WILLINGNESS TO PAY FOR DENGUE VACCINE AND ITS ASSOCIATED FACTORS AMONG HEALTHCARE WORKERS IN PETALING HEALTH DISTRICT

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ABSTRACT

Background: Dengue vaccine can assist in controlling the rise of dengue. Highly effective cost of dengue vaccine in Malaysia is estimated to be between RM50 to RM200 per dose. It is important to know the willingness to pay (WTP) for the vaccine to assist in policy-making decisions for future dengue vaccine programme. The aim of study was to determine willingness to pay for dengue vaccine among healthcare workers (HCW) in Petaling Health District.

Materials and Methods: A cross-sectional study was conducted among HCWs of Petaling Health District, Selangor from September to July 2018 via simple random sampling according to proportion of HCWs in specific facilities. A self-administered questionnaire using the contingent valuation method was used to estimate WTP. Factors associated with WTP for dengue vaccine were assessed and associations measured using Chi-square test with significance level at 0.05.

Results and Discussion: Response rate was 92.2%. Majority of the respondents were female (72.3%), presently married (73.4%) with 93.6% aged 40 years or less, having at least college or matriculation education (54.3%). For monthly household income, 51.1% was between RM 3001 to RM 9000. Only 17.0% had history of dengue with 43.1% having family history of dengue. The median WTP for dengue vaccine was RM 20 per dose ranging between RM1 to RM500. Among the HCWs, 51.1% had a high WTP for dengue vaccine defined as at or above the median WTP. Factors significantly associated with WTP for dengue vaccine were monthly household income ($\chi2=11.974$, $p=0.003$), dengue preventive practice ($\chi2=4.715$, $p=0.03$), knowledge of dengue vaccine ($\chi2=3.062$, $p=0.05$) and perception towards vaccination ($\chi2=5.593$, $p=0.02$).

Conclusion: The study revealed that the range of WTP for dengue vaccine among healthcare workers was RM 1 to RM 500; with 51.1% of HCWs of Petaling Health District having high WTP for dengue vaccine. The predictors for WTP for dengue vaccine were monthly household income, knowledge regarding dengue vaccine, dengue preventive practice and perception towards vaccination.

Keywords: Willingness to pay, dengue vaccine, healthcare workers

1.0 Introduction

1.1 Background of Dengue and Dengue Vaccine

Dengue has been known to be caused by dengue virus. The clinical manifestation of dengue fever, an acute systemic viral infection, is characterized by symptoms of fever, retro-orbital pain, headache, body rash, myalgia, joint pain, bleeding tendencies, lymphadenopathy and leucopenia (Martina, Koraka, & Osterhaus, 2009). Dengue hemorrhagic fever (DHF) which is the more severe form of dengue comes with further manifestations of hepatomegaly, increased vascular permeability and thrombocytopenia. When DHF worsens with incidence of hypovolemia and shock then the condition will be known as dengue shock syndrome (DSS) (WHO, 2011).

From known virology studies globally, there are four different dengue virus serotypes identified which are DEN-1, DEN-2, DEN-3, and DEN-4 with several virus strains (Henchal & Putnak, 1990). The mosquitoes *Aedes aegypti* and *Aedes albopictus* are recognized vectors that transmit dengue to the human host (Martina, Koraka, & Osterhaus, 2009). Dengue has become a major public health concern all over subtropical and tropical regions including in Malaysia especially with recent global climate change, (Ebi & Nealon, 2016). With an annual surge of approximately 390 million new cases every year and 96 million symptomatic cases reported from mild dengue fever to DHF and severe cases of DSS, dengue has resulted in increased mortality worldwide (Bhatt et al., 2013).

The spread of dengue has piqued universal interest for the development of dengue vaccine. The World Health Organisation (WHO), in its global strategy for dengue control 2012-2020, has suggested for future implementation of dengue vaccine to work together with existing vector control programs to combat dengue epidemics in endemic countries (World Health Organization, 2012).

The first dengue vaccine branded Dengvaxia, has been registered and licenced for use in December 2015 by several countries after passing phase III of clinical trials (Sanofi-Pasteur, 2015). Dengvaxia is a live attenuated (recombinant) tetravalent vaccine which confers protection from all four dengue virus serotypes in those recipients from the age of 9 to 45 years old. Several other dengue vaccine candidates are also currently under study for future licencing with three more new dengue vaccines expected to be licenced between 2018 to 2019 (World Health Organization, 2016).

