UNIVERSITI PUTRA MALAYSIA

CADMIUM CONCENTRATION IN FINGERNAILS AND ASSOCIATED HEALTH SYMPTOMS OF YOUNG CHILDREN LIVING NEAR TO PAJAM LANDFILL, NEGERI SEMBILAN

NURIZZATI BINTI YAZIB

CADMIUM CONCENTRATION IN FINGERNAILS AND ASSOCIATED HEALTH SYMPTOMS OF YOUNG CHILDREN LIVING NEAR TO PAJAM LANDFILL, NEGERI SEMBILAN

BY

NURIZZATI BINTI YAZIB

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

ACKNOWLEDGEMENT

First of all, I would like to express my sincere gratitude to my project supervisor and co-supervisor Dr. Sharifah Norkhadijah Syed Ismail and Dr. Sarva Mangala Praveena for their support, guidance and advices in my project. I am grateful and lucky being able to learn their insights that had helped me to complete my work on time.

I also like to thank Dr. Saliza Mohd Elias, the coordinator for our final year project. Her invaluable guidance and comments also had helped me to successfully complete my project. Apart from that, I would like to express my sincere thanks to all lecturers and staff of Environmental and Occupational Health Department who had contributed directly in making this study success.

Finally, I would like to thank my family and friends for their invaluable encouragement and endless moral support throughout this project. I submit gratitude to the parents or guardians and the children in Nilai and Mantin, Negeri Sembilan who participated in the survey and had therefore made this study possible and successful.

ABSTRACT

CADMIUM CONCENTRATION IN FINGERNAILS AND ASSOCIATED HEALTH SYMPTOMS OF YOUNG CHILDREN LIVING NEAR TO PAJAM LANDFILL, NEGERI SEMBILAN

NURIZZATI BINTI YAZIB

Introduction: Heavy metals such as Cadmium (Cd) are the most common elements found in waste landfill. The sources of Cd in landfill are through the leaching of cadmium from pigmented plastics and various consumer products disposed in landfill. Cd can cause severe health effects such as lung cancer, renal damage and severe osteoporosis especially to children. **Objective:** To determine the accumulation of cadmium in nails and the associated health symptoms among children living near to Pajam landfill in Nilai, Negeri Sembilan. Children was divided into exposed (those who lives within 2 km from the landfill) and unexposed group (those who lives more than 2 km radius from the landfill). **Instrument & Methodology:** This study is a cross-sectional comparative study and a total of 70 children were involved. Standard questionnaire consists of questions related to personal information, socio-demographic, history of exposure and health sign, symptom and disease of the children, family's lifestyle and information of smoking behavior in family was used. Nail samples was taken from the children. The air sample was also performed to determine the Cd concentration. Samples were analyzed using Inductive Coupled Plasma Mass Spectrometry (Thermo Elemental X7CCT Series). Data were analyzed by the Statistical Package for the Social Science (SPSS) Version 21.0 software. **Result:** The mean ± SD levels of Cd in exposed group were found to be higher (0.20 ± 0.03 mg/kg) than the unexposed group (0.10 ± 0.01 mg/kg). The Cd level was significance difference between groups at $p < 0.05$. The frequency of the health symptoms among exposed children was higher than the unexposed group, but no significant relationship was obtained between Cd in the fingernails and the health symptoms. There was also no significant relationship between cadmium concentration in fingernails and the personal air exposure of cadmium in air sample of the children in this study. Other factors that likely to influence Cd in the fingernails such as canned food intake and smoking habits among family members also showed no significant relationship. **Conclusion:** In conclusion, children who lives less than 2km radius from landfill has more influence on the Cd level than the children who lives more than 2km.

Keywords: Waste landfill, cadmium exposure, fingernails, children's health

ABSTRAK

KEPEKATAN KADMIUM DALAM KUKU DAN GEJALA KESIHATAN YANG BERKAITAN DENGAN KANAK-KANAK YANG TINGGAL BERHAMPIRAN TAPAK PELUPUSAN PAJAM, NEGERI SEMBILAN

NURIZZATI BINTI YAZIB

Pendahuluan: Logam berat seperti kadmium adalah unsur-unsur yang paling biasa ditemui di tapak pelupusan sisa. Sumber kadmium di tapak pelupusan adalah melalui larut lesap kadmium dari plastik berpigmen dan pelbagai produk pengguna yang dilupuskan di tapak pelupusan. Kadmium boleh menyebabkan kesan yang teruk seperti barah paru-paru, kerosakan buah pinggang dan osteoporosis yang teruk terutamanya kepada kanak-kanak. **Objektif:** Untuk menentukan pengumpulan kadmium di dalam kuku dan gejala kesihatan yang berkaitan di kalangan kanak-kanak yang tinggal berhampiran tapak pelupusan Pajam, Negeri Sembilan. Kanak-kanak dibahagikan kepada kumpulan yang terdedah (kanak-kanak yang tinggal dalam 2km dari tapak pelupusan) dan kumpulan yang tidak terdedah (kanak-kanak yang tinggal lebih dari 2km jejari dari tapak pelupusan). **Metodologi:** Kajian ini adalah satu kajian keratan rentas perbandingan dan sejumlah 70 orang kanak-kanak terlibat. Borang soal selidik terdiri daripada soalan yang berkaitan dengan maklumat peribadi, sosio-demografi, sejarah pendedahan dan tanda kesihatan, gejala dan penyakit kanak-kanak, gaya hidup keluarga, dan maklumat tabiat merokok di dalam keluarga telah digunakan. Sampel kuku telah diambil daripada kanak-kanak. Pensampelan udara juga telah dilakukan untuk menentukan kepekatan kadmium. Sampel dianalisis dengan menggunakan Inductive Coupled Plasma Mass Spectrometry (Thermo Elemental X7CCT Series). Data telah dianalisis dengan menggunakan perisian Statistical Package for Social Science (SPSS)Version 21.0. **Keputusan:** Mean ± SD tahap kadmium dalam kumpulan terdedah didapati lebih tinggi (0.20 ± 0.03 mg/kg) daripada kumpulan yang tidak terdedah (0.10 ± 0.01 mg/kg). Tahap kadmium terdapat perbezaan yang signifikan antara kumpulan pada ($p<0.05$). Kekerapan gejala kesihatan di kalangan kanak-kanak terdedah adalah lebih tinggi daripada kumpulan yang tidak terdedah, tetapi tiada hubungan yang signifikan diperoleh antara kepekatan kadmium dalam kuku dan gejala-gejala kesihatan. Tiada hubungan yang signifikan antara kepekatan kadmium dalam kuku dan pendedahan udara peribadi kadmium dalam sampel udara daripada kanak-kanak. Faktor-faktor lain yang mungkin mempengaruhi kadmium dalam kuku seperti pengambilan makanan dalam tin dan tabiat merokok di kalangan ahli keluarga juga hubungan yang tidak signifikan. **Kesimpulan:** Kesimpulannya, kanak-kanak yang tinggal kurang daripada 2km jejari dari tapak pelupusan lebih dipengaruhi terhadap tahap kadmium berbanding kanak-kanak yang tinggal lebih daripada 2km.

Kata kunci: Sisa pelupusan, pendedahan kadmium, kuku, kesihatan kanak-kanak

CONTENTS

CHAPTER 2: LITERATURE REVIEW

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Introduction

1.1.1 Cadmium

Cadmium is the most abundant element naturally-occurring as isotope and non-radioactive. It is found in nature in mineral forms and is obtained for commercial uses principally from cadmium ore, called greenockite, which is commonly found in association with zinc ore. Commercial production of cadmium ore depends on the mining of zinc (ATSDR 1999). Cadmium is commercially available as an oxide, chloride, or sulphide. Cadmium metal (Cd^{2+}) refined from the ore is a silver-white, blue-tinged lustrous heavy metal solid at room temperature (National Toxicology Program [NTP], 2004).

1.1.2 Source of Cadmium

Cadmium is a rare but widely dispersed element, is found naturally in the environment. Most cadmium ore (greenockite) which is exists as cadmium sulphide, and is refined during zinc production, andoccurs in association with zinc.It is released into the environment through mining and smelting, its use in various industrial processes, and enters the food chain from uptake by plants from contaminated soil or water (ATSDR, 2008).

Cadmium has been widely dispersed into the environment through the air by its mining and smelting as well as by other manmade routes which is by usage of phosphate fertilizers, presence in sewage sludge, and various industrial uses such as NiCd batteries, plating, pigments and plastics (ATSDR, 1999).

Concern has recently increased about the possible harmful effects of cadmium release to the environment. The most important sources of cadmium in landfill are by the leaching of cadmium from pigmented plastics disposed to landfill. As we know, some of the consumer products have the cadmium elements and from that all such materials eventually end up in municipal waste, and the cadmium thus causes pollution either in leachates draining from landfill sites or as off-gases from incinerators (David et al, 2002).

1.1.3 Cadmium in Municipal Solid Waste Landfill

Lead and cadmium enter the municipal solid waste stream as components of a variety of consumer products. Average empirical data from several resource recovery plants were analyzed to obtain an estimate of the source and fate of the subject elements. The total amounts of lead and cadmium found in municipal solid waste, determined from empirical data sources, were found to agree closely with those based on materials flow data. It was determined that most of the cadmium enters the waste stream in the combustible fraction and can account for a major share of the cadmium observed in fly ash and in atmospheric particulates. The most likely sources of cadmium are plastics and pigments. The cadmium emissions appeared to be derived from both combustible and non-combustible discards of batteries, plastics, and pigments (Edwin & Howell, 2013).

When MSW is directly landfilled the slower processes of biodegradation may produce a very slow initial release of these elements into landfill leachates. However, the acidic conditions that occur during biodegradation in a landfill could provide conditions that may lead to greater total release over long periods of time. Realizing that there is no plan to monitor landfills in perpetuity, they will eventually weather and erode and release their elemental components to the environment. Effectively, the disposal of various elements as components of municipal solid waste will eventually result in their re-entry into the environment, whether they are managed by landfilling or by resource recovery (Edwin & Howell, 2013).

1.1.4 Effect of Cadmium Exposure to Human Health

1.1.4.1 Respiratory Effects

Most studies have associates the chronic occupational exposure to cadmium fumes and dusts with increased risk of chronic obstructive lung disease and emphysema, but some studies reported no such association (Hendrick, 1996; ATSDR 1999). Study limitations, such as small sample size, lack of suitable cohorts, and failure to control for smoking and other confounding effects, render the association uncertain.

There have also been studies examining the role of cadmium in the development of chronic obstructive pulmonary disease (COPD) in smokers (ATSDR 1999). The most recent (Mannino *et al.* 2004) study showed that current and former smokers had higher body burdens of cadmium than non-smokers and that within smokers; the body burden of cadmium was related to lung injury related to smoking. The authors conclude that cadmium might be important in the development of tobacco related lung disease.

Chronic cadmium inhalation is also suspected to be a possible cause of lung cancer (Sorhan and Esmen 2004; Verougstratete *et al.* 2003). Other respiratory effects of chronic occupational exposure to cadmium include chronic rhinitis,

destruction of the olfactory epithelium with subsequent anosmia as well as the development of bronchitis (ATSDR 1999; Drebler 2002).

1.1.4.2 Cardiovascular Effects

Several studies have looked at this issue. A prospective population study looking at the health effects of low-level environmental exposure to cadmium in the general population has found no effect of cadmium on the blood pressure of the study subjects (Stassen J *et al.* 1991). Recent follow-up studies have found similar (Staessen J *et al.* 1999).

However, recent studies (Navas-Acien *et al.* 2004, 2005) have examined the contribution of cadmium and some other heavy metals to the development of peripheral artery disease. These studies found an association with cadmium exposure and the development of peripheral artery disease. In fact, the effect of smoking on peripheral artery disease decreased after adjustment for cadmium levels suggesting that the effect of smoking on the development of peripheral artery disease may be partially mediated by cadmium.

1.1.4.3 Renal Effects

The kidney is the principal organ targeted by chronic exposure to cadmium. Cadmium nephrotoxicity may follow chronic inhalation or ingestion. Data from

human studies suggest a latency period of approximately 10 years before clinical onset of renal damage, depending on intensity of exposure (ATSDR, 2008). However, subtle alterations of renal function have been described after acute exposure in animals, and there are rare reports of renal cortical necrosis after acute high-dose exposure in humans (ATSDR, 2008).

Toxic effects on the kidney are dose-related (Mueller *et al.* 1992). For workers, the risk of clinical nephropathy increases significantly with total airborne exposures greater than 300 mg/m^3, urine cadmium levels greater than 10 µg/g creatinine, and renal cortex levels greater than 200 ppm (Roels *et al.* 1999).

Early signs of renal damage were reported among members of the general population at urine levels between 2-4 nmol/mmol creatinine. A number of studies over the years have looked at the effects of cadmium on the kidney in the environmentally exposed including; in Cadmibel (Buchet *et al.* 1990), Japan (Ikeda *et al.* 2003, 2005, 2006; Kobayashi *et al.* 2006),OSCAR (Jarup *et al.* 2000), Sweden, and United States, (Noonan *et al.* 2002).

These studies have found that even very low-levels of cadmium may have adverse effects on the kidney. WHO currently stated that 200 µg/g levels wet weight in kidney causes adverse changes in 10% of the population (Satoh *et al.* 2002).

1.1.4.4 "Itai-Itai" Disease

"Itai-itai" or ouch-ouch disease was first described in post-menopausal Japanese women exposed to excessive levels of cadmium over their lifetimes. The women were exposed through their diet because the region of Japan in which they resided was contaminated with cadmium (Ikeda *et al.* 2000; Watanabe *et al.* 2000).

Symptoms and signs of "itai-itai" disease include; severe osteoporosis and osteomalacia with simultaneous severe renal dysfunction, normochromic anemia and low blood pressure sometimes also occur (Alfven *et al.* 2002; Nogawa *et al.* 2004), and average urinary cadmium level in these patients was20-30 μg/g-creatinine of cadmium in urine (Ezaki *et al.* 2003).

1.1.4.5 Developmental Effects

Cadmium has not been reported to induce birth defects in infants of women occupationally exposed to cadmium. However, there are reports that women in Japan with high urinary cadmium levels have increased rates of preterm delivery than mothers with lower levels. These mothers also had infants with birth weights that were lower than those of newborns of unexposed women but this difference was felt to be due to the increased incidence of early deliveries (Nishijo *et al.* 2002). However, other studies have not shown cadmium to cause pre-term labor (Zhang *et al.* 2004). At this time, the evidence of cadmium's effects on pregnancy is inconsistent and requires further investigation.

1.1.4.6 Other Effects

There is conflicting data that chronic cadmium exposure may cause mild anemia. Anosmia and yellowing of teeth have been reported. Although cadmium accumulates in bone, the bone disease that results from excessive cadmium exposure is believed to be secondary to changes in calcium metabolism due to cadmium-induced renal damage (ATSDR 1999). Clinically significant bone lesions usually occur late in severe chronic cadmium poisoning and include pseudo fractures and other effects of osteomalacia and osteoporosis. Pseudo fractures are spontaneous fractures that follow the distribution of stress in normal skeleton or occur at sites where major arteries cross the bone and cause mechanical stress through pulsation.

1.2 Problem Statement

There have been a number of epidemiological studies which have investigated whether there is a higher than usual incidence of adverse health events, such as cancer or congenital anomalies in populations living near landfill sites. In August 1998, a study of the incidence of congenital anomalies near hazardous waste landfill sites in Europe (the EUROHAZCON study) was published in *The Lancet* (Dolk et al, 1998). The cancers studied – leukemia and cancers of the liver, bladder and brain – were selected either to test hypotheses arising from previous studies of cancer around landfill sites or on the basis of the established human carcinogenicity of certain chemicals (HPA, 2011).

Air pollutants come from a variety of sources. Waste landfill emits fly ash, which can contain metals, including lead (Pb), nickel(Ni), cadmium(Cd), copper(Cu), and mercury(Hg), as well as dioxins and furans. Particulate matter contains a variety of carcinogenic or toxic heavy metals, including arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), copper (Cu), iron oxides (Fe), mercury (Hg), and others.

The health risks from air pollution are likely to be more serious for children who are already exposed to toxic chemicals, because they live or attend school near to landfills, toxic waste sites, bus depots and rail yards, industrial plants, or similar facilities. Because of low-quality housing, overcrowding, and lack of air conditioning, children in low-income communities may also spend more time outdoors (NRDC, 1997).

A recent study found that living near a landfill could expose residents to chemicals that can reduce immune system function and lead to an increased risk of infections (EPA, 2003). As opposed to children living in clean areas, the study found that children living near to waste sites, whether landfills or contaminated bodies of water, are hospitalized more frequently with acute respiratory infections. Children living near to waste sites also had increased rates of asthma (Carpenter, 2006).

Landfill sites such as hazardous landfill have been investigated as the possible cause of birth defects, cancers and respiratory illnesses including asthma. A study in the United Kingdomhas recently identified a link between living within 2 km from a landfill site and a small increased risk of birth defects (Dalton, 2003). Symptoms such as tiredness, sleepiness and headaches have also had been reported.

Cadmium (Cd) have raised concern due to their relatively high toxicity and elevated quantity in the environment caused by their widespread use (Cambra et al., 1999; Mielke et al., 1999; Gaw et al., 2006; Nabulo et al., 2006; Segura-Muñoz et al., 2006). Studies have found that Cd and have a tendency to accumulate in vital organs and have a half life up to 30 years (Yiin et al., 2000). Further, nails are more attractive biomarkers among biopsy materials due to their easy sample collection, storage and preparation for analysis (Samatha et al., 2004). However, limited studies have used fingernails as biomarker to check upon Cd accumulation among children and relate the accumulation to the area they lives.

Therefore, this study was performed to determine the accumulation level of cadmium in nails and the associated health symptoms among children living near to the municipal solid waste landfill which is Pajam landfill, Nilai, Negeri Sembilan.

1.3 Study Justification

This study was a medium to identify possible health effects of living near to MSW landfill especially to children. Study was done to determine the accumulation of cadmium in fingernails and appropriate mitigation measures can be taken based on finding. Most landfills in Malaysia are of daily waste disposal site as open dumps, without proper abatement measures to avoid environmental pollution (Ismail, 2013).

