were reported living with a father that smokes, while 5.9% (n= 4) of them lived with more than one smoker. 60.3% (n= 41) of them lived with a non-smoking father. It was reported that life long non- smoker and former smoker were 26 (38.2%) and 15 (22.1%) respectively. Table 4.4 shows the distribution of SHS exposure in household of the respondents.

Table 4.4: Distribution of Secondhand Smoke Exposure in household

Variables	Frequency	Percent (%)
Non- Smoking	41	60.3
Life long non-smoker	26	38.2
Former smoker	15	22.1
Smoking	27	39.7
Smoking father and family member	4	5.9

N=68

Figure 4.1 describes the distribution of cotinine concentration among children living in non-smoking homes and smoking homes. Cotinine concentration from children's saliva ranged from <0.01 ng/ml which was categorised as undetected to 1.13 ng/ml which was categorised as the highest concentration of cotinine in this study.

Approximately 20% (n= 13) of children had undetectable cotinine concentration (<0.01 ng/ml). Concentrations below than 0.1 ng/ml were recategorised into low (n=21, 32.31%), 0.1 ng/ml to 0.5 ng/ml as medium (n=22, 33.85%) and more than 0.5 ng/ml were high concentration (n=9, 13.85%). Among 40% (n= 27) of children living in smoking homes, 4.6% (n= 3) showed undetectable limit of cotinine concentration, 7.7% (n= 5) showed low concentration, 20% (n= 13) shows medium concentration and 7.7% (n= 5) showed high concentration of cotinine.

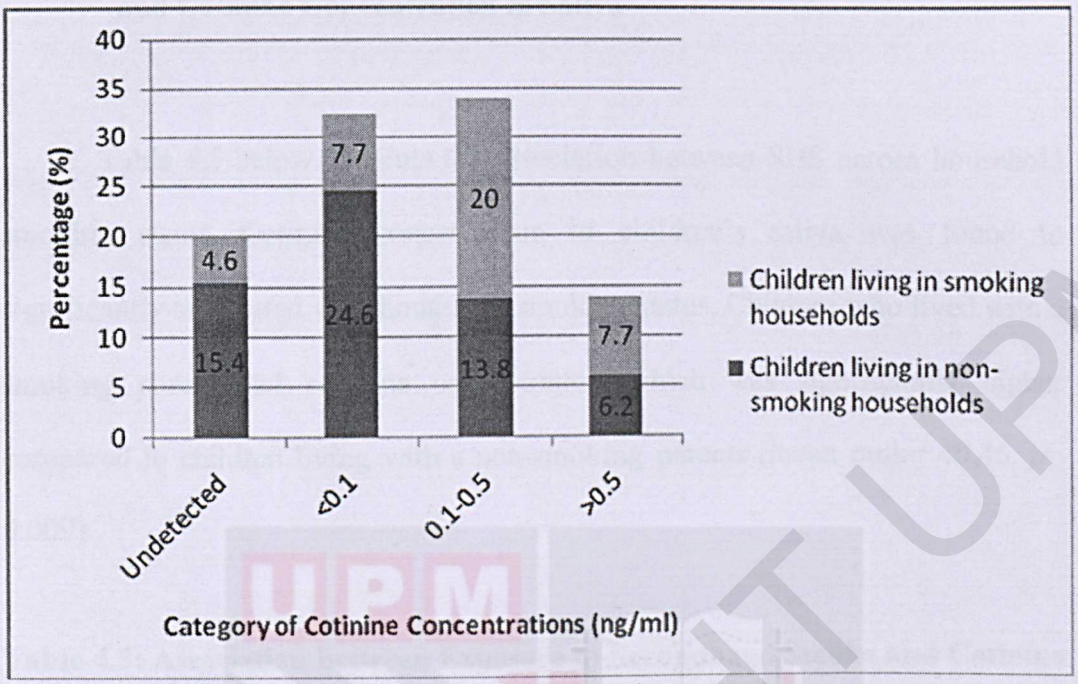

Figure 4.1: Distribution of salivary cotinine concentrations among respondents across household smoking status

4.4 Association between Frequency of Exposure to Secondhand smoke and Cotinine Concentration in Saliva

Table 4.5 below presents the association between SHS across household smoking status. Cotinine concentration in children's saliva was found to significantly associated with household smoking status. Children who lived with a smoking parent had cotinine concentration which was significantly higher compared to children living with a non-smoking parents (mean rank= 40.46, p= 0.009).

Table 4.5: Association between Exposure to Secondhand Smoke and Cotinine Concentration in Saliva

SHS Exposure	Cotinine Concentrations (ng/ml)				
	n	Mean Rank	U	z	*p*
Non-smoking (Unexposed)	39	28.03	313	-2.61	*0.009
Smoking (Exposed)	26	40.46			

N= 65

*Significant at p value < 0.05

Cotinine concentration was categorised according to the exposure hours to SHS and the number of parental cigarette smoking. This study found that there was a significant association between children's SHS daily exposure and the cotinine concentration measured from their saliva ($p< 0.05$), with a mean rank of 28.09 for none exposure, 34.34 for 1 to 3 hours exposure per day and 48.44 for > 3 hours per day. The results are shown in Table 4.6 below.

Table 4.6: Association between Exposure Hours to SHS and Cotinine Concentration in their Saliva

Exposure Hours to SHS (per day)	Cotinine Concentration (ng/ml)		
	n	Mean Rank	*p*
None	32	28.09	*0.022
1-3 hours/day	25	34.34	
>3 hours/day	8	48.44	

N= 65

*Significant at p value < 0.05

As for number of cigarette taken daily, this study found that there was no significant association between number of cigarette taken daily and cotinine concentration in children's saliva (p>0.05) with a mean rank of 28.45 for none cigarette taken, 36.39 for 1 to 5 cigarette staken daily and 40.97 for >5 cigarette taken daily by their smoking household members. However, a clear pattern of increasing number of cigarette and the increase of cotinine concentrations were observed. The results are shown in Table 4.7 below.

Table 4.7: Association between Number of Cigarettes and Cotinine Concentration in Saliva

No. of Cigarettes (per day)	Cotinine Concentration (ng/ml)		
	n	Mean Rank	*p*
None	40	28.45	0.066
1-5	10	36.39	
>5	15	40.97	

N= 65

*Significant at p value < 0.05

4.5 Relationship between Secondhand Smoke (SHS) Exposure and Academic Performance

There was no significant relationship between exposure to SHS (questionnaire based) and average marks for all subjects taken ($z= -0.72$, $p>0.05$). However, the mean rank for non-smoking (unexposed) was higher than smoking (exposed) which was 35.90 compared to 32.37. The mean and standard deviation of average marks was 67.4 ± 10.04.

As shown in Table 4.8, 4.9(a) and 4.9(b), the results by subjects between smoking and non-smoking, each of four subjects, showed no significant relationship ($p>0.05$) between smoking status and subjects (Mathematics, Sciences, BMP and BMK). However, it shows that children who lived with a smoking father had lower score of results compared to children who lived with a non-smoking father.

For mathematics subject, the mean and standard deviation for non-smoking (unexposed) was 55.00 ± 13.56, while smoking (unexposed) was 54.96 ± 13.58. As for sciences subject, the difference between smoking and non-smoking was quite obvious, with non-smoking (59.71 ± 14.28) compared to smoking (57.48 ± 15.11). *Bahasa Melayu Penulisan* for non-smoking was 61.95 ± 14.90 compared to smoking which was 56.63 ± 16.00. While, *Bahasa Melayu Kefahaman* for non-smoking had mean rank 37.49 compared to smoking which was 29.96 .

Table 4.8: Relationship between SHS Exposure (parental report) and Academic Performance (N=68)

Smoking status	Average mark for all subjects				
	n	Mean Rank	U	z	*p*
Non- smoking (Unexposed)	41	35.90	496	-0.72	0.47
Smoking (Exposed)	27	32.37			
Total	68				
Mean ± SD= 67.4 ± 10.04					

*Significant at *p* value < 0.05

Table 4.9(a): Relationship between SHS exposure (parental report) and subjects (Mathematics, Sciences, *Bahasa Melayu Kefahaman* and *Penulisan*) (N=68)

Subjects	Mean ± SD		95% CI	t	*p*
	Non- smoking n= 40	Smoking n= 26			
Math	55.00 ±13.56	54.96 ± 13.58	-6.68 ; 6.75	0.011	0.991
Sc.	59.71 ± 14.28	57.48 ± 15.11	-5.00 ; 9.46	0.615	0.541
BMP	61.95 ± 14.90	56.63 ± 16.00	-2.27 ; 12.91	1.40	0.166

*Significant at *p* value < 0.05

Math= Mathematics

Sc.= Science

BMP= Bahasa Melayu Penulisan

Table 4.9(b): Relationship between SHS exposure (parental report) and subject (*Bahasa Melayu Kefahaman*)

Smoking Status	Mark for *BMK				
	n	Mean Rank	U	z	*p*
Non smoking	41	37.49	431	-1.54	0.124
Smoking	27	29.96			
Total	68				

**BMK= Bahasa Melayu Kefahaman*

The relationship between salivary cotinine concentration and average mark for all subjects were shown in Table 4.10. There was no significant relationship between salivary cotinine concentration and average marks (academic performance). However, poor academic performance showed high mean rank (43.00) compared to good academic performance (32.52) with (p> 0.05). Table 4.11 shows the relationship between Salivary Cotinine Concentration and subjects (Mathematics, Sciences, *Bahasa Melayu Kefahaman* and *Penulisan*). No significant relationship was found. Children with lower cotinine concentration (lower mean rank) showed a pattern of good performances in those results of *Bahasa Melayu Penulisan*, Mathematics, Sciences. However, the differences were not significant.

