UNIVERSITI PUTRA MALAYSIA

KNOWLEDGE AND ATTITUDE REGARDING MERCURY HYGIENE AND THEIR PREDICTORS AMONG PRIMARY HEALTHCARE WORKERS IN SEREMBAN, NEGERI SEMBILAN

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Dissertation submitted to the Department of Community Health, Universiti Putra Malaysia, in fulfilment of the requirements for the Degree of Master of Public Health

July 2017

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Chairperson : Dr. Suhainizam Muhamad Saliluddin, MPH (OH) (UM)
Faculty : Medicine and Health Sciences

Background: Mercury poses a serious threat to human and environmental health. In Malaysia, health industry contributes to approximately 10% of mercury emission, mainly from incineration of medical waste, mercury-containing equipment and dental amalgams. Healthcare workers are potentially at risk for occupational mercury exposure, thus, should be equipped with proper training in mercury hygiene to ensure safety and health at work as well as to reduce the impact of mercury on the environment. Nevertheless, currently, data on knowledge and attitude regarding mercury hygiene among healthcare workers in Malaysia is scarce.

Objectives: To assess the level of and predictors for good knowledge and favourable attitude regarding mercury hygiene among primary healthcare workers in Seremban, Negeri Sembilan.

Methodology: An analytical cross-sectional study was conducted in health facilities in Seremban, Negeri Sembilan from April 2017 to June 2017 among 578 primary healthcare workers. Respondents were selected based on their job using proportionate stratified random sampling method and handed a validated self-administered questionnaire that focused on knowledge and attitude regarding mercury hygiene. Data was analysed using SPSS version 22.0. The Chi-square Test of Independence was used to determine the association between categorical variables. Multiple logistic regression using Enter method was used to identify significant predictors.

Results: The response rate was 91%. The median age of respondents was 33 years (*IQR* = 29, 38) and ranged from 22 to 59 years. The majority of respondents were staff nurses (20.0%), worked in health clinics (71.4%) and had less than 10 years of working experience (57.2%). Only 23.7% of the respondents had attended training in mercury hygiene, 15.4% had previous exposure to mercury spillage and 8.1% had prior experience in cleaning mercury spillage. The results showed that 81.2% of respondents had good knowledge while only 45.2% had favourable attitude towards mercury hygiene. Six factors, namely; level of education, monthly income, job, workplace, working experience in the Ministry of Health (MOH) and training in mercury hygiene, were found to be associated with knowledge and attitude regarding mercury hygiene. Significant predictor for good knowledge was job; being a health professional and a health associate professional increased the odds of attaining good knowledge by six (AOR = 5.94, 95% CI [2.25, 15.66], $p < 0.001$) and three times (AOR = 2.83, 95% CI [1.47, 5.46], $p = 0.002$), respectively, compared to a personal care workers in health service. Significant predictor for favourable attitude was good knowledge; respondents with good knowledge had three times higher odds of favourable attitude than those with poor knowledge (AOR = 2.75, 95% CI [1.66, 4.56], $p < 0.001$).

Conclusion: Attitude towards mercury hygiene among primary healthcare workers in Seremban was poor despite good knowledge. Future mercury hygiene awareness programme, education and training should focus on personal care workers in health service with emphasis on the importance of mercury hygiene and behaviourally-relevant knowledge.

Keywords: Mercury hygiene, healthcare worker, knowledge, attitude, predictor

Abstrak disertasi yang dikemukakan kepada Jabatan Kesihatan Komuniti, Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Sarjana Kesihatan Awam

PENGETAHUAN DAN SIKAP TERHADAP HIGEN MERKURI DAN FAKTOR PERAMAL DI KALANGAN KAKITANGAN PENJAGAAN KESIHATAN PRIMER DI SEREMBAN, NEGERI SEMBILAN

Oleh

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Latar belakang: Merkuri membawa ancaman serius terhadap kesihatan manusia dan alam sekitar. Di Malaysia, sektor kesihatan menyumbang sebanyak kira-kira 10% daripada pelepasan merkuri, kebanyakkannya daripada pembakaran sisa perubatan, peralatan yang mengandungi merkuri dan tampalan amalgam. Kakitangan penjagaan kesihatan adalah berisiko untuk terdedah kepada merkuri semasa bekerja, oleh sebab itu, mereka haruslah diberi latihan berkaitan higen merkuri demi memastikan keselamatan dan kesihatan semasa bekerja serta untuk mengurangkan kesan buruk merkuri terhadap alam sekitar. Walaubagaimanapun, buat masa ini, data berkaitan pengetahuan dan sikap terhadap higen merkuri di kalangan kakitangan penjagaan kesihatan di Malaysia adalah amat terhad.

