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Knowledge and attitudes towards child vaccination among public in Cyberjaya, Selangor and their level of vaccine hesitancy

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***Abstract*---**Vaccination is regarded as one of the greatest public health achievements and one of the most cost-effective interventions to prevent childhood major illnesses and mortality. However, despite being recognized as one of the most successful public health measures, vaccination is perceived as unsafe and unnecessary by a growing number of individuals that lead to vaccine hesitancy. This study aimed to determine public level of knowledge, attitudes and hesitancy towards child vaccination in Cyberjaya, Selangor. This study also aimed to measure the association between level of knowledge and attitudes with different respondents' demographic data. Another aim of this study is to measure correlation between knowledge and attitudes with hesitancy towards child vaccination. A guided self-administered questionnaire was used to assess the knowledge, attitudes and hesitancy of the respondents. This cross-sectional study involved 300 respondents identified from the public. Majority of the respondents were females (65.0%), age between 18-29 years (74.7%), Malay (82.3%), Muslim (84.0%), with tertiary education level (78.7%), students (50.0%) and unmarried (70.7%). This study found that the respondents had an overall poor knowledge towards child vaccination (mean knowledge score = 51.3 ± 20.1). However, the respondents had a positive attitudes towards child vaccination (mean attitude score = 66.4 ± 17.5) and less hesitant towards child vaccination (mean hesitancy score = 68.5 ± 20.7). The association between level of knowledge and respondents' demographic data were not statistically significant ($p > 0.05$). In contrast, there were statistically significant association between level of attitude with respondents' education level and occupational status ($p < 0.05$). Other than that, there were statistically significant positive correlation between knowledge and hesitancy towards child vaccination ($r = 0.396$, $p < 0.001$)) and also between attitudes and hesitancy towards child vaccination ($r = 0.695$, $p < 0.001$). Overall, this study shows that poor knowledge was not necessarily translated into negative attitude and high hesitancy towards child vaccination. This is because although the respondents have poor knowledge, yet they possessed positive attitude and high percentage of less hesitant towards this issue.

***Keywords*---**prevent childhood major illnesses and mortality, vaccination in Cyberjaya.

Introduction

The introduction of human vaccines has had an enormous impact on global health by dramatically reducing the mortality and morbidity caused by infectious diseases (Donaldson et al., 2015). According to the World Health Organization (WHO), vaccine is a biological preparation that improves immunity to a particular disease. The term 'vaccination' is generally accepted for 'immunization' and they are used interchangeably (Bazin, 2003). Centers for Disease Controls and Prevention (CDC) defined vaccination as the act of introducing a vaccine into the body to produce immunity to a specific disease while immunization is defined as a process by which a person becomes protected against a disease through vaccination.

The public policy goals of vaccination are to slow the spread of disease and to reduce mortality and morbidity which caused by the vaccine-preventable diseases (Rubin, Kasimow, Anderson, & May, 2009). As mentioned by National Institute of Allergy and Infectious Diseases (NIAID), vaccines contain the same antigens found on pathogens that cause the associated disease, but exposure to the antigens in vaccines is controlled. By administering the antigens to our body in order to sensitize and stimulate our immune response, immunity against the diseases will be developed by production of antibodies. Therefore, when the vaccinated individual is subsequently exposed to the live pathogens in the environment, a much stronger secondary immune response can destroy them before they can cause disease.

In conjunction with Malaysia's Vision 2020 which is to be a fully developed nation, it anticipates a nation of healthy individuals, families and communities. Ministry of Health (MOH) Malaysia has initiated National Immunization Program (NIP) for children about 40 years ago with DTP vaccine. This was followed by the BCG vaccine in 1961 and the OPV vaccine in 1972. Measles immunization was added to the program in 1984, with immunization against rubella being introduced in 1998 and against hepatitis B in 1989. Apart from that, MOH also established mandatory vaccine programs administered to children under 15 years old in public schools (Roesel & Wpro, 2008). According to Malaysia Clinical Practice Guidelines (CPG) of Childhood Immunization (2004), the strategic guiding principle of immunization program is that protection must be achieved before infants are at high risk of a disease, thus it is important to protect children through immunization as early as possible.

Vaccination is not just a personal issue; it's a community responsibility, largely because of a concept known as "herd immunity" or "community immunity" (CDC, 2016). Schools play an important role in community transmission of influenza viruses, and thus there has been discussion of slowing transmission either by closing schools or by vaccinating school children (Fine, Eames, & Heymann, 2011) and this explain the need for vaccination with regards to community protection.

