

# Knowledge, acceptance and willingness to pay for Dengue vaccine in Yogyakarta and Jakarta

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## ABSTRACT

Despite the fact that Dengue Hemorrhagic Fever (DHF) is one of diseases with the highest incidence rate in Indonesia, its prevention strategies remain ineffective. One of the most cost-effective strategies to prevent DHF is through vaccination. This study aimed to investigate correlations between the knowledge of DHF, the behavior of DHF prevention and the knowledge of vaccine with the acceptance of dengue vaccine and willingness-to-pay (WTP) of dengue vaccine in Yogyakarta and Jakarta, Indonesia. A cross-sectional study was conducted by collecting data from people visiting primary healthcare centers (PHCs) through a valid and reliable questionnaire. A purposive sampling was applied, which resulted in 838 respondents among PHCs in Yogyakarta (two selected districts: Bantul and Kulon Progo) and Jakarta (two selected districts: West Jakarta and Central Jakarta). The result showed that the percentage of respondents who had good knowledge of vaccine was estimated to be 67-77% in all districts. The percentage of respondent who had good acceptance of vaccine was estimated to be 68-81%. WTP of dengue vaccine among respondents was estimated to be IDR 10,000-50,000. The result showed that the knowledge of DHF was significantly correlated ( $p < 0.05$ ) with the acceptance of dengue vaccine in districts of West Jakarta, Bantul and Kulon Progo. In particular, the behavior of DHF prevention and the knowledge of dengue vaccine were significantly correlated ( $p < 0.05$ ) with the acceptance of dengue vaccine in all districts. Additionally, the knowledge and acceptance of vaccine were significantly correlated ( $p < 0.05$ ) with WTP in West Jakarta only. It can be concluded that correlation among variables in all districts are not the same. Hence, specific approach is required to be applied in each district.

*Key words:* Dengue Hemorrhagic Fever (DHF), prevention, behavior, primary healthcare center, p-value.

## INTRODUCTION

Dengue hemorrhagic fever (DHF) is a disease with high incidence rate in tropical and sub-tropical regions [1]. Dengue virus is transmitted through the bites of *Aedes aegypti* mosquito [2]. Indonesia is one of countries with the highest number of DHF cases in Southeast Asia [3]. It was reported that there were approximately 100,347 DHF cases (Incidence Rate/IR=39.9) and 907 DHF-associated deaths (Case Fatality Rate/CFR=0.9%) in 2014 [4]. Two provinces in Indonesia, Yogyakarta and Jakarta, were reported to have high IR (Yogyakarta: 54.39 and Jakarta: 83.34) and CFR (Yogyakarta: 0.56% and Jakarta: 0.11%) [4]. One of the main factors that increase the incidence rate of DHF in Indonesia is the poor knowledge of DHF [5]. It has been known that the lack of education and knowledge is strongly associated with poor attitude towards DHF prevention in the community [6].

Several strategies (e.g. vector control) remain ineffective to prevent dengue infection and decrease the number of DHF cases. Therefore, it is necessary to consider the implementation of dengue vaccination as a new prevention strategy in Indonesia [7]. A previous study reported that the combination of vector control and dengue vaccination are proven to be more effective than a single intervention [8]. In addition, the development of dengue vaccine itself has shown a rapid progress over the last decade [9]. In Indonesia, it has been licensed by the National Agency of Food and Drug Control, Republic of Indonesia in 2016 [10]. To include this vaccine in the national immunization program, however, there is still limited initial data on the acceptance of public [11]. It has been highlighted that the acceptance of dengue vaccine would affect the successful program of dengue vaccination, as reported in several published studies [11-17]. Therefore, it is necessary to investigate correlations between knowledge of DHF, behavior of DHF prevention and knowledge of vaccine with acceptance and willingness-to-pay (WTP) of dengue vaccine in Indonesia by using Yogyakarta and Jakarta as reference provinces.

## METHODS

We applied a cross-sectional study by taking into account correlations between knowledge of DHF, behavior of DHF prevention and knowledge of vaccine with acceptance and WTP of dengue vaccine. Data was collected from people visiting primary healthcare centers (PHCs) by using a valid and reliable questionnaire.

