ORIGINAL RESEARCH

Feasibility and willingness to pay for dengue vaccine in the threat of dengue fever outbreaks in Vietnam

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Background: The escalation of dengue fever (DF) cases in recent years and the occurrence of a large-scale DF outbreak in 2017 underline the importance of dengue vaccines in Vietnam. Given the potential benefits of the dengue vaccines and the need for copayment by the private sector, this study aims to evaluate the willingness to pay (WTP) for the dengue vaccines in patients with DF in Northern Vietnam.

Methods: A cross-sectional study was conducted on 330 in-and-out patients with DF admitted to the Bach Mai Hospital. We used the contingent valuation method to evaluate the WTP for dengue vaccines. Socioeconomic and clinical characteristics were also investigated. Multivariate interval and logistic regression models were used to estimate the average amount of WTP and identify the factors associated with the WTP.

Results: Around 77.3% patients were willing to pay an average amount of US$ 67.4 (95% CI=57.4–77.4) for the vaccine. People of higher ages, those having health insurance, those traveling in the past 15 days or suffering from anxiety/depression were less likely to be willing to pay for the dengue vaccine. However, people having a longer duration of DF or having problems with mobility were positively associated with WTP for the dengue vaccine. Patients educated to more than high school levels (Coeff.=31.31; 95% CI=3.26–59.35), those in the richest quintile (Coeff.=62.76; 95% CI=25.40; 100.13), or those having a longer duration of the disease (Coeff.=6.18; 95% CI=0.72–11.63) were willing to pay a higher amount.

Conclusion: This study highlights a relatively high rate and amount of WTP for the dengue vaccine among patients with DF. Psychological counseling services as well as educational campaigns should be undertaken to improve the WTP for the vaccine. Moreover, government subsidies should be given to increase the coverage of the vaccine in the future, especially for the poor.

Keywords: dengue, vaccine, willingness to pay, contingent valuation, Vietnam

Introduction

Dengue fever (DF) is one of the most common vector-borne infections causing great social and economic burdens globally.[1] Annually, more than 390 million cases are infected, and 4 billion people live in epidemic and endemic regions, particularly in tropical and subtropical countries.[2,3] The South-East Asia region has the highest incidence rate with more than 34.3 cases per 1,000 residents yearly,[1] and this rate continues to increase significantly over time due to climate change, urbanization and development of trade and travel across nations.[4] In addition, more than US$ 8.9 billion is spent every year on DF-related mortality and morbidity in the world.[5] Currently, no effective treatment for this infectious disease is available.[6,7] Efforts to control this illness primarily

concentrate on personal and environmental strategies such as using bed-net, insecticides or cleaning water storage containers.[1,5] However, these interventions are less effective in controlling and managing this infection.[1] Therefore, the development of dengue vaccines is an advanced strategy to alleviate dengue-related burden.[8,9]

In recent years, diverse dengue vaccines have been developed and tested in clinical trials.[8] However, one obstacle in developing an effective vaccine is that it should prevent transmission from all 4 serotypes of dengue virus.[10] Therefore, to date, only tetravalent chimeric vaccine (CYD-TDV) has been approved for the prevention of dengue infection among people aged 9 years or older in Mexico (in 2015), and then in some South-East Asian and Latin America countries.[7,11] This vaccine underwent two Phase III trials in more than 35,000 children aged 2–16 years. The results indicated that the efficacy of the vaccine against serotypes 3 and 4 was superior to serotypes 1 and 2, and the efficacy was relied dependent on age at immunization and history of DF.[12] The manufacturer (Sanofi Pasteur) suggested three doses every six months to achieve optimal preventive effect.[11] Five other dengue vaccines are being developed, of which two candidates (produced by NIH/Butantan and Takeda) are in Phase III trials.[12] With such difficulties faced in developing the vaccines it will take a long time to include a new dengue vaccine in a national immunization program at an affordable price.[13,14]