Table 4.10: Relationship between Salivary Cotinine Concentration and Academic Performance (N=65)

Average Marks	Cotinine Concentration (ng/ml)				
	n	Mean Rank	U	z	*p*
Poor	3	43.00	63.00	-0.942	0.346
Good	62	32.52			

*Significant at *p* value < 0.05

Table 4.11: Relationship between Salivary Cotinine Concentration and subjects (Mathematics, Sciences, *Bahasa Melayu Kefahaman* and *Penulisan*) (N=65)

Subjects	Cotinine Concentration (ng/ml)				
	n	Mean Rank	U	z	*p*
***BMK**			146.00	-0.71	0.48
Poor	6	27.83			
Good	59	33.53			
***BMP**			266.50	-1.50	0.14
Poor	14	39.46			
Good	51	31.23			
Math			394.00	-0.43	0.66
Poor	18	34.61			
Good	47	32.38			
Science			357.00	-0.28	0.77
Poor	15	34.20			
Good	50	32.64			

**BMK= Bahasa Melayu Kefahaman*

**BMP= Bahasa Melayu Penulisan*

4.6 Relationship between Secondhand Smoke (SHS) Exposure and Cognitive Ability

Based on the results, in Table 4.12, it shows that children who live with a non-smoking father performed the WNV test better with mean and standard deviation 101.49 ± 10.38 compared to smoking father which are 98.56 ± 13.58. However, the differences were not statistically significant.

Table 4.12: Relationship between household smoking status and Cognitive Ability (N= 68)

Smoking Exposure	Full scale score of WNV			
	Mean ± SD	95% CI	*t*	*p*
Non smoking (unexposed)	101.49± 10.38	-2.88 ; 8.74	1.007	0.317
Smoking (Exposed)	98.56 ± 13.58			

N= 68

*Significant at *p* value < 0.05

Table 4.13 shows relationship between salivary cotinine concentration and cognitive ability. There was no significant relationship between salivary cotinine concentration and cognitive ability among school children (r_s = -0.157, p>0.05). Table 4.14 reported that there was no significant relationship between salivary cotinine concentration and cognitive ability (p>0.05) with mean rank 38.44 for low average score of WNV, 30.42 for average score and 33.27 for high average score of WNV.

Table 4.13: Relationship between Salivary Cotinine Concentration and Cognitive Ability (N=65)

Variables	WNV Score		
	n	r_s	*P*
Cotinine Concentrations (ng/ml)	65	-0.157	0.213

*Significant at p value < 0.05

Table 4.14: Relationship between Salivary Cotinine Concentration and Cognitive Ability (N=65)

WNV score	Cotinine Concentration (ng/ml)		
	n	Mean Rank	*p*
Low average	13	38.44	0.347
Average	37	30.42	
High Average	11	33.27	

*Significant at p value < 0.05

4.7 Relationship between Academic Performance and Wechsler Nonverbal Scale of Ability (WNV) Score

The relationship between academic performance and WNV score was analyzed using spearman correlation test. There was a significant low relationship between academic performance and WNV score ($r_s = 0.344$, $p<0.05$).

Table 4.15: Relationship between Academic Performance and WNV score

Variable	WNV score		
	n	r_s	*P*
Average Mark	68	0.344	* 0.04

N= 68

*Significant at *p* value < 0.05

4.8 Association between Smoking Status with Socioeconomic Status

Based on the following table, there was a significant association between father's smoking status and level of income (X^2= 7.31, p< 0.05). The results show that most of non-smoking father were from low family income, 85% (n=17) and most of smoking father with 52% (n=13) were from family with low income.

Table 4.16: Association between smoking status and level of income (N= 68)

Family Income	Smoking status		Total	x^2	*p*
	Non-smoking	Smoking			
Low	12 (48%)	13 (52%)	25 (100%)	7.31	*0.026
Middle	17 (85%)	3 (15%)	20 (100%)		
High	12 (12%)	11 (11%)	23 (100%		
Total	41 (60.3%)	27 (39.7%)	68 (100%)		

*Significant at *p* value < 0.05

Based on the results from multiple linear regressions in Table 4.17, the following variables were included to be predictor factors for academic performances in this study. These predictor variables that had been analyzed were tuition, self- revision duration, number of days absent per year, pre- school education and total family income. Pre- school education and family income especially in family with high income were predictor variables that statistically significantly to the prediction, $p < 0.05$. The R^2 value for this model was 0.412, which means that 41.2% of variation in academic performance was demonstrated by this model.

4.9 Relationship between Academic Performance and other Selected Variables

Table 4.17: Factors that contribute to Academic Performance (N= 68)

Variables	Std. Error	B	Beta Value	*p*-value	95% CI (Lower; Upper)
Constant	7.493	54.24	-	0.00	39.26; 69.22
Tuition	2.478	-0.719	-0.034	0.77	-5.675; 4.237
Self-Revison Duration	1.893	2.250	0.142	0.24	-1.535; 6.035
No. of Days Absent	0.247	-0.296	-0.145	0.23	-0.790; 0.197
Pre-school	3.393	7.258	0.258	0.036*	0.473; 14.04
Middle Income	2.987	5.276	0.241	0.082	-0.697; 11.25
High Income	2.842	5.722	0.272	0.048*	0.040; 11.40

*Significant at p value < 0.05

Note: R^2= 0.412

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

This study found that there was a significant association between household smoking status and salivary cotinine concentration ($p<0.05$). There was also a significant association between children's exposure hours to SHS and cotinine concentration ($p<0.05$). However, there was no significant relationship between children's SHS exposure and academic performance as well as cognitive ability ($p>0.05$).

5.2 Study Strengths and Weaknesses

The strengths of this study were the use of salivary cotinine as biomarker to determine the exposure to SHS and the use of Wechsler Nonverbal Scale of Ability (WNV) as a tool to measure cognitive ability among children. It was stated in previous study that biochemically assessed cotinine levels can be an indicator of active smoking, smokeless tobacco use, exposure to SHS or use of pharmaceutical nicotine (Jarvis *et al.*, 2008). From the previous test review of WNV, the authors concluded that the scores obtained were an adequate representation of the test's reliability and WNV is a good measure of cognitive ability and can be used as a part of larger process of assessment (Wechsler & Naglieri, 2006).

The weaknesses of this study were small sample sizes and low response rate and the fact that the immunoassay used in this study was not as specific and sensitive as the gold standard method of Gas-Chromatography Mass-Spectrophotometry (GC-MS) (Avila- Tang, 2012). Salimetrics Ltd. stated that GC-MS method had advantage of higher specificity and sensitivity compared to immunoassay (EIA) method (Salimetrics, 2011). Another weakness of this study was this study only involved one primary school in Serdang, but it only represents the Malay ethnicity and that was not representative of the Malaysian population with ethnic distribution of Malay and Bumiputera (67.4%), Chinese

(24.6%), India (7.3%) and others (0.7%) (Department of Statistic Malaysia, 2011). Hence, fewer representatives of other races in this study could not represent the general school distribution in Malaysia (Abidin *et.al*, 2011).

5.3 Socio demographic distributions

This study was conducted in Sekolah Kebangsaan Serdang, Selangor on 22nd of January in 2013 until 18 of March 2013. The time period for data collection of this study was arranged according to school's agreement. One of the methods that were used in this study in order to obtain the respondents' background information was through questionnaire. Questionnaire and consent forms were disseminated to parents via their children. To minimize bias, all of the classes in year 5 were involved.

Based on socio-demographic information, there were more girls involved compared to boys with 95% of respondents were Malays although this is a national school. Most of the respondents' mothers had the higher educational level compared to the children's fathers.

Types of occupation were categorized into four which were non-working, unskilled worker, skilled worker and armed forces. Unskilled work was the type

of work that can be learned in the range of 30 days or less which does not requires worker to have special training or skills such as farmer, laborer, clerks or maid. Skilled worker is a type of work that requires the workers to have a specialized training or learned skills in order to perform the task, for example technician, electrician or lecturer. Distribution data of this study showed that most of the mothers and fathers of these schoolchildren were skilled workers.

Family total income was categorized into three levels which were low income, middle income and high income group. Family income with RM3000 and below per month was categorised as low income, RM4000 to RM5000 was categorised as middle income and more than RM5000 per month was categorised as high income group. The respondents of this study were mostly from low income family which was RM3000 and below.

5.4 Distribution of SHS Exposure

Schoolchildren were categorized according to whether they were living with non-smoking or smoking household members, non-smoking group consisted of long life non-smokers and former smokers. Based on these results, there was high number of schoolchildren unexposed to SHS compared to those who were exposed to SHS. Approximately 39.7% (n=27) of children lived with a smoking father based on parental reported (questionnaire). This data showed a comparable figure compared to a previous study which was 36% of students was exposed to SHS at home (Ho *et al.*, 2010). Thus, the prevalence of exposure to SHS among children in this study had an approximately close number to this previous study.

5.4.1 Association between Smoking Statuses with Socioeconomic Status

Based on the results of this study, it shows that more children who were from low income families, lived with smoking household members and exposed to SHS compared to middle income and high income family. In line with previous study, smoking was directly correlated with income level. It was reported that 29% of adults who were in below poverty level or low income were smoking, compared to 17.9% of adult above the poverty level (Centers for Disease Control and Prevention, 2012).

To relate the relationship of smoking and income, it could be suggested that when socioeconomic status of family is low, stress level will increase due to hardship of life. Thus, as smoking is one of the unhealthy practices to reduce stress for certain people, they tend to choose smoking in order to relax their mind (Scales *et al.*, 2008). Smoking also may cause addictiveness to the smoker and make them consume it regularly that make younger people of their household members could not have clean air without tobacco smoke exposures.

5.5 Salivary Cotinine Concentration among Schoolchildren

Based on the cotinine data, the minimum salivary cotinine concentration in this study was <0.1 ng/ml. While cotinine concentration which was more than 0.5 ng/ml were categorized as high exposure. Range of the cotinine concentration in this study was divided into categorized to create approximately equal divided group (Moore *et al.*, 2011).

Approximately 20% of the samples taken in this study were undetectable. Approximately 5% of it was from exposed children with smoking homes. As in previous study, 22.7% were undetected concentration (Abidin *et al.*, 2011). As cotinine could be validated till 72 hours of exposure, it might be at the time of

sampling the cotinine concentration in the saliva was reduced to the very low limit and could not be detected.