Nilai, the study area is a sub-urban area which has started to develop. Pajam landfill in Nilai is located within 2 to 5 km away from the residence area. This has created such an alarming signal to the safety and health of residence in this area. In addition, limited study was found on the health effect of children living near to the MSW landfills. Most of the researches are centered to the health effects of hazardous waste landfills rather than MSW landfills. Research using nails as a biological indicator of heavy metal exposure is also rarely being published and it is suitable to be highlighted from the context of this study.

1.4 Conceptual Framework

Figure 1.1 shows the conceptual framework of this study. The accumulation of cadmium in nails comes from the MSW landfills that potentially generate heavy metals exposure involved with cadmium. The most important sources of airborne cadmium are volatilization of municipal waste from landfill such as plastics and nickel-cadmium batteries (which can be deposited as solid waste). The most susceptible group that prone to get affected are elderly, pregnant woman and children (HPA, 2009). The route of exposure is potentially from inhalation. The other route is ingestion where is possible from the plant that grown on contaminated land because there have banana groves near to landfill site. Accumulation of cadmium in children's body can be determined in nails. To detect the concentration of cadmium exposure, will used the nails as a biological indicator. Nails are used in this study because nails can provide a continuous record of trace element concentrations of the body (Wilhelm and Hafner, 1991). Health risk assessment will be done to assess the health risk of cadmium exposure to children.

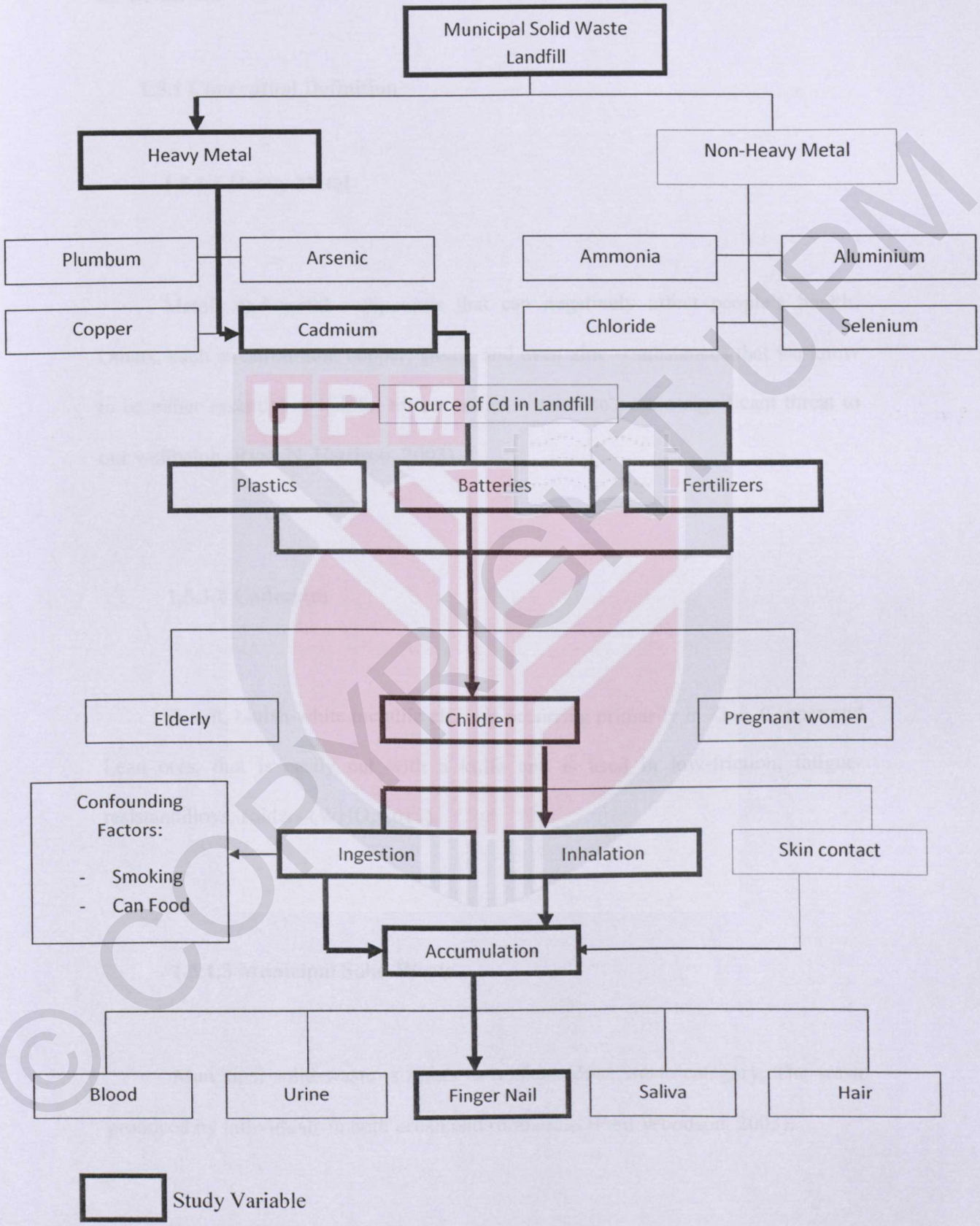

Figure 1.1 Conceptual Frameworks

1.5 Definition

1.5.1 Conceptual Definition

1.5.1.1 Heavy Metal

Metals and metal compounds that can negatively affect people's health. Others, such as chromium, copper, silver, and even zinc – substances that we know to be either essential or helpful to our bodies – can also pose a significant threat to our wellbeing (Ryan N. Harrison, 2003).

1.5.1.2 Cadmium

A soft, bluish-white metallic element occurring primarily in Zinc, Copper and Lead ores, that is easily cut with a knife and is used in low-friction, fatigue-resistantalloys, solders (WHO, 2011).

1.5.1.3 Municipal Solid Waste

Municipal solid waste is refers to nonhazardous waste category. The waste produced by individuals in both urban and rural areas (Paul Woodson, 2003).

1.5.1.4 Children

A child means every human being below the age of 18 years unless under the law applicable to the child, majority is attained earlier (CDC, 2011).

1.5.2 Operational Definition

1.5.2.1 Heavy Metal

Heavy metals accumulate in the body, building up in fat cells, bones, glands, and hair, and inevitably lead to a dizzying array of symptoms and chronic diseases. Heavy metal toxicity can result in damaged or reduced mental and central nervous function, lower energy levels, and damage to blood composition, lungs, kidneys, liver, and other vital organs (Ryan N. Harrison, 2003).

1.5.2.2 Cadmium

Cadmium is soluble in acids but not in alkalis. It is similar in many respects to zinc. The Atomic number is 48. Cadmium exerts toxic effects on the kidney, the skeletal and the respiratory systems, and is classified as a human carcinogen (WHO, 2011).

1.5.2.3 Municipal Solid Waste

According to USEPA 2003, Municipal solid wastes include everyday trash items, such as packaging, yard wastes, glass, paper, food scraps, appliances, and batteries. It should be noted too that this category of waste refers to trash from both urban and rural areas and city and county jurisdictions.

1.5.2.4 Children

The children in primary school within age 6 to 11 years old that schools focused to develop children's knowledge and understanding. These children are suitable for use of nails sample that live near the Pajam landfill in Nilai, Negeri Sembilan.

1.6 Research Objectives

1.6.1 General Objective

To determine the accumulation of cadmium in the finger nails and the associated health symptoms among children living near to Pajam landfill in Nilai, Negeri Sembilan.

1.6.2 Specific Objectives

1. To determine the difference of cadmium (Cd) concentration in finger nails of exposed children (living less than 2km from landfill) and unexposed children (living more than 2km from landfill).
2. To determine the difference of personal air exposure of cadmium among exposed and unexposed children.
3. To determine the relationship between cadmium concentration in finger nails and personal air exposures of children.
4. To determine the relationship between cadmium concentrations in finger nails and associated health symptoms of children in this study.

1.6.3 Hypothesis

1. There is a significant difference of cadmium concentration in finger nails between exposed (living less than 2km from landfill) and unexposed children (living more than 2km from landfill).
2. There is significant difference of cadmium level in the personal air exposure between exposed and unexposed children.
3. There is significant relationship between cadmium concentration in finger nails and cadmium in personal air exposures of studied children.
4. There is significant relationship between cadmium concentrations in finger nails and associated health symptoms of studied children.

CHAPTER 2

LITERATURE REVIEW

2.1 Cadmium

2.1.1 History

Cadmium is the most element abundant naturally-occurring as isotope and non-radioactive. It is found in nature in mineral forms and is obtained for commercial uses principally from cadmium ore, called green ockite, which is commonly found in association with zinc ore. Commercial production of cadmium ore depends on the mining of zinc (ATSDR 1999).Cadmium is commercially available as an oxide, chloride, or sulphide. Cadmium metal (Cd^{2+}) refined from the ore is a silver-white, blue-tinged lustrous heavy metal solid at room temperature (National Toxicology Program [NTP], 2004).

2.1.2 Physicochemical Properties

Cadmium is an element and is classified as a transition metal. Cadmium has a vapour pressure of 1 mmHg at 394ºC and is odorless. Cadmium is resistant to corrosion. Cadmium metal and its oxides are insoluble in water. Occurs in an oxidation state of +2.Solid cadmium is inflammable but powdered cadmium will burn and release corrosive and toxic fumes (Harbison 1998; NTP 2004; HSDB 2006; ATSDR 1999).Some cadmium salts are water soluble such as cadmium chloride, cadmium sulfate and cadmium nitrate; other insoluble salts can become more soluble by interaction with acids, light or oxygen. The melting point of cadmium is 321° C.

2.1.3 Route of Exposure for Cadmium

Inhalation is a major route of cadmium exposure. Cadmium air levels are usually thousands of times greater in the workplace than in the general environment. For example, the OSHA permissible exposure limit (PEL) of cadmium fume or cadmium oxide in the workplace is 0.1 mg/m^3, whereas concentrations of cadmium in ambient air are 1×10^{-6} mg/m^3 in non-industrialized areas and 4×10^{-5} mg/m^3 in urban areas (ATSDR, 1999).

Children are the greatest victims of unhealthy environments (Bellamy, 2003). Children are more vulnerable to their environments than adults and, for this reason, are a population that is more sensitive to the impact of pollution (Takaro, 2007). The respiratory system is among the organs and systems most exposed to the effects of the environment.

However, worldwide, there are areas with very high levels of cadmium in the soil. Crop uptake of cadmium in these areas can lead to significant dietary exposures to the people living nearby. There are negligible amounts of cadmium exposure through the skin. It is not considered a major route of exposure to this chemical.

2.1.4 Cadmium Toxicity

Landfills produce significant amounts of methane gas, along with leachate, a toxic liquid that comes out of all that compressed trash. Leachate is full of organic and inorganic pollutants, including toluene, phenols, benzene, ammonia, dioxins, polychlorinated biphenyls (PCBs), and chlorinated pesticides, heavy metals such as cadmium, plumbum, arsenic and endocrine-disrupting chemicals (EPA, 2003). Cadmium is also a potential environmental hazard. As a consequence, cadmium accumulates in the rice crops growing along the riverbanks downstream of the mines. Cadmium is a major factor in the Itailtai disease in Japan; most researchers have concluded that it was one of several factors. There has been research linking exposure to cadmium to lung and prostate cancer (Nogawa et al, 2004).

2.2 Source of Cadmium in Environment

2.2.1 Release by Industrial Process

The most important sources of airborne cadmium are smelters. Other sources of airborne cadmium include burning fossil fuels such as coal or oil and incineration of municipal waste such as plastics and nickel-cadmium batteries (which can be deposited as solid waste) (Sahmoun *et al.* 2005). Cadmium may also escape into the air from iron and steel production facilities.

Cadmium is used mainly in metal plating, producing pigments, NiCd batteries, as stabilizers in plastics, and as a neutron absorbent in nuclear reactors (ATSDR, 2006).

2.2.2 Contamination of the Natural Environment

When released into the atmosphere by smelting or mining or some other processes, cadmium compounds can be associated with respirable-sized airborne particles and can be carried long distances. It is deposited onto the earth below by rain or falling out of the air. Once on the ground, cadmium moves easily through soil layers and is taken up into the food chain by uptake by plants such as leafy vegetables, root crops, cereals and grains (ATSDR 2006).

Cadmium concentrations in drinking water supplies are typically less than 1 microgram per liter (µg/L) or 1 part per billion (ppb) (ATSDR 1999). Groundwater seldom contains high levels of cadmium unless it is contaminated by mining or industrial wastewater, or seepage from hazardous waste sites. Soft or acidic water tends to dissolve cadmium and lead from water lines; cadmium levels are increased in water stagnating in household pipes. These sources have not been reported to cause clinical cadmium poisoning, but even low levels of contamination add to the body's accumulation of cadmium.

Cadmium oxide also exists as small particles in air (fume) which are the result of smelting, soldering, or other high-temperature industrial processes. A certain percentage of these particles are respirable.

2.2.3 Cadmium in the Food Chain

From the soil, certain plants (tobacco, rice, other cereal grains, potatoes, and other vegetables) take up cadmium more avidly than they do other heavy metals such as lead and mercury (Satarag *et al.* 2003).

Cadmium is also found in meat, especially sweetmeats such as liver and kidney. In certain areas, cadmium concentrations are elevated in shellfish and mushrooms (Jarup, 2002). Cadmium can also enter the food chain from water. In Japan, zinc mining operations contaminated the local water supplies with cadmium.

Local farmers used that water for irrigation of their fields. The soil became contaminated with cadmium which led to the uptake of cadmium into their rice (Jarup, 2002).

2.2.4 Cadmium Exposure among Smokers

A cigarette contains approximately 2.0 µg of cadmium, 2-10% of which is transferred to primary cigarette smoke (Mannino *et al.* 2004). Of the cadmium in the primary inhaled cigarette smoke, nearly 50% is absorbed from the lungs into the systemic circulation during active smoking (Satarug *et al.* 2003; Jarup 2002). Smokers typically have cadmium blood and body burdens more than double those of non-smokers (Waalkes *et al.* 2003). Clinicians should be aware that smokers have a higher urinary cadmium levels than non-smokers (Mannino *et al.* 2004).

2.2.5 Cadmium Contaminant in Processing and Canned Food

Processing and manufacturing techniques, which are applied to specific products, may concentrate or dilute cadmium contaminant levels. Some products are known to naturally accumulate certain contaminants, for example, older animals and fish such as tuna are likely to have accumulated higher levels of cadmium contaminants than younger ones. Certain animal organs can selectively accumulate certain contaminants (e.g. kidney tends to concentrate cadmium). Some varieties of vegetables and fruits naturally absorb and accumulate higher levels of cadmium contaminants during growth. The use of unlacquered or plain cans may contribute to increase tin levels in a product (Food Contaminants Regulation, 2006).

2.3 Standard and Regulations for Cadmium Exposure

With increasing evidence of cadmium's toxicity, both national and international agencies have sought to regulate its exposure. Because much is known about the toxic and health effects of cadmium; there is a large database from which to set standards for occupational, health, and environmental levels (Satoh *et al.* 2002).

2.3.1 Workplace Standard

OSHA has established workplace levels to protect the health of people occupationally exposed to cadmium. The OSHA limits are Permissible Exposure Limit- TWA (PEL) is 5µg/m3 (fumes).The National Institute of Occupational Safety and Health (NIOSH) has set an Immediately Dangerous to Life and Health level (IDLH) which is 9 mg/m3 (NIOSH 2006; NTP 2004).

2.3.2 Health Standards

Many health agencies have set exposure standards designed to protect the general public from excess cadmium exposure from various sources.

Food and Drug Administration (FDA)

• Maximum limit of cadmium in bottled water: 0.005 mg/L.

Agency for Toxic Substances and Disease Registry (ATSDR)

• Chronic durational oral minimal risk level (MRL) of 0.0002 mg/kg/day of cadmium based on its renal effects.

• This MRL standard states how much cadmium can be taken in orally chronically without risk of adverse health effects (ATSDR 1999).

Environmental Protection Agency (EPA)

• Food – Reference dose is 1 x 10-3 mg/kg/day (ATSDR 1999).

• Water - Reference dose for human exposure is 5 x 10-4 mg/kg/day.

• Reference dose (Rfd) is an estimate of a daily exposure to the general population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime (IRIS 2006).

World Health Organization (WHO)

• Tolerable weekly intake for cadmium at 7 µg/kg/body weight/week

2.4 Mechanism of Heavy Metal Toxicity

Toxicity occurs when the body accumulates an excessive amount of heavy metal, such as mercury, lead, arsenic, cadmium, aluminium or nickel. This places the individual at risk for serious illness. These heavy metals can accumulate in the tissues (as they have storage sites in the body) over a period of time and cause serious health problems. Some of these heavy metals reach ground water and others accumulate in seafood or in plants and represent a major toxic source for humans.

Some of them cause deformation of birds and sea animals in addition to some diseases in humans (Warren, 2006).