Vietnam is among the tropical countries with the highest burden of dengue. The DF endemic, characterized by annual seasonal peaks and outbreaks, occurred every 4–10 years (1983, 1987, 1998, 2009 and 2017).[15] In the 1998 outbreak, ~240,000 cases were reported with 377 deaths; and in the 2009–2010 epidemic, more than 230,000 cases were infected (142 deaths).[15,16] In 1999, a National Dengue Control Program was established to implement DF control activities, primarily focusing on controlling the vector–human transmission.[17] However, despite significant efforts, in 2017, Vietnam again suffered a large-scale outbreak from July to December with more than 184,000 people infected (32 fatal cases).[18,19] Climate change was supposed to greatly contribute to the occurrence of the outbreaks since they coincided with the increased activity of El Nino and La Nina phenomenon.[15] Thus, the dengue vaccine has been proposed as a favorable approach and is being prioritized in the national DF control strategies.[20,21] Coudeville and Garnett in their mathematical models indicated that if the vaccine had 30-year protection, the coverage would be about 70%, and if the growth rate of the population were stable, the incidence rate of DF in

Vietnam would decrease to 57%.[22] To date, only the efficacy of the CYD-TDV vaccine was tested in Vietnam and it showed preliminary benefits in reducing dengue-related hospitalizations as well as having highly protective effects.[23,24] These results show a potential application of dengue vaccine in Vietnam although this vaccine should be evaluated more for social and economic impact.[25]

Nonetheless, to implement a new vaccine successfully, the Vietnam Government should consider public acceptance as public distrust of immunizations has been increasing in recent years.[26] Moreover, the availability of financial resources for distributing the new vaccine on a large-scale is also a great challenge. Lee et al estimated that to achieve an optimal coverage 1 million to 2.6 million doses would be required for routine vaccination of 9 year-old children in the first year of implementation and an additional 8–18 million doses for people aged 10–17 years for a one-off catch-up campaign.[27] Thus, it is not feasible for the government to provide this vast amount of vaccine thus necessitating the need of copayment by the private sector. Studies in other countries such as Thailand, Colombia, Philippines and Brazil found that a high percentage of people were willing to pay for the vaccine, with the average amount ranging from US$ 20 to US$ 69.8.[6,7,28,29] In Vietnam, there has been only one study in Nha Trang, investigating the willingness to pay (WTP) for the vaccine, which revealed that people were willing to pay US$ 26.1 for a three-dose regime.[6] More evidence about public acceptance and WTP are essential to evaluate the feasibility of the implementation of the vaccine, particularly among patients with DF. These patients may have an antibody-dependent enhancement after infection with dengue virus; however, they are expected to have a better perception of prevention of dengue transmission,[30] that makes them potential consumers of the dengue vaccine, not only for themselves but also for their families. Therefore, this study aims to understand the WTP for the dengue vaccine, in patients with DF in the 2017 DF outbreak in Hanoi, Vietnam.

Methods
Study design
A hospital-based survey was performed at the Department of Infectious Diseases, Bach Mai hospital in Hanoi, Vietnam from July to November 2017. During the dengue outbreak, there were around 50–70 patients with DF hospitalized every day at the department.[31] Patients were invited to the study if they: 1) used any services (inpatient or outpatient) at the department; 2) had DF symptoms; 3) had confirmed

positive results for dengue virus (via NS1 Ag/IgM/IgG rapid test); 4) did not have any severe cognitive impairment and thus unable to respond to the questionnaire and 5) agreed to enroll in the survey and gave their written informed consent. Expecting that 50% of patients would be willing to pay for the dengue vaccine, level of CI=95%, and margin of error=0.11 (relative precision), we computed that a minimum of 318 patients were required for the study. We added 5% of total sample size to compensate for people who did not complete the questionnaire. A total number of 334 patients were enrolled in the survey using the convenience sampling technique, and the data of 330 patients were used for data analysis (98.8%).