Among 13.8% of medium category and 6.2% from high category were from children living with reported non-smoking households. Consistent with previous study, parental report were more likely to under-report their children's exposures to SHS, especially if the parents are smokers (Abidin *et al.*, 2011). Since this data were not included in this study, the exposure of SHS among children might likely be from outside of home or public area, it might be one of the reasons contributing to the detection of cotinine concentration among children living in non-smoking home.

Therefore, the first specific specific objective of this study which was to determine exposure to SHS among primary school children was achieved and hypothesis was accepted as the data shows children reported living with smoking family members have higher SHS exposures and presents in high and medium cotinine concentration. Undetectable and low cotinine concentration were majority consists of children living with non-smoking households.

There was also a significant association between cotinine concentration and parental reports of smoking status found in this study ($p<0.05$). This results

support the first hypothesis, which is most of the children who were exposed to SHS had high salivary cotinine concentration. This study proves the clear significant association between these two variables.

5.5.1 Frequency of Exposure to SHS and Salivary Cotinine Concentration

The second specific objective of this study was to determine the association between the frequency of SHS exposure and cotinine concentration in children's saliva. Frequency of exposure to SHS measured consisted of smoking behavior of their smoking household members. Based on the data of exposures hours to SHS per day in Table 4.7, the longer exposure hours to SHS, was found to be associated with higher cotinine concentration in saliva were observed. It was significantly associated between parental report exposure hours and salivary cotinine concentration among children which was similar with the finding found in previous study (Abidin *et al.*, 2011).

As for the number of parental cigarette smoked per day, the higher number of cigarette smoked, was found to be associated with higher salivary cotinine concentration was observed among respondents. This result supported the finding of previous study which showed that each additional cigarette smoked per day

were found lead to the increase of salivary cotinine concentration (Etter *et al.*, 2000).

Generally, higher frequency of smoking among households were related to more exposure to the SHS. The hypothesis of the second specific objective was accepted. Therefore, children with high exposures to smoky environment have high possibilities to inhale the tobacco smokes as the frequency of exposures was higher. Hence, salivary cotinine was a good biomarker to measure the SHS exposure among children as it provides consistent information between questionnaire and cotinine data (Tutka *et al.*, 2002).

Finding of this study shows the association between parental report of smoking status and salivary cotinine concentration was much more significant than the association between parental reports on SHS exposure hours with cotinine concentration in children's saliva. This is because parents might under-reporting their frequency of smoking or their hours of smoking. Therefore, since children were more honest in reporting, using children's self-reports on exposure to SHS may be more accurate in reporting their exposure on SHS.

5.6 Academic Performance among Schoolchildren

Academic performance of schoolchildren in this study was obtained through the school record from their teacher. This method was used according to the recommendation of a previous study which suggested school records should be used to establish validity of academic performance (Ho *et.al*, 2010). To achieve more valid academic performance scores, latest examination results of final exam while in year 4 were obtained. All of the subjects had been total up and divided with subjects taken. Results from this calculation were value for academic performance score of respondents. The scores then were divided into two categories. A student was considered to be a poor academic achiever if he or she obtained a score of less than 50% in the subjects (Ong *et al.*, 2010).

5.6.1 Academic Performance and other Selected Variables

Academic performance of schoolchildren may also be related to other factors. By using the multiple linear regression, pre- school education and family income were the predictor variables that were statistically significant in this study. Previous study had reported that, socio-economic factors of parents were associated with children's academic performance. This is due to the factor that parents from higher socio-economic status may be able to assist their children in purchasing the appropriate reading materials and support their children in any

related educational programme such as tuition compared to parents with lower socio-economic back-ground (Hanafi, 2008).

5.7 Cognitive Ability among Schoolchildren

Cognitive ability was measured using two tests' Matrices and Spatial Span in Wechsler Nonverbal Scale of Ability (WNV). Matrices is the test to measure perceptual reasoning of children, while spatial span is the test to measure working memory of children. Perceptual reasoning involves skills such as forming theories about the nature of objects, ideas, processes, and problem solving. It enables students to apply what they learn in complex ways (Logsdon, n.d.). Working memory is crucial for reading and understanding the content (reading comprehension), mental arithmetic and interacting appropriately in peer activities (Cogmed, 2013). The full scale score was derived from the combination of Matrices and Spatial span scores obtained by specific calculation on WNV formula and also depending on respondent's age. The formula of calculation was explained in WNV administration and scoring manual (Wechsler & Naglieri, 2006).

Cognitive Ability may be the best indicator to know the effect of SHS exposure on mental performance as it is the short-term response that does not need

long-term practice as in examination score. As stated for the limitation in a previous study, the temporality of association between SHS exposure and poor academic performance could not be ascertained (Ho *et al*., 2010).

5.7.1 Academic Performance and Cognitive Ability

Based on Table 4.15, there was a positive correlation with significant relationship between academic performance and WNV scores. These results showed that WNV was the best tool to measure the cognitive ability as well as academic performance among children. As correlation test was not about cause and effect relationship, it could be explained that children who have better cognitive ability will perform better on their academic performance due to their good mental ability. The tests used in WNV were Matrices and Spatial Span, measures perceptual reasoning and working memory. Working memory of brain based on Spatial Span test and problems solving skills (perceptual reasoning) based on Matrices test can be indicators which contribute to performance in academic or school examinations as those are also part of components in brain ability to perform better in school.

Cognitive ability refers to biology- based differences in human brain function that affect the capacity of individual on benefit from instructions. It may influence the rate of quality and quantity of new learning. A previous study

reported that cognitive ability and academic achievement proportionally related to each other. The differences affect the rate, accuracy and retention of what is learned from school (Smith, 2011).

5.8 Relationship between SHS Exposure and Academic Performance

The third specific objective of this study was to determine the relationship between SHS exposures with academic performance among primary school children. SHS exposure in this study represents the reported results based on parental reported (questionnaire) and through cotinine concentration from saliva sample of school children.

As shown in results, although there was no significant relationship between SHS exposure and academic performance, there were clear patterns of higher SHS exposure and poorer academic performance on children. These results supported previous study by (Ho *et. al*, 2010) which concludes SHS exposure is associated linearly with poor academic performance. In addition, according to WHO background paper of '*Association of in utero or Postnatal Environmental Tobacco Smoke Exposure and Neurodevelopmental and Behavioral Problems in Children*', children of smokers have been shown in previous studies to perform

more poorly in school compared to children of non-smoker (Eskenazi & Castorina, 1999).

This study also measured students' scores in three subjects which were mathematics, sciences and *Bahasa Melayu (kefahaman and penulisan)* as these represented essential academic performance which was divided into the science field and the language field. English language was not included in this study as it was a second language for most students (Ong *et. al*, 2010). Based on Table 4.9 (a) and 4.9 (b), results showed that children who lived with a smoking father performed poorly compared to children who lived with a non-smoking father. However, the differences were not significant.

It was stated in previous study that biomarkers such as Cotinine are more accurate than reported SHS exposure through questionnaire (Ho *et al*., 2010). Hence, based on cotinine data, there were also clear pattern in ranking of higher salivary cotinine concentration and poorer academic scores even as the *p* value were not significant. Higher mean rank for poor scores, indicate that children with higher salivary cotinine concentration, shows poor academic performance. A previous study stated the increase of SHS exposure among children was associated with poor academic performance (Ho *et al*., 2010).

5.9 Relationship between SHS Exposure and Cognitive Ability

The last specific objective of this study was to determine the relationship between SHS exposure and cognitive ability. There was no significant relationship between SHS exposure and cognitive ability found in this study. However, based on Table 4.12, parental report on children SHS shows that children who lived in smoking households tend to have lower cognitive ability compared to children who lived in non-smoking households although the results were not statistically significant.

Table 4.13 and Table 4.14 determined the relationship between salivary cotinine concentration and WNV scores. There was a negative correlation between the continuous data of salivary cotinine concentration and the continuous data of WNV score. This results showed that the higher cotinine concentration, the lower cognitive ability of respondents or vice versa. As for categorical results of WNV, the results clearly presents that children with higher salivary cotinine level, present in low average of cognitive group. Consistent with the results of previous study, those with high level of cotinine concentration (more than 0.5 ng/ml) were more likely to be cognitively low than those exposed to little or no SHS within range of 0.0 to 0.1 ng/ml. (Llewellyn *et al.*, 2009).

The specific mechanism on how SHS exposure may impair the cognitive ability was not known (Yolton *et al.*, 2004). SHS exposure is known as a serious threat to public health. It has been suggested that exposure to SHS may increase the exposure to carbon monoxide. Carbon Monoxide from tobacco smoke can bind with hemoglobin to form carboxyhemoglobin in blood, thus depleting the oxygen supply to brain and adversely affect mental performance (Bauman *et al.*, 1991).

5.10 Conclusion

This study was a preliminary study which contributed baseline data on exposure to SHS and academic performance as well as cognitive ability among school children in Malaysia. From the findings of this study, it shows that most of the children who lived with smoking household members have higher salivary cotinine concentrations, thus the first hypothesis was accepted. Besides, it was reported that with higher higher frequency of SHS exposure, the higher was the salivary cotinine concentration. Thus, the second hypothesis was accepted.

From this study, exposure to SHS was found to have no significant relationship with academic performance and cognitive ability of children. However, there was a pattern of higher salivary cotinine concentrations among children with lower cognitive ability.

5.11 Recommendation

As the results of this study did not show significant differences between SHS exposure and academic performance, therefore this study suggested more research on exposure to SHS and academic performance to be performed in future study with a larger sample size. Longitudinal studies are required to determine if these children with poor academic performance are affected by exposure to SHS. Information on prenatal and post-natal exposure should also be included in any future study.

Results showed that reported unexposed children to SHS by parents did not concur with cotinine concentration and it might be caused by exposure from outside home. Thus, self- reported exposure of children to SHS via microenvironment diary also can be used to know exactly the frequency and sources of exposure to SHS including the exposure from public area.

