

FACTORS AFFECTING ACCEPTANCE AND PREFERENCE OF THE JAPANESE ENCEPHALITIS VACCINE AMONG THAIS AND WESTERN TRAVELERS

Punyisa Asawapaithulsert¹, Amornphat Kitro², Saranath Lawpoolsri Niyom³, Chayanis Kositamongkol⁴, Pochamana Phisalprapa⁵, Surachat Ngorsuraches⁶, Watcharapong Piyaphanee¹, Thundon Ngamprasertchai¹

¹*Department of Clinical Tropical Medicine, Faculty of Tropical Medicine, Mahidol University, Bangkok, Thailand.*

²*Department of Community Medicine, Faculty of Medicine, Chiang Mai University, Chiang Mai, Thailand.*

³*Department of Tropical Hygiene, Faculty of Tropical Medicine, Mahidol University, Bangkok, Thailand.*

⁴*Doctor of Pharmacy, Pharmacist at Faculty of Medicine Siriraj Hospital, Thailand.*

⁵*Division of Ambulatory Medicine, Department of Medicine, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand.*

⁶*Harrison School of Pharmacy, Auburn University, Auburn, AL, USA.*

ABSTRACT

There is a scarcity of the acceptance and preference data of the Japanese encephalitis vaccines (JEV) among Western international and Thai travelers. This study aimed to investigate the factors determinants in acceptance and preference proportion between two groups. This cross-sectional study was conducted using a questionnaire among Thais and Western international travelers visiting Thai travel clinics at Hospital for Tropical Diseases, Bangkok, Thailand between July and December 2023. The outcomes were the acceptance and preference rates, represented as percentages. The appropriate statistical method per data distribution was applied to demonstrate the factors differences between those travelers. Of 200 participants were recruited, in which 150 (75%) were Thais and the remaining were Western travelers. A majority of Thais were female (66%). Most of Western travelers were European (72%) and the main purpose was tourism (78%). Overall, the acceptance proportion of the JEV among targeted populations were similar, with the proportion in Thais and Western travelers of 80.7% and 84%, respectively (P -value = 0.59). Thai travelers had a preference toward vaccine types (69.3%) and manufacturing countries (67%), whereas only half of Western travelers did. Of 20% Western travelers accepted to JEV regardless of efficacy data. Both demonstrated the minimal side effects of JEV such as localized reactions were concerned. The preferred JEV price was less than 57 USD per shot for all. There was no significant difference in acceptance and preference proportion between Thais and Western travelers. The affordable price of JEV for all was less than 57 USD per shot.

Correspondence: Thundon Ngamprasertchai, Department of Clinical Tropical Medicine, Faculty of Tropical Medicine, Mahidol University, 420/6 Ratchawithi Road, Ratchathewi, Bangkok 10400
Email: thundon.ngm@mahidol.ac.th; Tel.: (+66) 8 5088 7736

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INTRODUCTION

Japanese encephalitis (JE) remains a vaccine-preventable encephalitis for residents of endemic areas and poses a risk to naive travelers from non-JE endemic countries visiting these areas. The JE virus, a flavivirus, causes the most severe viral encephalitis in Asia (South Asia, Southeast Asia), the Western Pacific, and Northern Australia (Solomon, 2004). An estimated 67,900 cases of JE occurred annually in 24 endemic countries between 1998 and 2011, representing an incidence of 1.8 per 100,000 (Campbell *et al*, 2011). The first JEV was launched in 1954, and the positive trend aligns with increased vaccine coverage over the past decade, leading to a significant decrease in JE burden among endemic populations (Organization, 2022).

Regarding international travelers, the estimated risk of JE infection is 0.5-1 per 1,000,000 population (Burchard *et al*, 2009; Hills *et al*, 2019; Walter Orenstein, 2017). Despite the low incidence among both local residents and naive international travelers in each country, the fatality rate and overall burden of JE infection have gradually declined but are not negligible due to the severity among infected patients. A review covering the period from 1973 to 2023 revealed a total of 85 cases of travel-associated JE in travelers who had visited endemic regions across 15 countries. Thailand, recognized as a frequent travel destination with year-round JE transmission, accounted for 26 infected cases among international travelers. Interestingly, not a single one of them had received immunization against JE (Buhl and Lindquist, 2009; Hills *et al*, 2010; Hills *et al*, 2019). It is evident that the risk of JE infection is prominent among international travelers and local people who have never received the JEV or were born before the vaccine's introduction. The acceptance rates

for the JEV vary widely, ranging from 0.2% to 28.5%, among international travelers visiting areas where JE is endemic (Deshpande *et al*, 2014; Hatz *et al*, 2009; Mills *et al*, 2021; Walker *et al*, 2015). Barriers to vaccination might include the vaccine's cost and a diminished perception of the associated risk (Asawapaithulsert *et al*, 2023).