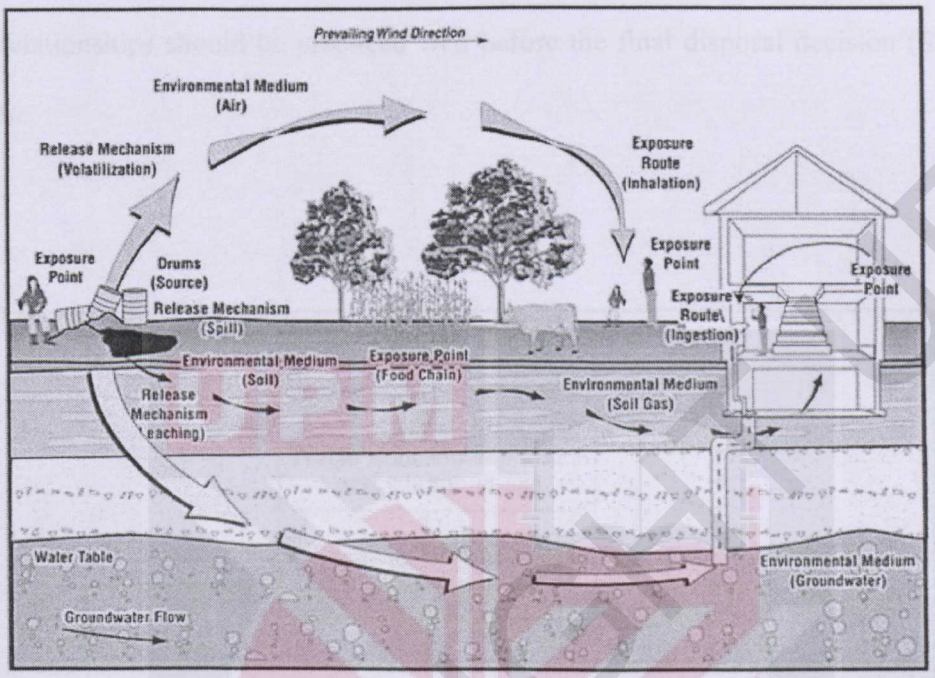

Figure 2.1 Site Conceptual Models – Exposure Pathway Schematic

Public Health Assessment Guidance Manual (PHAGM, 2005)

2.5 Municipal Solid Waste

2.5.1 Municipal Solid Waste Management

In general, MSW disposal requires an adequate environmental control from waste collection to disposal and finally regular monitoring of disposal sites. The local authority in most of the municipalities in Malaysia is responsible for the collection service of solid waste, even though some municipalities or city hall (for example

Kuala Lumpur City Hall) has outsourced to private companies. The monitoring of the overall MSW management however, is still under their responsibility (Visvanathan, 2007). To manage the solid waste in an efficient manner, four functional element interrelationships should be practiced well before the final disposal decision (Shah, 2000).

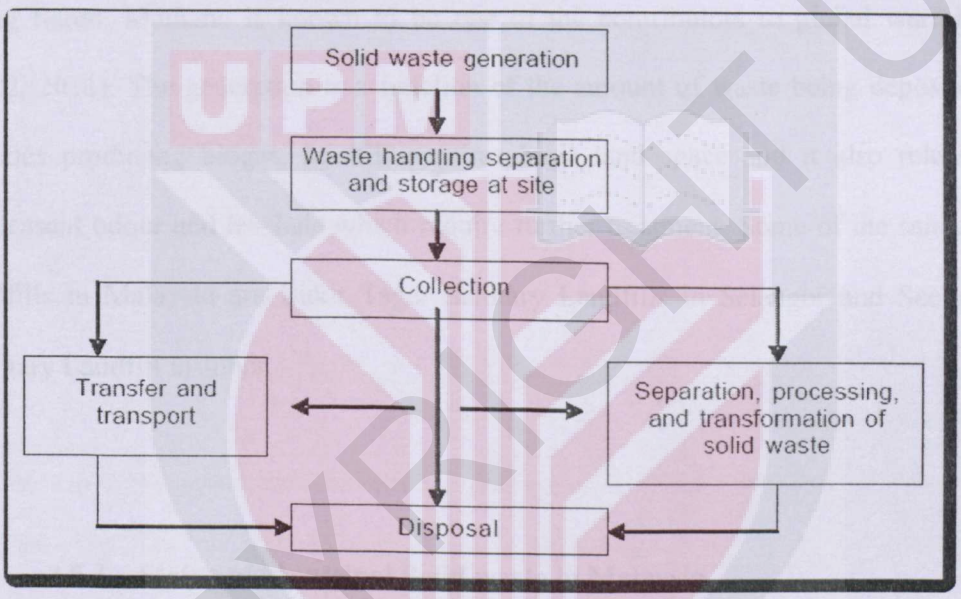

Figure 2.2 The basic solid waste management system (Shah, 2000).

2.5.2 Municipal Solid Waste Landfill in Malaysia

Malaysia government has been utilizing land filling as one of the main disposal for MSW. It can be divided into two broad categories i.e *open dumpsite and engineered sanitary landfill*. A sanitary landfill has features consisting of liners, leachate collection and treatment, gas harvesting and daily and final covers. An open dumpsite is a MSW site without facilities such as liner or leachate collection/treatment. According to Ministry of Housing and Local government

website, (as of January 2011) there are 296 landfill/dumpsites in Malaysia and 166 are still in operation which include 9 sanitary landfills.

More sanitary landfills are been planned in the future either to replace or to upgrade the current dumpsites. Solid waste landfilling is an anaerobic process. It produces landfill gases that consist of CO_2, CH_4, H_2S, NH_3 and other traces of gas. It can be harvested, treated and applied for electricity generation or direct heating if not being flared. Methane is known to be one of the contributors to global warming (NC2, 2011). The generation is a function of the amount of waste being deposited. Besides producing biogas, landfill requires huge land space and it also releases unpleasant odour and leachate which require further treatment. Some of the sanitary landfills in Malaysia are Bukit Tagar Sanitary Landfills in Selangor and Seelong Sanitary Landfill in Johor.

2.5.3 Status of Municipal Solid waste in Malaysia

For many decades, all municipalities in Malaysia have practiced the open dumping and land filling for disposal of the MSW. Landfills still cover 60 to 90% of the served areas, and are projected to cover more than 75% in the near future, with 80 % of the waste disposal sites having less than two years of remaining operating life. Landfilling is done almost solely through this method and open dumping is being practiced and takes place at about 50% of total landfills (CAP, 2001). The landfills sites can categorised into five types according to the landfill stages such as, (i) open dumping sites, (ii) open tipping site, (iii) landfill with bund and waste

disposal covered with layer of suitable cover materials, (iv) landfill equipped with pipe system for leachate recirculation and aeration, and (v) sanitary landfill (MHLG, 2001).

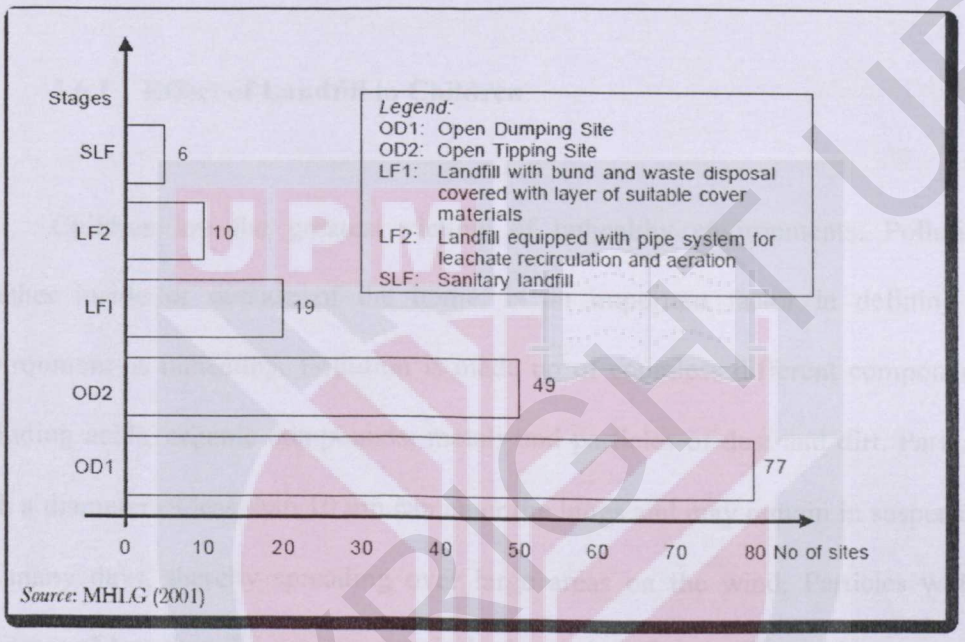

Figure 2.3 Number of landfills in Malaysia according to landfill stages (MHLG, 2001).

2.6 Health Effects Living Near to Landfill

The greenhouse gas GHG emission from waste sectors waste are from landfills, domestic and commercial wastewater treatment processes and industrial wastewater treatment processes. The main GHG gas from waste sectors are methane CH4 from landfill, methane and nitrous oxide N2O from wastewater and CO2from incineration of wastes that contain carbon. The intergovernmental Panel on Climate

Change IPCC2007 report states the contribution of waste sector is 3% to the total GHG emission (IPCC 2007). In comparison, the waste sector contributed 12 % to the total GHG emission in year 2000 in Malaysia (NC2, 2011).

2.6.1 Effect of Landfill to Children

Children are the greatest victims of unhealthy environments. Pollution, whether inside or outside of the home, is an important factor in defining an environment as unhealthy. Pollution is made up of countless different components, including acids, organic compounds, metals and particles of dust and dirt. Particles with a diameter of less than 10 μm can enter the lungs and may remain in suspension for many days, thereby spreading over large areas on the wind. Particles with a diameter of less than 2.5 μm can remain in the air indefinitely. These elements enter the environment from many different sources (Carlos et. al, 2011).

Waste produced by humans is a source of environmental contamination and a proportion of this waste is disposed of in landfills, particularly in urban areas. A landfill can be considered as a dynamic reactor, since chemical and biological reactions result in emission of gases; liquid effluents and mineralized waste. Landfills are classified as one of three types depending on the type of waste (UNICAMP, 2011)

2.7 Human Nails as a Bio-indicators

Human nail has been recognised as an invaluable tissue for monitoring human environmental exposure, as it provides a good indication of exposure to many toxic and essential trace metals over a period of time (Nowak and Chmielnicka, 2002; Samatha et al., 2004). Studies have found that Cd and Pb have a tendency to accumulate in vital organs and have a half life up to 30 years (Yiin et al., 2000). Unlike blood that gives transient concentrations, nails can provide a continuous record of trace element concentrations of the body (Wilhelm and Hafner 1991). They can be easily sampled and analysed for accumulated toxic and essential metals in the tissue. Studies on nails as bio indicators have been reported by Vance*et al* (1988), Hayashi *et al* (1993), Oluwole *et al* (1994) and Chaudhary *et al* (1995). However, studies on correlation of nail-metal levels with different parameters, as well as with various health disorders are scarce.

2.8 Exposure and Risk Assessment

2.8.1 Hazard Identification

Hazard Identification is the process of determining whether exposure to a stressor can cause an increase in the incidence of specific adverse health effects and whether the adverse health effect is likely to occur in humans. In the case of chemical stressors, the process examines the available scientific data for a given and

develops a weight of evidence to characterize the link between the negative effects and the chemical agent (USEPA, 2010).

2.8.2 Dose-Response Assessment

A dose-response relationship describes how the likelihood and severity of adverse health effects (the responses) are related to the amount and condition of exposure to an agent (the dose provided) (USEPA, 2010). A dose-response relationship describes the increase in the probability of an adverse effect with corresponding increase in the exposure dose to the hazard. Therefore, some form of toxicological parameter must be used to describe the relationship in order to enable us to assess the health risk. The first parameter is the Reference Dose (RfD) present in unit mg/kg/day is used to estimated daily oral exposure of a toxicant (Jamal and Zailina, 2010).

2.8.3 Exposure Assessment

Exposure assessment defined the amount of a chemical to which a population or individuals are exposed via inhalation, oral and dermal routes. Animal or human exposure is commonly defined by mg of the chemical per kg body weight per day (Greim and Snyder, 2008).

2.8.4 Risk Characterization

Risk characterization is the final step of baseline health risk assessment process (USEPA, 2010). It is the process of estimating the incidence of a health effect under the various conditions of human exposure describe in exposure assessment (Jamal and Zailina, 2010). Besides, the information from the hazard assessment, exposure assessment, and dose-response relationship helps scientists to estimate the extra risk to human health or the environment that is caused by toxic pollutants (CEPA, 2011).

CHAPTER 3

METHODOLOGY

3.1 Study Location

Figure 3.1 shows the study location in Nilai, Negeri Sembilan, Malaysia. Due to its proximity, and connection through the KTM to Kuala Lumpur, Putrajaya, and Kuala Lumpur International Airport, it is a rapidly growing town. Development projects can be seen as one drives around Nilai. As of 2010 the population of Nilai is 36, 720 inhabitants. Negeri Sembilan is mainly an agricultural state. However, the establishment of several industrial estates enhanced the manufacturing sector as a major contributor towards the state economy. It was selected as study location because there is a municipal solid waste disposal site of Pajam landfill. Within 2 km away from Pajam landfill, there are few resident's area namely as Taman Melor, Taman Dahlia and Taman Bukit Inai. Population in this area was potential to get exposed to cadmium (Cd) from the landfill.

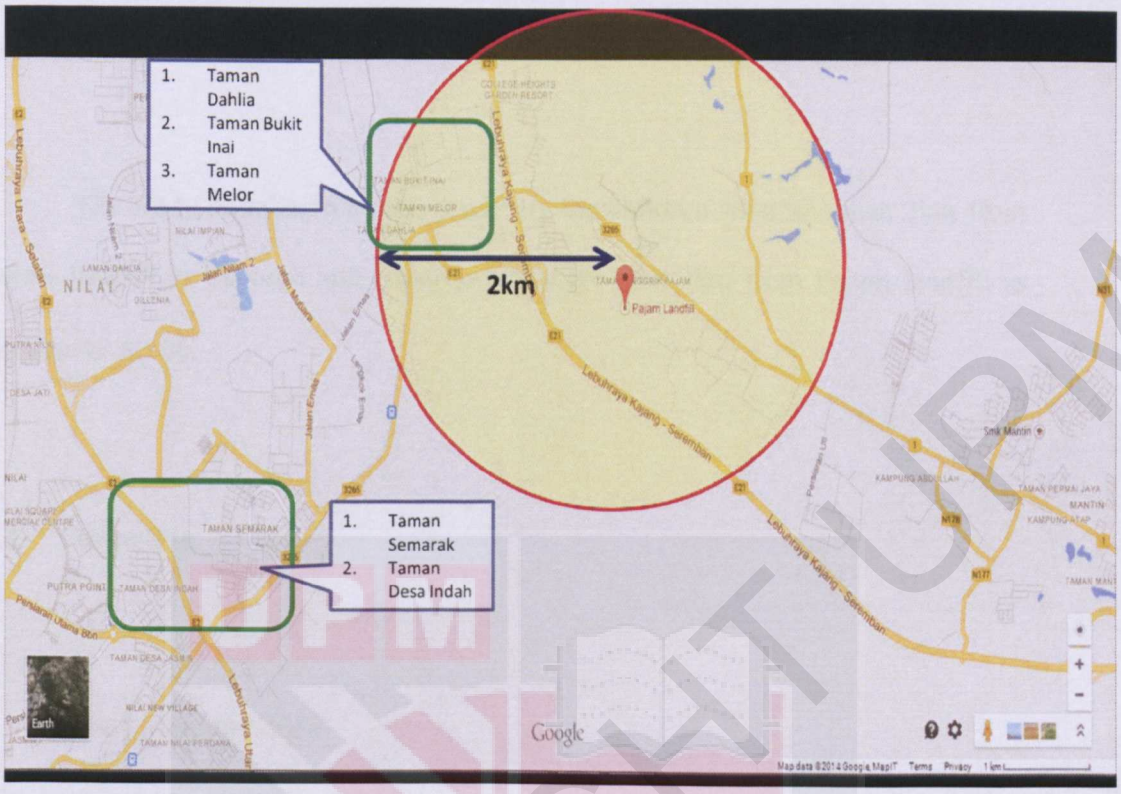

Figure 3.1 Study locations at Pajam, Negeri Sembilan

3.2 Study Design

This research is a cross-sectional comparative study with the aim at determining the accumulation of cadmium in fingernails and the associated health symptoms among children living near to Pajam landfill in Nilai, Negeri Sembilan. These study designs are relatively easy and economical to be conducted.

3.3 Study Population

The study population of this study are the children live less than 2km from Pajam landfill as exposed and children live more than 2km from Pajam landfill as unexposed group.

3.4 Sampling

3.4.1 Sample Size

The sample size of the study was determined by calculation method by using the formula by Lemeshow, Klar & Lawanga (1990). This formula use because the researcher wants to compare between exposed children and unexposed children.

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

Where;

σ = estimated standard deviation (assumed to be equal to each group)

μ_1 = Estimated mean (larger)

μ_2 = Estimated mean (smaller)

$Z_{1-\alpha/2}$= Standard error associated with confidential interval, 95% CI=1.96

$Z_{1-\beta}$ = Standard error associated with power, 80% of power =0.84

Based on the Environmental Agency (EA, 2010), there are μ_1= 0.925µg/m of cadmium concentration in urban area (larger) and μ_2= 0.159µg/m of cadmium concentration in rural area (small).

$$\sigma = \frac{0.925+0.159}{2}$$

$$\sigma = \sqrt{0.542}$$

$$\sigma = 0.74$$

$$n = \frac{4(0.74)^2[1.96+0.84]^2}{(0.925- 0.159)2}$$

$$n = 29$$

The value is rounded up to 20% to backup any missing data during data collection process.

20% x 29

= 5.80 → 6

= 6+29

= 35 respondents

Total respondents for exposed children and unexposed children,

N=35+35

N=70

3.4.2 Sampling Method

The sampling method in this study is purposive sampling method. The respondents selected based on inclusive and exclusive criteria. Individual who exhibit the criteria that will selected from a study location.

3.4.3 Sampling Unit

The sample unit for this study is the children that fulfill the inclusive and exclusive criteria. The inclusive criteria are Malaysian which is age 6 -11 years old (CDC 2011) live in the Nilai, Negeri Sembilan. The exclusive criteria are the children who have chronic disease.

3.5 Study Instrumentation and Data Collection

3.5.1 Questionnaire

The questionnaire is use in this study to elicited information on personal characteristic, environmental risk exposures and dietary habits of the respondents. This questionnaire was filled up by the parents or the guardians of the respondent. The questionnaire consists of 5 parts as stated;

i. Part A - Socio-demographic background

ii. Part B - Respiratory health information

iii. Part C - Kidney health information

iv. Part D – Information smoking habit in the family

v. Part E – Family dietary habit information

3.5.2 Nails Sampling and Analysis

To obtain more nail masses, respondents have been told in advance not to trim their nails for a couple of weeks or longer. Nails were collected by clipping with a stainless steel clipper from the two great thumbs and other fingers. Instructions were being given to the respondents to obtain as much nail as possible and clippings should be from both hands. Respondents were cut their nails at home and bring back after a week to be collected. The nail clippings from the great thumbs and the rest of the fingers were stored separately since the time frame represented by the great thumb is different from the rest of the fingers. These nail samples were placed in a labeled envelope and stored at room temperature in the driest condition possible in a pre-designated area until the samples can be analyzed in the future (Ka He, 2011).