As cotinine concentration detected using EIA method was in a range of low concentration, it is suggested for future study to use Gas-Chromatography Mass-Spectrophotometry method which has the advantage of being a method with a higher specificity and sensitivity in analyzing the cotinine concentration (Benowitz, 1996).

SHS is known as dangerous substance at any level exposures. Although the effects are not visible in early childhood time, but as for long- term effects it may cause serious health problem to the children. From the finding of this study, exposure to SHS occurred more at home for children living with smokers. Home smoking restriction needs to be emphasized as a health promotion step to further reduce children involuntary exposure to SHS.

REFERENCES

American Cancer Society. (2011). *What is Secondhand smoke*. Retrieved from: http://www.cancer.org/Cancer/CancerCauses/TobaccoCancer/secondhand-smoke

Abidin, E. Z., Semple, S., Omar, A., Rahman, H. A., Turner, S.W., & Ayres, J.G. (2011). A survey of schoolchildren's exposure to secondhand smoke in Malaysia. *BMC Public Health*, 11, 634. doi:10.1186/1471-2458-11-634.

Ashley, M. J., Cohen, J., & Ferrence R., et al. (1998). Smoking in the home: changing attitudes and current practices. *Am-J-Public-Health*, *88*(5), 797-800.

Avila-Tang, E., Al-Delaimy, W.K., Ashley, D.L., Benowitz, N., Bernert, J.T., Kim, S… (2012). Assessing secondhand smoke using biological markers. *Tobacco Control*. doi:10.1136/tobaccocontrol-2011-050298

Aylward G.P. (2002). Cognitive and neuropsychological outcomes: more than IQ scores. *Ment Retard Dev Disabil Res Rev, 8*(4):234-40.

Bauman, K. E., Flewelling, R. L., & LaPrelle J. (1991). Parental cigarette smoking and cognitive performance of children. *Health Psychol*, 10(4), 282-8.

Benowitz, N. L. (1996). Cotinine as a biomarker of environmental tobacco smoke exposure. *Epidemiol Rev*, 18(2), 188–204.

Boffetta, P. (2006). Human cancer from environmental pollutants: the epidemiological evidence. *Mutat Res*, 608, 157-62.

British Lung Foundation. (2011). *Chronic Obstructive Pulmonary Disease*. Retrieved from: http://www.blf.org.uk/Conditions/Detail/COPD

CDC. (2012). Current Cigarette Smoking Among Adults—United States, 2011. Retrieved from: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6144a2.htm

Chen, R. (2011). Association of environmental tobacco smoke with dementia and Alzheimer's disease among never smokers. *Alzheimer's & Dementia*, X, 1-6. doi:10.1016/j.jalz.2011.09.231.

Cheraghi, M., Dadgarinejad, A., & Salvi, S. (2011). A Cross-Sectional Study to Find Prevalence and Risk Factors for Childhood Asthma in Pune City, India. I*SRN Public Health*, 2012, 1-8. doi:10.5402/2012/361456.

Cummings, K.M., Swedrock, T., Hyland, A., Pauly, J.L. (2001). Consumers' knowledge and beliefs about the safety of cigarette filters. *Tobacco Control,* 10 (1), doi:10.1136/tc.10.1.84

Coultas, D. B., Howard, C. A., Peake, G. T., Skipper, B. J., & Samet, J. M. (1987). Salivary Cotinine Levels and Involuntary Tobacco Smoke Exposure in Children and Adults in New Mexico. *Am Rev Resp1r*, 36, 305-309.

Cogmed. (2013). *About Working Memory*. Retrieved from http://www.cogmed.com/

Department of Statistics. (2011). Population and housing census, malaysia 2010. Retrieved from http://www.statistics.gov.my

Delpisheh, A., Kelly, Y., & Brabin, B. J. (2006). Passive cigarette smoke exposure in primary school children in Liverpool. *Public Health*, 120, 65-69. doi:10.1016/j.puhe.2005.05.003

Eskenazi, B., & Castorina, R. (1999). Association of Prenatal Maternal or Postnatal Child Environmental Tobacco Smoke Exposure and Neurodevelopmental and Behavioral Problems in Children. *Environmental Health Perspectives*, 107: 991-1000

Etter, J. F., Due, T. V., & Perneger, T. V. (2000). Saliva Cotinine Levels in Smokers and Nonsmokers. *Am J Epidemiol*, 151(3), 251-8.

Ho, S. Y., Lai, H. K., Wang, M. P., & Lam, T. H. (2010). Exposure to Secondhand Smoke and Academic Performance in Non-Smoking Adolescents. *The Journal of Paediatrics*, 157(6), 1012-1017.

Hanafi, Z. (2008). The Relationship Between Aspects of Socio-Economic Factors and Academic Achievement. *Jurnal Pendidikan 33*, 95-105

Ilicali, O. C., Keles, N., Deger, K., Sag`un, O. F., & Güldíken, Y. (2001). Evaluation of the Effect of Passive Smoking on Otitis Media in Children by an Objective Method: Urinary Cotinine Analysis. *The Laryngoscope*, 111, 163–167.

IARC Handbooks of Cancer Prevention, Tobacco Control, vol. 13: Evaluating the effectiveness of smoke- free policies (2009: Lyon, France)

Behrman R.E, Butler A.S. (2007) *Preterm Birth: Causes, Consequences, and Prevention. Washington (DC): National Academies Press (US); 11, Neurodevelopmental, Health, and Family Outcomes for Infants Born Preterm*. Retrieved from: http://www.ncbi.nlm.nih.gov/books/NBK11356/

Jarvis M.J, Fidler J, Mindell J, et al .(2008). Assessing smoking status in children, adolescents and adults: Cotinine cut points revisited. *Addiction , 103*, 1553-61.

Kallio, K., Jokinen, E., Raitakari, O. T., Hämäläinen, M., Siltala, M., Volanen, I.,... Simell, O. (2007). Tobacco Smoke Exposure Is Associated With Attenuated Endothelial Function in 11-Year-Old Healthy Children. *Journal of the American Heart Association*, 115, 3205-3212. doi: 10.1161/CIRCULATIONAHA.106.674804.

Llewellyn, D. J., Lang, I. A., Langa, K. M., Naughton, F., & Matthews, F. E. (2009). Exposure to secondhand smoke and cognitive impairment in non-smokers: national cross sectional study with cotinine measurement. *BMJ*, 338:b462. doi:10.1136/bmj.b462.

Logsdon, A. (n.d.). What is Abstract Reasoning?. Retrieved from: http://learningdisabilities.about.com/od/glossar1/g/abstractreason.htm

Massa, I., & Rivera, V. (2009). Test Review: Wechsler, D., & Naglieri, J.A. (2006). Wechsler Nonverbal Scale of Ability. San Antonio, TX: Harcourt Assessment. *Journal of Psychoeducational Assessment, 27* (5), 426- 432. doi: 10.1177/0734282908329108

Md Daud, M.K., Mohd Noor, R., Abd Rahman, N., Sidek, D.S., Mohamad, A. (2010). The effect of mild hearing loss on academic performance in primary school children. *International Journal of Pediatric Otorhinolaryngology.74*, 67- 70. doi: 10.1016/j.ijporl.2009.10.013

Ministry of Education. (2012). *Primary Education*. Retrieved from: http://www.moe.gov.my/?id=47

Muggli, M.E., Ebbert, J.O., Robertson, C., & Hurt, R.D. (2008). Waking a Sleeping Giant: The Tobacco Industry's Response to the Polonium-210 Issue. *American Journal of Public Health*, *98*(9), 1643–1650. doi: 10.2105/AJPH.2007.130963

Moore, G.F., Holliday, J.C., Moore, L.A.R. (2011). Socioeconomic Patterning in Changes in Child Exposure to Secondhand Smoke after Implementation of Smoke-Free Legislation in Wales. *Nicotine and Tobacco Research, 13*(10), 903–910. doi: 10.1093/ntr/ntr093

Nandasena, S., Wickremasinghe, A.R., Lee, K., & Sathiakumar, N. (2012). Indoor fine particle (PM2.5) pollution exposure due to secondhand smoke in selected public places of Sri Lanka. *American Journal of Industrial Medicine, 55*(12), 1129-1136. doi: 10.1002/ajim.22040

Ong, L. C., Chandran, V., Lim, Y. Y., Chen, A. H., & Poh, B. K. (2010). Factors associated with poor academic achievement among urban primary school children in Malaysia. *Singapore Med J*, 51(3), 247- 252

Papastefanou C. (2000). Radioactivity in tobacco leaves. *Journal of Environmental Radioactivity*, 53, 67-73

Pearson Assessment and Information. (2012). *Wechsler Nonverbal Scale of Ability (WNV)*. Retrieved from: http://www.pearsonassessments.com

Penn, A, Chen, L. C., & Snyder, C. A. (1994). Inhalation of steady-state sidestream smoke from one cigarette promotes arteriosclerotic plaque development. *Circulation* 90, 1363-7.

Samet, J. M., Lewit, E. M, & Warner, K. E. (1995). Involuntary Smoking and Children's Health. *Current Problems in Pediatrics*, 25,189-204.

Scales, M. B., Monahan, J. L., Rhodes, N., Roskos-Ewoldsen, D. & Johnson-Turbes, A. (2008). Adolescents' Perceptions of Smoking and Stress Reduction. *Health Education Behavior*, 36(4), 746-758. doi: 10.1177/1090198108317628

Schick, S., & Glantz, S. (2005). Philip Morris toxicological experiments with fresh sidestream smoke: more toxic than mainstream smoke. *Center for Tobacco Control Research and Education and Division of Cardiology*, 14, 396–404. doi: 10.1136/tc.2005.011288.