### Ethical clearance

Ethical clearance for this study was approved by the Research Ethics Committee of Universitas Padjadjaran

(37/UN6.KEP/EC/2018). As one of ethical concerns, respondents were given the informed consent form before filling the questionnaire.

### Participants

Data was collected from May to September 2018 at selected PHCs in Yogyakarta and Jakarta. Data was collected in two districts of each province, which represented districts with the highest and lowest IR of DHF. Bantul and Kulon Progo represented districts with the highest and lowest IR of DHF in Yogyakarta, respectively. West and Central Jakarta represented districts with the highest and lowest IR in Jakarta, respectively.

A purposive technique sample was applied in this study by using the following Lemeshow formula to calculate the minimum number of samples [18]:

$$n = \frac{Z^2 \cdot p \cdot q}{d^2}$$

$n$  = minimum number of samples;  $Z^2 \cdot 1 - \frac{\alpha}{2}$  = statistic  $Z$  ( $Z = 1,96, \alpha = 0,05$ );  $p$  = estimated proportion in population;  $q = 1 - P$ ;  $d$  = delta, absolute precision desired on both sides of the proportion (+/-5%).

Applying the proportion of DHF knowledge at 9.6% [19], we calculated the number of minimum samples would be 137 in each selected PHC. In total, there were 6 selected PHCs in 4 selected districts: Bantul ( $n=2$ ); Kulon Progo ( $n=2$ ), West Jakarta ( $n=1$ ) and Central Jakarta ( $n=1$ ). We applied following inclusion criteria for the respondents: (i) age between 18 and 60 years old; (ii) a patient or a patient's family member in the research site; (iii) have adequate skills of reading, writing and communication; and (iv) willing to complete the questionnaire.

### Instrument of the study

A questionnaire to measure knowledge and WTP of dengue vaccine was based on a study by Hadisoemarto *et al.* in 2013 [20]. Several factors (e.g. the definition, causes, risk factors, symptoms and treatment of DHF, methods in DHF prevention and limitation of outdoor activities in endemic areas) were considered to measure knowledge of DHF and behavior of DHF prevention. Knowledge of vaccine was defined as respondents' knowledge on vaccine information and acceptance of dengue vaccine was defined as respondents' responses on the implementation of dengue vaccination. In particular, respondents' responses were scored in a Likert scale (1=strongly disagree; 2=disagree; 3=neutral; 4=agree; and 5=strongly disagree). Total score was classified in two categories: poor ( $< \bar{x}$ ) and good ( $\geq \bar{x}$ ). In addition, WTP was defined as a nominal amount in Indonesian Rupiah (IDR) that

respondents were willing to spend for a dengue vaccine by considering a range of values that were mentioned in the Decree of the Ministry of Health (112/Menkes/SK/III/2013). Validity and reliability tests of the questionnaire were applied by considering values of  $r_{\text{count}}$  ( $>0.361$ ) and Cronbach's Alpha ( $>0.6$ ), respectively.

### Data Analysis

Descriptive analyses were performed on the characteristics of patients, knowledge of DHF, behavior of DHF prevention, knowledge, acceptance and WTP of dengue vaccine. A Kruskal-Wallis test was conducted to determine the significance of each variable between districts and a Spearman test was conducted to determine the correlation between knowledge, behavior of DHF with acceptance and WTP of dengue vaccine. Data analysis was conducted by using SPSS Software version 24. A p-value

equal to or less than 0.05 was statistically considered to be significant.

## RESULTS

### Characteristics of respondents

The total number of respondents in this study was 838 respondents from 4 selected districts: West Jakarta (n=143), Central Jakarta (n=150), Bantul (n=280) and Kulon Progo (n=265) (see Table 1). In both districts of West Jakarta (n=43) and Central Jakarta (n=81), the majority respondents were in the same age group of 26-35 years old. In districts of Bantul (n=114) and Kulon Progo (n=74), the majority of respondents were in an age group of 18-25 years old and 26-35 years old, respectively. In particular, the majority of respondents in all districts were females (n=558). Based on the

