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Willingness to pay for dengue vaccine among parents of elementary school students in Denpasar

Ni Luh Astri Indraswari,^{1*} Dewa Nyoman Wirawan,²
Made Pasek Kardiwinata,² Pande Putu Januraga²

ABSTRACT

Background and purpose: The incidence of Dengue Hemorrhagic Fever (DHF) in Bali, especially in Denpasar, remains high. Efforts to eradicate mosquito nests have been carried out but did not give a significant reduction in the incidence number. The dengue vaccine is now available and can be a way of prevention. The dengue vaccine has not been included in the mandatory immunization program by the government so people who want to get vaccinated have to pay for it by themselves. This study aims to determine the relationship between socio-demographic factors and perceptions with the willingness to pay for the dengue vaccine among parents of elementary school students in Denpasar.

Methods: This study used a cross sectional design involving 100 mothers of students from grade 3 to grade 6 at Dauh Puri 5 Elementary School and Dauh Puri 6 Elementary School who were selected with systematic random sampling. Data collected included education level, income, respondents' perceptions and willingness to pay for dengue vaccine. Data were collected by interview using a questionnaire, the results were analyzed using a multivariate logistic regression.

Results: The average willingness of parents to pay for the dengue vaccine per dose was IDR 131,170. Percentage of respondents who were willing to pay for the dengue vaccine was 31%. The results of analysis showed that variables associated with parents' willingness to pay for the dengue vaccine were education level (OR=4.06; 95%CI: 1.19-13.76), perceived susceptibility (OR=1.59; 95%CI: 0.58-4.37) and perceived benefits (OR=2.60; 95%CI: 1.00-6.81).

Conclusion: Parents' willingness to pay for the dengue vaccine remains very low compared to the current price of vaccine per dose. The government needs to provide subsidies so that the dengue vaccine can be included in the national immunization program and be accessed by all people. Further research is needed with a broader scope and more varied population's characteristics to obtain a willingness to pay value that can represent society in general.

Keywords: willingness to pay, vaccine, dengue hemorrhagic fever

¹Public Health Postgraduate Program, Faculty of Medicine, Udayana University,
²Department of Public Health and Preventive Medicine, Faculty of Medicine, Udayana University

*Correspondence to:
Ni Luh Astri Indraswari; Public Health Postgraduate Program, Faculty of Medicine, Udayana University
astri.iins@gmail.com

INTRODUCTION

Dengue hemorrhagic fever (DHF) is a disease caused by dengue virus which is transmitted through the bite of the *Aedes aegypti* mosquito. This disease has become one of the causes of illness and death, especially among children in developing countries.¹ A modelling study conducted in 2013 estimated that there were a total of 390 million cases of dengue infections worldwide. This number was almost 8

times greater than the WHO estimate of only 50 million, which resulted in 1.5 million hospitalized cases due to dengue cases with case fatality rate (CFR) of 2.5%.¹

Indonesia is one of the endemic areas for DHF. The four dengue virus serotypes

are spread in at least 433 districts/cities (84.7%) and more than 200 million people are at risk of infection.² Bali is the province with the highest incidence of dengue fever in Indonesia, which was 105.7 per 100,000 population in 2017, far above the national incidence rate of only 26.12 per 100,000 population and the national target of <49 per 100,000 population.³ Denpasar, as an urban area, is the city in Bali with the highest number of DHF cases. From 2013 to 2016, the incidence rate of DHF cases in Denpasar was always over 200 per 100,000 population, even several working areas of public health center had an incidence rate over 400 per 100,000 population and the CFR continued to increase. In 2013 the CFR of DHF was 0.22%, in 2014

and 2015 it increased to 0.38% and 0.9% respectively.⁴

One of the efforts that has been carried out is to break the chain of transmission through eradication of mosquito nests. The existence of dengue vaccine is a new breakthrough which is expected to support that effort to prevent more new infections. The dengue vaccine has been licensed worldwide, including in Indonesia since 2016.⁵ This vaccine is targeted for children aged 9-16 years with 65.6% efficacy. The dengue vaccine is effective and safe in people who have had dengue virus infection in the past (seropositive individuals), but it increases the risk of severe dengue fever in those who develop their first natural dengue infection after

vaccination (seronegative individuals). For those who were seropositive, the efficacy of the vaccine was 81.9% and in those who were seronegative the efficacy was 52.5%. Therefore, giving dengue vaccine to seronegative individuals should be avoided so it is necessary to use IgG and IgM tests to identify individuals who have a history of dengue in the past.⁵