The possible effect of Dengvaxia on reducing dengue burden has shown to be significant in endemic populations where the rate of transmission (seroprevalence > 90% at 9 years) is high. This has been shown in 10 countries in Asia and Latin America (Philippines, Thailand, Vietnam, Indonesia, Malaysia, Honduras, Mexico, Brazil, Colombia, and Puerto Rico) involved in the phase III trials for Dengvaxia (Coudeville, Baurin, L'Azou, & Guy, 2016). Symptoms and hospitalization rate due to dengue were reduced up to 30% over a 30 year period despite some undesirable outcomes in those population with low seropositivity and younger children aged 2 to 3 years old (Flasche et al., 2016).

Although initially claimed by its developer to infer life-long immunity after 3 doses, the immunity coverage of Dengvaxia is still not yet fully conclusive clinically and Phase IV clinical trials for long-term efficacy post-licensure is still ongoing. However, from the

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beginning of its clinical trials in 2012 the vaccine has shown to be highly effective (more than 80%) in the recommended age group of 9 to 45 years old with high baseline seropositivity (Deen, 2016).

After the licensing of Dengvaxia in a few endemic countries since December 2015, in April the following year WHO released its official endorsement of the dengue vaccine (World Health Organization, 2016). This recommendation has likely influenced other developing countries to follow suit. In Malaysia, the Drug Control Authority (DCA) has decided to conditionally register Dengvaxia on 31st October 2016 for a two years period (National Pharmaceutical Regulatory Agency, 2016). Full registration would commence if the clinical benefits of the vaccine are verified or otherwise it would be withdrawn.

In the study by Flasche et al. (2016) of populations across Asia and Latin America part of the phase III clinical trials for Dengvaxia, the economic evaluation of dengue vaccine cost had been estimated using disability-adjusted life years (DALYs) averted with a rate of USD 2,000 for each DALY averted. Additionally, dengue vaccine may potentially be cost-effective if the costs of vaccinating an individual could be kept well below approximately USD 50 from a public health provider perspective or USD100 from a societal perspective. In Malaysia, a study by Shafie et al. showed that dengue vaccination is a good investment to help in reducing burden of dengue if the vaccine price can be negotiated to be at or below the cost-effective threshold price. Using scenarios of nationwide vaccination or targeted hotspot vaccination with population aged 9 years old or 13 years old, the highly cost-effective threshold price was estimated to be between USD 15 to 50 (Shafie et al., 2017).

Malaysia has a high national dengue burden which follows the trend of the global dengue burden. In 2016, there were 237 deaths reported out of 101, 357 cases for the whole country. According to the Malaysia Remote Sensing Agency (ARSM), there is rapid increase in death rate due to dengue in Malaysia which is currently five times higher in 2016 as compared to the rate in the 1990s (ARSM, 2016). Incidence rate in Malaysia have increased from 145.9 in the year 2000 to 328.3 per 100, 000 population in 2016 (ARSM, 2016). The success of current dengue prevention program is debatable in tackling this problem because of the increased dengue burden for the past few years. Hence, the introduction of a dengue vaccine may be able to tackle this issue. A study by Endo, Ziegelmann & Patel (2016), concluded that the reduction of the disease and economic burden by the introduction of a dengue vaccine could be substantial especially in dengue endemic areas, hence, may be economically advantageous when compared to other strategies of vector control alone (Endo, Ziegelmann, & Patel, 2016).

1.2 Overview of Willingness to Pay and Its Methods

Willingness to pay (WTP) is an economic term that can be defined as the maximum amount a person would be willing to pay to obtain goods or services that they desire (Mariani & Pego-Fernandes, 2014). WTP gives information to cost-benefit analysis (CBA), a form of economic evaluation used to assess cost and benefits of health programs in monetary terms (O'Brien & Viramontes, 1994). The information obtained from a CBA can inform key decisions for beginning a health service program which includes setting the price for any health goods or services that the program provides. For public health managers, good price-setting will be linked to good social coverage, affordability and sustainability (Foreit & Foreit, 2004). The results of WTP are usually used as an input into CBA for long-term demand and infrastructure planning base on needs assessment.

There are two methods to measure WTP which can be broadly classified into measurement of revealed preference which is based on market observations or measurement of stated preference which are usually derived from surveys (Breidert, Hahsler, & Reutterer, 2006). Stated preference is used when no market prices exist while revealed preference is used when there is a (proxy) of market values available. One of the advantages of stated preference is its relative simplicity since it can be evaluated via a survey. There are various methods to perform surveys to measure stated preference (Breidert et al., 2006). One of the methods under the measurement of stated preference is using the Contingent Valuation Method (CVM).