Objektif: Untuk menentukan tahap dan faktor peramal bagi pengetahuan dan sikap yang baik terhadap higen merkuri di kalangan kakitangan penjagaan kesihatan primer di Seremban, Negeri Sembilan.

Kaedah kajian: Kajian analitik berbentuk tinjauan telah dilaksanakan di Seremban, Negeri Sembilan dari bulan April 2017 sehingga Jun 2017 di kalangan 578 kakitangan penjagaan kesihatan primer. Responden dipilih berdasarkan pekerjaan menggunakan kaedah pensampelan rawak berstrata mengikut nisbah dan diberi borang kaji selidik yang telah disahkan untuk dijawab secara seliaan sendiri berkaitan pengetahuan dan sikap terhadap higen merkuri. Data telah dianalisa menggunakan SPSS versi 22.0. Ujian Khi Kuasa Dua untuk Kebebasan telah

digunakan bagi penentuan hubungan antara pembolehubah berkategori. Regresi logistik berganda telah digunakan untuk mengenalpasti faktor peramal yang penting.

Keputusan: Kadar respon adalah 91%. Median umur bagi kesemua responden adalah 33 tahun (*IQR* = 29, 38) dan berusia dalam lingkungan 22 hingga 59 tahun. Majoriti responden merupakan jururawat terlatih (20.0%), bekerja di klinik-klinik kesihatan (71.4%) dan mempunyai pengalaman bekerja kurang dari 10 tahun (57.2%). Hanya 23.7% responden pernah menghadiri latihan dalam higen merkuri, 15.4% pernah terdedah kepada tumpahan merkuri dan 8.1% mempunyai pengalaman membersihkan tumpahan merkuri. Hasil kajian menunjukkan sebanyak 81.2% responden mempunyai pengetahuan yang baik manakala hanya 45.2% mempunyai sikap yang baik terhadap higen merkuri. Enam faktor, iaitu; tahap pendidikan, gaji bulanan, pekerjaan, tempat kerja, tempoh berkhidmat dalam Kementerian Kesihatan Malaysia (KKM) dan latihan dalam higen merkuri telah dikenalpasti mempunyai hubungan dengan pengetahuan dan sikap terhadap higen merkuri. Faktor peramal untuk pengetahuan yang baik adalah pekerjaan; kakitangan kesihatan profesional dan kakitangan kesihatan profesional bersekutu adalah enam (AOR = 5.94, 95% CI [2.25, 15.66], $p < 0.001$) dan tiga kali ganda (AOR = 2.83, 95% CI [1.47, 5.46], $p = 0.002$) lebih tinggi untuk mempunyai pengetahuan yang baik berbanding pembantu perawatan kesihatan. Faktor peramal untuk sikap yang baik adalah pengetahuan; responden dengan pengetahuan yang baik adalah tiga kali ganda lebih tinggi untuk mempunyai sikap yang baik berbanding dengan mereka yang mempunyai pengetahuan yang kurang memuaskan (AOR = 2.75, 95% CI [1.66, 4.56], $p < 0.001$).

Kesimpulan: Sikap terhadap higen merkuri di kalangan kakitangan penjagaan kesihatan primer di Seremban adalah kurang memuaskan, walaupun mempunyai tahap pengetahuan yang baik. Program-program kesedaran, pendidikan dan latihan berkaitan merkuri higen pada masa hadapan perlu difokuskan kepada pembantu perawatan kesihatan dengan penekanan terhadap kepentingan dan pengetahuan yang berkait rapat dengan tingkah laku terhadap higen merkuri.

Kata-kata kunci: Higen merkuri, kakitangan penjagaan kesihatan, pengetahuan, sikap, faktor peramal

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I certify that a Dissertation Examination Committee has met on 31st July 2017 to conduct the final examination of Zaza Hulwanee binti Mohd Zainee on her dissertation entitled "Knowledge and Attitude regarding Mercury Hygiene and their Predictors among Primary Healthcare Workers in Seremban, Negeri Sembilan" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U. (A) 106] 15 March 1998. The Committee recommends that the student be awarded the degree of Master of Public Health.