Contingent valuation (CV) method

We applied the CV method to evaluate the WTP for dengue vaccination in patients with DF. This method allowed us to measure the WTP as well as the amount of WTP for a hypothetical product, ie, three doses of dengue vaccine, in customers. First, we presented all necessary information about: 1) the dengue epidemic in Vietnam; 2) the characteristics of the disease; 3) the available interventions and treatments for the disease and 4) the potential benefits of dengue vaccine (efficacy of vaccines and protective effect if scaling up the vaccine to a wider community). Awareness of the product was vital for patients to accurately estimate their WTP for the product.[32,33]

Then, we asked a series of questions, the so-called double-bounded dichotomous choice questions, followed by open-ended questions to assess the WTP. Patients were asked several "Yes/No" questions about their WTP for a certain amount. For instance, the first question would be "Suppose that the dengue vaccine costs US\$ 66.1 for three doses for one person, would you be willing to pay for this product?" Then, if they said "Yes," the next price would be double, and halved if they said "No." Finally, a final question about

the maximum amount of WTP that they were willing to pay for the dengue vaccine was asked. The bidding process is detailed in Figure 1.

Data collection

A structured questionnaire was administered via face-to-face interviews. Each interview lasted 15 minutes. This questionnaire was piloted in a small sample to test its validity and reliability. It was revised to correct for any misunderstood texts and questions. The data collection team included well-trained medical students at the Hanoi Medical University.

This questionnaire consisted of four parts: 1) sociodemographic characteristics (age, gender, occupation, education, marital status, income and health insurance status); 2) epidemiology characteristics (duration of infection, level of severity, types of service, whether neighborhood/relatives suffered DF, comorbidities, travel history and mosquito density at home); 3) health status; 4) awareness of and attitude toward the dengue vaccine and 5) CV questions for the dengue vaccine. Health status was measured using EuroQol-5 dimensions-5 levels tools, which evaluated patients' health in five domains: mobility, self-care, usual activities, pain/discomfort and anxiety/depression with five levels of response from no problem to extreme problem.[37]

Statistical analysis

Statistical significance was identified if the *P*-value was less than 0.05. Characteristics of respondents were described and compared regarding the WTP for dengue vaccine using Chi-squared and Mann–Whitney tests. The mean amount of WTP was estimated using interval regression. Multivariate logistic and interval regressions were used to identify potential predictors of WTP and the amount of WTP for dengue vaccine. These models were combined with stepwise backward strategies to construct reduced models (excluding
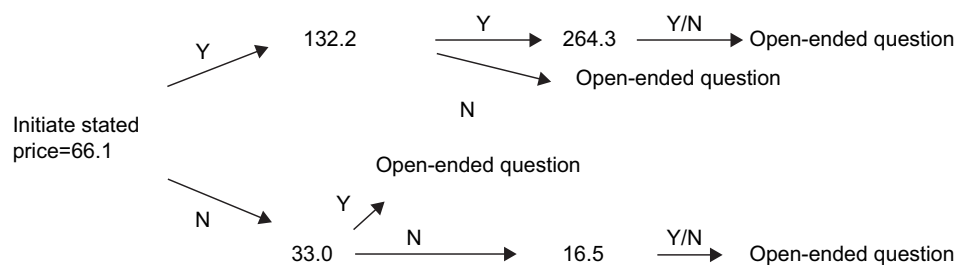

Figure 1 The Bidding process (Unit: US\$).
Notes: N indicates unwillingness to pay; Y indicates WTP. Since there was no data about the cost of dengue vaccine available in Vietnam, the starting bid (US\$ 66.1) was established by referring studies in other countries such as Brazil, Thailand and Colombia.[7,34–36]
Abbreviation: WTP, willingness to pay.

variables if their *P*-value of log likelihood test was higher than 0.2).

Ethical consideration

The study protocol was approved by the Institution Review Board of Hanoi Medical University.

Result

Table 1 shows that among 330 patients, the mean age was 31.6 (SD=12.7) years. The majority of respondents were male (52.1%), living in urban areas (77.9%), having more than high school education (51.5%) and married (52.8%), having health insurance (64.6%) followed by freelancers (25.8%). There were 77.3% willing to pay for the vaccine. Only difference in occupation was found significant between patients who were willing and not willing to pay (*P*<0.05).

Table 2 presents the WTP for the dengue vaccine according to the epidemiological characteristics of patients. The average duration of DF was 5.5 days (SD=4.3). Most of the respondents had symptomatic DF (68.5%) and used the

outpatient service (55.3%). There were 43.1% and 19.0% patients having neighborhoods and relatives with DF, respectively. More than one-third (34.2%) of patients had comorbidities. Only 14.3% and 6.8% of our sample traveled or had relatives traveling to other locales in the past 15 days, correspondingly. No differences were found between willingness and not willingness to pay for the dengue vaccine for the epidemiological characteristics.