CVM is a survey-based method usually used for measuring the monetary value of health goods or services that are introduced in the market or to the community (Carson, 2000) . CVM is the best method for a hypothetical service that is not on the market at the time of survey and it is a method that requires low cost to carry out with the least amount of time compared to other methods of measuring WTP (Accent, 2010). Therefore, for a service like dengue vaccine that is not yet available on the market in Malaysia, CVM would be a suitable and feasible method of measurement.

The four main mechanism commonly used under the CVM to elicit WTP are open ended question, bidding game approach, payment card, or dichotomous choice. Dichotomous choice questionnaires are usually used due to minimal bias as compared to other mechanisms (Carson, 2000). It is done by offering the respondent dichotomous choice between two alternatives where one is the status quo policy and the other alternative policy with higher cost. A scenario is given on the cost imposed by the government if the alternative policy is implemented. Information on how the service will be provided, how much it will cost and what the alternative policy provide will be key elements for the respondents to make their choice whether they favour or not the value stated.

Researchers will be able to trace out the distribution of willingness to pay (WTP) for the service from the assignment of cost numbers to the respondents. The amount of WTP and the percentage of the population who are willing to pay for it is determined and when a parametric or non-parametric curve is assumed for the WTP distribution accordingly, summary statistics such as mean and median WTP can be estimated (O'Brien & Viramontes, 1994).

In Malaysia, published study on WTP for dengue vaccine is very limited i.e. a conference paper reporting WTP for dengue vaccine in Penang on the general public population sampled conveniently in 2016 (Yeo & Shafie, 2016). Therefore, further information on willingness to pay and its associated factors can provide evidence for proper planning in the process of introducing dengue vaccine in the future.

This study was carried out to determine the willingness to pay for dengue vaccine among Healthcare Workers (HCWs) in Petaling Health District. The population in this district is an urban population from a dengue endemic area with variations in sociodemographic and socioeconomic backgrounds (Department of Statistics Malaysia, 2011). Evidence from the perspective of HCWs on willingness to pay for dengue vaccine could provide valuable indication on their own willingness to pay and whether they would be willing to advocate or recommend such prevention method to patients under their care. The aim of this study is to determine the WTP for dengue vaccine and its associated factors among HCWs of Petaling

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Health District. The study was carried out among healthcare workers because healthcare workers are important health advocator and can induce demand of healthcare to patient.

2.0 Methodology

2.1 Study location and study design

This study was conducted in Petaling Health District where there are 10 Health Clinics, 6 Community Clinics and 12 1Malaysia Clinics operating under the Petaling District Health Office (DHO) covering a total area of 549.3km2. A risk-mapping of states in Selangor showed that the area with the highest risk for dengue infection was Petaling and Gombak base on population density and rainfall as input factors (Hassan, Shohaimi, & Hashim, 2012). A cross-sectional study was carried out from September 2017 to July 2018 for 10 months duration. Data collection period was between April to May 2018.

2.2 Study population and sampling population

Study population was all 965 healthcare workers (HCWs) in the Petaling Health District (not including administrative staff) who are distributed throughout all the clinics under the Petaling DHO including those working in the office itself. HCWs was chosen as the study population since WTP for dengue vaccine of the public can be affected by supplier-induced demand where healthcare providers are in a position to manipulate their patients' demand for medical services to create induced demand for services (Bickerdyke, Dolamore, Monday, & Preston, 2002).

All permanent healthcare workers working under the jurisdiction of Petaling DHO in the year 2018 were included in the study with exclusion criteria of staffs on leave during data collection such as those on sick leave, maternity leave, study leave, etc., non-Malaysian staff and contract staffs.

2.3 Sampling frame and sampling size

The list of staff according to healthcare facilities was obtained from the Human Resource Department of Petaling DHO updated until April 2018. The sample size for this study was calculated using the formula for testing differences between two proportions for hypothesis testing. (Lemeshow, Hosmer, Klar, & Lwanga, 1990). Taking into account non-response rate of 20%, the minimum sample size calculated was 204.

2.4 Sampling method

Using simple random sampling according to the proportion of human resource distribution by facilities, respondents were randomly selected from the list of staff given per facility.