The acceptance of the dengue vaccine is an important factor that determines the success of the vaccination program. An assessment of public acceptance will affect the strategy for adjusting and administering the dengue vaccine, whether it still requires subsidies or it is possible to be financed out of pocket.⁶ Currently the dengue vaccine has not been included in the national immunization program so that people who want to get vaccinated must visit private health services and pay their own expenses. The price of vaccine remains quite expensive, around IDR 1,000,000 per dose, while it is necessary to do 3 times vaccines with 6 months interval so the total cost to be spent reaches IDR 3,000,000.

According to the Health Belief Model, people's perceptions of their vulnerability and benefits of an intervention can affect the decisions for their health behavior.⁷ This also applies to parents' decision to give dengue vaccine to their children. The willingness to pay for the vaccine will be affected by the parents' perceptions about the disease and the vaccine. Research on willingness to pay for dengue vaccine has been carried out in several countries such as Vietnam, Thailand and Colombia.⁸ In Indonesia, such study has been carried out in Bandung and Aceh¹⁰, however it has never been conducted in Bali. Bali has been a well-known international tourism destination in Indonesia and had been involved in the clinical trial phase for the dengue vaccine. The provision of dengue vaccine in Bali is necessary as a form of community health protection, therefore this study is important to identify the willingness to pay for dengue vaccine among parents of elementary school students in Denpasar City, Bali Province.

METHODS

This study was conducted at Dauh Puri 5 Elementary School and Dauh Puri

6 Elementary School Denpasar from November 2017 to February 2018 by using an analytic cross sectional design. The two schools were selected using purposive sampling technique with the consideration that they previously had been involved in the clinical trial phase for the dengue vaccine. Geographic characteristics and community demographics in Denpasar are represented by these two schools as well.

The samples were mothers of grade 3 to grade 6 students who were selected and willing to participate in this study. Samples were taken through a list of students obtained from the administrative archives of schools. The entire student list then became the sampling frame for the study. The sample size was determined using the sample size formula to estimate the proportion with a value of $p=0.5$, a confidence level of 95% and an accuracy level of 10%. The minimum sample size required is 97 people and from the sampling frame, 100 respondents were selected using systematic random sampling technique.

Data of characteristics of respondents, perceptions of the susceptibility of children to dengue fever, perceptions of dengue severity in children, perceptions of the benefits of dengue vaccine, perceptions of barriers in providing the dengue vaccine, and the amount that the parents willing to pay for the dengue vaccine were collected by interview using a questionnaire. The questionnaire was developed based on similar research that has been done previously. Perception variable was developed based on the Health Belief Model⁷ and assessed using a Likert Scale. Willingness to pay assessment was carried out by directly asking respondents the amount that they are willing to pay after being given information about dengue vaccine. Trial of the questionnaire had been carried out before being used to ensure that respondents can understand and answer the questions. Respondents' perceptions were grouped into "good" and "poor" categories. Respondents' willingness to pay was stated in nominal and the average was calculated. Average value was chosen because the average calculation can consider all data values. Respondents whose willingness to pay

above the average value were grouped into the "willing to pay" category, while respondents whose willingness to pay are below the average value are grouped in the "not willing to pay" category. Data analysis included univariate analysis, bivariate analysis using simple logistic regression and multivariate analysis using multiple logistic regressions to determine which variables were most associated with willingness to pay.

This research has received approval from the Ethics Commission of the Faculty of Medicine, Udayana University/Sanglah General Hospital with number 2017.02.1.1170 on 23 November 2017.