Sharina, D., Zulkifli, A., Nyi, NN. (2003). Secondhand smoke exposure at homeand respiratory symptomsamong primary school children in Kota Bharu, Kelantan. *Malaysian Journal of Public Health Medicine, 7* (2), 59- 63

Smith, R. (2011). Investigating the Relationship between Cognitive Ability and Academic Achievement in Elementary Reading and Mathematics. Retrieved from http://chalkboardproject.org

Surgeon General. (2007). U.S. Department of Health and Human Services. Children and Secondhand Smoke Exposure. Excerpts from The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General. Retrieved from: http://www.surgeongeneral.gov/library/reports/smokeexposure/index.html

Swan, G. E., & Lessov- Schlaggar, C. N. (2007). The Effects of Tobacco Smoke and Nicotine on Cognition and the Brain. *Neuropsychol Rev*, 17, 259-273. doi: 10.1007/s11065-007-9035-9.

Teo, K. K., Ounpuu, S., Hawken, S., Pandey, M. R., Valentin, V., Hunt, D., et al. (2006). Tobacco use and risk of myocardial infarction in 52 countries in the INTERHEART study: a case-control study. *Lancet*, 368, 647-58.

Tutka, P., Wielosz, M., & Zatoński, W. (2002). Exposure to Environmental Tobacco Smoke and Children Health. *International Journal of Occupational Medicine and Environmental Health*, *15*(4), 325-335.

United States Environmental Protection Agency (USEPA). (2011). Health Effects of Exposure to Secondhand Smoke. Retrieved from: http://www.epa.gov/smokefre/healtheffects.html

United States Environmental Protection Agency (EPA). 2012. *How does Indoor Air Quality impact student health and academic performance?*.. Retrieved from: http://www.epa.gov/iaq/schools/student_performance/

Wechsler, D., & Naglieri, J.A. (2006). Wechsler Nonverbal Scale of Ability Administration and Scoring Manual. USA: Pearson Education, Inc.

World Health Organisation (WHO). 1999. *Consultation report on International Consultation on Environmental Tobacco Smoke (ETS) and Child Health.* Retrieved from: http://www.who.int/tobacco/framework/consultation/ets2/en/index.html

World Health Organisation (WHO). 2002. *The tobacco atlas (first edition)*. Retrieved from http://www.who.int/tobacco/resources/publications/tobacco_atlas/en/

Yolton, K., Dietrich, K., Auinger, P., Lanphear, B. P., & Hornung, R. (2005). Exposure to environmental tobacco smoke and cognitive abilities among US children and adolescents. *Environmental Health Perspective,* 113(1), 98-103.

APPENDIX 1: ETHICAL COMMITTEE CONSENT LETTER

APPENDIX 2: APPROVAL LETTER FROM MINISTRY OF EDUCATION

APPENDIX 3: APPROVAL LETTER FROM *JABATAN PELAJARAN SELANGOR*

APPENDIX 4: INFORMATION SHEET

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

HELAIAN MAKLUMAT UNTUK RESPONDEN

TAJUK KAJIAN:

Pendedahan kepada asap rokok pasif dan prestasi akademik di kalangan kanak-kanak sekolah rendah di kawasan Serdang.

Exposure to Secondhand Smoke and Academic Performance among Primary School Children in Serdang.

PENGENALAN

Kajian ini dijalankan untuk mengkaji kesan pendedahan asap rokok pasif terhadap prestasi akademik kanak-kanak. Asap rokok pasif adalah asap dari perokok di persekitaran yang bersama dengan kanak-kanak. Ianya memerlukan penyertaan kanak-kanak yang berada dalam lingkungan umur 10 tahun hingga 11 tahun. Kelayakan untuk penyertaan di dalam penyelidikan ini tidak tertakluk kepada jantina, bangsa, pekerjaan ibu atau bapa atau faktor-faktor lain. Penyertaan di dalam kajian ini adalah secara sukarela. Anda dan anak anda berhak untuk mengundurkan diri dari mengambil bahagian dalam kajian ini pada bila- bila masa.

APA YANG ANDA PERLU LAKUKAN?

1) Ibubapa atau penjaga diminta untuk mengisi borang soal-selidik yang disediakan. Soal-selidik ini merangkumi bahagian seperti ciri-ciri rumah, tabiat merokok dan pendedahan kepada asap rokok dan prestasi akademik anak anda. Pakej soal- selidik ini mengambil masa kira- kira selama 5 hingga 10 minit untuk dilengkapkan.
2) Anak anda akan diminta untuk memberikan sampel air liur dengan menggunakan kaedah yang mudah dan selamat. Kaedah ini hanya memerlukan anak anda mengunyah gulungan kapas yang bersih dan menepukan gulungan kapas tersebut dengan air liur selama 2 minit. Aktiviti akan dijalankan di sekolah dibawah pemerhatian guru. Sampel air liur ini akan dianalisa di makmal bagi menentukan tahap pendedahan asap rokok pasif yang mungkin mereka alami.
3) Anak anda akan diminta untuk menjalankan satu ujian menggunakan peralatan mesra kanak-kanak yang mudah dan selamat iaitu, Wechsler Nonverbal Scale of Ability (WNV).

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SELANGOR, MALAYSIA

SIAPA YANG TIDAK PATUT MENGAMBIL BAHAGIAN?

Kanak- kanak yang tidak patut mengambil bahagian dalam kajian ini adalah mereka yang mempunyai alahan kepada gulungan kapas. Walaubagaimanapun, peratusan populasi yang menghidapi alahan ini adalah sangat minima. Sekiranya anak anda pernah mengalami alahan jenis ini, adalah disarankan supaya tidak mengambil bahagian dalam kajian ini untuk mengelak sebarang risiko ke atas kesihatan anak anda.

APAKAH FAEDAH DARIPADA KAJIAN INI:

(a) KEPADA ANDA SEBAGAI SUBJEK?

Maklumat yang anda berikan akan dapat membantu penyelidik, saintis dan pihak kerajaan kearah pemahaman yang lebih mendalam mengenai ciri-ciri isi rumah dan tabiat merokok serta kesannya terhadap prestasi akademik kanak- kanak. Dengan itu, anda telah menyumbang kepada usaha mengkaji kesan pendedahan asap rokok pasif terhadap kanak-kanak.

b) KEPADA PENGKAJI?

Maklumat yang anda berikan ini akan dapat membantu pengkaji dalam usaha mengkaji kesan pendedahan asap rokok pasif terhadap prestasi akademik kanak- kanak. Hasil kajian ini juga akan dapat menyumbang sesuatu untuk kempen anti rokok yang masih dijalankan oleh kerajaan disamping dapat menjadi pencetus lebih banyak kajian tentang kesan pendedahan asap rokok pasif ke atas kesihatan kanak- kanak.

ADAKAH TERDAPAT SEBARANG RISIKO?

Tidak terdapat sebarang risiko yang merbahaya dalam kajian ini. Kajian ini tidak menggunakan peralatan yang menyakitkan atau kaedah invasif. Oleh itu, tiada kemudaratan atu ketidakselesaan yang akan dialami oleh anak anda akibat penglibatannya di dalam kajian ini.

APAKAH HAK ANDA DALAM KAJIAN INI?

Semua responden berhak untuk menarik diri pada bila- bila masa tanpa memberikan apa- apa sebab.

APPENDIX 5: CONSENT FORM (PARENTS/GUARDIAN)

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BORANG KEBENARAN (Ibu bapa/ Penjaga)

TAJUK KAJIAN : Pendedahan Kepada Asap Rokok Pasif dan Prestasi Akademik di Kalangan Kanak-Kanak Sekolah Rendah di Kawasan Serdang

PENGKAJI : Khairunnisa Binti Saliman

Saya.....No.K/P.....
alamat.....
..... dengan ini secara sukarela bersetuju bahawa saudara saya untuk mengambil bahagian dalam penyelidikan klinikal yang dinyatakan di atas.

Saya telah diberitahu berkaitan dengan butir- butir kajian yang akan dijalankan dari segi kaedah kajian (Sila rujuk helaian maklumat). Saya tahu bahawa saya mempunyai hak untuk menarik diri daripada kajian pada bila-bila masa tanpa memberikan sebarang alasan saya berbuat demikian. Saya juga tahu bahawa kajian ini adalah sulit dan segala maklumat yang saya berikan berkaitan dengan identiti saya tidak akan didedahkan serta akan kekal sulit dan persendirian.

Saya ingin tahu / tidak ingin tahu keputusan ujian yang dilakukan ke atas sampel saudara saya.

* Potong mana yang perlu

T/ tangan .....
(Ibu bapa /Penjaga)

Tarikh :.....

T/ tangan .....
(*Saksi*)

Nama : .....

No K/P : .....

Saya mengesahkan bahawa saya telah menerangkan kepada ibu bapa/ penjaga responden tentang butir-butir kajian dari segi kaedah kajian serta tujuan kajian seperti disebut di atas.

Tarikh .....

T/ tangan .....
(Pengkaji)

APPENDIX 6: CONSENT FORM (RESPONDENTS)

FAKULTI PERUBATAN DAN SAINS KESIHATAN
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BORANG KEBENARAN (Responden)

Untuk diisi oleh pelajar (anak anda)

TAJUK KAJIAN : Pendedahan Kepada Asap Rokok Pasif dan Prestasi Akademik di Kalangan Kanak-Kanak Sekolah Rendah di Kawasan Serdang

PENGKAJI : Khairunnisa Binti Saliman

Saya.....No.K/P.....
alamat.....
..... dengan ini saya secara sukarela bersetuju mengambil bahagian dalam penyelidikan klinikal yang dinyatakan di atas.

Saya telah diberitahu berkaitan dengan butir- butir kajian yang akan dijalankan dari segi kaedah kajian (Sila rujuk helaian maklumat). Saya tahu bahawa saya mempunyai hak untuk menarik diri daripada kajian pada bila-bila masa tanpa memberikan sebarang alasan saya berbuat demikian. Saya juga tahu bahawa kajian ini adalah sulit dan segala maklumat yang saya berikan berkaitan dengan identiti saya tidak akan didedahkan serta akan kekal sulit dan persendirian.