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LIST OF ABBREVIATIONS AND GLOSSARY OF TERMS

AAPOR	American Association for Public Opinion Research
ACGIH	American Congress of Governmental Industrial Hygienists
ALSPAC	Avon Longitudinal Study of Parents and Children
Amalgam	As applied to dentistry, a filling material composed of mercury, silver, tin, copper and zinc
Anecdotal	Not necessarily true or reliable, because based on personal accounts rather than facts or research
Anthropogenic	Environmental pollution or pollutants originating from human activity
AOR	Adjusted odds ratio
Aphrodisiac	An agent that stimulates sexual desires
ARDS	Adult respiratory distress syndrome
Artisanal	Traditional way
ASGM	Artisanal and small-scale gold mining
ATDSR	Agency for Toxic Substances and Disease Registry
Attitude	Attitude is related to peoples' behaviour and includes three components: 1) a cognitive or knowledge element 2) an affective or feeling element and 3) a tendency to action (Park, 1970).
Barometer	An instrument for measuring atmospheric pressure
BCE	Before common era
BEI	Biological exposure indices
Bioavailability	The proportion of a substance example heavy metal that enters the circulation when introduced into the body and so is able to have an active effect
Carcinogenicity	of, relating to, or causing cancer
Catalyst	A substance that increases the rate of a chemical reaction without itself undergoing any permanent chemical change.
CE	Current era
CHD	Coronary heart disease
CI	Confidence interval
CNS	Central nervous system
CVA	Cerebrovascular accidents
CVD	Cardiovascular diseases
DALY	Disability-adjusted life years
Dermal	of or relating to skin
DOE	Department of Environment Malaysia
DOSH	Department of Occupational Safety and Health, Malaysia
Dysphagia	Difficulty or discomfort in swallowing, as a symptom of disease
EEA	European Environment Agency
Effluent	Liquid waste or sewage discharged into a river or the sea

EPA	Environmental Protection Agency
Erethism	A state of abnormal mental excitement or irritation
Food chain	Food chain is a linear network starting from producer organisms and ending at the apex predator species
Food web	Food web is an intricate network of interdependent food chains
Fulminate	A salt or ester of fulminic acid
Hg	Elemental mercury
HPFS	Health Professionals Follow-up Study
Hygrometer	An instrument for measuring the humidity of the air or a gas.
IARC	International Agency for Research on Cancer
IDLH	Immediately dangerous to life or health
In vitro	(of a process) performed or taking place in a test tube, culture dish, or elsewhere outside a living organism
In vivo	(of a process) performed or taking place in a living organism.
JECFA	Joint FAO/WHO Expert Committee on Food Additives
Knowledge	Knowledge of mercury hygiene is what the health workers need to know about mercury safety example the common acute symptoms of mercury toxicity or the proper procedures for handling mercury spillage
Leachate	Water that has percolated through a solid and leached out some of the constituents
Manometer	An instrument for measuring the pressure acting on a column of fluid, especially one with a U-shaped tube of liquid in which a difference in the pressures acting in the two arms of the tube causes the liquid to reach different heights in the two arms
Mariculture	The cultivation of fish or other marine life for food
Mercury hygiene	Mercury hygiene is defined as proper handling and use of mercury in the healthcare setting
Miller-Abbott tubes	A tube used to treat obstructions in the small intestine through intubation
MOH	Ministry of Health Malaysia
MWQI	Marine Water Quality Index
NHS	National Health Service
NIOSH	National Institute for Occupational Safety and Health, Malaysia
OR	Odds ratio
Paresthesia	A sensation of prickling, tingling, or creeping on the skin
PEL	Permissible exposure limit
Prenatal period	Period before birth
PTWI	Provisional tolerable weekly intake
PVC	Polyvinyl chloride
RM	Ringgit Malaysia
Sphygmomanometer	An instrument for measuring and indicating blood pressure

SPSS	Statistical Package for Social Sciences
Teratogenicity	of, relating to, or causing malformations of an embryo or foetus
Thermometer	An instrument for measuring and indicating temperature
TLV	Threshold limit value
UK	United Kingdom
UNEP	United Nation Environment Program
USA	United States of America
Vermilion	A brilliant red pigment made from mercury sulphide (cinnabar)
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Background

Mercury is a natural heavy metal that can be found in the atmospheric, aquatic and terrestrial systems. Three most common forms of mercury are elemental mercury (Hg), organic mercury and inorganic mercury. Under normal pressure and at ambient temperature, elemental mercury is a shiny, silvery-white liquid metal that can readily evaporate to odourless and colourless mercury vapours. These vapours can last in the atmosphere for a significant period of time. In its various forms, mercury is a known toxicant to humans, animals and the environments even in trace amounts (Hajeb, Jinap, Ismail, & Mahyudin, 2012; Hammerschmidt, Sandheinrich, Wiener & Rada, 2002; Rice & Barone, 2000; Grandjean, Weihe & White, 1995; Nicholson, Kendall & Osborn, 1983).