RESULTS

Characteristics of respondents

Table 1 shows characteristics, perceptions and willingness to pay of respondents. The range of respondents' ages was from 23 to 56 years with an average of 39.2 years. Most of the respondents are in the productive age range 30-49 years (89%). The majority of respondents are housewives (54%) and have completed higher education (69%). For the family income, 53% of respondents have income \leq IDR 3,500,000 and the average income of parents is IDR 4,425,000 with a median value of IDR 3,500,000. Most of the respondents' knowledge about DHF was in the moderate category (82%). As many as 58% of respondents have a good perception of the susceptibility of children to dengue fever, 83% of respondents have a good perception of the severity of DHF in children, 47% of respondents have a good perception of the benefits of the dengue vaccine, and 42% of respondents have a good perception of barriers in giving dengue vaccine to their children. The average amount that respondents willing to pay for the dengue vaccine per dose is IDR 131,170 with the highest value is only IDR 500,000, which is still below the currently price of the dengue vaccine (IDR 1,000,000).

Willingness to pay for dengue vaccine

Table 2 shows the results of the bivariate analysis using a simple logistic regression between each independent variable and parents' willingness to pay for the dengue vaccine.

From **Table 2**, it can be seen that most respondents in both categories of education level, family income, perceived susceptibility, severity, benefits and barriers did not have willingness to pay for dengue vaccine.

Based on the results of the bivariate analysis, all variables with p value <0.25 were entered into the model. Using the backward method, variables with p value >0.05 were then excluded from the model. Significant variables obtained in the final model are education level, perceived

susceptibility and perceived benefits. The results of multivariate analysis of independent variables with the willingness to pay using multiple logistic regression are showed in **Table 3**.

Based on the results of the multivariate analysis above, it can be seen that parents with higher education level have a tendency to be more willing to pay compared to parents with lower education level (OR=4.06). Parents with good perceived susceptibility have a tendency to be more willing to pay compared to parents who

have poor perceived susceptibility but it is not statistically significant (OR=1.59). Parents with good perceived benefits have a tendency to be more willing to pay compared to parents who have poor perceived benefits (OR=2.60).

DISCUSSION

From this study, it was found that the amount respondents willing to pay was still very low when compared to the current vaccine price. This indicates that public utility to health is quite low. Factors that may affect this condition are public perceptions of service quality and awareness of their health status.⁸ The low level of public awareness and perception of the risk of illness also results in a lower community willingness to pay for health services. Products that are tangible and directly beneficial tend to have a high willingness to pay, especially if these products provide health benefits and have added value such as for hobbies, increasing social status, etc. The real benefits of vaccines cannot be seen immediately so that people are not willing to buy vaccines particularly if they are expensive. It is different from buying consumptive goods which the impact can be seen immediately so that even though they are expensive, people still want to buy them.

This finding is in line with the results of study conducted by Karneli (2013) regarding the willingness to pay for cervical cancer vaccines where 70% of respondents are only willing to pay for vaccines under IDR 237,500 for 3 vaccinations while the price of cervical cancer vaccines currently reaches 1 million rupiah per dose.¹¹ Willingness to pay for dengue vaccine study conducted by Hadisoemarto (2013) in Bandung found that the majority of respondents (37.2%), were willing to pay for dengue vaccine not more than IDR 10,000 per dose.⁹ Lee (2015) conducted a study on 400 households in Vietnam, Thailand, and Columbia to calculate the average willingness to pay for dengue vaccine. The results showed that the average willingness to pay for vaccines per dose in Vietnam was USD 8.8 (IDR 123,200), in Thailand USD 23.4 (IDR 327,600), and USD 7.7 (IDR 107,800) in Colombia.⁸

Table 1. Respondents' characteristics, perceptions and willingness to pay

Variable	n	%
Age		
Mean ± SD	39.2±6.23 years	
Min-max	23-56 years	
20-29 years	5	5.0
30-39 years	46	46.0
40-49 years	43	43.0
50-59 years	6	6.0
Education level		
High	69	69.0
Low	31	31.0
Family income		
Mean±SD	IDR 4,425,000±2,643,206	
Min-max	IDR 1,000,000-15,000,000	
>IDR 3,500,000	47	47.0
≤IDR 3,500,000	53	53.0
Occupation		
Civil servant	9	9.0
Private employee	19	19.0
Self employed	18	18.0
Housewife	54	54.0
Knowledge level		
Good	8	8.0
Moderate	82	82.0
Poor	10	10.0
Perceived susceptibility		
Good	58	58.0
Poor	42	42.0
Perceived severity		
Good	83	83.0
Poor	17	17.0
Perceived benefits		
Good	47	47.0
Poor	53	53.0
Perceived barriers		
Good	42	42.0
Poor	58	58.0
Willingness to pay		
Willing to pay	31	31.0
Not willing to pay	69	69.0