Saya ingin tahu / tidak ingin tahu keputusan ujian yang dilakukan ke atas sampel saya.

* Potong mana yang perlu

T/ tangan .....
(Responden)

Tarikh :.....

T/ tangan .....
(*Saksi*)

Nama : .....

No K/P : .....

Saya mengesahkan bahawa saya telah menerangkan kepada ibu bapa/ penjaga responden tentang butir-butir kajian dari segi kaedah kajian serta tujuan kajian seperti disebut di atas.

Tarikh .....

T/ tangan .....

APPENDIX 7: QUESTIONNAIRE (MALAY VERSION)

Nombor Siri:

BORANG SOAL SELIDIK

JABATAN KESIHATAN PERSEKITARAN DAN PEKERJAAN

FAKULTI PERUBATAN DAN SAINS KESIHATAN

UNIVERSITI PUTRA MALAYSIA

TAJUK:

PENDEDAHAN KEPADA ASAP ROKOK PASIF DAN PRESTASI AKADEMIK KANAK-KANAK SEKOLAH RENDAH DI SERDANG

Adalah dimaklumkan bahawa satu kajian tentang prestasi akademik kanak-kanak akibat pendedahan asap rokok pasif sedang dijalankan di sekolah anak anda. Sehubungan dengan itu, sukacita dimaklumkan bahawa anda dan anak anda telah terpilih untuk menjadi salah seorang responden kajian ini. Anda diminta menjawab semua soalan yang dikemukakan dengan mengikut arahan yang telah diberikan. Segala maklumat yang anda berikan hanya akan digunakan untuk kajian ini dan nama anda akan dirahsiakan.

NO. SIRI:

Masa yang dianggarkan untuk melengkapkan borang kaji selidik ini adalah selama 5 hingga 10 minit.

Tarikh soal selidik dilengkapkan: _____

Nombor Siri:

ARAHAN: Soal-selidik ini terbahagi kepada 3 seksyen. Ia mengambil masa 5 hingga 10 minit untuk dilengkapkan. Dalam soal-selidik ini, 'ANAK ANDA' dan 'KANAK-KANAK INI' merujuk kepada kanak-kanak yang telah membawa pulang soal-selidik ini dari sekolah ke rumah. Anda diminta untuk menjawab soalan-soalan dibawah dengan menandakan di dalam 1 KOTAK SAHAJA kecuali apabila diminta atau MENULIS di ruangan yang disediakan.

SEKSYEN A: MAKLUMAT LATAR BELAKANG

1) Tarikh Lahir kanak- kanak ini: .....

2) Jantina : ☐ Lelaki ☐ Perempuan

3) Bangsa: ☐ Melayu ☐ Cina ☐ India

☐ Lain- lain (Sila nyatakan): .....

4) Berapakah bilangan Adik-beradik kanak- kanak ini? (Sila nyatakan):

.....

5) Anak anda adalah anak keberapa di dalam adik- beradiknya? (Anak keberapa, contoh: anak tunggal, pertama, kedua, ketiga dan sebagainya)

.....

6) Tarikh lahir IBU kanak- kanak ini:

.....

7) Tarikh lahir BAPA kanak- kanak ini:

.....

8) Apakah tahap pendidikan tertinggi ibu dan bapa kanak-kanak ini?

	Kolej/Universiti	Diploma/Sijil	Sekolah Menengah	Sekolah Rendah
IBU	☐	☐	☐	☐
BAPA	☐	☐	☐	☐

9) Apakah pekerjaan IBU kanak-kanak ini?

.....

Nombor Siri:

10) Apakah pekerjaan BAPA kanak-kanak ini?

.....

11) Berapakah jumlah pendapatan keseluruhan yang dijana oleh keluarga kanak-kanak ini di dalam satu bulan? (Sila nyatakan. umumnya adalah pendapatan ibu dan bapa)

.....

CIRI-CIRI RUMAH

12) Namakan jenis rumah yang didiami oleh keluarga anda sekarang.

Rumah Sewa ☐ Rumah Sendiri ☐ Perumahan rakyat ☐

13) Berapakah bilangan BILIK TIDUR yang terdapat di dalam rumah anda?

1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ ≥6 ☐

14) Berapakah bilangan penghuni yang tinggal dirumah anda? (Sila nyatakan bilangan, contoh: 5)

Bilangan orang dewasa ☐ Bilangan kanak-kanak ☐

(kurang dari 16 tahun)

15) Pada kebiasaannya, di manakah anak anda tidur di waktu malam?

Di bilik sendiri..... ☐

Berkongsi bilik dengan adik-beradik yang lain..... ☐

Berkongsi bilik dengan ibu dan bapa..... ☐

Berkongsi bilik dengan orang dewasa yang lain..... ☐

Di ruang tamu rumah..... ☐

Nombor Siri:

16) Adakah anda menggunakan unit penghawa dingin atau *air-cond* di rumah? Sila tandakan mana yang berkenaan

- ☐ Tidak menggunakan penghawa dingin
- ☐ Ya, di ruang tamu
- ☐ Ya, di ruang makan
- ☐ Ya, di bilik di mana kebiasaanya anak saya tidur di waktu malam
- ☐ Ya, di bilik lain (Sila nyatakan dimana): _____

SEKSYEN B: PENDEDAHAN KEPADA ASAP ROKOK

17) Secara purata, berapa JAM di dalam 1 hari anak anda terdedah kepada asap rokok SEPANJANG 1 MINGGU YANG LEPAS?

0	1-3 Jam/sehari	4-6 Jam/sehari	7-10 Jam/sehari	Lebih 10 Jam/sehari
☐	☐	☐	☐	☐

18) Di manakah perokok dibenarkan untuk merokok semasa berada di rumah anda? (Sila tandakan mana yang berkenaan)

- ☐ Bukan di bahagian dalam rumah
- ☐ Ruang tamu
- ☐ Ruang makan
- ☐ Dapur
- ☐ Bilik tidur
- ☐ tandas/Bilik mandi

19) Selain dari IBU DAN BAPA, adakah terdapat AHLI KELUARGA LAIN yang merokok dan tinggal bersama- sama anak anda di rumah anda?

- ☐ Ya
- ☐ Tidak

20) Sekiranya YA, sila nyatakan siapa individu tersebut.

.....

21) Pernahkah BAPA kanak- kanak ini merokok?

- ☐ Ya
- ☐ Tidak (Sekiranya tidak, sila melangkah ke soalan 26)

Nombor Siri:

22) Sekiranya Ya, adakah BAPA kanak- kanak ini masih merokok?

☐ Ya ☐ Tidak (Sekiranya tidak, sila melangkah ke soalan 26)

23) Sekiranya Ya, Pernahkah BAPA kanak- kanak ini merokok sepanjang tahun? ('YA' bermaksud sekurang-kurangnya 20 pek rokok atau 360 gram tembakau seumur hidup atau sekurang-kurangnya 1 batang rokok setiap hari atau sebatang curut setiap minggu untuk tempoh 1 tahun)

☐ Ya ☐ Tidak

24) Apakah jenis produk tembakau yang digunakan oleh BAPA kanak-kanak ini? Sila tandakan mana yang berkenaan

Rokok (contoh: Dunhill, Salem dan sebagainya)..... ☐

Rokok Kretek (Contoh: Gudang garam Sampoerna sebagainya)..... ☐

Curut..... ☐

Rokok paip..... ☐

Rokok daun..... ☐

Lain-lain (Sila nyatakan)... ☐

.....

25) Berapakah anggaran jumlah produk tembakau yang dihisap oleh BAPA kanak- kanak ini? (Sila tandakan mana yang berkenaan)

	1-5	5-10	10-15	15-20	lebih 20
Bilangan rokok dalam 1 hari	☐	☐	☐	☐	☐
Bilangan rokok kretek dalam 1 hari	☐	☐	☐	☐	☐
Bilangan curut dalam 1 hari	☐	☐	☐	☐	☐
Rokok paip dalam gram/ 1 hari	☐	☐	☐	☐	☐
Bilangan rokok daun dalam 1 hari	☐	☐	☐	☐	☐

Nombor Siri:

26) Pernahkah IBU kanak- kanak ini merokok?

☐ Ya ☐ Tidak (Sekiranya tidak, sila melangkah ke seksyen C)

27) Sekiranya Ya, adakah IBU kanak- kanak ini masih merokok?

☐ Ya ☐ Tidak (Sekiranya tidak, sila melangkah ke seksyen C)

28) Apakah jenis produk tembakau yang digunakan oleh IBU kanak-kanak ini? Sila tandakan mana yang berkenaan

Rokok (contoh: Dunhill, Salem dan sebagainya)..... ☐

Rokok Kretek (Contoh: Gudang garam, Sampoerna sebagainya)..... ☐

Curut..... ☐

Rokok paip..... ☐

Rokok daun..... ☐

Lain-lain (Sila nyatakan)

.....

29) Berapakah anggaran jumlah produk tembakau yang dihisap oleh IBU kanak- kanak ini? Sila tandakan mana yang berkenaan

	1-5	5-10	10-15	15-20	lebih 20
Bilangan rokok dalam 1 hari	☐	☐	☐	☐	☐
Bilangan rokok kretek dalam 1 hari	☐	☐	☐	☐	☐
Bilangan curut dalam 1 hari	☐	☐	☐	☐	☐
Rokok paip dalam gram/ 1 hari	☐	☐	☐	☐	☐
Bilangan rokok daun dalam 1 hari	☐	☐	☐	☐	☐

Nombor Siri:

SEKSYEN C: PENCAPAIAN AKADEMIK ANAK ANDA

30) Adakah anak anda pernah memasuki pra-sekolah?

☐ Ya ☐ Tidak

31) Adakah anak anda menghadiri kelas tambahan atau tuisyen berbayar di luar sekolah? (Sekiranya tidak sila pergi ke soalan 33)

☐ Ya ☐ Tidak

32) Berapa lamakah masa anak anda mengikuti kelas tambahan?