2.5 Questionnaire

To assess the WTP of HCWs, a bilingual Malay and English self-administered questionnaire was used in adapted from a study on willingness to pay for dengue vaccine conducted among

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population of Aceh in 2016 (Harapan et al., 2017). The questionnaire was divided into several sections on sociodemographic characteristics, socioeconomic characteristics, history of dengue fever, knowledge of dengue, knowledge of dengue vaccine, attitude towards dengue, dengue preventive practice, perception towards vaccination and willingness to pay for dengue vaccine.

2.6 Contingent Valuation Method

The questions on willingness to pay were formulated given a hypothetical dengue vaccine scenario and using the Contingent Valuation Method. The respondents were first asked if they were willing to pay for the vaccine or not if it was not given for free. If they answered yes to the initial question on WTP, the respondent will be prompted to proceed to the next question with dengue vaccine price starting from RM50 which the estimated minimum cost-effective price per vaccination of dengue in Malaysia is (Shafie et al., 2017). Price stated were with an increment of RM50 for 6 levels up to RM 300. They would stop at the given amount that they are not willing to pay and would be asked to give the exact amount they are willing to pay for. If they answered no, they would be prompted to skip and move to questions on WTP for dengue vaccine with prices stated from RM 40 with a decrement of RM 10 for 5 levels down until RM 10 to RM 5 and finally below RM 1. Questions were structured with a dichotomous answer to elicit the WTP of respondents for dengue vaccine.

2.7 Validity and reliability of instruments

Validity and reliability testing of the questionnaire were conducted with the Cronbach's Alpha coefficient value of variables noted to be between 0.55 to 0.78 for each section with total average value of 0.7 which showed good internal consistency. Data was analysed using IBM Statistical Package for Social Science (SPSS) version 23. Analysis of data starts with normality testing, description of continuous variables using means and standard deviations or median and interquartile range, description of categorical data summarized using frequency and percentage. Subsequently, bivariate analysis was completed using Chi square test to measure the association between two categorical variables. Two-sided hypothesis testing was done with a level of significance set at 0.05. Then, multivariate analysis using multiple logistic regression for determining predictors of WTP for dengue vaccine were performed to come up with adjusted odds ratio at 95% confidence interval.

2.8 Ethic approval

Prior to data collection, approval or consent was obtained from the Medical Research and Ethic Committee (MREC), Ministry of Health, the Petaling Health District Office in charge of the facilities that respondents work under and the Ethic Committee for Research Involving Human Subjects, Universiti Putra Malaysia or *Jawatankuasa Etika Universiti untuk Penyelidikan Melibatkan Manusia* (JKEUPM). Consent from individual respondent was obtained via an administered consent form.

3.0 Results

This study had a response rate of 92.2%. Testing for normality was conducted on all continuous variables by using measures of skewness and kurtosis as well as Kolmogorov-Smirnov test. Score for attitude towards dengue and score for perception towards vaccination were normally distributed. All other variables were not normally distributed. All variables were then converted to categorical variables for bivariate analysis of association.

3.1 General Description of the Respondents

Table 1 shows the distribution of the sociodemographic characteristics of the study respondents. From 188 respondents, 92 (frequency) HCWs were aged 30 years or less (percentage=48.9%) followed by 84 of those aged 31 to 40 years old (44.7%) and 12 aged above 40 years old (6.4%). Females made up 136 (72.3%) of the total study respondents. 138 respondents (73.4%) were presently married while the remaining 26.6% (50) were single including those widowed. Education status showed 54.3% (102) had studied until College, Matriculation or Diploma level, followed by those having at least a university degree (64, 34.0%) and 11.7% (22) had only finished secondary school or gotten their SPM/ STPM certificates.

As for the socioeconomic distribution of the study respondents, staffs doing clinical support services made up 39.9% (75) of the study respondents, followed by those in the clinical services (63, 35.5%) which included staffs doing managerial work and those seeing patients directly. The median (IQR) monthly household income of the respondents was RM 5000 (5900). Household income were categorized approximately according to quartiles. Those in the first quartile making RM 3000 or less a month made up 27.1% (51) of the study respondents while those in the fourth quartile making more than RM 9000 a month made up 20.8% (39). From the total respondents, 98 HCWs (52.1%) had household monthly income within the interquartile range between RM 3001 to RM 9000.