Table 2. Willingness to pay based on socio-demographic factors and perceptions

Variable	Willing to pay n (%)	Not willing to pay n (%)	P
Education level			
High	24 (34.8)	45 (65.2)	0.040
Low	7 (22.6)	24 (77.4)	
Family income			
>IDR 3,500,000	17 (36.2)	30 (63.8)	0.294
≤IDR 3,500,000	14 (26.4)	39 (73.6)	
Perceived susceptibility			
Good	20 (34.5)	38 (65.5)	0.188
Poor	11 (26.2)	31 (73.8)	
Perceived severity			
Good	27 (32.1)	57 (67.9)	0.467
Poor	4 (25.0)	12 (75.0)	
Perceived benefits			
Good	20 (42.6)	27 (57.4)	0.021
Poor	11 (20.8)	42 (79.2)	
Perceived barriers			
Good	13 (31.0)	29 (69.0)	0.993
Poor	18 (31.0)	40 (69.0)	

Table 3. Multivariate analysis of independent variables with willingness to pay for dengue vaccine

Variable	Willing to pay n (%)	Not willing to pay n (%)	OR	95%CI
Education level				
High	24 (34.8)	45 (65.2)	4.06	1.19–13.76
Low	7 (22.6)	24 (77.4)		
Perceived susceptibility				
Good	20 (34.5)	38 (65.5)	1.59	0.58–4.37
Poor	11 (26.2)	31 (73.8)		
Perceived benefits				
Good	20 (42.6)	27 (57.4)	2.60	1.00–6.81
Poor	11 (20.8)	42 (79.2)		

In order for the dengue vaccine price to be in accordance with the community's willingness to pay, intervention from the government is required. Vaccines subsidies can be carried out by allocating funds from mosquito nests eradication efforts to be used for vaccine subsidies. Mosquito nests eradication efforts require a lot of money but unfortunately these efforts did not give a significant reduction in the incidence of DHF due to the large number of vectors and it is difficult to predict vectors' mobilization, reproduction, etc. So far, efforts to prevent DHF are still focused on vector control while dengue vaccination can be an easy and effective alternative for prevention. Fitzpatrick's study in 2017 regarding the evaluation of vector control in the era of the dengue vaccine states that the cost of vector control per year exceeds

the costs incurred for DHF cases per year, where the cost of vector control ranges from USD 679-USD 1331, which was greater than the cost of the vaccine for 3 doses (USD 214) with a protective effect of approximately 5 years.¹²

Respondents' income does not have a significant effect on willingness to pay. The willingness to pay assessment depends on the economic and social strata in which the survey is conducted. If only high socioeconomic strata were considered, then if the same study was carried out again considering only low socioeconomic strata the results might be different. It may appear that certain services that proved to be efficient and effective are seen as more accessible to some groups of people depending on their capacity to pay. Most of the respondents more focus on the

intervention costs than the results, so that it was not in accordance with the actual value of benefits owned by the goods or services. In other words, the concept of willingness to pay only considers individual willingness and can only be used for the perspective of the patient's point of view. However, from other perspectives such as health care providers, it should also be noted that the required services must be provided regardless of willingness or capacity to pay.¹³

The variation in education level of parents is quite large, there are those with low education, including those who did not complete primary school and on the other hand, most parents have high school education and above. This difference in education level may affect the ability to analyze the positive and negative sides of dengue vaccination as an effort to prevent DHF. The analysis shows that higher education is associated with the willingness to pay for dengue vaccine (OR=4.06). Parents who have a higher level of education are 4.06 times more likely to be willing to pay for dengue vaccine than parents who have lower level of education.