About 85.0% patients wanted to vaccinate their family members. Only 19.8% knew of any dengue vaccines and 92.8% perceived the necessity of dengue vaccine. The percentage of people willing to pay for the dengue vaccine decreased with the levels of necessity (*P*<0.01) (Table 3).

Figure 2 reveals that 77.3% of patients were willing to pay US$ 67.4 (95% CI=57.4–77.4) for the three-dose regime of the vaccine or US$ 22.5 per dose. People who were males, having less than a high school education, singles, unemployed and living in rural areas were willing to pay less than others.

Figure 3 reveals that among 77.3% patients willing to pay for the vaccine, 42.5% of patients reported that their

Table 1 Sociodemographic characteristics of participants

	Willing to pay		Not willing to pay		Total		P-value
	n	%	n	%	n	%	
Total	255	77.3	75	22.7	330	100.0	
Gender							
Male	133	77.3	39.0	22.7	172	52.1	0.98
Female	122	77.2	36.0	22.8	158	47.9	
Education							
< High school	48	75.0	16.0	25.0	64	20.3	0.23
High school	75	84.3	14.0	15.7	89	28.2	
> High school	123	75.5	40.0	24.5	163	51.5	
Marital status							
Single	120	77.9	34.0	22.1	154	47.2	0.90
Married	133	77.3	39.0	22.7	172	52.8	
Occupation							
Unemployed	17	77.3	5.0	22.7	22	6.7	0.03
Freelancer	75	88.2	10.0	11.8	85	25.8	
White-collar worker	44	67.7	21.0	32.3	65	19.7	
Worker/farmer	22	64.7	12.0	35.3	34	10.3	
Students	61	80.3	15.0	19.7	76	23.0	
Others	36	75.0	12.0	25.0	48	14.6	
Living location							
Urban	200	77.8	57.0	22.2	257	77.9	0.66
Rural	55	75.3	18.0	24.7	73	22.1	
Health insurance							
Yes	170	80.2	42.0	19.8	212	64.6	0.15
No	85	73.3	31.0	26.7	116	35.4	
	Mean	SD	Mean	SD	Mean	SD	P-value
Age	31.3	12.6	32.6	13.2	31.6	12.7	0.47
Monthly household income (USD)	861.0	1,222.5	1,199.1	2,373.0	918.3	1,477.6	0.45

Table 2 Epidemiological characteristics

Clinical characteristics	Willing to pay		Not willing to pay		Total		P-value
	n	%	n	%	n	%	
Types of patients							
In-patient	113	79.0	30	21.0	143	44.7	0.64
Out-patient	136	76.8	41	23.2	177	55.3	
Level of severity							
Mild	38	73.1	14	26.9	52	15.8	0.73
Symptomatic	176	77.9	50	22.1	226	68.5	
Severe	41	78.9	11	21.2	52	15.8	
Having comorbidities	92	81.4	21	18.6	113	34.2	0.20
Having problems in mobility	91	79.1	24	20.9	115	35.0	0.61
Having problems in self-care	67	77.0	20	23.0	87	26.4	0.90
Having problems in usual activities	79	73.2	29	26.8	108	33.0	0.17
Pain/discomfort	171	75.7	55	24.3	226	68.9	0.25
Anxiety/depression	82	73.2	30	26.8	112	34.2	0.19
Epidemiological characteristics	n	%	n	%	n	%	
Having neighborhoods with DF	111	79.3	29	20.7	140	43.1	0.59
Having relatives with DF	47	77.1	14	23.0	61	19.0	0.81
Traveled to other locales in the last 15 days	36	81.8	8	18.2	44	14.3	0.53
Having relatives who traveled to other locales in the last 15 days	17	81.0	4	19.1	21	6.8	0.76
Mosquitoes density at home							
Very low	87	78.4	24	21.6	111	38.0	0.10
Low	58	85.3	10	14.7	68	23.3	
Normal	28	70.0	12	30.0	40	13.7	
High	41	69.5	18	30.5	59	20.2	
Very high	13	92.9	1	7.1	14	4.8	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**P-value**
Duration of illness (days)	5.5	3.3	5.4	7.0	5.5	4.3	0.06

Abbreviation: DF, dengue fever.

maximum amount of WTP equaled or was less than US\$ 66.1/three doses – equal to the starting bid. The median of the maximum amount of WTP was US\$ 132.2/three doses or US\$ 44.1 per dose, which means that among those being willing to pay, 50% of patients were willing to pay for this amount or less.