The properties that make mercury exceptionally difficult to manage include its non-degradability and indestructibility by burning (Bigham, Henry & Bessinger, 2010), its bio-accumulative nature (Syaripuddin, Kumar, Sing, Halim, Nursyereen & Wilson, 2014; Bank, Chesney, Shine, Maage & Senn, 2007) and its tendency to bio-magnify (Hajeb, Jinap, & Ahmad, 2010a). Bio-accumulation is the gradual build-up of mercury in a living organism; this occurs because it cannot be broken down for use by the organism (Bio-accumulation, n.d.). On the other hand, bio-magnification is the phenomenon where the amount of mercury is small in a living organism at the lowest level of the food chain and may not cause any damage to the organism, but will continue to multiply towards the top of the food web, resulting in top predators having the highest level of mercury accumulated in their bodies (Bio-magnification, n.d.). Humans, being at the top of the food chain, will be affected the most (Zahir, Rizwi, Haq & Khan, 2005). For these reasons, mercury poses a major public health concern, despite its various unique chemical properties that are useful to humans.

In the nineteenth century, Europe and North America were the dominant mercury-emitting regions, but the trend had shifted slowly to Russia and subsequently to Asia. Since 1950, Asia has been the dominant mercury-emitting region. It was approximated that in 2008, Asia had contributed 64% of total worldwide mercury emission (Streets et al., 2011). Human activities has been one of the major contributors to mercury emission. It was estimated that the total anthropogenic mercury emission up to 2008 was 350,000 tonnes, of which; majority (61%) was emitted after 1850, due to the extensive production of gold and silver as well as the growth in coal combustion (Streets et al., 2011). Another report from the United Nations Environment Programme (UNEP) estimated that in 2010, 1,960 tonnes of mercury was emitted to the atmosphere from human activities and the major sources were coal burning, artisanal and small-scale gold mining (ASGM), iron production and oil refining (UNEP, 2013).

Health sector is also one of the sources of mercury emission albeit its small contribution. In 2010, it was estimated that the health sector contributed approximately 1% of total worldwide anthropogenic mercury emission from the cremation of human remains with dental amalgam and from the production, preparation, removal and disposal of amalgam dental fillings (UNEP, 2013). In the USA, 10% of all mercury atmospheric emission before 1997 was from the incineration of medical waste (EPA, 1997). This figure was reported before the U.S Environmental Protection Agency (EPA) introduced the emission guidelines for medical waste incinerators in 1997.

Another source of anthropogenic mercury emission from the health sector is mercury spill. Mercury spillage from broken mercury-containing devices can be a source of significant acute mercury inhalational toxicity for healthcare workers and patients as such devices are often wrongly handled and disposed. A study conducted in India found that an average-sized hospital can release approximately 3 kg of elemental mercury into the environment annually (Agrawal, Singh & Priti, 2004). Mercury waste is either emitted to the atmosphere or released into aquatic environments through water effluent or leachate. Improper disposal of mercury waste will not only contaminate healthcare facilities, but also the immediate environment, thus exposing the surrounding communities to the ill-effects of mercury. For example, the amount of mercury from a typical clinical thermometer, if not properly disposed, is sufficient to contaminate a 20-acre lake, rendering the fish from the lake unsafe to be eaten (Toxics Link, 2004).