The nail samples were scraped and clean of dust particles with non-ionic detergent (Triton X-100) following a standardized washing procedure (Ciszewski, 1997). This was followed by soaking the nail samples in acetone to remove external contamination, and finally the samples were rinse five times with deionised water, dried in an oven at 110°C and stored in a desiccators pending analysis. The dried nail

samples (1g) were place in a furnace and ashes at 550°C for 4 hours. The ashes were digested with 10 ml of 6 : 1 mixture of concentrated nitric and perchloric acid kept overnight at room temperature to prevent excessive foaming and subsequently the samples were heated at 160–180°C until the mixture become water clear and reduces to 1 ml. Each sample solution was then diluted with 0.1N nitric acid and made to a volume of 50 ml with distilled water. Determinations of cadmium were made directly on each final solution using Inductively Coupled Plasma Mass Spectrometry Multi-element Analysis (Thermo Elemental X7CCT Series) (Figure 3.2). Quantification limits ranged from 0.04 pg/mg or ng/g (U) to 0.1 ng/mg or µg/g (B).

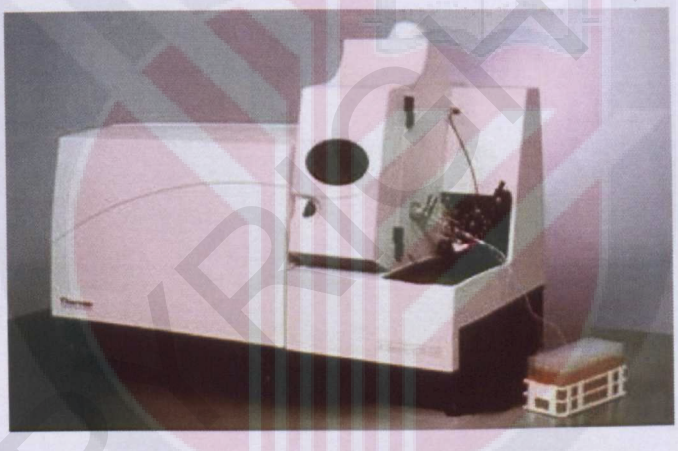

Figure 3.2 Inductively Coupled Plasma Mass Spectrometry Multi-element Analysis (Thermo Elemental X7CCT Series)

3.5.3 Personal Air Sampling

The standard sampling duration for environment ambient air is 24 hours. In this study, the average sampling duration is 8 hours where is four times of sampling

for overall sampling duration which is morning, afternoon, evening and night. At the field, air-sampling pump with the cyclone is wearing to the respondent for 2 hours for each time. Before that the respondents was be interviewed to know their background and also exposure to the cadmium during outdoor activities. The sampling equipment was placed on the respondents. The cyclone and cassette was attached to the shirt collar or at the breathing zone of the respondents. Every 1 hour, the position and condition of the equipment was being checked. This is for ensuring that the hose has not become pinched or detached from the cassette or the pump. After 2 hours, the pumps was turn off and remove from the respondents. For the blank field sample, one blank prepared by opened it at the field but not used to take samples.

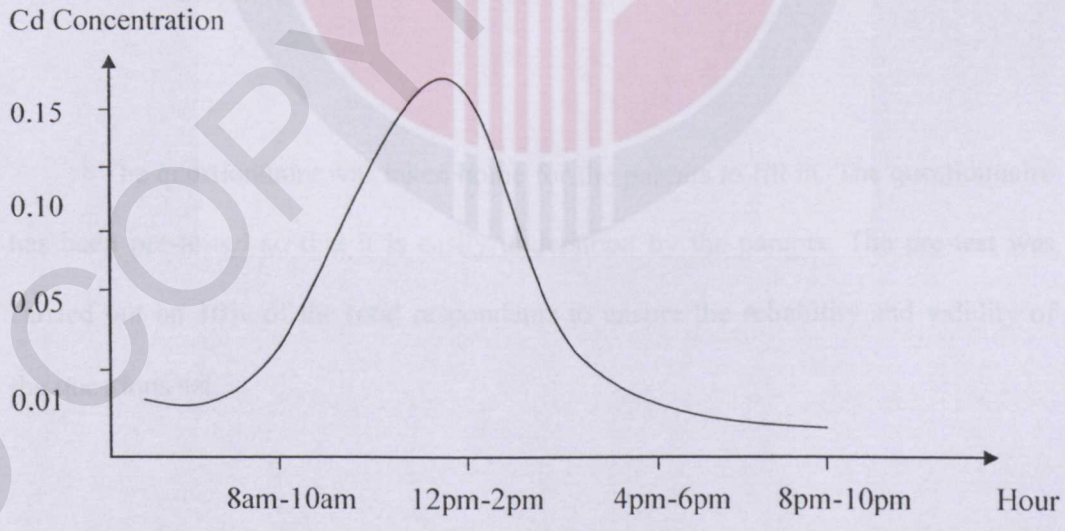

Figure 3.3 Average of Sampling Duration

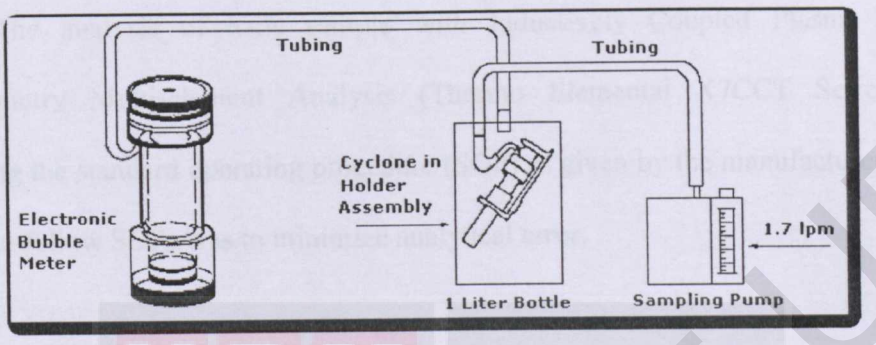

Figure 3.4 Schematic of Air Sampling Pump with the Cyclone and Cassette

3.6 Quality Control

3.6.1 Questionnaire

The questionnaire was taken home for the parents to fill in. The questionnaire has been pre-tested so that it is easily understood by the parents. The pre-test was carried out on 10% of the total respondents to ensure the reliability and validity of the questions set.

3.6.2 Standard Operating Procedure (SOP)

The analysis of nails sample with Inductively Coupled Plasma Mass Spectrometry Multi-element Analysis (Thermo Elemental X7CCT Series)was following the standard operating procedure (SOP) as given by the manufacturer. The reason to follow SOPs was to minimize analytical error.

3.6.3 Calibration

All instruments used were calibrated before used. This is to ensure the instruments are valid to be used.

3.7 Ethical Consideration

The permission to conduct this study was obtained from Research Ethic Committee of Universiti Putra Malaysia. The purpose of study has been explained to respondents and a participant consent form was signed by the parents of respondent before nails sample were collected. The identity of the respondents including their personal information will remain confidential and individual data not going to be stated in any parts of the study or publication. After ethical considerations were approved by Research Ethic Committee of Universiti Putra Malaysia, the data collection was conducted.

3.8 Data Analysis

All the data were analysed using Statistical Package for Social Science (SPSS) Version 21.0. The descriptive test was used to calculate mean, median, mode and standard deviation. The normality test used to obtain further information to achieved study objectives. The values of the metal concentrations in nail of the respondents were presented as arithmetic mean (mg/kg) with standard error (±SE) or standard deviation (±SD)and tabulated to show concentration profile over each parameter. The comparison of concentration of Cd in nails and personal air exposure between different groups of respondents was determined by Mann Whitney-U as appropriate. The association between Cd concentration in nails and associated health symptoms was determined by Spearmen's rank correlation (Rho), 95% confidence interval for Rho (Fisher's Z transformed), and a two-sided *p*-value. The null hypothesis was that no relationship between associated health symptoms and Cd concentration in fingernails. The Spearman's rank correlation test statistic was utilized in the present study because it is generally recognized as a nonparametric statistical test, and hence, it requires minimal assumptions regarding the overall distribution of the data examined.

3.9 Study Limitation

There are some limitations in this study that was unavoidable by the researcher. One of the limitations includes the sample size for this study as the number of children for exposed and unexposed was limited. In addition, it is hard to get the enough of the nails sample from the children because of the high unresponsive rate from the respondents. Other than that, information bias also was occur in answering the questionnaire among parental because of misinterpretation of the questions given or in remembering the history of activities. Finally, the cooperation of the respondents as well as the parents to give permission in taking the children's nail also is one of the limitations in this study.

CHAPTER 4

RESULTS

4.1 Socio-demographic data of respondent

The study was conducted in Nilai, Negeri Sembilan. A total of 70 children, (i.e. 35 exposed and 35 unexposed groups) were involved in this study. Table 4.1 shows the socio-demographic data of respondents. The mean ± SD of the age of exposed children was 9 ± 1 year old and range between 8 to 11 years. The mean ± SD of the age of unexposed children was 11 ± 1 year old and range between 8 to 12 years. All respondents in this study were Malays, consist of 36 boys and 34 girls. For the exposed children, the highest education level of the parents was PhD (N=1, 2.9%). They were 27.5% of the parents have educational level until Degree, 14.3% of Diploma, 45.7% of SPM and 11.4% of SRP or PMR. For the unexposed children, the highest education level of the parents was also PhD with N=3, (8.6%). There were 22.9% of the parents have educational level until Degree, 25.7% of Diploma, 37.1% of SPM and 5.7% of SRP/PMR. Majority of the parents were a full time employment (N=64) with monthly income above RM3000 (N = 33).

Table 4.2 shows the respondent's residence duration. The mean ± SD of duration for exposed group was 6.80 ± 3.74 years while for the unexposed group was 9.23 ± 3.78 years. Majority of the respondents in exposed group lives in the area for 5 to 9 years (N=16). Ten (N = 10) of the respondents lives for 1 to 4 years and 9 of them lives for more than 10 years. For the unexposed group, majority of the respondents (N=19) have lives in the area for more than 10 years (N=19), 13 of the respondents have lives for 5 to 9 years and 3 respondents for 1 to 4 years.

Table 4.1 Socio-demographic data of respondent

Variable	Categories	Exposed n (%)	Unexposed n (%)	p-value
Age (Years)	8	8 (22.9)	2 (5.7)	
	10	15 (42.9)	3 (8.6)	
	11	12 (34.3)	9 (26.7)	0.001
	12	0 (0)	21 (60.0)	
Gender	Male	19 (54.3)	17 (48.6)	
	Female	16 (45.7)	18 (51.5)	0.635
Race	Malay	35 (100)	35 (100)	0.154
Educational Level	SRP/PMR	4(11.4)	2(5.7)	
	SPM	16 (45.7)	13 (37.1)	
	Diploma	5 (14.3)	9 (25.7)	0.902
	Degree	9 (25.7)	8 (22.9)	
	PhD	1 (2.9)	3 (8.6)	
Employment Status	Full Time	34 (97.1)	30 (85.7)	
	Unemployed	1 (2.9)	5 (14.3)	0.041
Monthly Income*	<RM500	1 (2.9)	3 (8.6)	
	RM501-RM1000	0 (0)	1 (2.9)	
	RM1001-RM1500	2 (5.7)	3 (8.6)	
	RM1501-RM2000	3 (8.6)	4 (11.4)	0.327
	RM2001-RM2500	6 (17.1)	1 (2.9)	
	RM2501-RM3000	7 (20.0)	6 (17.1)	
	>RM3001	16 (45.7)	17 (48.6)	

n=70, * Malaysia Poverty Line (Economic Planning Unit, 2009)

Table 4.2 Respondent's residence duration

Variable	Range (Years)	Exposed n=35	Exposed Mean ± SD	Unexposed n=35	Unexposed Mean ± SD
Duration of residence (years)	1-4	10	6.80 ± 3.74	3	9.23 ± 3.78
	5-9	16		13	
	>10	9		19	

4.2 Smoking habits and family lifestyle

Table 4.3 compares the smoking habits in family of exposed and unexposed children. Smoking habit is considered as one of the factors that affect the cadmium concentration in nails. The number of regular smokers among parents in unexposed group was higher (N = 11) than the exposed group (N = 9). The number of social smokers were the same (N=5, 14.3%) for exposed group and unexposed group. Besides parents, 3 of the unexposed respondents have smokers in their household (N= 3, 8.6%). The chi-square test shows that there was no significant difference of smoking habits in family between exposed and unexposed children ($p>0.05$).

Table 4.3 Descriptive statistics of smoking habits in family of exposed group and unexposed group along with Chi-square test (p=0.05)

Variable		Exposed		Unexposed		x^2	p-value
		n=35	(%)	n=35	(%)		
Parents are regular smokers	**Yes**	9	25.7	11	31.4	0.280	0.597
	No	26	74.3	24	68.6		
Parents are social smokers	**Yes**	5	14.3	5	14.3	0.000	1.000
	No	30	85.7	30	85.7		
Other household are smokers	**Yes**	0	0	3	8.6	3.134	0.077
	No	35	100	32	91.4		

N=70,*Indicate significant difference level at p = 0.05

4.3 Dietary habits of children

Table 4.4 indicates the frequency and means dietary habits of canned food among respondents. This is one of the confounding factors in the study as highly processed canned food with high fat content; contained high input of toxic metals such as cadmium and to a larger extent increased the absorption of these metals in the gastrointestinal tract (Oostdam et al., 1999). The highest frequency intake of canned food for exposed group was sardine (4.89 ± 0.182, once a week). The frequently consumed of usual canned foods such as mushroom, lychee and tuna were once a month (5.97 ± 0.190, 5.86 ± 0.179 and 5.94 ± 0.209). The canned food like tomato puree, fruit slice, pineapple and baked beans were the rare canned food intake in once every 3 to 6 months (6.17 ± 0.190,6.31 ± 0.121,6.26 ± 0.138, 6.26 ± 0.144). The exposed group was never taken cuttlefish, curry, cheese sauce, prawn sauce/anchovies and corn in their dietary habits as the mean was between 6.37 to 6.91.

For the unexposed group, the highest frequency intake of canned food was sardine (4.83 ± 0.199, once a week). Almost the others processed and canned food like mushroom, tomato puree, fruit slice, pineapple, lychee, baked beans, tuna cuttlefish, curry cheese sauce, prawn sauce/anchovies and corn was rare canned food intake in once every 3 to 6 months for unexposed group. They also never take mushroom, pineapple, cuttlefish, curry, cheese sauce, prawn sauce/anchovies and corn in their dietary.

The independent t-test compared the mean of consumed canned food habits of exposed group and unexposed group. From the result, significant difference of canned food intake was observed between the exposed group and unexposed group only for lychee (at p=0.016), baked beans (p=0.023) and corn (p=0.007). Other type of canned food shows no significant difference.

Table 4.4 The frequency of canned food intake of exposed group and unexposed children along with independent t-test (p=0.05)

Variable	Exposed (n=35)	Unexposed (n=35)	t-value	p-value
	Mean[1] ± SE	Mean[1] ± SE		
Sardines	4.89 ± 0.182	4.83 ± 0.199	0.421	0.127
Mushroom	5.97 ± 0.190	6.14 ± 0.189	-0.536	0.676
Tomato puree	6.17 ± 0.190	6.26 ± 0.118	-0.256	0.385
Fruit slice	6.31 ± 0.121	6.23 ± 0.117	0.510	0.545
Pineapple	6.26 ± 0.138	6.49 ± 0.111	-1.132	0.564
Lychee	5.86 ± 0.179	6.09 ± 0.095	-1.126	0.016*
Baked beans	6.26 ± 0.144	6.06 ± 0.108	1.286	0.023*
Tuna	5.94 ± 0.209	6.14 ± 0.143	-0.571	0.180
Cuttlefish	6.91 ± 0.048	6.89 ± 0.055	0.394	0.432
Curry	6.86 ± 0.060	6.80 ± 0.080	0.888	0.070
Cheese sauce	6.77 ± 0.174	6.83 ± 0.065	-0.307	0.415
Prawn sauce/Anchovies	6.74 ± 0.176	6.89 ± 0.055	-0.777	0.125
Corn	6.37 ± 0.124	6.60 ± 0.084	-1.546	0.007*

n=70, [1]indicates mean frequency of intake from a Likert scale value in the questionnaire; 1- Never, 2 - Every 3-6 months, 3 –Once a month, 4 - Once a week, 5 –Twice per week, 6 -3 times per week, 7- Everyday *Indicate significant difference level at p=0.05

4.4 Cadmium concentration in fingernails of exposed and unexposed group

Table 4.5 compares the Cd levels (mg/kg ± SE) in fingernails sample of exposed and unexposed group. The mean ± SE of Cd in exposed group was slightly higher (0.20 ± 0.03 mg/kg) than the unexposed group (0.10 ± 0.01 mg/kg). The mean ± SE of Cd for girls in the exposed group was higher (0.23 ± 0.05 mg/kg) than the

boys (0.16 ± 0.03 mg/kg), while the concentration in unexposed group was remained low. The highest concentration of Cd in the fingernails was obtained for the exposed children (0.75 mg/kg). The Mann Whitney U test indicates a significant difference was observed between Cd level in fingernails in exposed and unexposed children at p=0.005.