Table 1: Distribution of sociodemographic and socioeconomic characteristics (N=188)

Characteristics	Median (IQR)	n (%)
Age	31.0 (6.0)	
≤ 30 years		92 (48.9%)
31-40 years		84 (44.7%)
> 40 years		12 (6.4%)
Gender		
Female		136 (72.3%)
Male		52 (27.7%)
Marital Status		
Married		138 (73.4%)
Single		50 (26.6%)
Highest Formal Education		
Up to Secondary school/ SPM/ STPM		22 (11.7%)
Up to College/ Matriculation/ Diploma		102 (54.3%)
Degree Level above		64 (34.0%)
Main job description		
Clinical Services		63 (35.5%)

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Clinical Support Services		75 (39.9%)
Public Health Services		50 (26.6%)
Household Monthly Income	5000 (5900)	
≤ RM 3000		51 (27.1%)
RM 3001 – RM 9000		98 (52.1%)
> RM 9000		39 (20.8%)

3.2 Willingness to Pay for Dengue Vaccine

Table 2 shows the willingness to pay for dengue vaccine among respondents. The resulting median WTP for dengue vaccine among respondents were RM 20.00 (50.00). Those with WTP at the median point or above was categorized as having high WTP while those below was categorized as having low WTP. From 188 respondents, 51.1% (96) showed a high WTP for dengue vaccine as compared to 48.9% (92) with low WTP. The range of WTP for dengue vaccine among HCWs in Petaling Health District was RM 1 to RM 500.

Table 2: Willingness to pay for dengue vaccine of all respondents (N=188)

Characteristics	Median (IQR)	n (%)
Willingness to Pay (RM)	20.00 (50.00)	
High		96 (51.1%)
Low		92 (48.9%)

3.3 Factors associated with WTP for Dengue Vaccine

The following tables in this section illustrates the association between several factors under study with WTP for dengue vaccine. Chi- square test were used to examine all the associations.

Table 3: Association between willingness to pay with sociodemographic factors (N = 188)

Variables	Willingness to Pay		Test Statistics		
	High N = 96 (51.1%)	Low N = 92 (48.9%)	χ^2	df	P-value
Age					
≤ 30 years	48 (52.2%)	44 (47.8%)	0.470	2	0.791
31-40 years	41 (48.8%)	43 (51.2%)			
> 40 years	7 (58.3%)	5 (41.7%)			
Gender					
Male	25 (48.1%)	27 (51.9%)	0.257	1	0.612
Female	71 (52.2%)	65 (47.8%)			
Marital Status					
Married	76 (55.1%)	62 (44.9%)	3.337	1	0.068
Single	20 (40.0%)	30 (60.0%)			
Highest Formal Education					

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Secondary school/ SPM/ STPM	9 (40.9%)	13 (59.1%)	4.059	2	0.131
College/ Matriculation/ Diploma	48 (47.1%)	54 (52.9%)			
University/ Degree	39 (60.9%)	25 (39.1%)			

* Significant at P ≤ 0.05

Table 3 above shows the association between WTP for Dengue Vaccine with sociodemographic and socioeconomic characteristics. The association between WTP of dengue vaccine and sociodemographic factors that are age, gender, marital status and highest formal education status were not significant.

Table 4: Association between willingness to pay with socioeconomic factors (N = 188)

Variables	Willingness to Pay		Test Statistics		
	High N = 96 (51.1%)	**Low** N = 92 (48.9%)	χ^2	*df*	*P-value*
Main job description					
Clinical Services	35 (55.6%)	28 (44.4%)	3.348	2	0.188
Clinical Support Services	41 (54.7%)	34 (45.3%)			
Public Health Services	20 (40.0%)	30 (60.0%)			
Monthly Household Income					
≤ RM 3000	17 (33.3%)	34 (66.7%)	11.974	2	0.003*
RM 3001 – RM 9000	52 (53.1%)	46 (46.9%)			
> RM 9000	27 (69.2%)	12 (30.8%)			

* Significant at P ≤ 0.05

The association between socioeconomic factors and WTP for dengue vaccine is presented in Table 4 above. The two factors studied were respondents job description i.e. the area of work they are in and their monthly household income. Job description did not show any significant association with WTP for dengue vaccine. The association between respondents' monthly household income and WTP were significant (χ^2=11.974, p = 0.003). Monthly household income factor showed that with higher income category, more respondents had high WTP for dengue vaccine.

Table 5 below shows the association between history of dengue fever and WTP for dengue vaccine. There were no significant association between history of dengue fever of respondents and family members with WTP for dengue vaccine.