Upon exposure to mercury, the primary targets for toxicity in humans are the nervous system and kidneys. Other systems such as respiratory, gastrointestinal, cardiovascular (Gribble, Cheng, Berger, Rosman & Guallar, 2015), haematologic (Yorifuji, Tsuda & Kawakami, 2007), immune (Crowe et al., 2017) and reproductive systems may also be affected. Common symptoms following mercury exposure include mood changes, headaches, tremors, insomnia, memory loss, neuromuscular effects, cognitive impairment and motor dysfunction (Zahir et al., 2005). Pregnant women and young children are the most vulnerable groups to mercury poisoning (Bose-O'Reilly, McCarty, Steckling & Lettmeier, 2010; Agency for Toxic Substances and Disease Registry [ATSDR], 1999). Transplacental exposure is dangerous as mercury may interfere with the neurological development of a foetus while *in utero* (Chen et al., 2014). Mercury has been found to accumulate in the foetus at concentrations higher than those in the mother's blood. Neurodevelopmental effects of mercury include developmental delays, brain damage with mental retardation, blindness and muscle weakness (Bose-O'Reilly et al., 2010; ATSDR, 1999).

The vulnerability to the dangers of mercury exposure also extends to infants and young children for the same reason as the foetus, that their brains are still developing and exposure to a very high level of mercury may cause young children to have irreversible neurodevelopmental damage, manifested by problems with language, attention span, coordination and visual-spatial skills (Bose-O'Reilly et al., 2010;

ATSDR, 1999). Other neurological symptoms in children include seizures, delayed development as well as gradual vision, hearing and memory loss (Zahir et al., 2005).

The severity of the adverse effects of mercury on humans depends on the form, amount and concentration of mercury as well as the route and frequency of exposure. In the healthcare setting, the most common route of exposure to mercury is through inhalation of mercury vapour from broken mercury-containing equipment and during placement or removal of dental amalgam from the tooth. Exposure through inhalation is a major concern because 80% of inhaled vaporised mercury is easily absorbed into the bloodstream (Cherian, Hursh, Clarkson & Allen, 1978). Absorption of elemental mercury through the skin is possible after accidental skin contact, although the amount absorbed is negligible (Hursh, Clarkson, Miles & Goldsmith, 1989).

Apart from these possible paths of exposure, healthcare workers as well as the general population are also exposed to chronic mercury toxicity through ingestion of mercury-contaminated water and food, mercury from dental amalgams and mercury found in pharmaceutical and herbal products. The catastrophe which took place in Minamata Bay, Japan was one well-documented case of chronic mercury toxicity. It was an effect of continuous ingestion of methylmercury-contaminated fish and shellfish from 1932 to 1968. This incident dramatically demonstrated the neurotoxic effects of methylmercury to human, particularly to infants who had been exposed during gestation. A more recent study reported that in a mercury-contaminated area in the Amazon, the incidence rate for mild mental retardation among infants born in a fishing community was estimated to be as high as 17 per 1000 infants, with a loss of 202.8 disability-adjusted life years (DALYs) per 1000 infants (Gibb & Buckley, 2009).

1.2 Problem statement

Approximately 1% of the global anthropogenic mercury emission is from the health industry, mainly from medical and dental waste (UNEP, 2013). As for Malaysia, health sector contributed around 10% of potential mercury emission in the year 2012 from thermometers, incineration of medical waste and dental amalgam (Yoshimoto et al., 2012). Foreseeing the bad impact of mercury on people, animals and the environment, Malaysia has agreed to be a signatory of the Minamata Convention on Mercury since 24th September 2014. Currently, the Ministry of Health (MOH) Malaysia is making an effort to phase out the use of mercury-containing devices in healthcare settings. However, the MOH has taken a position to still allow the use of dental amalgam as a restorative material in dentistry practice in Malaysia (MOH, 2013a).

In 2015, there were 190,939 healthcare workers in Malaysia, consisting of doctors, dentists, assistant medical officers, staff nurses, community nurses, dental nurses and dental technologists, all of whom routinely work with mercury-based devices and

dental amalgam (MOH, 2015). Thus, these groups of healthcare workers are all potentially at risk of mercury toxicity from the exposure to mercury vapour. The risk is even higher for a pregnant healthcare worker as exposure to a significant amount of occupational mercury vapour may cause harm not only to herself but also to the developing foetus (Lindbohm et al., 2007). Common factors found to contribute to the release of mercury vapour at healthcare facilities include mercury leakage, breakage or spillage due to equipment failure, mishandling of mercury-containing devices and poor mercury hygiene practices in handling dental amalgam (Zeitz, Orr & Kaye, 2002).