Table 4.5 Cd levels (mg/kg) in fingernail samples of exposed group and unexposed group along with Mann Whitney-U (p=0.05)

Variable	Gender	Mean ± SD	Range (mg/kg)	z	p-value
Exposed	Boys	0.16 ± 0.03			
Group	Girls	0.23 ± 0.05	0.01 – 0.75		
N=35	Total	0.20 ± 0.03		-2.828	0.005*
Unexposed	Boys	0.10 ± 0.01			
Group	Girls	0.10 ± 0.02	0.00 – 0.21		
N-35	Total	0.10 ± 0.01			

n=70, *Indicate significant difference level at $p < 0.05$

4.5 Personal air exposure of cadmium among exposed and unexposed group

Table 4.6 shows the Cd personal air exposure (mg/m^3 ± SE) in air sample of exposed and unexposed group. The total mean ± SE of personal air exposure of Cd level of exposed group was 3.85 ± 0.01mg/m^3 with a range of 3.40 – 4.60mg/m^3. This was slightly higher than the unexposed group with the total mean ± SE of 3.19 ± 0.08 mg/m^3(range of 2.50 – 3.60mg/m^3). Significant difference was observed between personal air exposure of Cd level in exposed and unexposed group p=0.001.

Table 4.6 Descriptive statistics of personal air exposure of Cd levels (mg/kg) in air samples of exposed and unexposed group along with Mann Whitney-U (p=0.05)

Variable	Gender	Mean ± SE mg/m^3	Range (mg/m^3)	z	p-value
Exposed Group	Boys	3.83 ± 0.10			
	Girls	3.85 ± 0.10	3.40 – 4.60		
	Total	3.85 ± 0.01		-3.992	0.001*
Unexposed Group	Boys	3.12 ± 0.10			
	Girls	3.30 ± 0.10	2.50 – 3.60		
	Total	3.19 ± 0.08			

N=70,*Indicate significant difference level at p<0.05

4.6 Frequency of associated health symptoms of children

Table 4.7 shows the frequency of associated health symptoms of studied children between boys and girls. The highest symptoms reported for the exposed group was abdominal pain or nausea or vomiting (n=6, 17.1%) followed by rash and itching on body (n=5, 14.3%) (common among girl respondents), feeling tired (n=4, 11.4%), loss of appetite (n=3, 8.6%), frequent urination (n=2, 5.7%), and skin darkening (n=2, 5.7%). The highest symptoms reported for the unexposed group were rash and itching on body (n=6, 17.1%) (common among girl) followed by abdominal pain or nausea or vomiting (n=4, 11.4%), difficulty concentrating and decreased school performance (n=4, 11.4%), feeling tired (n=3, 8.6%), and loss of appetite (n=3, 8.6%).

The children that had stunted growth was n=1 (2.9%) for exposed and unexposed group. One children from the exposed group (n=1, 2.9%) had been diagnosed of kidney problem. Only 4 of the children was reported with urinary tract infection (n=3, 8.6% for the exposed group and n=1, 2.9% for the unexposed group).

Table 4.7 Frequency of associated health symptoms of children

Variable	Exposed		Unexposed	
	Boys n (%)	Girl n (%)	Boys n (%)	Girl n (%)
Frequent urination	1 (2.9)	1 (2.9)	0 (0)	1 (2.9)
Feeling tired	1(2.9)	3 (8.6)	2 (5.7)	1 (2.9)
Loss of appetite	2 (5.7)	1 (2.9)	1 (2.9)	2 (5.7)
Abdominal pain/nausea/vomiting	3 (8.6)	3 (8.6)	2 (5.7)	2 (5.7)
Swelling of the hand/feet/face	1 (2.9)	0 (0)	1 (2.9)	0 (0)
Rash and itching on body	1 (2.9)	4 (11.4)	2 (5.7)	4 (11.4)
Skin darkening	1 (2.9)	1 (2.9)	0 (0)	0 (0)
Lost weight	1 (2.9)	0 (0)	1 (2.9)	1 (2.9)
Difficulty concentrating and decreased school performance	1 (2.9)	1 (2.9)	2 (5.7)	2 (5.7)
Stunted growth	0 (0)	1 (2.9)	1 (2.9)	0(0)
Diagnosed of kidney problem	1 (2.9)	0 (0)	0 (0)	0(0)
Urinary Tract Infection (UTI)	2 (5.7)	1 (2.9)	1 (2.9)	0 (0)

n=70,*Indicate significant difference level at $p<0.05$

4.7 The relationship between Cd concentration in fingernails and personal air exposure

Table 4.8 shows the relationship between Cd concentration in fingernails and personal air exposure. This result indicates there was no significant relationship between cadmium concentration in fingernails and personal air exposure of cadmium in air sample of children as the p value > 0.05.

Table 4.8 Analytical statistic of cadmium concentration in fingernails and personal air exposure of cadmium in air samples along with Pearson correlation (p=0.05)

Variable	Mean ± SE	Range	r	p-value
Cadmium concentration in fingernails	0.15 ± 0.02	0.01 – 0.75 mg/kg	0.075	0.537
Personal air exposures of cadmium	3.50 ± 0.30	2.50 – 4.60 mg/m^3		

N=70, *Indicate significant level at p=0.05 (2-tailed)

4.8 The relationship between Cd concentration in fingernails and associated health symptoms of children

Table 4.9 shows the relationship between cadmium concentration in fingernails and associated health symptoms of children. Results of this study indicate there was no significant relationship between cadmium concentration in fingernails and associated health symptoms of children as the p value > 0.05.For the exposed group, symptoms of abdominal pain / nausea or vomiting, swelling of the hand/feet/face, kidney problem and coughing were the variables that have positive relationship with Cd concentration in the fingernails although not significant. The rest symptoms were indicated as negative relationship with Cd concentration in fingernails. For the unexposed group, symptoms of frequent urination, abdominal pain / nausea or vomiting, rash and itching on body and coughing were the variables that have positive relationship with Cd concentration in the fingernails although not significant. The rest symptoms were indicated negative relationship with Cd concentration in fingernails.

Table 4.9 Analytical statistic of cadmium concentration in fingernails and associated health symptom along with Spearmen's rank correlation (p=0.05)

	Exposed		Unexposed	
Variable	**Rho**	**p-values**	**Rho**	**p-values**
Frequent urination	-0.055	0.754	0.255	0.139
Feeling tired	-0.089	0.611	-0.046	0.795
Loss of appetite	-0.187	0.282	-0.086	0.623
Abdominal pain/nausea/vomiting	0.034	0.847	0.040	0.819
Swelling of the hand/feet/face	0.221	0.202	-0.196	0.260
Rash and itching on body	-0.138	0.431	0.053	0.764
Skin darkening	-0.226	0.192	0	0
Lost weight	-0.204	0.240	-0.122	0.485
Difficulty concentrating and decreased school performance	-0.128	0.463	-0.111	0.524
Stunted growth	-0.263	0.126	-0.196	0.260
Diagnosed of kidney problem	0.000	1.000	0	0
Urinary Tract Infection (UTI)	-0.212	0.221	-0.111	0.527
Coughing	0.146	0.403	0.032	0.856
Chest pain	-0.204	0.240	0	0

N=70, *Indicate significant level at p=0.05 (2-tailed)

4.9 The relationship between Cd concentration in fingernails and dietary habits of canned food

Table 4.10 shows the relationship between Cd concentration in fingernails and dietary habits of canned food of children. The result indicates that there was significant relationship between dietary habits of lychee and Cd concentration in

fingernails of exposed group at p = 0.025 (r = 0.378). However other types of canned food have no correlation with the Cd concentration in both groups.

Table 4.10 Spearman's rank correlation between dietary habits of canned food and cadmium concentration in fingernails of children

	Exposed		Unexposed	
Variable	**Rho**	**p-values**	**Rho**	**p-values**
Sardines	0.154	0.376	-0.113	0.519
Mushroom	0.043	0.806	-0.148	0.395
Tomato puree	-0.068	0.699	0.032	0.856
Fruit slice	0.010	0.953	0.032	0.857
Pineapple	0.041	0.815	0.133	0.447
Lychee	0.378	0.025*	0.140	0.421
Baked beans	0.015	0.932	0.065	0.710
Tuna	0.162	0.353	0.228	0.188
Cuttlefish	0.051	0.773	0.312	0.068
Curry	0.040	0.817	0.167	0.337
Cheese sauce	0.091	0.602	0.064	0.715
Prawn sauce/Anchovies	0.052	0.765	0.040	0.819
Corn	0.024	0.891	0.026	0.882

N=70, *Indicate significant level at p=0.05 (2-tailed)

4.10 The relationship between Cd concentration in fingernails and smoking habit in family of the children

Table 4.11 shows the relationship between Cd concentration in fingernails and smoking habit in family of the children. The result indicates that there was significant relationship between Cd concentration in fingernails of the children and other household who are smokers at p = 0.050 with moderate correlation at r = 0.334.

Table 4.11 Analytical statistic of cadmium concentration in fingernails and smoking habit in family along with Spearmen's rank correlation (p=0.05)

	Exposed		Unexposed	
Variable	**Rho**	**p-value**	**Rho**	**p-value**
Parents are regular smokers	-0.149	0.393	0.156	0.372
Parents are social smokers	-0.316	0.065	-0.215	0.216
Other household are smokers	0	0	0.334	0.050*

N=70, *Indicate significant level at p=0.05 (2-tailed)

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 DISCUSSION

5.1.1 Socio-demographic

A total of 70 children who lives nearby to Pajam landfill in Nilai, Negeri Sembilan were involved in this study. The age of respondents was range from 8 to 12 years old. Majority of the respondents in exposed group aged 10 years old and 12 years old in unexposed group. This study was unable to collect sample of children aged 12 years old in the exposed group as at the time of sampling, the children were involved with trial examination. All respondents are Malays. According to the Negeri Sembilan Investment Centre (NSIC), the majority ethnic in Nilai are Malays (56%), Chinese (24.2%), Indian (15.3%) and other races (4.5%). The number of girl respondents were higher compared to boys for the exposed group while the number of boys respondent were slightly higher compared to girls for the unexposed group.

For both groups of respondents, the highest education level of the parents or guardian was SPM, followed by degree and diploma. There is no significant difference of parent's education level for both groups. Majority of the parents were a full time employment with monthly income above RM3000. Majority of the parents works in engineering and aerospace industry near to Kuala Lumpur International Airport (KLIA).

Family's occupation is one of the vital exposure pathways that exposed children to cadmium. Children may be at increased risk to expose to Cd if they live near to municipal solid waste landfill or if their parents or others family members work with cadmium. For example, the metal may be brought into the home on work boots, tools, work clothing, or on the skin. The duration of living in the area was also another factor that influenced the accumulation of Cd. Based on the result in Table 2, even thought the respondents from unexposed group lives more than 10 years in the area compared to the exposed group (only in 6 years) but, the exposed group indicated high cadmium concentration in the children fingernails.

5.1.2 Smoking habits and family lifestyle

The number of regular smokers, social smokers among parents and other household who are smokers in unexposed group were higher than the exposed group. However there was no significant difference of smoking habit in family between both groups because most of the parents are non-smokers. Smoking habit is

considered as one of the factors that affect the cadmium concentration in nails. The most recent (Mannino *et al.* 2004) study showed that current and former smokers had higher body burdens of cadmium than non-smokers. There have also been studies examining the role of cadmium in the development of chronic obstructive pulmonary disease (COPD) in smokers (ATSDR 1999).

5.1.3 Dietary habits of children

The dietary habits of the children also had been taken into account in this study as it is one of the confounding factors in this study. From the result, significant difference of canned food intake was observed between the exposed group and unexposed group only for lychee ($p=0.016$), baked beans ($p=0.023$) and corn ($p=0.007$). Result has indicates that the exposed group consumed lychee, baked beans and corn more frequent compared to the unexposed group. There was no significant difference for other types of canned food.

5.1.4 Cadmium in fingernails of exposed and unexposed children

The mean of Cd concentration in the fingernails of exposed group was higher than the unexposed group. The highest concentration of Cd was determined in exposed group (0.75 mg/kg) as compared to the unexposed group (0.21 mg/kg). This result is consistent with previous study by Hussein *et al*, (2008), whom indicated the

Cd levels in nails obtained in urban areas were slightly higher (0.00 – 3.70 µg/g) than the in rural areas (0.00 – 2.15 µg/g). This is because the population in urban areas living closer to the sources of pollution such as industrial area. Living closer to the source of pollution i.e. landfill, within 2 km away also has been related to heavy metal exposure through dust (Dalton, 2003). From the results of this study showed that the value was still within an acceptable limit for safe humanity. According to World Health Organization (WHO), tolerable weekly intake for cadmium was at 7 µg/kg/body weight/week.

5.1.5 Personal air exposure of cadmium among exposed and unexposed group

As for Cd in air, the higher mean personal air exposure of Cd level was obtained in the exposed group (3.85 ± 0.01mg/m^3) as compared to the unexposed group (3.19 ± 0.08mg/m^3). Significant difference was observed between personal air exposure of Cd level in air sample in exposed group and unexposed group (at $p < 0.001$). High Cd in exposed group possibly comes from the municipal solid waste landfill (EA, 2010). However, this value was still within an acceptable limit. OSHA set a legal limit of 5 µg/m^3 cadmium in air averaged over an 8-hour work day.

The health risks from air pollution are likely to be more serious for children who are already exposed to toxic chemicals, because they live or attend school near to landfills, toxic waste sites, bus depots and rail yards, industrial plants, or similar facilities. Because of low-quality housing, overcrowding, and lack of air conditioning, children in low-income communities may also spend more time outdoors (NRDC, 1997).

5.1.6 Relationship between cadmium concentration in fingernails and personal air exposure

Though the frequency of health symptoms reported among exposed group was higher than the unexposed group, but no significant relationship was obtained between Cd in the fingernails and the health symptoms. There was also no significant relationship between cadmium concentration in fingernails and the personal air exposure of cadmium in air sample of the children in this study. This result is consistent with the Environmental Agency (EA), 2010 that has found particulates emitted from landfills may contain metals such as cadmium. However, monitoring of metal compounds at the boundary of landfill sites indicated that the 50th percentile concentrations of metals were well below the relevant health guideline level. As a result, it is difficult to judge whether concentrations of total cadmium at the boundary of these landfill sites present a significant risk to health. This result is consistent with previous study by Drebler, 2002, where no correlation was determined between Cd levels below the 30 - 40 mg/l Cd with acute health symptoms such as vomiting, abdominal cramps and severe nausea.

5.1.7 The relationship between cadmium concentration in fingernails and associated health symptoms of children

The most common perceived health symptoms reported for children in exposed group in this study was abdominal pain or nausea or vomiting, skin rash, feeling tired, loss of appetite, frequent urination and skin darkening. As for the unexposed group, the most common symptoms were rash and itching on body, abdominal pain or nausea or vomiting, difficulty concentrating and decreased school performance, feeling tired and loss of appetite. Rare health cases such as stunted growth, kidney problem and urinary tract infection were also reported. The frequency of the health symptoms among exposed children was higher than the unexposed group.

Health symptoms reported in this study might be related with the exposure of directly or indirectly to various exposures. Based on previous study by Defra (2004), living within 1 km from landfill potentially exposed the children to chemicals that can reduce immune system function and lead to an increased risk of infections (EPA, 2003). As opposed to children living in clean areas, children living near to waste sites, whether landfills or contaminated bodies of water, are hospitalized more frequently with acute respiratory infections and asthma (Carpenter, 2006). A study by Dalton (2003), in the United Kingdom has identified a link between living within 2 km from a landfill site a small increased risk of symptoms such as tiredness, sleepiness and headaches. Besides that, the kidney is the principal organ targeted by chronic exposure to cadmium. Cadmium nephrotoxicity may follow chronic inhalation or ingestion (Mueller *et al.* 1992). Studies by i.e.,Cadmibel (Buchet*et al.*

1990), Japan (Ikeda *et al.* 2003, 2005, 2006; Kobayashi *et al.* 2006),OSCAR (Jarup *et al.* 2000), Sweden, and United States, (Noonan *et al.* 2002), have found that even very low-levels of cadmium (2.71 μg/g) may have adverse effects on the kidney. WHO currently stated that 200 μg/g levels wet weight of cadmium in kidney causes adverse changes of disease in 10% of the population. In addition, based on the previous study by Steinheider, (1999), odors are frequently a key issue for landfill sites, especially those receiving biodegradable waste. Odors emissions are often accompanied by reports of ill-health from communities. Individuals may report a wide range of non-specific health symptoms, attributing these to odor exposure, including nausea, headache, drowsiness, fatigue and respiratory problems. Although no relationship between health symptoms and Cd concentration in the study, but the reported health symptoms obtained in this study was similar to what have been reported in most of the previous studies.

5.1.8 The relationship between cadmium concentration in fingernails and dietary habits of canned food

Frequency of canned food intake among respondents also one of the confounding factors in this study. This is because, highly processed canned food with high fat content, contained high input of toxic metals such as cadmium and to a larger extent increased the absorption of these metals in the gastrointestinal tract (Oostdam et al., 1999). From the results of the questionnaire on canned food dietary habits in this study, there was no significant correlation between frequency of the canned food intake and the cadmium concentration in fingernails except for lychee (significant relationship with cadmium concentration in fingernails in exposed

group). According to the Food Contaminant Regulations 2006, lychee was in listed of food commodities and contaminants from cadmium and lead controlled by the regulatory limit. For the others of dietary habit of canned food that no significant relationship between cadmium concentrations in fingernails is because of majority of packaging and preparation of process canned food have more Pb content compare to Cd (Oostdam et al. 1999). Based on the EU legislation, for tinned food other than beverages, the maximum level was laid down at 200 mg/kg of heavy metal.

5.1.9 The relationship between cadmium concentration in fingernails and smoking habit in family of the children

Smoking habit also one of the factors that affect the cadmium concentration in fingernails. Based on the result in Table 11, there was significant relationship between cadmium concentration in fingernails of the children and other household are smokers at $p = 0.050$ with moderate correlation at $r = 0.334$. This result shows that probably the others household who are smokers such as the brothers, uncles or near relatives of the respondents from unexposed group were closely connected with the respondents besides their parents. However, results indicate concentration of Cd among children whom their parents are smoker was higher compared to the non-smoker. This was consistent with a study by Mannino *et al.* (2004) which has showed that current and former smokers had higher body burdens of cadmium than non-smokers and that within smokers. The body burden of cadmium was related smoking that lead to lung injury.