A research finding done by Al-lela, Bahari, Al-qazaz, & Salih (2014) found that any increase in parental knowledge and practice will lead to increases in vaccination rates of children. While there was some understanding that vaccination offers protection from illness, there was little knowledge about vaccine-preventable diseases. Freed et al., (2010) mentioned that healthcare

providers are well known named as parents' most trusted source of vaccine information hence, public should seek their advice regarding vaccination instead of other unreliable sources of information in order to get accurate information on this issue.

A wide variety of reasons were reported for vaccination attitudes including lack of awareness about vaccination and misinformed (Yaqub, Castle-clarke, Sevdalis, & Chataway, 2014). Pursuant to Shui et al., (2006), attitudes towards child vaccination significantly associated with concern, including worry that immunizations could be linked to autism or other learning disabilities as well as concerns on vaccine safety.

Meanwhile, a proportion of the population are hesitant to receive vaccines although routine vaccination is a major tool in the primary prevention of some infectious diseases, (Borràs et al., 2009). Vaccine hesitancy is complex and context specific varying across time, place and vaccines. It includes factors such as complacency, convenience and confidence. Furthermore, hesitancy towards vaccination often leads to partial vaccination and intentional delay in vaccine administration to children (Smith, Humiston, Parnell, Vannice, & Salmon, 2010).). An attitude of hesitancy differs from an action of vaccine refusal. Even those who are vaccinated can harbour hesitancy towards certain aspects of vaccination. The policy concern is that, hesitancy soon becomes refusal and unvaccinated clusters emerge in which disease outbreaks can occur (Salathé & Bonhoeffer, 2008).

Materials and Methods

Study Design

A cross-sectional study with convenience sampling was conducted from August to October 2016 in Cyberjaya, Selangor which is a township well-known as "Intelligent City". Public areas such as recreational parks and malls were the targeted sites to approach potential respondents.

The data was collected by using a guided self-administered questionnaire. The questionnaire used was adopted and adapted from a previous studies assessing parents' knowledge and attitudes towards childhood immunization (Ma, Albarraq, Abdallah, & Elbur, 2013) and Larson et al., (2015) for measuring vaccine hesitancy.

The questionnaire comprises of 4 sections; Demographic data, Knowledge towards child vaccination, Attitude towards child vaccination, and Hesitancy towards child vaccination.

Knowledge of respondents about child vaccination was assessed with 8 items, with an answer choices of 'Yes', 'No' and 'Don't know'. For scoring purposes, each correct answer was equal to 1 score and incorrect or don't know answer was equal to 0 score. The total knowledge scores ranged from 0 to 8, with higher scores indicating a higher level of knowledge on vaccination. The total accumulated score is then converted into percentage (100% scores). These scores

are graded such that respondents who scored ≤ 60% was graded as poor knowledge, 61-79% as medium and scored ≥ 80% was graded as good knowledge. Scoring mechanism for respondents' level of knowledge were adapted from Gao et al., (2012).

There are a total of 7 items used to assess the attitudes of respondents towards child vaccination. Respondents will rate the statements on a 5-point Likert scale where 1 means "Strongly Disagree", 0 means "Not Sure" and 4 means "Strongly Agree". In the case of negatively-quoted questions, reverse scoring was used. The mean value of each questions were obtained and expressed as percentage. The scoring system used for attitude is based on Yusra Habib Khan et al., (2012) where the mean value on attitude range from 0 to 4 will be calculated and converted into percentage with the cut point of (0%-50%) as negative attitude, fair attitude (51%-69%) and positive attitude (70%-100%).

Meanwhile, hesitancy of respondents about child vaccination was assessed with 7 items where respondents will rate the statements on a 5-point Likert scale where 1 means "Strongly Disagree", 0 means "Not Sure" and 4 means "Strongly Agree". In the case of negatively quoted questions, reverse scoring was used. Based on Strelitz et al., (2015), collapsed responses of 'strongly agree/agree' corresponded to less hesitant towards vaccines and collapsed responses of 'strongly disagree/disagree' responses reflected those who were more strongly hesitant towards vaccines. The mean value of each questions were obtained and expressed as percentage. The percentage then were dichotomized into two categories (< 50% and ≥ 50%) where < 50% indicates more hesitant responds and ≥ 50% indicates less hesitant responds.

Statistical Analysis

Descriptive statistics were used to make general observation on the demographic data and mean score for knowledge, attitude and hesitancy towards child vaccination. Data analyses were performed using the statistical software IBM SPSS Statistic version 20. Chi Square test were conducted to assess association between level of knowledge and respondents' demographic data as well as to assess association between level of attitude and respondents' demographic data. Besides that, Pearson's correlation test done to determine the correlation between level of knowledge and attitude with the level of hesitancy towards child vaccination.