This is in accordance with the Health Belief Model which states that acceptance of health is affected by internal factors, one of which is the level of education.⁷ Education level is related to perceptions that will determine a person's reaction to the situations they face. People with higher education level can consider aspects such as costs and benefits, important objects or services for the health of themselves and their families so that they are able to place them as top priority. According to the study by Karneli (2015), it shows that higher education levels have high awareness and willingness about the importance of vaccination to prevent cervical cancer.¹¹ Similar study conducted by Wong et al (2017) in Japan, 74% of the 940 total samples willing to pay for zika virus vaccine comes from a higher education level.¹⁴ Study conducted by Aryani et al (2013) regarding the BPJS participation fee shows that the latest education has a real positive association to the willingness to pay BPJS membership and it is statistically significant.¹³

This study shows that there was a difference in the willingness to pay

between parents who had good perceived susceptibility and parents who had poor perceived susceptibility with an OR value of 1.59. Respondents with good perceived susceptibility tended to be more willing to pay (34.5%) compared to respondents who had poor perceived susceptibility (26.2%). Respondents feel that they are not susceptible to DHF because everyone, both children and adults, can get DHF. In other words, the susceptibility is equal for everyone, not like the other diseases that only have a high risk on people from certain groups, such as cervical cancer which only affects women. The right perception of the dangers or susceptibility of dengue will increase the willingness of parents to pay for dengue vaccination for their children, so the knowledge about dengue needs to be improved. Parents who are aware of the threat of a disease will enter the next stage of adoption, feeling attracted, considering benefits, and then take preventing action. According to Suhardi's study (2014), an adequate willingness and ability causes a person to be ready to face challenges. Susceptibility can often be addressed through information sought and implemented as an effort to protect from disease.¹⁶

The results of analysis show that good perceived benefits had an association with willingness to pay (OR=2.60). Parents who have a good perception of the benefits of the dengue vaccine have a tendency to be willing to pay for dengue vaccine 2.60 times more than parents who have a poor perception of the benefits of the dengue vaccine. The respondents' willingness to pay for a new marketed product is determined by purchasing power, perception of the product, and whether the product has value, quality benefits and can satisfy customer desires. If the vaccine can satisfy the respondents in providing a sense of security and strongly convincing the respondents, the vaccine product will be very valuable and will definitely be purchased by the respondents.

According to the Health Belief Model theory, apart from the benefits of a product or service being offered, the role of the government, information from the mass media, advice from local figures and culture also affect willingness to pay. Although the benefits offered are still low, if supported

by these factors, the willingness to pay for vaccines will increase. The results of study conducted by Christell et al (2019) show that 90% of respondents who are willing to pay for osteoporosis screening consider that the benefits obtained are in accordance with expenses which means that a person has shown a desire because of the perceived benefits that will be obtained after purchasing a product.¹⁷

When this study was conducted, there were no recommendations from WHO regarding serostatus screening in individuals before receiving the dengue vaccine. If adding the cost for serostatus examination in the laboratory, the price of the vaccine can exceed IDR 1,000,000 per dose. With this new nominal and procedure it will certainly affect the willingness of respondents to provide dengue vaccine for their children. The sample in the study only came from 2 elementary schools in Denpasar so the results cannot be generalized to the general population of the broader community outside Denpasar. Dengue vaccination program hopefully can support the eradication mosquito nests program thereby can increase the health status of the children and community.

CONCLUSION

The average of respondent's willingness to pay for the dengue vaccine per dose was IDR 131,170. This study shows that education level, perceived susceptibility and perceived benefits are associated with the willingness to pay for dengue vaccine. Further research is needed with a broader population scope and more varied characteristics to obtain a willingness to pay value that can represent society in general. Health promotion efforts that emphasize the susceptibility and severity of dengue and the benefits of the dengue vaccine also need to be done to increase knowledge and perceptions in order to encourage the public to be willing to get dengue vaccine. This study is also expected to be a reference for the government in determining the amount of dengue vaccine subsidies.

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CONFLICT OF INTEREST

None declared (there is no conflict of interests).

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AUTHOR CONTRIBUTION

AI designed and conceived the study, collected and analyzed data, wrote the first draft of manuscript and edited the manuscript. **DNW** was involved in the design and conception of the study, provided feedback in data analysis. **PK** critically reviewed the data analysis and edited the manuscript. **PJ** provided feedback for the manuscript.

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