5.2 CONCLUSION

In conclusion, this study showed that the highest concentration of Cd in the fingernails was obtained for the exposed group. This study found that the mean of Cd levels in fingernails had significant difference between exposed and unexposed group. The personal air exposure of Cd concentration also found slightly highest in exposed group. This study found that the mean of personal air exposure of Cd concentration had significant difference between exposed and unexposed group.

There were no significant relationships between Cd concentration in fingernails and personal air exposure of Cd concentration and no significant relationship between Cd concentration and associated health symptoms.

5.3 RECOMMENDATION

Since there are 35 (50%) children for exposed group potential to get more exposure from Cd for future, more action to reduce the Cd level in body must be taken into consideration by governments and company that manage the landfill to ensure safe for population. Municipal solid waste landfill should be regular monitored and properly managed. The regularly monitoring and properly managed waste landfill system can control the Cd levels in landfill site.

Further research is needed to improve toxicological and exposure assessments around landfill sites. Future research should consider further surveys of pollutant concentrations around more sites and the development of more sensitive sampling and analytical methods for pollutants detected at low concentrations, particularly for those chemicals or heavy metals where the detection limits in the studies considered were below health criteria values or associated health symptoms.

REFERENCES

ATSDR (Agency for Toxic Substance and Disease Registry) (2006).*Public Health Statement: Cadmium.* United States: Division of Toxicology and Environmental Medicine.

ATSDR (Agency for Toxic Susbtance and Disease Registry) (2008). *Toxicologycal Profile for Cadmium.* United States: Department of Health and Human Services.

ATSDR (Agency for Toxic Substance and Disease Registry) (2009).*Priority Data Needs for Cadmium.* United States: Department of Health and Human Services.

ATSDR (Agency for Toxic Substance and Disease Registry) (2008). Cadmium Toxicity: *What Disease are Associated with Chronic Exposure to Cadmium?*

Bellamy, 2003. The health of children and adolescent: Preventive care for children in low-income families

Buchet, J., R. Lauwerys, (1990). *"Renal effects of cadmium body burden of the general population."* Lancet 336: 699-702.

Cambra (1999). Heavy metals may enter the human body through inhalation of dust, direct ingestion of soil, and consumption of food plants grown in metal-contaminated soil.

Carpenter (2006). Adolescent Swimmers: Breathing Complaints and Prescription Asthma Medication Use and Misuse.

Centers for Disease Control and Prevention. (2005). Third National Report on Human Exposure to Environmental Chemicals. Atlanta, Georgia: National Center for Environmental Health.

Dalton P (2003). Upper airway irritation, odour perception and health risk due to airbone chemicals. *Toxic Lett,* **140-141,** 239-48.

Dalton P, Wysocki CJ Brody MJ and Lawley HJ (1997). The influence of cognitive bias on the perceived odour, irritation and health symptoms from chemical exposure. *InrArchoccup Environ Health,* **69,** 407-17.

David M. Mannino, (2004). "Association between 24-hour Urinary Cadmium and Pulmonary Function among Commuity-Exposed Men".

Defra (Department for Environment, Food and Rural Affairs) (2004). Health Effects of Waste Management: Municipal Waste and Similar Wastes. Report No. PB9052A, prepared by Enviros Consulting Ltd and Birmingham University, may 2004.

Defra (Department for Environment, Food and Rural Affairs) (2007). The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.Volume 1.

Dolk, (1998). Risk of Congenital Anomalies after the Opening of Landfill Sites.

Drebler, J., K. Schulz, (2002). *"Lethal manganese-cadmium intoxication. A case report."* Archives of Toxicology 76: 449-451.

EA (Environment Agency) (2001). A Study of Ambient Air Quality at a Landfill Site in Llanduual. Publication No. NCAS/TR/2001/021.

EA (Environment Agency) (2004). Monitoring of Particulate Matter in Ambient Air around Waste Facilities. Technical Guidance Document (Monitoring) M17.

Edwin & Howell (2013). Source of cadmium emissions from municipal solid waste landfill.

Ezaki, T., T. Tsukhara, (2003). *"No clear-cut evidence for cadmium-induced renal tubular dysfunction among over 10,000 women in the Japanese general population: a nationwide large-scale survey."* International Archives of Occupational and Environmental Health 76: 186-196.

Food Contaminant Regulation (2006). "Commodities and contaminants food controlled by the regulatory limit.

Garland M, Morris JS, Rosner BA. Toenail trace element levels as biomarkers: reproducibilityover a 6-year period. Cancer Epidemiol Biomarkers Prev. 1993; 2:493–7. [PubMed: 8220096].

HPA (Health Protection Agency) (2009). Compendium of Chemical Hazards. Methane. Jarup, L. (2002). "Cadmium overload and toxicity." Nephrology Dialysis Transplantation 17(Suppl 2): 35-39.

Jamal and Zailina, (2010). Guidance document on health impact assessment (HIA) In Environmental impact assessment (EIA): Dose-response.

Lemeshow, S., Hosmer, D. W., Jr., Klar, J., &Lwanga, S. K. (1990). *Adequacy of sample size in health studies.* Hoboken, NJ: Wiley.

Mannino, D., F. Holguin, (2004). "*Urinary cadmium levels predict lower lung function in current and former smokers: data from the Third National Health and Nutrition Examination Survey.*" Thorax 59: 194-198.

MHLG. 2002. *Ministry of Housing and Local Government Annual Report 2002.* Kuala Lumpur.

Mueller, P., D. Paschal, (1992). *"Chronic renal effects in three studies of men and women occupationally exposed to cadmium."* Archives of Environmental Contamination and Toxicology 23: 125-136.

National Institute of Occupational Safety and Health. 1990. Testimony on Occupational Exposure to Cadmium. J D Millar, September 18, 1990.

Navas-Acien, A., E. Silbergeld, *et al.* (2005). *"Metals in Urine and Peripheral Artery Disease."* Environmental Health Perspectives 113(2): 164-169.

Nishijo, M., H. Nakagawa, (2002). *"Effects of maternal exposure to cadmium on pregnancy outcome and breast milk."* Occupational and Environmental Medicine 59: 394-397.

Nogawa, K., E. Kobayashi, (2004). "Environmental cadmium exposure, adverse effects and preventive measures in Japan." BioMetals 17: 581-587.

Noonan, C., S. Sarasua, (2002). *"Effects of exposure to low levels of environmentalcadmium on renal biomarkers."* Environmental Health Perspectives 110(2): 151-155.

NRDC (Natural Resources Defense Council) (1997). "Low-quality housing, overcrowding, and lack of air conditioning, children in low-income communities may also spend more time outdoors."

NSIC (Negeri Sembilan Investment Centre) (2014). The population and average annual grow rate (%) in Negeri Sembilan.

NTP (National Toxicity Program) (2004). *Characteristic of Cadmium.*

Paul Woodson, (2003). Issues And Challenges Of *Solid Waste* Management Practices.

Roels, H., P. Hoet, (1999). *"Usefulness of biomarkers of exposure to inorganic mercury, lead, or cadmium in controlling occupation and environmental risks of nephrotoxicity."* Renal failure 21(3,4).

Ryan N. Harrison, (2003). Municipal Solid Waste Composting: Physical and biological processing.

Sahmoun, A., L. Case, (2005). *"Cadmium and prostate cancer: a critical epidemiological analysis."* Cancer Investigation 23: 256-263.

Samatha G, Sharma R, Roychowdhury T, Charkraborti D. Arsenicand other elements in the hair, nails and skin scales of arsenicvictims in West Bengal India. Sci Total Environ 2004;326:30–45.

Satarug, S., B. JR, (2003). *"A global perspective on cadmium pollution and toxicity in non-occupationally exposed population."* Toxicology Letters 137: 65-83

Satoh, M., H. Koyama, (2002)."Perspectives on cadmium toxicity research." Tohoku J Exp Med 196: 23-32.

Sharifah Norkahdijah S.I & Latifah A.M (2013). *"The challenge of future landfill":* A case study of Malaysia

Sorahan, T. and N. Esmen (2004). "*Lung cancer mortality in UK nickel-cadmium battery workers, 1947-2000*." Occupational Environmental Medicine 61: 108-116.

Staessen, J., T. Kuznetsova, (1991). *"Exposure to cadmium and conventional and ambulatory blood pressures in a prospective population study."* American Journal of Hypertension.

Staessen, J., H. Roels, (1999). *"Environmental exposures to cadmium, forearm bone density, and risk of fractures; prospective population study."* Lancet 353: 1140-1144.

Steinheider B (1999). Environmental odours and somatic complaints.*Zentralblatt fur Hygiene und Umweltmedizin (International Journal of Hygiene and Environmental Medicine),* **202,** 101 – 19.

US EPA, "Criteria for Municipal Solid Waste Landfills," US Environmental Protection Agency, Washington, D.C., July (1988b).

Verougstraete, V. and D. Lison (2003). *"Cadmium, lung, and prostate cancer: a systematic review of recent epidemiological data."* Journal of Toxicology and Environmental Health 6(Part B): 227-255.

Waalkes M, Wahba ZZ, Rodriguez E.(2001) Cadmium. In: Sullivan JB Jr. Krieger GR.
Clinical Environmental Health and Toxic Exposures. 2nd Edition. *Lippincott Williams & Wilkins.*

WHO (World Health Organzation) (2011). Cadmium.10 Chemicals of major public health
concern. Available atwww.who.int/ipcs/features/cadmium.pdf - accessed 22 September 2011.

Wilhelm and Hafner, (1991). Fingernails as biological indices of metal exposure.

Yinn, (2000). Half-life of cadmium accumulated in the body.

Zamali Tarmudi (2009). An Overview of Municipal Solid Wastes Generation in Malaysia *Journal Teknologi, 51(F), December 2009. Universiti Teknologi Malaysia.*

Zhang, Y., Y. Zhao, (2004). *"Effect of environmental exposure to cadmium on pregnancy outcome and fetal growth: a study on healthy pregnant women in China."* Journal of Environmental Science and Health A39 (9): 2507-2715.

APPENDICES

BORANG B1: PENERANGAN DAN PERSETUJUAN RESPONDEN

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

1. TAJUK KAJIAN

Pengumpulan Kadmium dalam Kuku dan Kesan Kesihatan Kanak-kanak yang Tinggal Berhampiran Tapak Pelupusan Sampah Pajam, Negeri Sembilan.

2. PENGENALAN

Sisa yang dihasilkan oleh manusia adalah punca pencemaran alam sekitar dan sebahagian sisa ini dilupuskan di tapak pelupusan. Tapak pelupusan sisa mengeluarkan abu terbang, yang boleh mengandungi logam iaitu kadmium (Cd). Satu kajian baru-baru ini mendapati bahawa kanak-kanak yang tinggal berhampiran tapak pelupusan boleh terdedah kepada bahan kimia yang boleh mengurangkan fungsi sistem imun dan membawa kepada peningkatan risiko jangkitan (EPA 2003). Berbanding dengan kanak-kanak yang tinggal di kawasan yang bersih, kajian itu mendapati bahawa "kanak-kanak yang tinggal berhampiran tapak sisa buangan, sama ada tapak pelupusan atau kawasan air tercemar, dimasukkan ke hospital lebih kerap dengan jangkitan pernafasan akut. Kanak-kanak yang tinggal berhampiran tapak pelupusan juga telah menaikkan kadar kemasukan ke hospital untuk penyakit asma (Carpenter 2006). Oleh itu, kajian ini dijalankan untuk menentukan hubungan pengumpulan kadmium dalam kuku dan kesan-kesan kesihatan bersekutu kanak-kanak yang tinggal berhampiran dengan tapak pelupusan Panchang Bedena di Sabak Bernam, Selangor.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Responden dikehendaki untuk menjawab soalan dalam borang soal selidik untuk mendapatkan maklumat berkaitan dengan kajian ini. Borang soal selidik akan diberikan kepada penjaga untuk dijawab dirumah. Responden juga akan dibekalkan pengetip kuku serta beg plastik untuk mengambil sampel kuku. Sampel kuku akan diambil dirumah oleh penjaga masing-masing. Kuku yang diperlukan adalah kuku jari tangan sahaja tidak termasuk kuku jari kaki. Jumlah kuku yang diperlukan adalah sebanyak 1g iaitu kuku dari kedua-dua belah tangan kanan dan tangan kiri. Setelah dua minggu, responden perlu membawa sampel kuku yang telah diambil ke sekolah untuk dikumpulkan semula.

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Individu yang berumur di bawah 6 tahun dan atas 11 tahun dan menghidap penyakit kronik tidak boleh menyertai kajian ini.

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

(a) KEPADA ANDA SEBAGAI SUBJEK?

Ia akan membantu organisasi untuk mengetahui mengenai kekerapan melakukan aktiviti luar berhampiran tapak pelupusan dan pendedahan terhadap kadmium dalam kehidupan seharian. Sebarang maklumat akan diberikan kepada ibu bapa/penjaga responden sekiranya kandungan kadmium dapat dikenalpasti dalam kuku responden dan perkhidmatan kaunseling/pakar perubatan akan disediakan jika perlu.

(b) KEPADA PENYELIDIK?

Ia akan membantu penyelidik untuk mengenal pasti faktor-faktor yang berhubungkait dengan kepekatan kadmium dalam sampel kuku.

6. ADAKAH IA BERISIKO?

Tiada sebarang risiko dalam kajian ini.

7. ADAKAH MAKLUMAT DAN IDENTITI SAYA KEKAL RAHSIA?

Segala maklumat yang diterima dari responden dan identiti responden kekal rahsia.

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

Untuk pertanyaan dengan lebih lanjut, anda boleh menghubungi Dr Sharifah Norkhadijah Syed Ismail, Supervisor kajian di talian 012-2646712 atau Nurizzati Yazib, penyelidik di talian 019-5201283.

*Sila tandatangan disini sekiranya anda telah membaca dan memahami kandungan halaman ini*_____

9. PERSETUJUAN

Saya..... No Kad Pengenalan. .....
beralamat.....
.....dengan ini bersetuju untuk mengambil bahagian secara sukarela dalam penyelidikan yang tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/soal selidik).

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

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

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

*potong yang tidak berkenaan

Tandatangan..... Tandatangan.....
(*Responden*) (*Saksi*)

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

No. K/P:.....

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

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

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

BORANG B2: PENERANGAN DAN PERSETUJUAN IBUBAPA/PENJAGA

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

1. TAJUK KAJIAN

Pengumpulan Kadmium dalam Kuku dan Kesan Kesihatan Kanak-kanak yang Tinggal Berhampiran Tapak Pelupusan Sampah Pajam, Negeri Sembilan.

2. PENGENALAN

Sisa yang dihasilkan oleh manusia adalah punca pencemaran alam sekitar dan sebahagian sisa ini dilupuskan di tapak pelupusan. Tapak pelupusan sisa mengeluarkan abu terbang, yang boleh mengandungi logam iaitu kadmium (Cd). Satu kajian baru-baru ini mendapati bahawa kanak-kanak yang tinggal berhampiran tapak pelupusan boleh terdedah kepada bahan kimia yang boleh mengurangkan fungsi sistem imun dan membawa kepada peningkatan risiko jangkitan (EPA 2003). Berbanding dengan kanak-kanak yang tinggal di kawasan yang bersih, kajian itu mendapati bahawa "kanak-kanak yang tinggal berhampiran tapak sisa buangan, sama ada tapak pelupusan atau kawasan air tercemar, dimasukkan ke hospital lebih kerap dengan jangkitan pernafasan akut. Kanak-kanak yang tinggal berhampiran tapak pelupusan juga telah menaikkan kadar kemasukan ke hospital untuk penyakit asma (Carpenter 2006). Oleh itu, kajian ini dijalankan untuk menentukan hubungan pengumpulan kadmium dalam kuku dan kesan-kesan kesihatan bersekutu kanak-kanak yang tinggal berhampiran dengan tapak pelupusan Panchang Bedena di Sabak Bernam, Selangor.

3. APAKAH YANG PERLU ANDA LAKUKAN?

Responden dikehendaki untuk menjawab soalan dalam borang soal selidik untuk mendapatkan maklumat berkaitan dengan kajian ini. Borang soal selidik akan diberikan kepada penjaga untuk dijawab dirumah. Responden juga akan dibekalkan pengetip kuku serta beg plastik untuk mengambil sampel kuku. Sampel kuku akan diambil dirumah oleh penjaga masing-masing. Anda perlu mengambil sampel kuku responden (anak) yang telah dipilih. Kuku yang diperlukan adalah kuku jari tangan sahaja tidak termasuk kuku jari kaki. Jumlah kuku yang diperlukan adalah sebanyak 1g iaitu kuku dari kedua-dua belah tangan kanan dan tangan kiri. Setelah dua minggu, responden perlu membawa sampel kuku yang telah diambil ke sekolah untuk dikumpulkan semula.

4. SIAPA YANG TIDAK BOLEH MENYERTAI KAJIAN INI?

Individu yang berumur di bawah 6 tahun dan atas 11 tahun dan menghidap penyakit kronik tidak boleh menyertai kajian ini.

5. APAKAH FAEDAH MENYERTAI KAJIAN INI?

(a) KEPADA ANAK/JAGAAN SAYA SEBAGAI PESERTA?

Ia akan membantu organisasi untuk mengetahui mengenai kekerapan melakukan aktiviti luar berhampiran tapak pelupusan dan pendedahan terhadap kadmium dalam kehidupan seharian. Sebarang maklumat akan diberikan kepada ibu bapa/penjaga responden sekiranya kandungan kadmium dapat dikenalpasti dalam kuku responden dan perkhidmatan kaunseling/pakar perubatan akan disediakan jika perlu.

(b) KEPADA PENYELIDIK?

Ia akan membantu penyelidik untuk mengenal pasti faktor-faktor yang berhubungkait dengan kepekatan kadmium dalam sampel kuku.

6. ADAKAH IA BERISIKO?

Tiada sebarang risiko dalam kajian ini.

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

Segala maklumat yang diterima dari responden dan identiti responden kekal rahsia.

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

Untuk pertanyaan dengan lebih lanjut, anda boleh menghubungi Dr Sharifah Norkhadijah Syed Ismail, Supervisor kajian di talian 012-2646712 atau Nurizzati Yazib, penyelidik di talian 019-5201283.