**TABLE 1. Characteristics of respondents**

VARIABLES	RESPONDENTS BASED ON THEIR CHARACTERISTICS				p-value
	Jakarta		Yogyakarta		
	West Jakarta n = 143	Central Jakarta n = 150	Bantul n = 280	Kulon Progo n = 265	
<b>Age (years old)</b>					
18-25	23 (16.0%)	8 (5.3%)	114 (40.7%)	69 (26%)	0.000
26-35	43 (30.1%)	81 (54.0%)	93 (33.2%)	74 (27.9%)	
36-45	42 (29.4%)	55 (36.7%)	49 (17.5%)	67 (25.3%)	
46-65	35 (24.5%)	6 (4%)	24 (8.6%)	55 (20.8%)	
<b>Gender</b>					
Male	45 (31.5%)	48 (32%)	83 (29.6%)	104 (39.2%)	0.102
Female	98 (68.5%)	102 (68%)	197 (70.4%)	161 (60.8%)	
<b>Education</b>					
Elementary school	30 (21.0%)	2 (1.3%)	41 (14.6%)	18 (6.8%)	0.000
Junior high school	24 (16.8%)	6 (4%)	30 (10.7%)	52 (19.6%)	
Senior high school	58 (40.6%)	93 (62%)	166 (59.3%)	124 (46.8%)	
College	31 (21.7%)	49 (32.7%)	43 (15.6%)	71 (26.8%)	
<b>Occupation</b>					
Private employee	46 (32.2%)	37 (24.7%)	79 (28.2%)	39 (14.7%)	0.000
Civil Servant	6 (4.2%)	9 (6.0%)	0%	22 (8.3%)	
Housewife	64 (44.8%)	73 (48.7%)	69 (24.6%)	113 (42.6%)	
Entrepreneur	21 (14.7%)	31 (20.7%)	132 (47.1%)	37 (14%)	
College student	6 (4.2%)	0%	0%	54 (20.4%)	
<b>Income (in IDR million)</b>					
1-1.7	56 (39.2%)	65 (43.3%)	185 (66.1%)	152 (57.4%)	0.000
1.8-3.0	54 (37.8%)	67 (44.7%)	56 (20%)	80 (30.2%)	
3.1-5.0	27 (18.9%)	18 (12%)	33 (11.8%)	28 (10.6%)	

TABLE 1. Characteristics of respondents

VARIABLES	RESPONDENTS BASED ON THEIR CHARACTERISTICS				p-value
	Jakarta		Yogyakarta		
	West Jakarta n = 143	Central Jakarta n = 150	Bantul n = 280	Kulon Progo n = 265	
<b>Income (in IDR million)</b>					
>5.0	6 (4.1%)	0%	6 (2.1%)	5 (1.9%)	0.000
<b>Experience on suffering DHF</b>					
Patient	8 (5.6%)	27 (18%)	35 (12.5%)	33 (12.4%)	0.000
Family	20 (14.0%)	5 (3.3%)	21 (7.5%)	35 (13.2%)	
Neighbor	24 (16.8%)	0%	12 (4.3%)	33 (12.4%)	
Never	91 (63.6%)	118 (78.7%)	212 (75.7%)	164 (61.9%)	
<b>Annual number of estimated cases</b>					
<30 DHF cases	143 (100%)	132 (88%)	252 (90%)	253 (95.5%)	0.716
30-60 DHF cases	0%	18 (12%)	28 (10%)	9 (3.4%)	
>60 DHF cases	0%	0%	0%	3 (1.1%)	

education level, the majority respondents in all districts graduated from senior high school (n=441). Regarding respondents' occupation, the majority of respondents in districts of West Jakarta, Central Jakarta and Kulon Progo were housewives (n=250). In contrast, the majority of respondents in Bantul were entrepreneurs (n=132). Most respondents' income in West and Central Jakarta were in a range of IDR 1-1.7 million per month (n=56) and IDR 1.8-3 million per month (n=67), respectively. While, most of respondents' income in both districts of Bantul and Kulon Progo were in the same range of IDR 1-1.7 million per month (n=337). In the context of respondents' experiences on suffering DHF, most respondents in all districts confirmed to have no experiences (n=585). When respondents were asked about the annual number of DHF cases in their neighborhood, most respondents in all districts answered the annual number would be less than 30 cases (n=780).