Table 5: Association between history of dengue and willingness to pay (N=188)

Variables	Willingness to Pay		Test Statistics		
	High N = 96 (51.1%)	Low N = 92 (48.9%)	χ^2	df	P-value
Previous History of Dengue					
Yes	15 (46.9%)	17 (53.1%)	0.271	1	0.603
No	81 (51.9%)	75 (48.1%)			
Family History of Dengue					
Yes	39 (48.1%)	42 (51.9%)	0.484	1	0.487
No	57 (53.3%)	50 (46.7%)			

* Significant at $P \leq 0.05$

Shown in the following Table 6 is the association between WTP of dengue vaccine with factors that are knowledge of dengue, knowledge of dengue vaccine, attitude towards dengue, dengue preventive practice and perception towards vaccination. There was no significant association between knowledge of dengue (χ^2=0.054, p=0.817) and attitude towards dengue (χ^2=1.482, p=0223) with WTP for dengue vaccine. However, the association between WTP for dengue vaccine with knowledge of dengue vaccine (χ^2=3.062, p=0.05), dengue preventive practice (χ^2=4.715, p=0.03) and perception towards vaccination (χ^2=5.593, p=0.02) are shown to be significant.

Table 6: Association between knowledge, attitude, practice and perception of respondents and willingness to pay (N = 188)

Variables	Willingness to Pay		Test Statistics		
	High N = 96 (51.1%)	Low N = 92 (48.9%)	χ^2	df	P-value
Knowledge of Dengue					
Good	36 (52.2%)	33 (47.8%)	0.054	1	0.817
Poor	60 (50.4%)	59 (49.6%)			
Knowledge of Dengue Vaccine					
Good	4 (28.6%)	10 (71.4%)	3.062	1	0.050*
Poor	92 (52.9%)	82 (47.1%)			
Attitude towards Dengue					
Good	34 (57.6%)	25 (42.4%)	1.482	1	0.223
Poor	62 (48.1%)	67 (51.9%)			
Dengue Preventive Practice					
Good	65 (46.4%)	75 (53.6%)	4.715	1	0.030*
Poor	31 (64.6%)	17 (35.4%)			
Perception towards Vaccination					
Good	71 (57.3%)	53 (42.7%)	5.593	1	0.018*
Poor	25 (39.1%)	39 (60.9%)			

* Significant at $P \leq 0.05$

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4.0 Discussion

The target population in this study is unique compared to other WTP studies for dengue vaccine that usually samples respondent from the public. This study targeted the healthcare workers population as compared to the general public. Healthcare workers are civil servants working in the public healthcare system who might be used to getting most health services conveniently and presumably free. The resulting median WTP for dengue vaccine among HCWs of Petaling Health District was RM 20.00 (50.00) (USD 5.01 (12.53)). Using the median as cut-off point, WTP were then categorized into high and low with 51.1% of respondent showing high WTP for dengue vaccine as compared to 48.9% showing low WTP. Comparison with other studies, associations and predictors were examined using the median value.

For analysis and comparison, median is taken to avoid the sensitivity effect of the mean to outliers (Buckland, Macmillan, & Duff, 1999). The median WTP of RM 5 for this study is quite low considering that Malaysia is an upper middle-income country. In countries like the Philippines, Vietnam, Thailand and Columbia the median WTP for dengue vaccine ranges between USD 25 to USD 60 per dose for different vaccine scenarios reflecting the level of income of these developing countries (Lee, Mogasale, Lim, & Carabali, 2015; Palanca-Tan, 2008). However, studies done in Aceh and Bandung in Indonesia showed a lower median WTP which is USD 4.04 and USD 1.94 per dose respectively. The only study using vaccine scenario mimicking Dengvaxia done in Brazil reported a median WTP of USD 11.20 which is lower than the price per dose of the vaccine in that country, USD 37.71 (Godói et al., 2017).

One of the reasons for the difference in median WTP per dose in this study as compared to other study may be attributed to the protest bids made in this study. There are three approaches to handle protest bids either to exclude it, to replace it with the mean or median value or to include it as zero values (Halstead, Luloff, & Stevens, 1992). According to Halstead et al, how services such as dengue vaccine are provided and how it will be paid for is a public policy issue thus cannot be strictly separated from the valuation of the service. Therefore, protest bids should be taken as real zero values. The assumption was made because the sample is taken from the population of HCWs who are civil servants that are working in the public healthcare sector who may be used to easy access of healthcare services. Their answers to the CVM questions may be in protest of the price given and not a reflection of their real valuation of the vaccines' benefit.