Table 4 shows that people with higher age (OR=0.94; 95% CI=0.89; 0.99), having health insurance (OR=0.34; 95% CI=0.12; 0.95), who had travelled in the past 15 days (OR=0.14; 95% CI=0.03–0.70) or suffering from anxiety/

depression (OR=0.13; 95% CI=0.03–0.55) were less likely to be willing to pay for dengue vaccine. Meanwhile, having higher a duration of the disease or having problems with mobility were positively associated with the WTP for dengue vaccine. In terms of the amount of WTP, patients having high school education (Coeff.=31.31; 95% CI=3.26–59.35), being in the richest quintile (Coeff.=62.76; 95% CI=25.40; 100.13) or having a higher duration of the disease (Coeff.=6.18; 95% CI=0.72–11.63), were willing to pay higher compared to the reference group. Meanwhile, suffering problems in

Table 3 Awareness and Attitude toward dengue vaccine

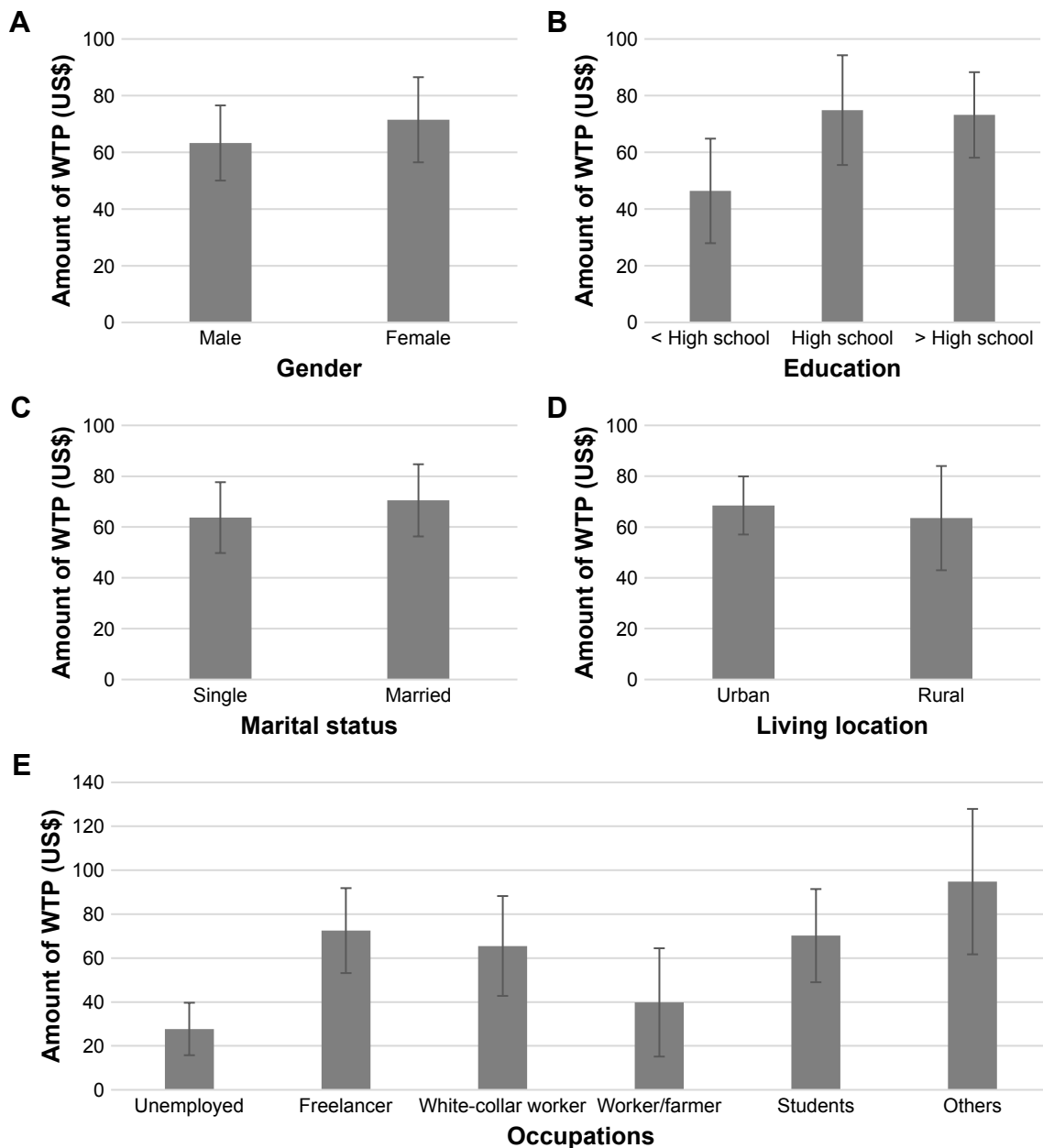|	Willing to pay		Not willing to pay		Total		P-value
	n	%	n	%	n	%	
Know any dengue vaccine	51	82.3	11	17.7	62	19.8	0.80
Necessity of dengue vaccine							
Extreme necessary	38	92.7	3	7.3	41	13.4	<0.01
Very necessary	91	91.9	8	8.1	99	32.3	
Necessary	108	75.5	35	24.5	143	46.6	
Not necessary	13	54.2	11	45.8	24	7.8	
Want family's members to be vaccinated							
Yes					267	85.0	
No					47	15.0	