There is a scarcity of the acceptance and preference data of the JEV among Western international and Thai travelers. A few papers studies about JEV acceptance have study in non-endemic JE countries. However, a current study on travelers who visit endemic countries is still lacking. This knowledge gap, encompassing JEV acceptance, influencing factors, and the willingness to accept the JEV among both Thais and international travelers, remains significantly limited in the existing literature. Therefore, this study aimed to investigate the factors determinants in acceptance and preference proportion between two groups and might fulfill the gap and assist travel medicine practitioners to deliver better pre-travel consultations, particularly to travelers planning to visit JE-endemic areas and to recommend appropriate JEV based on their itineraries.

MATERIALS AND METHODS

This study was a multi-center, cross-sectional study, questionnaire-based survey among Thais and western traveler who visited The Thai travel clinic at the Hospital for Tropical Diseases, Bangkok and Maharaj Nakorn Chiang Mai Hospital, Chiang Mai, Thailand, from July to November 2023. Eligible participants were adult international traveler aged 18-years and older living in or originating from the West, in particular Eastern Europe/European Union, North America (The United States and Canada), Central

America and South America including both short-term (travel as less than 4 weeks) and long-term (travel as more than 4 weeks) visitors to Thailand. Compared Adult Thai travelers aged 23 years and older, born before the Thailand Expanded Program on Immunization (EPI) launched JE vaccine coverage in 2000, who visit travel clinics for domestic and international travel. The exclusion criteria in both groups were participants who had been vaccinated against Japanese encephalitis or have a history of Japanese encephalitis vaccination, those who have Japanese encephalitis vaccine contraindications, and those who visited a travel clinic to acquire the JE vaccine. The ability to read and understand the Thai or English questionnaire. All participant provided a written-informed consents before enrolment into the study.

The questionnaire included 4 parts, focused on basic demographic information, knowledge and attitude towards JE infection, attitude towards JE vaccination, and factors affecting JEV acceptance. The questionnaire was designed after a literature review of related published studies. All participants were able to understand and complete the questionnaire within 10-15 minutes.

Participants could complete the questionnaire independently or with the assistance of the investigator or with the investigator team. There was no follow-up questionnaire. Good knowledge in this study was defined as score of at least 4 points out of 6. The same method was used to select a cut-point for good attitude toward the JEV; 80% of total score was defined as a good attitude towards JEV. This proposal was approved by the Ethics Committee of the Faculty of Tropical Medicine, Mahidol University [MUTM 2023-054-01].

The sample size was calculated using the following approach to determine the equation for a cross-sectional survey study to estimate the proportion of traveler.

Previous literature showed acceptance rate of JEV among international travelers were 0.2-28.5% (Deshpande *et al*, 2014; Hatz *et al*, 2009; Mills *et al*, 2021; Walker *et al*, 2015), while the acceptance rate for Asian children was 54.6% (Thang HN *et al*, 2018). We anticipated that the acceptance rate for Asian adults would be approximately 15% lower than that for Asian children. Accordingly, we estimated that the acceptance rate for western travelers and Thais travelers were 25% and 15%, respectively. Calculating the sample size with a precision error of 0.05, a type I error of 0.05, and a power of 80%. The calculated sample size equaled 289 western travelers and 196 Thais. Therefore, we estimated the dropout rate to be 5%. Finally, the sample size was calculated as 300 participants from the western traveler group and 200 participants from Thai group. A total of 500 participants were initially enrolled into the study. For the preliminary analysis, we used a data ratio of 3:1. As the result, the sample size for this paper comprised 50 participants from the Western traveler group and 150 participants from the Thai group, making a total of 200 participants initially enrolled in the study.

SPSS version was used to conduct statistical analysis. Chi-square and Fisher's exact tests were used to compare the two groups. Parametric tests (t-test and ANOVA) and nonparametric tests (Mann-Whitney u test) were used, as appropriate, to test the association between demographic characteristics, knowledge and attitudes. A p-value < 0.05 was regarded as statistically significant.