Majority of the respondent (>90%) in this study are in the lower age group below 40 years old. More than 70% are female with majority married and having at least a college/ matriculation/ education. This reflects the sociodemographic distribution of the civil servants working population in the healthcare sector.

In this study, sociodemographic factors were found not to have any significant association with WTP for dengue vaccine. Findings from several studies of WTP for dengue vaccine also showed that association between WTP for dengue vaccine and sociodemographic factors were weak and inconsistent across studies (Godói et al., 2017; Harapan et al., 2017; Palanca-Tan, 2008). One of the possible reasons as to why sociodemographic factors is not a significant factor in this study is because of the difference in the target population used. This study used

healthcare workers with different sociodemographic background that may not be a contributing factor to influence WTP for dengue vaccine.

Majority of respondents are staffs doing clinical support services, followed by those in the clinical services including clinical managerial work and those seeing patients directly. A smaller percentage works to provide public health services. More than half of those doing clinical support services and clinical services have a high WTP for dengue vaccine that is 55.6% and 54.7% respectively. The percentage (40.0%) is lower for those in the public health services. Job description did not show any significant association with WTP for dengue vaccine.

The median monthly household income of the respondents was RM 5000.00 (5900) with majority of the respondent (53.1%) having household income between RM 3001 to RM 9000. There is an association between monthly household income with WTP for dengue vaccine. Higher income category is associated with high WTP for dengue vaccine ($\chi2=11.974$, p=0.003). This finding coincides with all studies of WTP for dengue vaccine done which reported a highly significant association between WTP for dengue vaccine with monthly household income of respondents (Bracho-Churio et al., 2017; Godói et al., 2017; Hadisoemarto & Castro, 2013; Harapan et al., 2017; Lee et al., 2015; Palanca-Tan, 2008).

With regards to the history of dengue of respondents or their family members, there is no significant association between previous history of dengue with WTP for dengue vaccine. There is a fairly equal distribution where 46.9% respondents among people with previous history of dengue and 48.1% from those having family members with history of dengue have a high WTP for dengue vaccine. This echoes majority of the studies on WTP for dengue vaccine which reported that history of dengue fever is not significantly associated with WTP for the vaccine (Godói et al., 2017; Hadisoemarto & Castro, 2013; Harapan et al., 2017; Lee et al., 2015; Palanca-Tan, 2008). Two studies, however, did show a significant association between history of dengue fever with WTP for the dengue vaccine that is in Vietnam and North Columbia where respondents with positive history of dengue fever having a higher WTP for dengue vaccine (Bracho-Churio et al., 2017; Lee et al., 2015).

This study showed that 52.2% of those with good knowledge compared to 50.4% of those with poor knowledge of dengue have a high WTP for dengue vaccine. Nevertheless, there is no significant association between WTP for dengue vaccine with knowledge of dengue. This finding is contrary to several of the studies of WTP for dengue vaccine conducted previously which showed significant association between knowledge of dengue with WTP for dengue vaccine (Bracho-Churio et al., 2017; Hadisoemarto & Castro, 2013; Harapan et al., 2017; Lee et al., 2015). These studies reported that knowledge have a significant association with WTP for dengue vaccine where good knowledge is related to a higher WTP for dengue vaccine. This is perhaps explained by the differences of target population between this study and the other studies. Since HCWs distribution of knowledge score are overall generally high in this study (majority scored more than 70%) and the same throughout the respondents, no association with WTP for dengue vaccine could be elicited as compared to the general public which may have different levels of knowledge of dengue.

For the relationship between WTP for dengue vaccine with knowledge of dengue vaccine, there is significant association reported from this study ($\chi^2=3.062$, *p*=0.05). 52.9% from those with poor knowledge of dengue vaccine compared to 28.6% from those with good knowledge

of the vaccine have a high WTP for dengue vaccine. Systematic review of studies on WTP for dengue vaccine revealed that knowledge of dengue vaccine had not been a factor under study previously. However, studies on WTP of other vaccines such as the HPV vaccine, the Ebola vaccine and the Influenza vaccine have assessed the association between knowledge of related vaccines with WTP for those vaccines respectively (Dinh Thu et al., 2018; Kruiroongroj, Chaikledkaew, & Thavorncharoensap, 2014; Mari Kannan Maharajan, Kingston Rajiah, Kelly Sze Fang Num, 2015; Ughasoro, Esangbedo, Tagbo, & Mejeha, 2015; Umeh, Nduka, & Ekwunife, 2016; Worasathit et al., 2015). In three of the aforementioned studies, two on WTP for HPV vaccines and one of WTP for Ebola vaccines, it was shown that knowledge regarding the vaccines had a significant association with WTP for the respective vaccines (Dinh Thu et al., 2018; Mari Kannan Maharajan, Kingston Rajiah, Kelly Sze Fang Num, 2015; Ughasoro et al., 2015).