☐ 1 jam/minggu ☐ 2 jam/minggu ☐ 3 jam/minggu

☐ ≥4 jam/minggu

33) Pada kebiasaannya, berapa lamakah masa anak anda mengulangkaji pelajaran sendiri dalam sehari?

☐ 1 jam/sehari ☐ 2 jam/sehari ☐ 3 jam/sehari

☐ ≥4 jam/sehari

34) Berapa hari kah anak anda tidak hadir ke sekolah dalam tahun semasa?

.....

APPENDIX 8: WNV RECORD FORM

WNV™ Record Form

WECHSLER NONVERBAL SCALE OF ABILITY

David Wechsler and Jack A. Naglieri

Calculation of Examinee's Age	Year	Month	Day
Date of Testing			
Date of Birth			
Age at Testing			

Examinee's Name: I.D.:

Examinee's School: Grade:

Examiner's Name:

Selected Subtest Battery

☐ 4-Subtest ☐ 2-Subtest

Ages 4:0–7:11

Total Raw Score to *T* Score Conversions

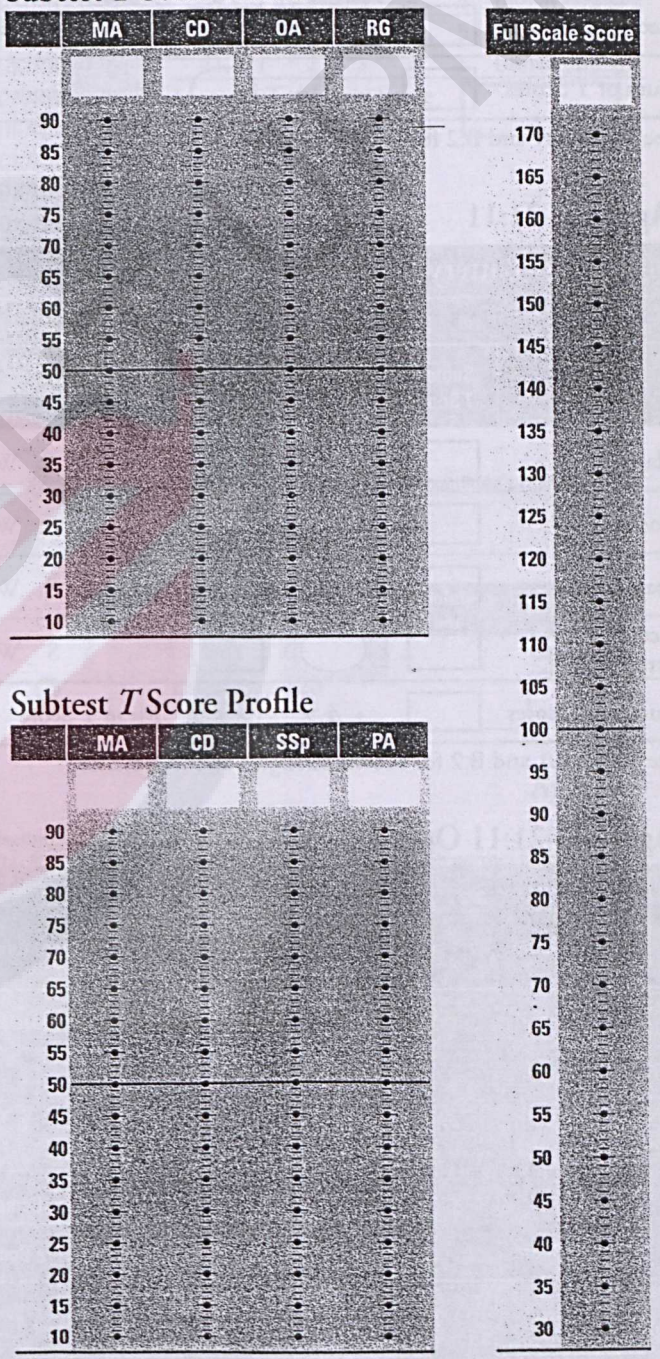
Subtest	Raw Score	*T* Score	
Matrices			
Coding			
Object Assembly			
Recognition			

Sum of *T* Scores: 4-Subtest ☐ 2-Subtest ☐

Sum of *T* Scores to Full Scale Score Conversion

Sum of *T* Scores	Full Scale Score	Percentile Rank	Confidence Interval 90% or 95%
			–

Subtest *T* Score Profile



Ages 8:0–21:11

Total Raw Score to *T* Score Conversions

Subtest	Raw Score	*T* Score	
Matrices			
Coding			
Spatial Span			
Picture Arrangement			

Sum of *T* Scores: 4-Subtest ☐ 2-Subtest ☐

Sum of *T* Scores to Full Scale Score Conversion

Sum of *T* Scores	Full Scale Score	Percentile Rank	Confidence Interval 90% or 95%
			–

Subtest *T* Score Profile

PEARSON

PsychCorp

ISBN 015433855-9

9 780154 338556

6 7 8 9 10 11 12 A B C D E 276817-2 321

Ages 4:0–7:11

4–Subtest Battery

Subtest Strengths and Weaknesses

Subtest	Subtest *T* Score	Mean *T* Score	Difference From Mean	Critical Value .15 or .05	Strength or Weakness (S) or (W)	Base Rate
Matrices					S W	
Coding					S W	
Object Assembly					S W	
Recognition					S W	
Sum of *T* Scores		÷ 4 =		Mean *T* Score		

See Tables B.1 and B.2 for subtest strengths and weaknesses.

2–Subtest Battery

Subtest Comparison

T Score Comparison	*T* Score MA	*T* Score RG	Difference	Critical Value .15 or .05	Base Rate
Matrices–Recognition					

Significant Difference: Y or N

See Tables B.3 and B.4 for subtest comparison.

Ages 8:0–21:11

4–Subtest Battery

Subtest Strengths and Weaknesses

Subtest	Subtest *T* Score	Mean *T* Score	Difference From Mean	Critical Value .15 or .05	Strength or Weakness (S) or (W)	Base Rate
Matrices					S W	
Coding					S W	
Spatial Span					S W	
Picture Arrangement					S W	
Sum of *T* Scores		÷ 4 =		Mean *T* Score		

See Tables B.1 and B.2 for subtest strengths and weaknesses.

2–Subtest Battery

Subtest Comparison

T Score Comparison	*T* Score MA	*T* Score SSp	Difference	Critical Value .15 or .05	Base Rate
Matrices–Spatial Span					

Significant Difference: Y or N

See Tables B.3 and B.4 for subtest comparison.

Ages 8:0–21:11 Optional Analysis

Total Raw Score to *T* Score Conversions

Score	Raw Score	*T* Score
Spatial Span Forward		
Spatial Span Backward		

See Table C.1 for *T* score conversions.

T Score Comparison

Score Comparison	*T* Score SSpF	*T* Score SSpB	Difference	Critical Value .15 or .05	Base Rate
SSpF–SSpB					

Significant Difference: Y or N

See Tables C.2 and C.3 for *T* score comparison.

Raw Score to Base Rate Conversions

Score	Raw Score	Base Rate
Longest Spatial Span Forward		
Longest Spatial Span Backward		

See Table C.4 for base rates.

Raw Score Comparison

Score Comparison	Raw Score LSSpF	Raw Score LSSpB	Difference	Base Rate
LSSpF–LSSpB				

See Table C.5 for raw score comparison.

Matrices

Ages 4–21

Start
Ages 4–5: Demonstration Item, Sample Items A–C, then Item 1
Ages 6–15: Demonstration Item, Sample Items A–C, then Item 7
Ages 16–21: Demonstration Item, Sample Items A–C, then Item 12

Reverse
Ages 6–21: Score of **0** on *either* of the first two items given, administer preceding items in reverse sequence until two consecutive perfect scores are obtained

Discontinue
After **4** scores of **0** on *five* consecutive items

Score
Score **0** or **1** point
Correct responses are in **color**

Item		Response						Score
4–21	D.	1	2	3	4		DK/NR	
	A.	1	2	3	4		DK/NR	
	B.	1	2	3	4		DK/NR	
	C.	1	2	3	4		DK/NR	
4–5	1.	1	2	3	4		DK/NR	0 1
	2.	1	2	3	4	5	DK/NR	0 1
	3.	1	2	3	4	5	DK/NR	0 1
	4.	1	2	3	4	5	DK/NR	0 1
	5.	1	2	3	4	5	DK/NR	0 1
	6.	1	2	3	4	5	DK/NR	0 1
6–15	7.	1	2	3	4	5	DK/NR	0 1
	8.	1	2	3	4	5	DK/NR	0 1
	9.	1	2	3	4	5	DK/NR	0 1
	10.	1	2	3	4	5	DK/NR	0 1
	11.	1	2	3	4	5	DK/NR	0 1
16–21	12.	1	2	3	4	5	DK/NR	0 1
	13.	1	2	3	4	5	DK/NR	0 1
	14.	1	2	3	4	5	DK/NR	0 1
	15.	1	2	3	4	5	DK/NR	0 1
	16.	1	2	3	4	5	DK/NR	0 1
	17.	1	2	3	4	5	DK/NR	0 1
	18.	1	2	3	4	5	DK/NR	0 1
	19.	1	2	3	4	5	DK/NR	0 1
	20.	1	2	3	4	5	DK/NR	0 1
	21.	1	2	3	4	5	DK/NR	0 1
	22.	1	2	3	4	5	DK/NR	0 1
	23.	1	2	3	4	5	DK/NR	0 1
	24.	1	2	3	4	5	DK/NR	0 1
	25.	1	2	3	4	5	DK/NR	0 1
	26.	1	2	3	4	5	DK/NR	0 1
	27.	1	2	3	4	5	DK/NR	0 1
	28.	1	2	3	4	5	DK/NR	0 1
	29.	1	2	3	4	5	DK/NR	0 1
	30.	1	2	3	4	5	DK/NR	0 1
	31.	1	2	3	4	5	DK/NR	0 1
	32.	1	2	3	4	5	DK/NR	0 1
	33.	1	2	3	4	5	DK/NR	0 1
	34.	1	2	3	4	5	DK/NR	0 1
	35.	1	2	3	4	5	DK/NR	0 1
	36.	1	2	3	4	5	DK/NR	0 1
	37.	1	2	3	4	5	DK/NR	0 1
	38.	1	2	3	4	5	DK/NR	0 1
	39.	1	2	3	4	5	DK/NR	0 1
	40.	1	2	3	4	5	DK/NR	0 1
	41.	1	2	3	4	5	DK/NR	0 1