Results

A total of 300 respondents were participating in this study. Of these, almost two-thirds of the respondents were females (65.0%, n= 195). The mean age of the respondents was 25.07 ± 7.403 years with most falling within the 18-29 age groups. The minimum age of the respondents was 18 and the maximum age was 57 years old. Among the respondents, 82.3% were Malay and 84.0% were Muslim which corresponded to the majority ethnic group and religion group responded to the questionnaire. With regard to their education level, most of them have tertiary education level. Other than that, majority of them were students and unmarried. The summary of respondents' demographic data is as shown in Table 1 on page 5.

This study managed to identify the public knowledge, attitudes and hesitancy towards child vaccination in Cyberjaya, Selangor. Malay, male, age group of 30-39 respondents had the highest knowledge scores compared to other groups. It was also found that knowledge scores on child vaccination were the highest among Muslims, respondents with higher education level, working in healthcare field, as well as among married respondents. Meanwhile, female, age within 18-29, Malay, Muslim, received no formal education, healthcare workers and married respondents reported with higher attitude and hesitancy scores. The summary of mean knowledge, attitude and hesitancy score is stated in Table 2 on page 6.

Based on the analyses, the knowledge towards child vaccination of most of the respondents was low (59.7%, n= 180), attitude towards child vaccination was positive (51.3%, n= 154) and majority of them were less hesitant towards child vaccination (84.3%, n= 253). Besides, there were no statistically significant associations between levels of knowledge with respondents' demographic data ($p > 0.05$) (Table 3). However, there were statistically significant association between levels of attitude with respondents' education level and occupational status ($p < 0.05$) (Table 4). Other than that, there were statistically significant positive correlation between knowledge and hesitancy towards child vaccination ($r = 0.396$, $p < 0.001$)) and also between attitudes and hesitancy towards child vaccination ($r = 0.695$, $p < 0.001$).

Table 1: Summary of Respondents' Demographic Data

Demographic Data	**Characteristics**	**Frequency, n (%)**
Gender	Male	105 (35.0)
	Female	195 (65.0)
Age group (years)	18-29	224 (74.7)
	30-39	64 (21.3)
	≥ 40	12 (4.0)
Ethnicity	Malay	247 (82.3)
	Chinese	28 (9.3)
	Indian	25 (8.3)
Religion	Muslim	249 (83.0)
	Non-Muslim	51 (17.0)
Education level	None	2 (0.7)
	Primary	51 (17.0)
	Secondary	11 (3.7)
	Tertiary	236 (78.7)
Occupational status	Healthcare worker	14 (4.7)

	Student	150 (50.0)
	Self-employed	43 (14.3)
	Gov. employee	47 (15.7)
	Non-Gov. employee	46 (15.3)
Marital status	Married	88 (29.3)
	Not married	212 (70.7)

Table 2: Summary of respondents' mean knowledge, attitude and hesitancy score

Demographic Data	**Mean Knowledge Score (in %)**	**Mean Attitude Score (in %)**	**Mean Hesitancy Score (in %)**
Gender			
Male	**52.5**	64.9	67.1
Female	50.6	**67.3**	**69.3**
Age group (years)			
18-29	51.1	67.0	**69.2**
30-39	**53.1**	63.4	66.2
≥ 40	44.8	**71.7**	67.9
Ethnicity			
Malay	**52.1**	**67.0**	**68.8**
Chinese	48.5	63.9	67.0
Indian	46.0	63.4	67.4
Religion			
Muslim	**52.3**	**67.0**	**68.7**
Non-muslim	45.8	63.5	67.5
Education level			
None	50.0	**82.1**	**83.9**
Primary	48.3	58.3	59.1
Secondary	**58.0**	65.3	72.1
Tertiary	51.6	68.1	70.1
Occupational status			

Healthcare worker	**53.7**	**70.9**	**72.3**
Student	52.7	63.0	68.9
Self-employed	46.8	60.2	60.9
Gov. employee	53.5	62.5	66.3
Non-Gov. employee	45.1	62.7	65.5
Marital status			
Married	**53.7**	**67.9**	**70.8**
Not married	50.3	65.8	67.6

Table 3: Association between Level of Knowledge and Respondents' Demographic Data