### Knowledge of DHF and behavior of DHF prevention

The result showed that the majority of respondents (n=486) in all districts had poor knowledge of DHF (p<0.05) (see Table 2). Regarding behavior of DHF prevention, the majority of respondents in West Jakarta (n=87) and Kulon Progo (n=163) had good behavior. In contrast, the majority of respondents in Central Jakarta (n=104) and Bantul (n=142) had poor behavior.

### Knowledge, acceptance, and WTP of dengue vaccine

Since a successful vaccination program requires support from the community, it is necessary to gather data related to the public's knowledge, acceptance, and WTP of dengue vaccine, as presented in Table 3. Most respondents in all districts had good knowledge of dengue vaccine (n=607) and good acceptance of dengue vaccine (n=605). Furthermore, the majority of WTP of dengue vaccine among respondents in all districts (n=694) was reported to be IDR 10,000-50,000 (p>0.05).

### Correlations between knowledge of DHF, behavior of DHF prevention and knowledge of vaccine with acceptance and WTP of dengue vaccine

The result showed that age, gender, education, occupation and income were not significantly correlated (p>0.05) with acceptance and WTP of dengue vaccine in all districts (see Table 4). Respondents' knowledge of DHF was significantly correlated (p<0.05) with acceptance of dengue vaccine in districts of West Jakarta, Bantul and Kulon Progo. Additionally, behavior of DHF prevention and knowledge of vaccine were significantly correlated (p<0.05) with acceptance of dengue vaccine in all districts. While, knowledge of vaccine and acceptance of vaccine were significantly correlated (p<0.05) with WTP in West Jakarta only.

TABLE 2. Knowledge of DHF and behavior of DHF prevention

VARIABLES	RESPONDENTS BY CATEGORY OF EACH VARIABLE				p-value
	Jakarta		Yogyakarta		
	West Jakarta n = 143	Central Jakarta n = 150	Bantul n = 280	Kulon Progo n = 265	
<b>Knowledge of DHF</b>					
Good	60 (42.0%)	56 (37.3%)	110 (39.3%)	126 (47.5%)	0.000
Poor	83 (58.0%)	94 (62.7%)	170 (60.7%)	139 (52.5%)	
<b>Behavior of DHF prevention</b>					
Good	87 (60.8%)	46 (30.7%)	138 (49.3%)	163 (61.5%)	0.102
Poor	56 (39.2%)	104 (69.3%)	142 (50.7%)	102 (38.5%)	

TABLE 3. Knowledge, acceptance, and WTP of dengue vaccine

VARIABLES	RESPONDENTS BY CATEGORY OF EACH VARIABLE				p-value
	Jakarta		Yogyakarta		
	West Jakarta n = 143	Central Jakarta n = 150	Bantul n = 280	Kulon Progo n = 265	
<b>Knowledge of Vaccine</b>					
Good	110 (76.9%)	101 (67.3%)	192 (68.6%)	204 (77%)	0.045
Poor	33 (23.1%)	49 (32.7%)	88 (31.4%)	61 (23%)	
<b>Acceptance of Vaccine</b>					
Good	116 (81.1%)	120 (80%)	189 (67.5%)	180 (67.9%)	0.000
Poor	27 (18.9%)	30 (20%)	91 (32.5%)	85 (32.1%)	
<b>WTP (in IDR)</b>					
10,000-50,000	119 (83.2%)	125 (83.3%)	231 (82.1%)	219 (82.6%)	0.231
51,000-100,000	19 (13.3%)	24 (16.0%)	38 (13.6%)	29 (10.9%)	
101,000-250,000	2 (1.4%)	1 (7%)	11 (3.9%)	9 (3.4%)	
251,000-500,000	2 (1.4%)	0%	0%	1 (1.1%)	
>500,000	1 (7.0%)	0%	0%	5 (1.9%)	

TABLE 4. Correlations between knowledge of DHF, behavior of DHF prevention and knowledge of vaccine with acceptance and WTP of dengue vaccine