Throughout 2016, there had been sporadic reports by the mainstream media on thermometer breakages in healthcare facilities, schools, colleges and private residences. However, the exact figure for the total of mercury spill incidents in healthcare facilities is unknown as there is no surveillance for these incidents. There is a possibility of more cases of mercury spills occurring in healthcare facilities, all of which might have not been reported.

The importance of mercury hygiene is irrefutable. A few available studies reported that the level of knowledge regarding mercury hygiene among healthcare workers is only average, at best (Senanayake & Gunawardena, 2016; Hosseini, Nili & Naebi, 2015; Halder, Peshin, Pandey & Gupta, 2015). Agrawal et al. (2004) reported that although mercury-containing devices are commonly used in healthcare facilities, the seriousness of the harmful effects was not appreciated by most healthcare staff even though they had some knowledge about mercury toxicity. The general perception among the study respondents was that the amount of mercury generated by the healthcare sector is too little to cause any bad impact to humans or the environment (Agrawal et al., 2004). Another alarming finding from the study was that although majority (89%) of the nurses were aware of mercury health hazards, only 18% of them followed the correct procedure in managing mercury spillage (Agrawal et al., 2004). Another study involving 540 final-year nursing students in Ahmedabad, India found that 10.2% of the participants were unable to correctly identify mercury-containing devices; 6.5% considered mercury as non-hazardous; 7.6% had the opinion that mercury does not pose health hazards and 15.5% considered mercury spillage as having no or minor risk (Tiwari, Patel, Soju, Trivedi & Purohit, 2015). As for Malaysia, to date, there is no available data on the level of knowledge and attitude regarding mercury hygiene among the healthcare workers.

1.3 Significance of the study

Most studies on mercury and its toxic effects had been done on artisanal miners as the artisanal mining industry contributes most of mercury emission to the environment. For healthcare workers, studies on knowledge and attitude regarding mercury hygiene had been mostly conducted among dentists (Hosseini et al., 2015; Sawair, Hassoneh, Jamleh & Al-Rabab'ah, 2010; Kulkarni et al., 2008), nurses (Sananayake & Gunawardena, 2016) and student nurses (Tiwari et al., 2015). Only

one study had actually made comparisons of knowledge across healthcare worker categories (Halder et al., 2015).

In light of this background, this study was conducted to assess the level of knowledge and attitude regarding mercury hygiene across all healthcare worker categories in primary healthcare facilities, considering that mercury-containing medical equipment and dental amalgam are still being used widely in the Malaysian health sector. Recommendation on areas to be improved in the training of mercury hygiene for healthcare workers can be conveyed to the District Health and Dental Offices based on the analysis of the level of knowledge and attitude and their predictors obtained from the primary healthcare workers in Seremban, Negeri Sembilan.

1.4 Research questions

1. What is the level of knowledge and attitude regarding mercury hygiene among primary healthcare workers in Seremban?
2. Is there any association between socio-demographic and employment characteristics with the level of knowledge and attitude regarding mercury hygiene among primary healthcare workers in Seremban?
3. What are the predictors for good knowledge and favourable attitude regarding mercury hygiene among primary healthcare workers in Seremban?

1.5 Research objectives

1.5.1 General objective

The general objective of this study is to determine the level of and predictors for good knowledge and favourable attitude regarding mercury hygiene among primary healthcare workers in Seremban, Negeri Sembilan.

1.5.2 Specific objectives

1. To describe the socio-demographic characteristics (age, gender, marital status, level of education and monthly income), employment characteristics (job, workplace, duration of service in the MOH, previous exposure to mercury spillage, training in biomedical waste management and training in mercury hygiene), level of knowledge and level of attitude among primary healthcare workers in Seremban, Negeri Sembilan.
2. To determine the association between socio-demographic and employment characteristics and the level of knowledge and attitude regarding mercury hygiene among primary healthcare workers in Seremban, Negeri Sembilan.
3. To determine the association between the level of knowledge and level of attitude regarding mercury hygiene among primary healthcare workers in Seremban, Negeri Sembilan.

4. To identify the predictors for good knowledge and favourable attitude regarding mercury hygiene among primary healthcare workers in Seremban, Negeri Sembilan.

1.6 Alternative hypotheses

1. There is a significant association between socio-demographic and employment characteristics and the level of knowledge and attitude regarding mercury hygiene among primary healthcare workers in Seremban, Negeri Sembilan.
2. There is a significant association between the level of knowledge and level of attitude regarding mercury hygiene among primary healthcare workers in Seremban, Negeri Sembilan.

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