Demographic Data	**Poor Knowledge n (%)**	**Moderate Knowledge n (%)**	**Good Knowledge n (%)**	**X2 statistic (df)**	**p-value**
Gender					
Male	57 (54.3)	37 (35.2)	11 (10.5)	2.045 (2)	0.360*
Female	122 (62.6)	58 (29.7)	15 (7.7)		
Age groups (years)					
<30	137 (61.2)	68 (30.4)	19 (8.5)	0.844 (2)	0.656*
≥30	42 (55.3)	27 (35.5)	7 (9.2)		
Ethnicity					
Malay	146 (58.4)	80 (32.0)	24 (9.6)	-	0.412#
Others	33 (66.0)	15 (30.0)	2 (4.0)		
Religion					
Muslims	146 (57.9)	82 (32.5)	24 (9.5)	-	0.329#
Non-muslims	33 (68.8)	13 (27.1)	2 (4.2)		
Education level					
Tertiary	142 (60.2)	73 (30.9)	21 (8.9)	0.304 (2)	0.859*
Others	37 (57.8)	22 (34.4)	5 (7.8)		

Occupational status					
Students	92 (61.3)	45 (30.0)	13 (8.7)	0.403 (2)	0.818*
Others	87 (58.0)	50 (33.3)	13 (8.7)		
Marital status					
Married	46 (52.3)	32 (36.4)	10 (11.4)	3.054(2)	0.217*
Not-married	133 (62.7)	63 (29.7)	16 (7.5)		

*Chi Square Test #Fisher Exact Test

Table 4: Association between Level of Attitude and Respondents' Demographic Data

Demographic Data	**Positive Attitude n (%)**	**Fair Attitude n (%)**	**Negative Attitude n (%)**	**X2 statistic (df)**	**p-value ***
Gender					
Male	50(47.6)	33(31.4)	22(21.0)	1.247(2)	0.536*
Female	104(53.3)	59(30.3)	32(16.4)		
Age group (years)					
<30	117(52.2)	68(30.4)	39(17.4)	0.337(2)	0.845*
≥30	37(48.7)	24(31.6)	15(19.7)		
Ethnicity					
Malay	129(51.6)	78(31.2)	43(17.2)	0.693(2)	0.707*
Others	25(50.0)	14(28.0)	11(22.0)		
Religion					
Muslims	131(52.0)	78(31.0)	43(17.0)	0.939(2)	0.625*
Non-muslims	23(47.9)	14(29.2)	11(22.9)		
Education level					
Tertiary	128(54.2)	75(31.8)	33(14.0)	12.181(2)	**0.002***
Others	26(40.6)	17(26.6)	21(32.8)		

Occupational status					
Students	92(61.3)	44(29.3)	14(9.3)	18.537(2)	**< 0.001***
Others	62(41.3)	48(32.0)	40(26.7)		
Marital status					
Married	47(53.4)	27(30.7)	14(15.9)	0.407(2)	0.816*
Not-married	107(50.5)	65(30.7)	40(18.9)		

*Chi Square Test

Discussion

Although majority of the respondents came from tertiary education background, they still possessed poor knowledge towards child vaccination. It is a truism that knowledge increases with education. However, it is questionable whether the respondents actually received their information from health professionals. According to Malaysia Communications and Multimedia Commission (MCMC) survey on Internet Users (2014), most of the Internet users reside in Selangor, and public are known to utilize the Internet as one of resources in their search for health-related information (Bouche & Migeot, 2008). However, the validity and quality of the information on the internet is an area that has not been well documented and health information from Internet has been shown to be of poor quality whereas correct information may not be readily understandable to a non-clinician (Scullard, Peacock, & Davies, 2010). For some respondents who receive information from healthcare professionals, the information provided may not have been targeted to their level of understanding or to their specific questions and concerns (Al-zahrani, 2013).

Besides that, this result might be due to scoring mechanism adapted from Gao et al., (2012) that categorized the respondents' knowledge into 3 levels; respondents with <60% correct answers were indicated as poor knowledge, followed by medium knowledge (61-79%) and good knowledge (≥ 80%). The mean knowledge score for respondents in this study was 51.3 (SD ± 20.1), hence it falls under poor level of knowledge. In contrast, Al-lela, Bahari, Salih, et al., (2014) using a split median method, and categorized knowledge into 2 levels; where respondents with a total score of less than 4 (median) out of 8 questions were considered as having inadequate knowledge on child immunization and respondents with scores from 4 to 8 were considered as having adequate knowledge. The result from this study using the scoring mechanism revealed higher percentage of respondents to have adequate knowledge (66.1%) and only 33.9% with inadequate knowledge.