VARIABLES		VALUE OF CORRELATION BETWEEN VARIABLES (P-VALUE)			
		Jakarta		Yogyakarta	
		West Jakarta	Central Jakarta	Bantul	Kulon Progo
<b>Age</b>	Acceptance of dengue vaccine	0.762	0.964	0.101	0.067
	WTP of dengue vaccine	0.621	1.000	1.000	0.480
<b>Gender</b>	Acceptance of dengue vaccine	0.891	0.068	0.051	0.525
	WTP of dengue vaccine	1.000	1.000	0.503	1.000
<b>Education</b>	Acceptance of dengue vaccine	0.658	0.837	0.284	0.946
	WTP of dengue vaccine	0.461	0.931	0.661	1.000

**TABLE 4. Correlations between knowledge of DHF, behavior of DHF prevention and knowledge of vaccine with acceptance and WTP of dengue vaccine**

VARIABLES		VALUE OF CORRELATION BETWEEN VARIABLES (P-VALUE)			
		Jakarta		Yogyakarta	
		West Jakarta	Central Jakarta	Bantul	Kulon Progo
<b>Occupation</b>	Acceptance of dengue vaccine	0.343	0.795	0.900	0.331
	WTP of dengue vaccine	1.000	0.567	0.583	0.974
<b>Income</b>	Acceptance of dengue vaccine	0.907	0.970	0.006*	0.699
	WTP of dengue vaccine	0.733	1.000	0.517	0.594
<b>Knowledge of DHF</b>	Acceptance of dengue vaccine	0.002*	0.085	0.000*	0.000*
	WTP of dengue vaccine	0.174	0.721	0.845	0.435
<b>Behavior of DHF prevention</b>	Acceptance of dengue vaccine	0.000*	0.000*	0.000*	0.000*
	WTP of dengue vaccine	0.059	0.113	0.155	0.785
<b>Knowledge of vaccine</b>	Acceptance of dengue vaccine	0.000*	0.000*	0.000*	0.000*
	WTP of dengue vaccine	0.003*	0.117	0.912	0.947
<b>Acceptance of dengue vaccine</b>	WTP of dengue vaccine	0.001*	0.743	0.449	0.465

\*significant p value < 0.005

## DISCUSSION

This study confirmed that most respondents who visited PHCs were in age groups of 18-25 years and 25-35 years old, which is similar with the result of a previous study in 2015 confirming an age group of 26-45 years old (33%) was the most dominant age group visiting PHCs in Tangerang, the neighboring district of West Jakarta [21]. This situation might be caused by the fact that the majority of people in this age group are active workers [22]. In addition, most population in Yogyakarta and Jakarta were reported to be in an age group of 20-34 years old [23]. It can be highlighted that most people taking advantage from the facilities of PHCs are people in working age groups, where health problems of people in these groups are still treatable in PHCs. Furthermore, the majority of respondents in all districts were females that are in line with total population in all districts that is dominated by females [23]. It strengthens the result of a previous study in Indonesia, which mentioned that females used PHCs more frequent and intense than males [20,24]. Another published study also mentioned that females paid more attention to dengue fever than males due to their economic and emotional natures [25]. Based on the education level, the majority respondents graduated from senior high school, which is similar with the finding of a previous study [22]. To compare the education level of population in Jakarta and Yogyakarta, data from Statistics of Indonesia highlighted that the average of education level in Jakarta (college) was

higher than in Yogyakarta (senior high school) [26]. In the context of DHF, education level has a strong association with knowledge of DHF [27,28]. Regarding respondents' occupation, the majority of respondents in all districts were housewives, which might be associated with knowledge of DHF and decision-making process in the family [29,30]. The result of this study showed that most respondents' income in all districts were in a range of IDR 1-1.7 million per month, which is similar with the result of a previous study confirming people with low income are more likely to use PHCs [29]. In the context of respondents' experiences on suffering DHF, most respondents in all districts confirmed to have no experiences. However, experience on suffering from a certain disease can affect attitudes and knowledge toward the disease [31]. A study by Marestika *et al.* in 2012 confirmed that respondent had fair knowledge of DHF because they are already familiar with DHF [19]. In addition, about 89.9% of respondents had known about dengue fever that means good since initial awareness of dengue fever is associated with better practice of DHF prevention and better knowledge of dengue vaccine [27,32].