RESULTS

This study enrolled 200 participants and is eligible for this preliminary analysis. Table 1 shows 150 (75%) were Thais and 50 (25%) were Western travelers. The survey among Thai participants revealed a mean age of 37 years (37.38±11.68). Of these participants, 66.0% were female (n =

99), 34% were male (n = 51), 74.7% were single, 92.7% held a Bachelor's degree or above, and 53.3% were employed. The monthly income for 49.3% was > 30,000 THB (> 960 USD), 78% reported healthy, and 98.7% had no history of vaccine allergy. Among Western travelers, the mean age was 31 years (31.86 ± 12.68), with 64% male (n = 32) and 36% female (n = 18).

Approximately 72% were from Europe, and 28% were from North America. The purposes among Western traveler participants were primarily tourism (78%), followed by business (8%), study (6%), and visiting friends and relatives (4%). The vast majority reported healthy (92%). Baseline characteristics were shown in Table 1.

Table 1 Demographic data

Baseline Characteristics		Thais n (%)	Western traveler n (%)	p-value
Gender				<0.001*
	Male	51 (34.0)	32 (64.0)	
	Female	99 (66.0)	18 (36.0)	
Age (years)		37.38±11.68	31.86±12.68	0.005*
Living status				0.570
	Single	112 (74.7)	41 (82.0)	
	Married	34 (22.7)	8 (16.0)	
	Divorced/ widowed	4 (2.6)	1 (2.0)	
Nationality				
	Eastern Europe/ European Union	0 (N)	36 (72.0)	
	North America	0 (N)	14 (28.0)	
	Thai	150 (100)	0 (N)	
Purpose of travel				
	Tourism	0 (N)	39 (78.0)	
	Business	0 (N)	4 (8.0)	
	Study	0 (N)	3 (6.0)	
	Visiting friend and relative	0 (N)	2 (4.0)	
	Other	0 (N)	2 (4.0)	
Occupation				<0.001*
	Employee	53 (35.3)	8 (16.0)	
	Civil servant	26 (17.3)	1 (2.0)	
	Health care provider	24 (16.0)	2 (4.0)	
	Retired	10 (6.7)	4 (8.0)	
	Teacher/ Student	9 (6.0)	23 (46.0)	
	Entrepreneur	6 (4.0)	3 (6.0)	
	Other	22 (14.7)	9 (18.0)	
Education level				<0.001*
	less than Bachelor's degree	11 (7.3)	14 (28.0)	
	Bachelor's degree	82 (54.7)	16 (32.0)	
	Postgrad or higher	57 (38.0)	20 (40.0)	
Average monthly income				<0.001*
	< 7,500 Baht	8 (5.3)	7 (14.0)	
	7,500 - 15,000 Baht	8 (5.3)	3 (6.0)	
	15,001 - 22,500 Baht	29 (19.3)	0 (0.0)	
	22,501 - 30,000 Baht	31 (20.7)	4 (8.0)	
	> 30,000 Baht	74 (49.3)	36 (72.0)	
Underlying Disease(s)				0.027*
	No	117 (78.0)	46 (92.0)	
	Yes	33 (22.0)	4 (8.0)	
History of vaccine allergy				1.000
	No	148 (98.7)	50 (100.0)	
	Yes	2 (1.3)	0 (0.0)	

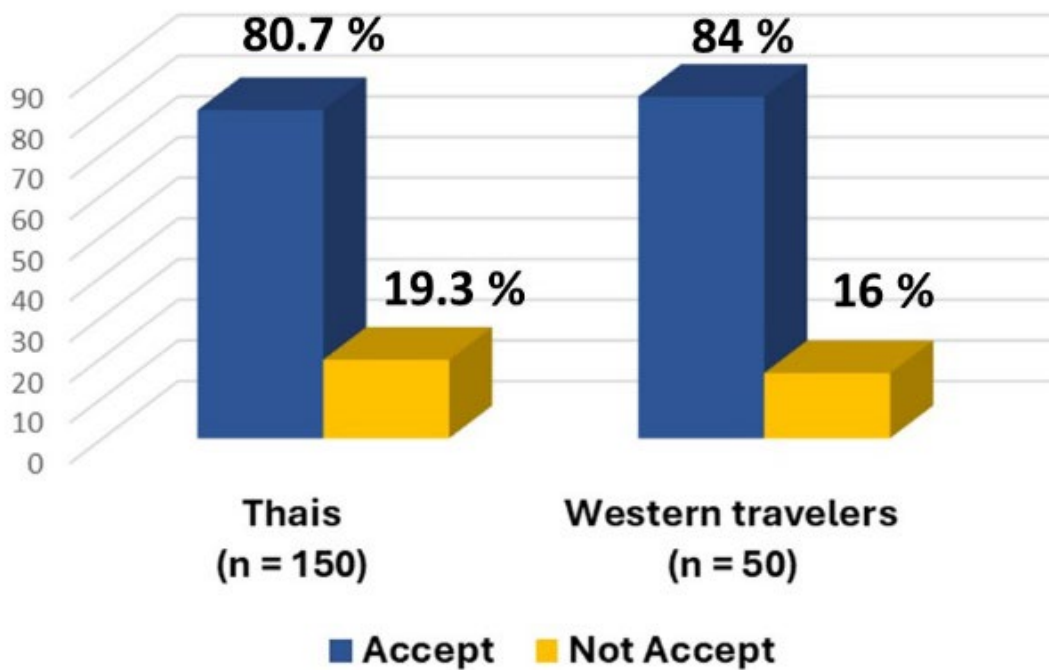
As indicated in Table 2, a significant lack of understanding regarding JE infection was evident among both Thai and Western participants, with proportions of 94.7% and 100%, respectively. In terms of