Figure 2 Amount of WTP among respondents for a three-dose regime of the vaccine.
Notes: According to different sociodemographic characteristics: (**A**) gender; (**B**) education; (**C**) marital status; (**D**) living location and (**E**) occupations.
Abbreviation: WTP, willingness to pay.

usual activities was negatively associated with the amount of WTP (Coeff.= −31.18; 95% CI= −61.09; −1.28).

Discussion

This study offered insights into the WTP for the dengue vaccine among patients with DF in the outbreak in Vietnam. In this study, we found a high acceptance rate as well as high amount of WTP for the vaccine, implying the feasibility of the implementation of the dengue vaccine in Vietnam. Our regression models also found some potential factors associated with WTP in terms of socioeconomic and

epidemiological characteristics, which might contribute to some implications to improve the WTP of people for the dengue vaccine.

Our findings indicated that a relatively high fraction of our sample were willing to pay for the dengue vaccine (77.3%). This was similar to recent community-based studies in Aceh, Indonesia (77.3%)[38] and Philippines (75%);[29] and lower than that of previous studies in Bandung, Indonesia (94.6%)[13] and Colombia (88.6%).[35] Notably, most of these studies used hypothetical scenarios to evaluate the WTP for dengue vaccine. The differences could be explained by several reasons.
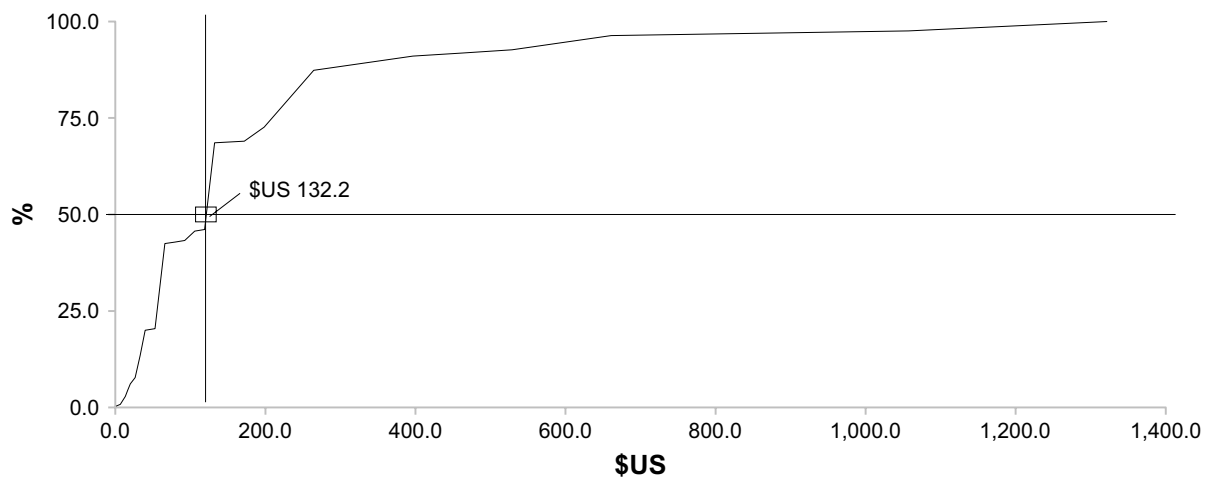
Figure 3 Cumulative proportion of patients willing to pay for three-dose regime vaccine according to the maximum amount reported.