*Sila tandatangan disini sekiranya anda telah membaca dan memahami kandungan halaman ini*_____

9. PERSETUJUAN

Saya..... No Kad Pengenalan. .....
beralamat.....
.....dengan ini secara sukarela bersetuju membenarkan *anak/jagaan saya.....menyertai penyelidikan tersebut di atas *(kajian klinikal/percubaan ubat-ubatan/rakaman video/kumpulan sasaran/temuduga/soal selidik).

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

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

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

*potong yang tidak berkenaan

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

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

No. K/P:.....

Saya mengesahkan bahawa saya telah menerangkan kepada ibubapa/penjaga responden ini sifat dan tujuan penyelidikan yang tersebut diatas.

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

Nama Penyelidik:
Nurizzati Yazib
No tel.: 019-5201283

No. tel. ibu/bapa(akan dihubungi jika borang soal selidik tidak lengkap):

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

NO. ☐☐☐
TARIKH ☐☐☐

BORANG SOAL SELIDIK

PENGUMPULAN KADMIUM DALAM KUKU DAN KESAN KESIHATAN KANAK-KANAK YANG TINGGAL BERHAMPIRAN TAPAK PELUPUSAN SISA PEPEJAL PERBANDARAN

Arahan kepada ibubapa atau penjaga:

Sila jawab **semua** soalan dengan jujur dan terang

Bagi bapa tunggal/ibu tunggal/ penjaga sila jawab soalan yang berkaitan sahaja.

Terima kasih di atas kerjasama anda

Soal selidik ini mengandungi 24 helaian bercetak (termasuk muka depan)

NOTIS:
Semua maklumat yang diisi adalah rahsia. Maklumat yang diberikan adalah untuk rujukan penyelidik dan penyelidikan sahaja.

BAHAGIAN I: SOSIO-DEMOGRAFI

Soalan ini berkaitan dengan status sosio-demografi keluarga anda. Sila jawab semua soalan. Bagi bapa tunggal/ibu tunggal/penjaga sila jawab soalan yang berkaitan sahaja.

MAKLUMAT BAPA/PENJAGA(LELAKI)

1. Sila nyatakan sama ada anda adalah:
   - ☐ Bapa kandung
   - ☐ Bapa tiri
   - ☐ Bapa angkat
   - ☐ Lain-lain _____(sila nyatakan *contoh abang, abang saudara, sepupu, pakcik*)

2. Bangsa:
   - ☐ Melayu
   - ☐ India
   - ☐ Cina
   - ☐ Lain-lain _____(sila nyatakan)

3. Sila nyatakan tarikh lahir anda:
   Tarikh lahir (hari/bulan/tahun) : _____/_____/_____

4. Sila nyatakan berat (kg) and tinggi (cm) anda:
   Berat : _____kg
   Tinggi: _____cm

5. Kelayakan tertinggi akademik anda:
   - ☐ Tidak bersekolah
   - ☐ SRP/PMR
   - ☐ SPM
   - ☐ Diploma
   - ☐ Ijazah Sarjana Muda
   - ☐ Ijazah Sarjana
   - ☐ Doktor Falsafah

5. Status pekerjaan sekarang:

☐ Bekerja sepenuh masa

☐ Bekerja sambilan

☐ Tidak bekerja (*Jika tidak bekerja, sila abaikan soalan 5(a) dan 6 dibawah*)

5 (a). Jika bekerja, sila nyatakan nama pekerjaan dan bidang/industri pekerjaan

Nama pekerjaan: _____

Bidang/Industri: _____

6. Pendapatan semasa dalam sebulan:

☐ Dibawah RM 500

☐ RM 501-1000

☐ RM 1001-1500

☐ RM 1501-2000

☐ RM 2001-2500

☐ RM 2501-3000

☐ Diatas RM 3001

MAKLUMAT IBU/PENJAGA (PEREMPUAN)

7. Sila nyatakan sama ada anda adalah:

☐ Ibu kandung

☐ Ibu tiri

☐ Ibu angkat

☐ Lain-lain _____(sila nyatakan *contoh kakak, kakak saudara, makcik, sepupu*)

8. Bangsa:

☐ Melayu

☐ India

☐ Cina

☐ Lain-lain _____(sila nyatakan)

9. Sila nyatakan tarikh lahir anda:

Tarikh lahir (hari/bulan/tahun) : _____/_____/_____

10. Sila nyatakan berat (kg) and tinggi (cm) anda:

Berat : _____kg

Tinggi: _____cm

11. Kelayakan tertinggi akademik anda:

- ☐ Tidak bersekolah
- ☐ SRP/PMR
- ☐ SPM
- ☐ Diploma
- ☐ Ijazah Sarjana Muda
- ☐ Ijazah Sarjana
- ☐ Doktor Falsafah

12. Status pekerjaan sekarang:

- ☐ Bekerja sepenuh masa
- ☐ Bekerja sambilan
- ☐ Tidak bekerja (*Jika tidak bekerja, sila abaikan soalan12 (a)dan 13 dibawah*)

12 (a). Jika bekerja, sila nyatakan nama pekerjaan dan bidang/industri pekerjaan:

Nama pekerjaan: _____

Bidang/Industri: _____

13. Pendapatan semasa dalam sebulan:

- ☐ Dibawah RM 500
- ☐ RM 501-1000
- ☐ RM 1001-1500
- ☐ RM 1501-2000
- ☐ RM 2001-2500
- ☐ RM 2501-3000
- ☐ Diatas RM 3001

MAKLUMAT ANAK

(***Responden** : *Anak yang dipilh oleh penyelidik dalam kajian ini, berumur di antara 7 hingga 11 tahun*)

14. Berapa bilangan ahli keluarga yang tinggal di rumah anda sekarang (termasuk anda dan pasangan)?

☐ 2 orang	☐ 7 orang	☐ 12 orang
☐ 3 orang	☐ 8 orang	☐ 13 orang
☐ 4 orang	☐ 9 orang	
☐ 5 orang	☐ 10 orang	
☐ 6 orang	☐ 11 orang	

15. Sudah berapa lama anda sekeluarga tinggal di kawasan ini? ☐ tahun

16. Sila nyatakan alamat penuh rumah terkini:

No. rumah: _____

Taman/Jalan/Lorong: _____

Poskod: _____

Daerah: _____

Negeri: _____

17. Bilangan anak anda:

☐ seorang	☐ 7 orang
☐ 2 orang	☐ 8 orang
☐ 3 orang	☐ 9 orang
☐ 4 orang	☐ 10 orang
☐ 5 orang	☐ 11 orang
☐ 6 orang	☐ 12 orang atau lebih

18. Sila nyatakan maklumat anak anda dalam ruangan di bawah (lampirkan kertas berasingan jika ruangan dibawah tidak mencukupi).

Bil	Nama	Jantina (P/L)	Tarikh Lahir (Hari/Bulan/Tahun)	Berat Lahir (kg)	Berat Sekarang (kg)	Tinggi Sekarang (cm)

19. Nama anak yang dipilih sebagai ***responden** oleh penyelidik:

_____

20. Di bandar atau di pekan manakah anak anda (***responden**) lahir?

Sila nyatakan: _____

21. Sila nyatakan pada usia berapa anak anda (***responden**) berhenti menyusu susu ibu:

_____

22. Alamat sekolah anak anda (***responden)** sekarang :

_____

_____

_____

_____

_____

MAKLUMAT HAIWAN PELIHARAAN

23. Adakah anda memelihara haiwan peliharan **di dalam** rumah?

☐ Ya ☐ Tidak (abaikan soalan 23(a) dibawah jika jawapan anda "Tidak")

23 (a). Jika ***"Ya"* pada 23 di atas**, apakah jenis haiwan peliharaan anda? (Boleh tanda lebih dari satu)

☐ Kucing

☐ Anjing

☐ Arnab

☐ Lain-lain, sila nyatakan: _____

BAHAGIAN II: KESIHATAN PERNAFASAN ANAK ANDA (RESPONDEN)

Soalan ini berkaitan dengan kesihatan pernafasan anak anda. Pilih yang berkaitan.

MAKLUMAT BERKENAAN BATUK

24. Adakah responden biasanya menghidap batuk **dengan** selsema?

☐ Ya ☐ Tidak (abaikan soalan 24(a) dibawah jika jawapan anda "tidak")

24 (a). Berapa kerap responden menghidap batuk **dengan** selsema?

- ☐ Sangat kerap (Setiap hari)
- ☐ Kerap (1minggu sekali)
- ☐ Kadang-kala (1-3 bulan sekali)
- ☐ Jarang (6-8 bulan sekali)
- ☐ Sangat jarang (1 tahun sekali)
- ☐ Tidak pernah

25. Adakah responden biasanya menghidap batuk **tanpa** selsema?

☐ Ya ☐ Tidak (abaikan soalan 25(a)-25(c) dibawah jika jawapan anda "Tidak")

Jika **"Ya"** pada soalan 25 diatas, sila jawab soalan 25(a) hingga 25(c) dibawah.

25 (a). Berapa kerap biasanya responden batuk **tanpa** selsema?

- ☐ Sangat kerap (Setiap hari)
- ☐ Kerap (1minggu sekali)
- ☐ Kadang-kala (1-3 bulan sekali)
- ☐ Jarang (6-8 bulan sekali)
- ☐ Sangat jarang (1 tahun sekali)
- ☐ Tidak pernah

25 (b). Dalam tempoh 3 bulan pada tahun ini, pernahkah responden batuk pada kebanyakan hari (selama 4 hari atau lebih dari seminggu)?

☐ Ya ☐ Tidak ☐ Tidak pernah lansung

25 (c). Sudah berapa tahun responden menghidap batuk ini?

_____tahun

MAKLUMAT BERKENAAN SESAK DADA

26. Adakah responden selalu mengalami sesak dada atau mempunyai **selsema dan kahak**?

☐ Ya ☐ Tidak

27. Berapa kerap responden mengalami sesak dada?

- ☐ Sangat kerap (Setiap hari)
- ☐ Kerap (1minggu sekali)
- ☐ Kadang-kala (1-3 bulan sekali)
- ☐ Jarang (6-8 bulan sekali)
- ☐ Sangat jarang (1 tahun sekali)
- ☐ Tidak pernah

28. Adakah responden selalu mengalami sesak dada atau mempunyai **kahak tanpa selsema**?

☐ Ya ☐ Tidak

29. Dalam tempoh 3 bulan dalam setahun, pernahkah responden mengalami sesak dada atau selalu mempunyai kahak atau lendir dalam dada (selama 4 hari atau lebih seminggu)?

☐ Ya ☐ Tidak ☐ Tidak pernah lansung

Jika **"*Ya*" pada 23 di atas,** sila jawab soalan 29(a) hingga 29(c) dibawah.

29 (a). Sudah berapa lama responden menghidap penyakit ini?

_____tahun ☐ Tidak pernah lansung

29 (b). Dalam tempoh selama 1 minggu atau lebih dalam setahun, adakah serangan batuk, sesak dada dan kahak responden semakin bertambah?

☐ Ya ☐ Tidak

29 (c). Sudah berapa tahun responden mendapat serangan ini?

_____tahun

30 . Secara purata, berapa kerap responden menghidap selsema dalam setahun?

- ☐ Sangat kerap (Setiap hari)
- ☐ Kerap (1minggu sekali)
- ☐ Kadang-kala (1-3 bulan sekali)
- ☐ Jarang (6-8 bulan sekali)
- ☐ Sangat jarang (1 tahun sekali)
- ☐ Tidak pernah

MAKLUMAT BERKENAAN DADA BERDEHIT/BERSIUL

31. Pernahkah dada responden berbunyi seperti berdehit atau bersiul:

A. Ketika selsema	☐ Ya	☐ Tidak
B. Kadang-kadang tanpa selsema	☐ Ya	☐ Tidak
C. Pada waktu siang	☐ Ya	☐ Tidak
D. Pada waktu malam	☐ Ya	☐ Tidak

31 (a). Berapa kerap bunyi berdehit atau bersiul di dada responden ini hadir?

☐ Setiap hari ☐ Tidak pernah

☐ Setiap minggu

☐ Setiap 3 bulan

☐ Setiap 6 bulan

☐ Sekali setahun

31 (b). Sudah berapa tahun responden mengalami dada berdehit atau bersiul?

_____tahun

32. Adakah responden pernah mendapat serangan dada berdehit dan sesak nafas?

☐ Ya ☐ Tidak (abaikan soalan 32(a)-32(d) dibawah jika jawapan anda "Tidak")

Jika **"*Ya*" pada soalan 32 di atas,** sila jawab soalan **32 (a) hingga 32 (d)** di bawah.

32 (a). Dalam tempoh 4 minggu yang lepas, adakah responden mengalami 2 atau lebih serangan sesak nafas?

☐ Ya ☐ Tidak

32 (b). Adakah responden memerlukan ubat atau rawatan untuk serangan ini?

☐ Ya ☐ Tidak

Jika ya, sila nyatakan jenis ubat atau rawatan untuk itu:

_____

32 (c). Di usia berapa responden mendapat serangan dada berdehit/bersiul yang pertama?
Umur _____ tahun

32 (d). Adakah pernafasan responden normal ketika mengalami dada berdehit/bersiul?

☐ Ya ☐ Tidak

33. Adakah responden terlibat secara aktif dalam apa-apa aktiviti sukan di sekolah?

☐ Ya ☐ Tidak

Jika **ya**, nyatakan jenis sukan: _____

33 (a). Jika **"*Ya*" pada 33 di atas**, berapa kerap responden melibatkan diri dalam aktiviti sukan?

☐ Setiap hari

☐ Dua/tiga kali seminggu

☐ Sekali seminggu

☐ Sekali sebulan

☐ Sekali setahun

34. Adakah responden pernah mendapat serangan dada berdehit selepas bermain atau bersenam?

☐ Ya ☐ Tidak (abaikan soalan 34(a) dibawah jika jawapan anda "Tidak")

34 (a). Jika **"*Ya*" pada 34 di atas**, berapa kerap responden mendapat serangan dada berdehit selepas bermain atau bersenam?

☐ Setiap hari

☐ Setiap minggu

☐ Setiap 3 bulan

☐ Setiap 6 bulan

☐ Sekali setahun

MAKLUMAT BERKENAAN SAKIT DADA

35. Dalam 3 tahun yang lalu, adakah responden mempunyai apa-apa sakit dada yang telah menghalang beliau melakukan aktiviti biasa melebihi 3 hari?

☐ Ya ☐ Tidak (abaikan soalan 35(a)-35(d) dibawah jika jawapan anda tidak)

Jika **"*Ya*" pada soalan 35 di atas,** sila jawab soalan **35 (a) hingga 35 (d)** di bawah.

35 (a). Berapa kerap responden mendapat sakit dada yang menghalang beliau melakukan aktiviti biasa ?

☐ Setiap hari ☐ Sekali sebulan

☐ Tiga kali seminggu ☐ Sekali setiap 3-6 bulan)

☐ Sekali seminggu ☐ Sekali setahun

35 (b). Berapa kerap sakit dada yang dihidapi dalam tempoh 3 tahun yang lalu?

- ☐ Sangat kerap (Setiap hari)
- ☐ Kerap (1minggu sekali)
- ☐ Kadang-kala (1-3 bulan sekali)
- ☐ Jarang (6-8 bulan sekali)
- ☐ Sangat jarang (1 tahun sekali)
- ☐ Tidak pernah

35 (c). Sudah berapa tahun sakit dada ini telah hadir?

_____ tahun ☐ Tidak pernah lansung

35 (d). Adakah responden pernah dimasukkan ke hospital untuk sakit dada yang teruk sebelum berumur 2 tahun?

- ☐ Ya, lebih dari 4 kali dalam tempoh umur 2 tahun
- ☐ Ya, 3 kali dalam tempoh umur 2 tahun
- ☐ Ya, 2 kali dalam tempoh umur 2 tahun
- ☐ Ya, sekali dalam tempoh umur 2 tahun
- ☐ Tidak pernah langsung

MAKLUMAT BERKENAAN GEJALA-GEJALA LAIN

36. Adakah responden mempunyai gejala awal ini pada usia kurang 6 bulan selama 1atau 2 minggu? (Boleh tanda lebih dari satu)

A. Hidung berair atau tersumbat	☐ Ya	☐ Tidak	☐ Tidak pasti
B. Bersin	☐ Ya	☐ Tidak	☐ Tidak pasti
C. Mata berair	☐ Ya	☐ Tidak	☐ Tidak pasti
D. Batuk yang kering	☐ Ya	☐ Tidak	☐ Tidak pasti
E. Sakit tekak	☐ Ya	☐ Tidak	☐ Tidak pasti
F. Suhu tinggi sedikit dari normal	☐ Ya	☐ Tidak	☐ Tidak pasti
G. Sentiasa kelihatan tidak sihat	☐ Ya	☐ Tidak	☐ Tidak pasti

36(a). Jika ***"Ya"*** **kepada SATU atau SEMUA gejala di atas**, pernahkah responden ketika usia 6 bulan ke bawah menghadapi gejala yang lebih teruk selepas satu atau dua minggu seperti di bawah? (Boleh tanda lebih dari satu)

A. Batuk teruk dan kahak yang pekat	☐ Ya	☐ Tidak	☐ Tidak pasti
B. Bunyi berciut selepas batuk	☐ Ya	☐ Tidak	☐ Tidak pasti
C. Muntah selepas batuk	☐ Ya	☐ Tidak	☐ Tidak pasti
D. Letih dan kemerahan di muka, kerana batuk	☐ Ya	☐ Tidak	☐ Tidak pasti

Jika ***"Ya"*** **kepada SEMUA gejala di 36(a)**, sila jawab soalan **36(b)hingga 36(d)**.

36 (b). Pernahkah doktor mengdiagnosis bahawa responden menghidap batuk Kokol *(Pertusis)?*

☐ Ya ☐ Tidak

36 (c). Adakah responden masih mempunyai batuk kokol ketika ini? ☐ Ya ☐ Tidak

36 (d). Adakah responden sedang mengambil ubatan atau rawatan untuk batuk kokol?