This study reported that there was no significant difference on public knowledge of DHF in all districts. The highest percentage was reported to be only about 62.7% in Central Jakarta. A previous study confirmed that public knowledge related to DHF was considered to be fair [19]. In particular, several previous studies mentioned that different living area could affect people knowledge [33]. These results showed that the government needs to work hard on

increasing public knowledge of DHF and public awareness of health behavior by providing well-known information [34,35]. Regarding behavior of DHF prevention, the majority of respondents in West Jakarta and Kulon Progo had good behavior, while the majority of respondents in Central Jakarta and Bantul had poor behavior. In addition, West Jakarta and Bantul represented districts with the highest IR of DHF, while Central Jakarta and Kulon Progo represented districts with the lowest IR of DHF [36,37]. It can be highlighted that respondents' behaviors would vary in different districts with different epidemiological characteristics, which means that specific health promotion and DHF prevention strategies are required to be applied in different districts. Additionally, previous studies mentioned that knowledge had an impact on the practice of DHF prevention [28,31]. Hence, data on public knowledge would be beneficial for the government to plan, design and initiate DHF control programs [38]. This issue is crucial since knowledge of DHF would give significant and positive effects on the practice of DHF prevention, as reported on several published studies [39-41].

Most respondents in all districts had good knowledge and good acceptance of dengue vaccine with significant differences. The number of respondents with good knowledge in West Jakarta and Kulon Progo were reported to be higher than in East Jakarta and Central Jakarta. While, the number of respondents with good acceptance in West Jakarta dan East Jakarta were reported to be higher than in Bantul and Kulon Progo. Despite the fact that knowledge and acceptance of dengue vaccine differ in all districts, information about the benefit of dengue vaccine (including safety issues) is required by the community both in high and low IR districts since it can improve public knowledge and acceptance of this vaccine [20]. It has been known that good knowledge and strong acceptance of dengue vaccine would reflect the high value of vaccine [42,43,14]. In particular, the majority of WTP of dengue vaccine among respondents in all districts was reported to be IDR 10,000-50,000, which can be concluded that respondents in both high and low IR of DHF had the same value of WTP. A relatively low value might be caused by the lack of information on the potential of vaccine to prevent DHF cases. Even though wealthier people are willing to pay more for dengue vaccine [44], a high price of dengue vaccine would be a great barrier to include this in the national immunization program.

The result showed that age, gender, education, occupation and income were not significantly correlated with acceptance and WTP of dengue vaccine in all districts, which confirmed the similar result from a previous study that focused in another district [20]. Respondents' knowledge of DHF was significantly correlated ( $p < 0.05$ ) with acceptance of vaccine dengue in districts of West Jakarta, Bantul and Kulon Progo. Additionally, behavior of DHF prevention and knowledge of vaccine were significantly correlated with acceptance of vaccine dengue in all districts. This study strengthens the result of a study by Harapan *et al.*, which

confirmed that knowledge, attitude and practice of DHF prevention and attitude towards vaccination would affect acceptance of dengue vaccine in Aceh, Indonesia [45]. Furthermore, knowledge of vaccine and acceptance of vaccine were significantly correlated with WTP in West Jakarta only. Learning from the experience of Brazil as the largest market for dengue vaccine, key issue associated with high acceptance is vaccine price [32]. In addition, WTP of dengue vaccine would increase when information about vaccine efficacy has been well-known by the public [20].

This study is not the first study in Indonesia, which investigated correlations between knowledge of DHF, behavior of DHF prevention and knowledge of vaccine with acceptance and WTP of dengue vaccine. Nevertheless, this study has several major novelties. Firstly, this study focused in two provinces with high IR of DHF in Indonesia by taking into account districts with the highest and lowest IR of DHF in each province. This would give a good insight for the government to plan, design and initiate DHF control programs with specific approach. Secondly, this study was the first study conducted after the only dengue vaccine was licensed and marketed in Indonesia. This would be beneficial for the stakeholder to obtain the latest information about public acceptance of dengue vaccine in Indonesia. Despite the fact that this study has several novelties, a major limitation was found in this study. A multivariate analysis was not taken into account, so that the predictor variables that specifically correlate with acceptance and WTP of dengue vaccine remains unknown.

## CONCLUSION

It can be concluded that correlation among variables in all districts are not the same. Hence, specific approach is required to be applied in each district.

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## Conflict of interest

The authors report there is no conflict of interest in this work.

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