First, we conducted this study in clinical settings while all of previous studies were performed in community settings. Second, in Vietnam, to date, no type of dengue vaccine is available; therefore, when there were no official reports about the efficacy of this vaccine from Vietnam authorities, our patients might not believe in the hypothetical dengue vaccine in the CV scenario. Thus, the WTP for this vaccine would be different if the actual dengue vaccine were available in the market. In addition, all of them were patients with DF, resulting in the opinion that they would have antibody-dependent enhancement, or in other words, they did not need to be vaccinated to prevent this disease. Finally, since the public confidence on vaccination has been decreased due to several adverse events in previous years, we observed that our patients expressed their fears about vaccination, leading to their unwillingness to pay for the vaccine. Notably, although more than 90% of patients perceived the necessity of the vaccine, 15.0% of patients refused to vaccinate their family' members even if the vaccine was assumed to be provided free of cost. This result was significantly higher than that in

Table 4 Several factors are associated with willingness to pay for dengue vaccination services

Characteristics	Willingness to pay for dengue vaccine		Amount of willingness to pay (unit: US$)	
	OR	95% CI	Coef.	95% CI
Age	0.94[a]	0.89–0.99		
Education (vs < high school)				
> High school			31.31[a]	3.26–59.35
Marital status (married vs single)			28.02	−1.19 to 57.22
Having health insurance (yes vs no)	0.21[a]	0.05–0.82		
Income quintile (vs poorest)				
Richest			62.76[a]	25.40–100.13
Traveled to other locales in the last 15 days (yes vs no)	0.14[a]	0.03–0.70		
Mosquito density at home (vs very low)				
Normal			−35.01	−72.88 to 2.86
Duration of DF (day)	1.41[a]	1.08–1.84	6.18[a]	0.72–11.63
Level of severity (vs mild)				
Symptomatic			29.05	−7.95 to 66.05
Having comorbidities (yes vs no)	3.61	0.89–14.64		
Having problems in mobility (yes vs no)	5.13[a]	1.18–22.31		
Having problems in usual activities (yes vs no)			−31.18[a]	−61.09 to −1.28
Anxiety/depression (yes vs no)	0.13[a]	0.03–0.55	−49.43	−81.63 to 17.24
Being aware of dengue vaccine (yes vs no)			−24.45	−62.38 to 13.48
Perceiving necessity of dengue vaccine (yes vs no)	5.17	0.69–38.78		

Note: [a]$P<0.05$.
Abbreviation: DF, dengue fever.

Brazil, Indonesia, Thailand and Colombia,[7,34] necessitating the need for educational campaigns to promote dengue vaccination in the future.