Matrices Total Raw Score (Maximum = 41) ____

Coding

(Time Limit: 120 seconds)

Ages 4–21

Start
Ages 4–7: Coding A Demonstration Items, Sample Items, then Test Items
Ages 8–21: Coding B Demonstration Items, Sample Items, then Test Items

Discontinue
Ages 4–7: After 120 seconds
Ages 8–21: After 120 seconds

Score
Use the Scoring Template to check the examinee's responses
Score **1** point for each correct response

	Form	Time Limit	Completion Time	Total Raw Score
4–7	A.	120"		(Max = 72) ____

	Form	Time Limit	Completion Time	Total Raw Score
8–21	B.	120"		(Max = 144) ____

Object Assembly

(Time Limit: See Item)

Ages 4–7

Start
Ages 4–5: Demonstration Item, Sample Item, then Item 1
Ages 6–7: Demonstration Item, Sample Item, then Item 3

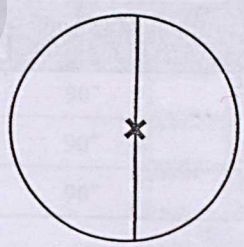
Reverse
Ages 6–7: Imperfect assembly on *either* of the first two items given, administer preceding items in reverse sequence until two consecutive perfect scores are obtained

Discontinue
After **2** consecutive scores of 0

Score
Items 1–7: Score **1** point for each correct juncture
Items 8 & 10: Score **1** point for each correct juncture plus any additional time bonus points
Items 9 & 11: Score **1/2** point for each correct juncture plus any additional time bonus points

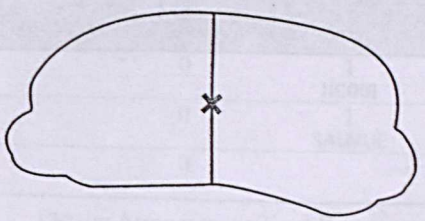
	Item	Time Limit	Completion Time
4–7	D. Basketball	None	

Number of Correct Junctures: 0 1



Item	Time Limit	Completion Time
S. Hot Dog	None	

Number of Correct Junctures: 0 1



Continue

Recognition

(Stimulus Exposure Time: 3 seconds)

Ages 4–7

Start
Ages 4–5: Demonstration Item, Sample Items A–C, then Item 1
Ages 6–7: Demonstration Item, Sample Items A–C, then Item 4

Reverse
Ages 6–7: Score of **0** on *either* of the first two items given, administer preceding items in reverse sequence until two consecutive perfect scores are obtained

Discontinue
After **4** scores of 0 on *five* consecutive items

Score
Score **0** or **1** point
Correct responses are in **color**

Item		Response	Score
4–7	D.	1 2 3 DK/NR	
	A.	1 2 3 DK/NR	
	B.	1 2 3 DK/NR	
	C.	1 2 3 DK/NR	
4–5	1.	1 2 3 4 DK/NR	0 1
	2.	1 2 3 4 5 DK/NR	0 1
	3.	1 2 3 4 5 DK/NR	0 1
6–7	4.	1 2 3 4 5 DK/NR	0 1
	5.	1 2 3 4 5 DK/NR	0 1
	6.	1 2 3 4 5 DK/NR	0 1
	7.	1 2 3 4 5 DK/NR	0 1
	8.	1 2 3 4 5 DK/NR	0 1
	9.	1 2 3 4 5 DK/NR	0 1
	10.	1 2 3 4 5 DK/NR	0 1
	11.	1 2 3 4 5 DK/NR	0 1
	12.	1 2 3 4 5 DK/NR	0 1
	13.	1 2 3 4 5 DK/NR	0 1
	14.	1 2 3 4 5 DK/NR	0 1
	15.	1 2 3 4 5 DK/NR	0 1
	16.	1 2 3 4 5 DK/NR	0 1
	17.	1 2 3 4 5 DK/NR	0 1
	18.	1 2 3 4 5 DK/NR	0 1
	19.	1 2 3 4 5 DK/NR	0 1
	20.	1 2 3 4 5 DK/NR	0 1
	21.	1 2 3 4 5 DK/NR	0 1

Recognition Total Raw Score (Maximum = 21)

Spatial Span

Ages 8–21

Start
Forward, Ages 8–21: Demonstration Item, Sample Item, then Item 1
Backward, Ages 8–21: Demonstration Item, Sample Item, then Item 1

Discontinue
After scores of 0 on *both trials* of an item

Score
Score **0** or **1** point for each trial
SSpF & **SSpB:** Total Raw Score for Forward and Backward, respectively
LSSpF & **LSSpB:** Number of taps recalled on last trial scored 1 point for Forward and Backward, respectively

FORWARD

Item		Trial	Response	Trial Score	Item Score
8–21	D.	10 – 1			
	S.	1 – 6 5 – 8			
	1.	3 – 10 7 – 4		1 0 1 0	0 1 2
	2.	1 – 9 – 3 8 – 2 – 7		1 0 1 0	0 1 2
	3.	4 – 9 – 1 – 6 10 – 6 – 2 – 7		1 0 1 0	0 1 2
	4.	6 – 5 – 1 – 4 – 8 5 – 7 – 9 – 8 – 2		1 0 1 0	0 1 2
	5.	4 – 1 – 9 – 3 – 8 – 10 9 – 2 – 6 – 7 – 3 – 5		1 0 1 0	0 1 2
	6.	10 – 1 – 6 – 4 – 8 – 5 – 7 2 – 6 – 3 – 8 – 2 – 10 – 1		1 0 1 0	0 1 2
	7.	7 – 3 – 10 – 5 – 7 – 8 – 4 – 9 6 – 9 – 3 – 2 – 1 – 7 – 10 – 5		1 0 1 0	0 1 2
	8.	5 – 8 – 4 – 10 – 7 – 3 – 1 – 9 – 6 8 – 2 – 6 – 1 – 10 – 3 – 7 – 4 – 9		1 0 1 0	0 1 2

LSSpF (Maximum = 9)

SSpF Total Raw Score (Maximum = 16)

Continue

BACKWARD

Item	Trial	Response	Trial Score	Item Score
8–21 D.	10 – 1			
S.	5 – 8			
	1 – 6			
1.	7 – 4		1 0	0 1 2
	3 – 10		1 0	
2.	8 – 2 – 7		1 0	0 1 2
	1 – 9 – 3		1 0	
3.	10 – 6 – 2 – 7		1 0	0 1 2
	4 – 9 – 1 – 6		1 0	
4.	5 – 7 – 9 – 8 – 2		1 0	0 1 2
	6 – 5 – 1 – 4 – 8		1 0	
5.	9 – 2 – 6 – 7 – 3 – 5		1 0	0 1 2
	4 – 1 – 9 – 3 – 8 – 10		1 0	
6.	2 – 6 – 3 – 8 – 2 – 10 – 1		1 0	0 1 2
	10 – 1 – 6 – 4 – 8 – 5 – 7		1 0	
7.	6 – 9 – 3 – 2 – 1 – 7 – 10 – 5		1 0	0 1 2
	7 – 3 – 10 – 5 – 7 – 8 – 4 – 9		1 0	
8.	8 – 2 – 6 – 1 – 10 – 3 – 7 – 4 – 9		1 0	0 1 2
	5 – 8 – 4 – 10 – 7 – 3 – 1 – 9 – 6		1 0	

LSSpB (Maximum = 9) | SSpB Total Raw Score (Maximum = 16)

Spatial Span Total Raw Score (Maximum = 32)

Picture Arrangement

(Time Limit: See Item)

Ages 8–21

Start
Ages 8–21: Demonstration Item, Sample Item, then Item 1

Discontinue
After **4** consecutive scores of **0**

Score
Score **0**, **1**, or **2** points

Item	Time Limit	Completion Time	Response	Score		
8–21 D. CAP						
S. WALK						
1. MILK	45"			0		2 MILK
2. CHASE	45"			0		2 CHASE
3. WORMS	45"			0		2 WORMS
4. SMOKE	45"			0		2 SMOKE
5. DUCK	45"			0		2 DUCK
6. STORM	45"			0		2 STORM
7. FARM	60"			0		2 FARM
8. SPEAK	60"			0		2 SPEAK
9. BROKEN	60"			0		2 BROKEN
10. SHADOW	60"			0		2 SHADOW / WODAHS
11. CHOIR	90"			0	1 HCOIR	2 CHOIR
12. SAMUEL	90"			0	1 SALMUE	2 SAMUEL / AMUELS
13. SHARK	90"			0		2 SHARK

Picture Arrangement Total Raw Score (Maximum = 26)

WNV™

VECHSLER NONVERBAL SCALE OF ABILITY

Record Form

Examinee's Name: I.D.:

Sex: ☐ M ☐ F Handedness: ☐ R ☐ L

Examinee's School: Grade:

Parent/Guardian's Name:

Testing Site:

Examiner's Name:

Behavioral Observations

Referral source/Reason for referral/Presenting complaints

Language (e.g., first/native language, other language, English fluency, expressive and receptive language ability, articulation)

Physical appearance

Visual/Auditory/Motor problems (Were problems corrected, e.g., with glasses, hearing aids?)

Attention and concentration (e.g., normal, hyperactive, remains in seat/out of seat)

Attitude toward testing (e.g., rapport, eager to speak, working habits, interest, motivation, reaction to success/failure)

Affect/Mood

Unusual behaviors/Verbalizations (e.g., perseverations, stereotypic movements, bizarre and atypical verbalizations)

Other notes