Assessment of attitude towards dengue showed no significant association with WTP for dengue vaccine where 57.6% of those with good attitude compared to 48.1 % of those with poor attitude portrayed a high WTP for dengue vaccine. However, several WTP for dengue vaccine studies showed significant association between attitude towards dengue with WTP for dengue vaccine (Bracho-Churio et al., 2017; Hadisoemarto & Castro, 2013; Harapan et al., 2017; Lee et al., 2015). In these studies, it was reported that attitude had a significant association with WTP for dengue vaccine where there was high WTP for dengue with good attitude of respondents. As with the variable knowledge of dengue, this may be explained by the choice of target population. Attitude score of HCWs in this study are generally good with more than half scoring more than 70% which may have contributed to the resulting 'no association' with WTP for dengue vaccine as compared to the general public which may have diverse attitude scores.

This study showed that there is a significant association between dengue preventive practice and WTP for dengue vaccine (χ^2=4.715, p=0.030). A bigger proportion (64.6%) of those with poor dengue preventive practice compared to a smaller proportion (46.4%) of those with good dengue preventive practice have a high WTP for dengue vaccine. Comparing with three other studies in Indonesia, Philippines and a multicounty study in Thailand, Vietnam and Columbia (Harapan et al., 2017; Lee et al., 2015; Palanca-Tan, 2008), the findings of this study is similar in eliciting a significant association between WTP and dengue preventive practice. However, in contrast to the other studies, this study showed that a poor dengue preventive practice is associated with high WTP for dengue vaccine as compared to a good preventive practice. A plausible reason may be because as HCWs these respondents know what the good and bad practices are, hence, they would realize if they have poor practices themselves. Having this realization may prompt them to be more willing to pay for dengue vaccine to compensate for their lack of good preventive practice.

Relationship between perception of vaccination with WTP for dengue vaccine showed a significant association (X^2=5.593, p=0.18). Approximately 57.3% of respondents with good perception towards vaccination as compared to 39.1% of those with poor perception towards vaccination have a high WTP for dengue vaccine. Good perception towards vaccination was shown to be significantly associated with WTP for dengue vaccine in one study in North Columbia (Bracho-Churio et al., 2017). In contrast, other studies did not produced any significant association between perception towards vaccination and WTP for dengue vaccine (Godói et al., 2017; Hadisoemarto & Castro, 2013; Harapan et al., 2017; Lee et al., 2015; Palanca-Tan, 2008).

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5.0 Conclusion & Recommendation

In conclusion, this study revealed that 51.1% of HCWs in Petaling Health District have a high WTP for dengue vaccine with median WTP of RM20.00 (USD5.01). The range of their WTP amount was between RM1 to RM500 per dose of dengue vaccine in for all three doses. Associated factors of WTP for dengue vaccine among HCWs of Petaling Health District was found out to be monthly household income, perception towards vaccination, dengue preventive practice and knowledge regarding dengue vaccine.

This study is a cross sectional study on WTP for dengue vaccine among HCWs and gives new information on WTP of HCWs and its associated factors. It provides important information how much HCWs are willing to pay for a dengue fever vaccine. The study can also assist decision makers to understand aspects of subsidizing dengue vaccines when implementing nationwide campaigns and what are the factors influencing vaccine take up. For future studies for HCWs, WTP for each category of staff could be evaluated for example a breakdown into WTP of doctors, nurses, medical assistants, and other categories. For a larger study, it is recommended that the target population be expanded to include the public to get a better perspective of WTP for dengue vaccine of the population.

Since this study used a cross sectional study design, it did not analyse the behaviour of respondents over a period of time, hence, a temporal relationship cannot be established. Apart from that, the specific sample taken from HCWs may not be representative of the public population, thus cannot be generalised. Findings from this study may only be applied to the study population with similar characteristics.

Declaration

Authors declare that this manuscript has never been published in any other journal.

Authors' contribution

Author 1: Information gathering, data collection, analysis and preparing draft of manuscript
Author 2: Supervising the research and manuscript editing
Author 3: Supervising the research and final manuscript editing

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