☐ Ya ☐ Tidak

Sila nyatakan apa jenis rawatan perubatan yang sedang beliau ambil?
Perubatan / Rawatan:_____

37. Pernahkah doktor mengdiagnosis bahawa responden mempunyai asma?

☐ Ya ☐ Tidak (abaikan soalan 37(a)-(e) jika jawapan anda "Tidak")

Jika **"Ya" untuk 37 diatas,** sila jawab **soalan 37(a) hingga 37(e).**

37 (a). Bilakah responden menghidap asma? Berumur _____tahun

37 (b). Adakah responden masih mempunyai asma? ☐ Ya ☐ Tidak

37 (c). Adakah responden sedang mengambil ubatan atau rawatan untuk asma? ☐ Ya ☐ Tidak

37 (d). Jika **ya**, sila nyatakan jenis ubat atau rawatan diambil kini?
Perubatan /
Rawatan:_____

Jika **"Tidak" kepada soalan 37 (b).**

37 (e). Pada usia berapa asma responden telah berhenti? _____ tahun

38. Adakah responden pernah menghidapi penyakit berikut? Jika **ya**, pada usia berapa? (Boleh tanda lebih dari satu)

		Di diagnosis pada usia
A. Campak	☐ Ya ☐ Tidak	_____tahun
B. Masalah resdung	☐ Ya ☐ Tidak	_____tahun
C. Bronkiolitis	☐ Ya ☐ Tidak	_____tahun
D. Bronkitis	☐ Ya ☐ Tidak	_____tahun
E. Asma bronkitis	☐ Ya ☐ Tidak	_____tahun
F. Pneumonia	☐ Ya ☐ Tidak	_____tahun
H. Batuk yang kuat	☐ Ya ☐ Tidak	_____tahun
I. Cystic fibrosis	☐ Ya ☐ Tidak	_____tahun

BAHAGIAN III: MAKLUMAT ALAHAN ANAK (RESPONDEN)

Soalan-soalan ini adalah berkaitan alahan anak anda. Sila pilih mana yanag berkaitan.

39. Adakah responden pernah mengalami tanda-tanda/gejala seperti yang di bawah?

A. Ruam yang biasanya bermula di lipatan siku atau lutut / leher / pergelangan tangan / kaki dan / atau lipatan antara punggung dan kaki. ☐ Ya ☐ Tidak
Jika **ya**, pada usia : Umur _____ tahun

B. Gatal, kering dan bersisik tompok di tempat ruam muncul ☐ Ya ☐ Tidak
Jika **ya**, usia usia : Umur _____ tahun

C. Warna kulit pudar (atau gelap) di tempat ruam muncul ☐ Ya ☐ Tidak
Jika **ya**, pada usia : Umur _____ tahun

40. Adakah doktor pernah mengdiagnosis responden menghidap ekzema sebelum usia 2 tahun?

☐ Ya ☐ Tidak

41. Adakah doktor pernah mengdiagnosis responden mempunyai reaksi alahan kepada makanan atau ubat?

☐ Ya, kedua-dua makanan dan ubat.
Sila nyatakan jenis makanan dan ubat :_____

☐ Ya, makanan sahaja
Sila nyatakan jenis makanan :_____

☐ Ya, ubatan sahaja
Sila nyatakan jenis ubat :_____

☐ Tidak

42. Adakah responden pernah di diagnosis mempunyai alahan kepada debunga atau habuk?
☐ Ya ☐ Tidak

43. Adakah responden pernah di diagnosis mempunyai alahan kulit kepada bahan pencuci atau bahan kimia yang lain?
☐ Ya ☐ Tidak

Jika **ya**, sila nyatakan jenis bahan pencuci atau bahan kimia:_____

44. Adakah responden pernah menerima suntikan alahan?

☐ Ya ☐ Tidak (abaikan soalan 44 dibawah jika jawapan anda "Tidak")

44(a). Jika ***"Ya"*** pada **44 diatas**, berapa kerap responden menerima suntikan alahan?

☐ Sekali seminggu
☐ Sekali sebulan
☐ Sekali setiap 3 bulan
☐ Sekali setiap 6 bulan
☐ Sekali setahun

BAHAGIAN IV: MAKLUMAT KESIHATAN BUAH PINGGANG ANAK (RESPONDEN)

Soalan-soalan ini berkaitan dengan kesihatan buah pinggang anak anda. Sila pilih mana yang berkaitan.

45. Pernahkah responden mengalami gejala di bawah?

a.) Kerap membuang air kecil	☐ Ya	☐ Tidak	☐ Tidak pasti
b.) Rasa letih	☐ Ya	☐ Tidak	☐ Tidak pasti
c.) Sakit/pening kepala	☐ Ya	☐ Tidak	☐ Tidak pasti
d.) Hilang selera makan	☐ Ya	☐ Tidak	☐ Tidak pasti
e.) Sakit perut atau loya/muntah	☐ Ya	☐ Tidak	☐ Tidak pasti
f.) Bengkak di tangan/kaki/muka	☐ Ya	☐ Tidak	☐ Tidak pasti
g.) Ruam & gatal di tubuh	☐ Ya	☐ Tidak	☐ Tidak pasti
h.) Kulit menjadi gelap	☐ Ya	☐ Tidak	☐ Tidak pasti
i.) Berat badan menurun	☐ Ya	☐ Tidak	☐ Tidak pasti
j.) Gejala seperti selsema	☐ Ya	☐ Tidak	☐ Tidak pasti
k.) Sukar menumpukan perhatian dan prestasi di sekolah menurun	☐ Ya	☐ Tidak	☐ Tidak pasti

45 (a). Jika ***"Ya"*** **kepada <u>SEMUA</u> gejala di atas**, berapa kerap responden mengalami gejala ini?

☐ Sekali seminggu

☐ Sekali sebulan

☐ Sekali setiap 3 bulan

☐ Sekali setiap 6 bulan

☐ Sekali setahun

Sila nyatakan usia responden ketika mula meghidapi gejala ini : Umur_____tahun

45 (b). Adakah pembesaran responden kelihatan terbantut atau perlahan berbanding dengan rakan-rakan dalam kumpulan umur yang sama?

☐ Ya ☐ Tidak

46. Pernahkah doktor mendiagnosis responden mempunyai masalah buah pinggang?

☐ Ya ☐ Tidak

47. Pernahkah responden menghidap Jangkitan Saluran Kencing (UTI)?

☐ Ya ☐ Tidak (abaikan soalan 47(a) dibawah jika jawapan anda"Tidak")

Jika **ya**, sila nyatakan pada usia berapa responden telah mula mendapat jangkitan ini
Umur_____ tahun

47 (a). Jika ***"Ya"***, berapa kerap responden mengalami Jangkitan Saluran Kencing (UTI)?

☐ Sekali seminggu ☐ Sekali setiap 6 bulan

☐ Sekali sebulan ☐ Sekali setahun

☐ Sekali setiap 3 bulan

BAHAGIAN V: MAKLUMAT TAHAP KOGNITIF & PERLAKUAN ANAK (RESPONDEN)

Soalan-soalan ini berkaitan dengan tahap kognitif dan tingkah laku anak anda. Sila pilih yang berkaitan.

48. Adakah responden pernah mengalami gejala berikut? Jika **ya**, pada usia berapa? (Boleh tanda lebih dari satu)

		Pertama didiagnosis pada usia
A. Pencapaian bahasa dan motor lambat	☐ Ya ☐ Tidak	_____tahun
B. Lemah penyebutan ucapan	☐ Ya ☐ Tidak	_____tahun
C. Lemah pemahaman atau penggunaan bahasa	☐ Ya ☐ Tidak	_____tahun
D. Sukar menumpukan perhatian	☐ Ya ☐ Tidak	_____tahun
E. Hiperaktif	☐ Ya ☐ Tidak	_____tahun
F. Masalah dengan pembelajaran dan mengingat maklumat baru	☐ Ya ☐ Tidak	_____tahun
G. Tidak fleksibel dalam kebolehan menyelesaikan masalah	☐ Ya ☐ Tidak	_____tahun
H. Masalah mengawal tingkah laku (contohnya, agresif, impulsif)	☐ Ya ☐ Tidak	_____tahun
I. Masalah dengan koordinasi motor halus atau kasar	☐ Ya ☐ Tidak	_____tahun
J. Memerlukan pengawasan orang dewasa yang lebih	☐ Ya ☐ Tidak	_____tahun
K. Masalah pembelajaran di sekolah (membaca, bahasa, matematik, penulisan)	☐ Ya ☐ Tidak	_____tahun

BAHAGIAN VI: MAKLUMAT PENYAKIT LAIN (RESPONDEN)

Soalan-soalan ini berkaitan dengan penyakit lain anak anda. Sila pilih yang berkaitan.

49. Pernahkah responden mengalami jangkitan pada telinga luar (terusan telinga)?

☐ Ya ☐ Tidak (abaikan soalan 49(a) dibawah jika jawapan anda "Tidak")

49 (a). Jika ***"Ya"* pada 49 di atas**, berapa kerap responden mendapat jangkitan ini?

☐ Sekali seminggu
☐ Sekali sebulan
☐ Sekali setiap 3 bulan
☐ Sekali setiap 6 bulan
☐ Sekali setahun

49 (b). Pernahkah responden memerlukan tiub untuk mengeringkan telinga beliau?

☐ Ya ☐ Tidak (abaikan soalan 49(c) dibawah jika jawapan anda "Tidak")

49 (c) Jika ***"Ya"* pada 49 (b) di atas**, berapa kerapkah dia memerlukan tiub?

☐ Sekali seminggu
☐ Sekali sebulan
☐ Sekali setiap 3 bulan
☐ Sekali setiap 6 bulan
☐ Sekali setahun

50. Pernahkah responden menjalani pembedahan pada tonsil atau adenoid beliau?

☐ Ya ☐ Tidak

Jika **ya**, pada usia berapa :_____

51. Pernahkah responden menjalani pembedahan pada dada beliau?

☐ Ya ☐ Tidak

Jika **ya**, pada usia berapa:_____

52. Pernahkah doktor mendiagnosis responden menghidapi penyakit jantung?

☐ Ya ☐ Tidak

Jika **ya**, terangkan berkenaan penyakit jantung yang dihidapi;

_____

Pada usia berapa responden di sahkan menghidap penyakit jantung :_____

53. Pernahkah responden ditahan di hospital selepas selepas dilahirkan atas sebab-sebab tertentu?

☐ Ya ☐ Tidak

Jika **ya**, nyatakan sebab dan berapa lama:

_____

BAHAGIAN VII : MAKLUMAT TABIAT MEROKOK DALAM KELUARGA

Kami ingin mendapatkan beberapa maklumat mengenai ibu bapa atau penjaga yang tinggal dengan responden ini. **Sila isi bahagian A dan B.**

Sekiranya anda adalah **ibu atau bapa tunggal**, lengkapkan bahagian **A atau B.**

A. MAKLUMAT BAPA/PENJAGA LELAKI DALAM AMALAN MEROKOK

54. Adakah anda merokok secara **tetap** (sekurang-kurangnya 1batang rokok sehari atau 1 oz tembakau sebulan)?

☐ Ya ☐ Tidak

Jika **"ya"** sila tandakan seperti yang di bawah. Boleh pilih lebih dari satu:

☐ Rokok

☐ Cerut

☐ Paip

☐ Rokok serta paip dan / atau cerut

☐ Paip dan cerut

☐ Lain-lain. Nyatakan _____

55. Pernahkah anda merokok secara **berkala** (sekurang-kurangnya 20 pek rokok atau 12 oz tembakau) ketika tinggal bersama responden?

☐ Ya ☐ Tidak

Jika "**ya**" sila tandakan seperti yang dinyatakan di bawah. Boleh pilih lebih dari satu:

☐ Rokok

☐ Cerut

☐ Paip

☐ Rokok serta paip dan / atau cerut

☐ Paip dan cerut

☐ Lain-lain. Nyatakan _____

56. Pernahkah doktor mendiagnosis anda sebagai penghidap:

A. Bronkitis	☐ Ya	☐ Tidak	☐ Tidak pasti
B. Emfisema	☐ Ya	☐ Tidak	☐ Tidak pasti
C. Asma	☐ Ya	☐ Tidak	☐ Tidak pasti
E. Sakit pernafasan yang lain*	☐ Ya	☐ Tidak	☐ Tidak pasti

*Sila nyatakan : _____

B. MAKLUMAT IBU ATAU PENJAGA PEREMPUAN DALAM AMALAN MEROKOK

57. Adakah anda merokok secara **tetap** (sekurang-kurangnya 1batang rokok sehari atau 1 oz tembakau sebulan)?

☐ Ya ☐ Tidak

Jika "**ya**" sila tandakan seperti yang di bawah. Boleh pilih lebih dari satu:

☐ Rokok

☐ Cerut

☐ Paip

☐ Rokok serta paip dan / atau cerut

☐ Paip dan cerut

☐ Lain-lain. Nyatakan _____

58. Pernahkah anda merokok secara **berkala** (sekurang-kurangnya 20 pek rokok atau 12 oz tembakau) ketika tinggal bersama responden?

☐ Ya ☐ Tidak

Jika "**ya**" sila tandakan seperti yang dinyatakan di bawah. Boleh pilih lebih dari satu:

☐ Rokok

☐ Cerut

☐ Paip

☐ Rokok serta paip dan / atau cerut

☐ Paip dan cerut

☐ Lain-lain. Nyatakan _____

59. Pernahkah doktor mendiagnosis anda sebagai penghidap:

A. Bronkitis	☐ Ya	☐ Tidak	☐ Tidak pasti
B. Emfisema	☐ Ya	☐ Tidak	☐ Tidak pasti
C. Asma	☐ Ya	☐ Tidak	☐ Tidak pasti
E. Sakit pernafasan yang lain*	☐ Ya	☐ Tidak	☐ Tidak pasti

*Sila nyatakan : _____

MAKLUMAT AHLI ISI RUMAH YANG LAIN

60. Adakah ahli isi rumah yang lain kerap merokok di dalam rumah (tidak termasuk ibubapa)?

☐ Ya ☐ Tidak

Sila nyatakan bilangan rokok sehari dan di mana biasanya merokok (contoh 2 batang rokok, merokok di ruang tamu):

_____

BAHAGIAN VIII: MAKLUMAT GAYA HIDUP KELUARGA

Soalan-soalan ini berkaitan dengan gaya hidup keluarga anda. Sila tanda (✓) pada yang berkaitan.

Soalan 61	Setiap hari	3 kali seminggu	2 kali seminggu	1 kali seminggu	1 kali sebulan	Jarang (3-6 bulan sekali)	Tidak pernah
a. Kekerapan keluarga anda makan makanan di bawah dalam sebulan: 1. Nasi							
2. Daging							
3. Ayam							
6. Kerang-kerangan (*cth:lala/kupang/kerang/siput sedut*)							
6. Ikan							
7. Udang							
8. Sotong							
9. Ketam							
4. Sayur daun (*cth: sawi, bayam, salad*)							
5.Sayur buah (*cth: terung,cili,labu*)							
6. Ubi (*cth: kentang, keledek*)							
7. Kekacang dan bijirin							
b. Kekerapan keluarga anda makan makanan segera dalam sebulan: 1. Kentucky Fried Chicken							
2. Mc Donald							
3. Pizza Hut/Dominos							
4. A & W							
5. Burger King							
6. Subway							
7. Dunkin Donut/Big Apple							
8. Ayamas							
9. Kenny Rogers							

	Setiap hari	3 kali seminggu	2 kali seminggu	1 kali seminggu	1 kali sebulan	Jarang (3-6 bulan sekali)	Tidak pernah
d. *Sambungan-* **b. Kekerapan keluarga anda makan makanan segera dalam sebulan:** 10. Nando's							
11. Secret receipe							
c. Kekerapan keluarga anda makan makanan di bawah dalam sebulan: 1. Burger ayam/daging (yang di beli di pasaraya)							
2. Sosej ayam/daging (yang di beli di pasaraya)							
3. Mee segera (PaMa, Maggi, etc.)							
4. Nugget ayam/daging							
d. Kekerapan keluarga anda makan makanan dalam tin seperti di bawah dalam sebulan: 1. Sardin (dalam tin)							
2. Cendawan (dalam tin)							
3. Tomato Puri (dalam tin)							
4. Buah-buahan potong (dalam tin)							
5. Nenas (dalam tin)							
6. Laici (dalam tin)							
7. Kacang panggang/Baked beans (dalam tin)							
8. Tuna (dalam tin)							
9. Sotong (dalam tin)							
10. Kari (dalam tin)							
12. Sos Keju (dalam tin)							
13. Sambal udang/ikan bilis (dalam tin)							
14. Jagung (dalam tin)							

	Setiap hari	3 kali seminggu	2 kali seminggu	1 kali seminggu	1 kali sebulan	Jarang (3-6 bulan sekali)	Tidak pernah
e. Kekerapan keluarga anda minum minuman seperti di bawah dalam sebulan: 1. Minuman kordial (*sirap, sarsi, etc.*)							
2. Minuman bergas (*Cola, F&N, etc.*)							
3. Minuman beralkohol							
f. Kekerapan keluarga anda bersenam dalam sebulan: (*Contoh: Berlari, berjogging,berbasikal*)							

62. Adakah mana-mana ahli keluarga anda mempunyai masalah berat badan berlebihan atau obesiti?

☐ Ya ☐ Tidak

Jika **"ya"** sila nyatakan nama panggilan, hubungan anda dengan ahli keluarga yang mempunyai masalah berat badan: (*Contoh: Angah-Anak, Bang Long-Abang, Kak Ina-Sepupu)*

_____

_____

_____

63. Adakah mana-mana ahli keluarga anda mempunyai penyakit yang serius atau mana-mana penyakit yang diwarisi seperti kanser, kencing manis, gout atau masalah jantung?

☐ Ya ☐ Tidak

Jika **"ya"** sila nyatakan nama panggilan, hubungan anda dan jenis penyakit tersebut. (*Contoh: Angah-Anak (kanser kulit), Bang Long-Abang (sakit jantung), Kak Ina-Sepupu(kanser rahim)).*

_____

_____

_____

-TAMAT-