This study was reported that most of the respondents had positive attitudes towards child vaccination. This finding was similar with another study conducted by Hak et al., (2005) where out of the 283 participants, 123 (43%) reported a positive attitude towards child vaccination and this finding also supported by

another study done in England on parental attitudes to the MMR vaccine, where parents in both groups either MMR acceptors or MMR refusers indicated support for vaccination regardless their concern about the safety of MMR vaccine (Casiday, Cresswell, Wilson, & Panter-Brick, 2006). In addition, 99.1% of the mothers in Nigeria had very positive attitudes to child immunization (Odusanya et al., 2008). The belief that vaccination is safe and the best way to protect children against infectious diseases positively influenced respondents' attitudes (Paulussen, Hoekstra, Lanting, Buijs, & Hirasing, 2006).

Respondents in this study were shown to be less hesitant towards child vaccination and the result was consistent with another study by Freed, Clark, Butchart, Singer, & Davis, (2010) in which majority of respondents were less hesitant and agreed with the statement that vaccines are a good way to protect children from diseases and that they generally do what their doctor recommends regarding vaccine. Apart from that, this result was in line by studies conducted in 3 countries which were England, Poland, and Sweden where the respondents reported to have a very low proportion of refusal towards vaccination offered to their children (< 6.0%) (Stefanoff et al., 2010).

However, this study was inconsistent with another study in which 28.0% of parents reported having doubts about vaccines (Gust et al., 2008). Vaccine-declining parents believe that vaccines are unsafe and ineffective and vaccine-preventable diseases to prevent are mild and uncommon. Furthermore, they mistrust their health professionals along with numbers of specific vaccine safety concerns including risks of asthma, allergies and autism (Brown et al., 2010).

Chi Square Tests shows no statistically significant association between level of knowledge and respondents demographic data. This means that level of knowledge is independent to the demographic data. Regardless of their gender, age groups, race, religion, education level, occupational and marital status, the respondents had equal level of knowledge. This may be due to all respondents receive similar information as they received healthcare under the same immunization program by the government.

However, it was reported that there were statistically significant association between levels of attitude with respondents' education level. This means that the level of attitude is depends on their education level. This result was in line with Khan et al., (2015) who studied the knowledge, attitudes and perceptions towards polio immunization in Pakistan in which positive attitudes of participants towards polio immunization were statistically significant associated with tertiary education ($p < 0.001$).

Apart from that, this study also found that the level of attitude is dependent to the occupational status. This result was not similar with a previous study in which it was stated that the mother's work did not affect the child's immunization status as 79.45% of working mothers completed their children's immunization (Al-moukhtar & Al-, 2011). There was a different study conducted in Singapore among men on knowledge on cervical cancer and human papillomavirus (HPV) and their attitudes towards HPV vaccination by Pitts et al., (2009) which reported no statistically significant association between their occupational status and

attitudes towards vaccinations. These inconsistent results may be due to different targeted gender population. Besides that, half of respondents in this study were students; meanwhile Pitts only involved 14.1% students and no students were involved in the study done by Al-Moukhtar.

Statistically significant positive correlation was reported between knowledge and hesitancy towards child vaccination which means the higher the knowledge, the less hesitant the respondent is. This result was not in line with a study by Dubé et al., (2013) in which less knowledgeable respondents were found to be less hesitant towards child vaccination. Parents with limited knowledge about vaccination and vaccine-preventable diseases were less hesitant towards vaccination and choose to vaccinate their child compared with parents with higher knowledge, but refuse to vaccinate.

Besides that, another study revealed that increase in knowledge did not reduce the level of hesitancy. Cassell et al., (2006) reported hesitant and non-compliant parents appear to have looked at a lot of information about vaccination and to have considerable interest in health-related issues. The inconsistent result between this study and previous studies may be due to different distribution of respondents participated where most of respondents in this study were not yet married and have no child as compared to respondents from previous studies who involved all parents.

In addition, statistically significant positive correlation was also reported in this study between attitude and hesitancy towards child vaccination. This means, the more positive the attitude, the less hesitant the respondent is. A national survey found parents that Hispanics, despite being more concerned about the serious adverse effects of vaccines, were also more likely to follow their doctors' vaccine recommendations, and less likely to have ever refused a vaccine (Freed et al., 2010). It can be concluded that hesitancy towards child vaccination does not depends on someone's attitudes as there are many other related factors such as external factors, vaccine-specific factors, and parent-specific factors that may affect and shape level of hesitancy towards child vaccination

Conclusion

Throughout this study, it can be concluded that publics in Cyberjaya, Selangor had poor knowledge but positive attitudes and less hesitant towards child vaccination.

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