Among people being willing to pay for the vaccine, the mean amount of WTP was US$ 67.4 for a three-dose regime or US$ 22.5 per dose. This amount was in the cost interval that was revealed in prior community surveys such as in Nha Trang, Vietnam (US$ 26.1 for three doses), Thailand (US$ 69.8), Colombia (US$ 20–22.6),[6,28] and Brazil (US$ 33.6 for three doses)[7] and was consistent to the finding in Philippines (US$ 27.1–32.3 per dose).[29] We supposed that people were willing to pay this high amount because our study was conducted during the outbreak of dengue. Our finding was much higher than that in two community-based studies in Indonesia (US$ 1.94 per dose[13] or US$ 4 for a dengue vaccine).[39] It should be noted that the study in Indonesia was conducted to investigate the WTP for pediatric dengue vaccines, which the Indonesian Government would want to use in the national immunization program.[21] Therefore, the price used for the WTP approach in the Indonesian study equaled the production cost (~ US$ 0.2 per dose if the quantity of doses produced were 60 million per year).[40] However, literatures have highlighted that a significant effort would be required to bring the cost of a new vaccine to an affordable level for developing countries (more than 20 years in the case of hepatitis B).[13,14]

In this study, we found associations of age, education and income with WTP and amount of WTP, which were similar to previous studies.[6,13,28,38] As more than 50% of our patients were willing to pay less than US$ 132.2 for a three-dose scheme, and wealthier patients were willing to pay more for the dengue vaccine, it suggests an establishment of a private market for the dengue vaccine in the near future, as well as a threshold where sales would be robust.[28] Nonetheless, a high price of the dengue vaccine would be a great barrier to increasing coverage as social insurance schemes in Vietnam do not cover vaccination services. Clearly, government subsidies or financial aid as well as efforts to include the dengue vaccine into the national Expanded Programme on Immunization should be considered, particularly for the poor people, who have a higher likelihood of being affected by DF.[41]

Mobility impairment and higher duration of DF were found to be associated with the WTP. These findings were consistent with the previous literature since people having illnesses were more likely to accept and be willing to pay for preventive services against this diseases.[38,42–44] Meanwhile, those suffering anxiety/depression had a lower likelihood of being willing to pay for the vaccine. These patients were more likely to develop pessimism and thus, had a negative viewpoint of the preventive measures and were less likely to be willing to pay for the vaccine.[45] Notably, we did not find any relationships between awareness of and attitude toward the dengue vaccine and the WTP for the vaccine. Previous studies in Indonesia, Philippines and Vietnam indicated significant associations between the knowledge of preventive methods against dengue with WTP.[6,29,38] The difference might be probably because of the homogeneous nature of our sample. Moreover, people who had traveled to other locales in the past 15 days were less likely to be willing to pay for the dengue vaccine. Literature indicated that travel was a critical factor in transmitting the dengue virus from endemic to non-endemic settings.[46,47] This result suggested an emerging problem among travelers, requiring educational campaigns to improve their awareness about the usefulness of the vaccine in preventing dengue infection not only for them but also for their community.

The findings of this study would be used to propose several implications. First, appropriate counseling services should be provided to patients with DF helping them increase their psychological health, thus increasing their likelihood of willingness to pay. Second, educational campaigns should be implemented carried out to improve people's awareness and attitude toward the dengue vaccine, particularly among travelers, resulting in acceptance and WTP of the community for the vaccine. Third, the findings of this study could be used by policy makers in economic evaluations to have appropriate resource allocation strategies for the introduction of the dengue vaccine. In addition, the understanding of the contextual factors is important in designing vaccination programs as well as marketing strategies in the future. Moreover, this study will give the authorities and vaccine manufactures knowledge of people's perception of dengue vaccines in a dengue outbreak.

Several limitations should be acknowledged. First, our scenarios did not mention any specific vaccines. However, because this study aimed at exploring the demand of people for vaccines, this is an appropriate approach since no dengue vaccine is officially available in Vietnam.[28] Second, a social desirability bias possibly occurred when patients tended to respond to favorable options. Third, a cross-sectional design used in the study limited the possibility of drawing causal relations between WTP and its determinants. Finally, a convenience sampling approach was used in this study, decreasing the generalizability of our results.

Conclusion

In conclusion, this study emphasized a relatively high rate and amount of WTP for the dengue vaccine among patients with DF. Psychological counseling services as well as educational campaigns should be implemented to improve the WTP for the vaccine. Moreover, government subsidies should be given to increase the coverage of the vaccine in future, especially for the poor.

Disclosure

The authors report no conflicts of interest in this work.

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