attitude toward the JEV, there was no significant difference between two groups. Approximately 87.3% of Thais and 80% of Western travelers demonstrated positive attitudes toward the JEV.

Table 2 Knowledge of the JE infection and attitude toward the JEV

Knowledge and attitude toward JE infection	Thais n (%)	Western travelers n (%)	p-value
Knowledge towards JE infection			0.205
Good knowledge	8 (5.3)	0 (0.0)	
Poor knowledge	142 (94.7)	50 (100.0)	
Attitude towards JEV			0.202
Good attitude	131 (87.3)	40 (80.0)	
Poor attitude	19 (12.7)	10 (20.0)	

Figure 1 Acceptance of the JEV among Thais and Western travelers



The overall acceptance proportion of the JEV among Thais and Western traveler populations was similar, with acceptance rates of 80.7% and 84%, respectively (p-value = 0.59) (Figure 1). Thai travelers carefully considered the type of vaccine, specifically whether it was a live or killed vaccine, before deciding to receive the JEV, with a notable percentage of 69.3%.

Additionally, they expressed a preference for vaccine manufacturing countries (67%), indicating a predilection for vaccines originating from Europe (70.3%), Thailand (25.7%), and India (4%). In contrast, a quarter of Western travelers expressed reservations about vaccine types (12%), and only half exhibited a preference for specific vaccine manufacturing countries (56%).

Interestingly, an absolute majority of Western travelers (100%) supported vaccines manufactured exclusively in Europe.

Regarding vaccine efficacy, 52.7% of Thais endorsed efficacy levels of 90% or more, and an additional 26% accepted efficacy levels within the range of 80-89%. Among Western travelers, 38.0% found vaccines with 80-89% efficacy acceptable, and 12% expressed a preference for vaccine

efficacy exceeding 90%. Furthermore, 20% of Western travelers accepted the JEV regardless of efficacy data. Both groups exhibited minimal concerns regarding the side effects of JEV, particularly localized reactions. A notable 86.0% of Western travelers expressed concerns, while only 42.7% of Thais shared similar apprehensions. In terms of the preferred JEV price, 90% of Thais and 84% of Western travelers indicated a preference for a cost below 57 USD per shot. (Table 3)

Table 3 Factor affecting Japanese encephalitis vaccine acceptance

Factor	Thais (n = 150)	Western travelers (n = 50)	p-value
Type of vaccine			<0.001*
No concern	46 (30.7)	38 (76.0)	
Concern	104 (69.3)	12 (24.0)	
The country manufacturer			0.147
No concern	49 (32.7)	22 (44.0)	
Concern	101 (67.3)	28 (56.0)	
Europe	71 (70.3)	28 (100.0)	
Thailand	26 (25.7)	0 (0.0)	
India	4 (4.0)	0 (0.0)	
Vaccine efficacy			<0.001*
50-59%	1 (0.7)	2 (4.0)	
60-69%	6 (4.0)	2 (4.0)	
70-79%	14 (9.3)	10 (20.0)	
80-89%	39 (26.0)	19 (38.0)	
≥ 90 %	79 (52.7)	6 (12.0)	
No matter how much efficacy is, I will receive vaccine	11 (7.3)	10 (20.0)	
No matter how much efficacy is, I will NOT receive vaccine	0 (0.0)	1 (2.0)	
Acceptable side effect			<0.001*
Local	64 (42.7)	43 (86.0)	
Systemic	84 (56)	7 (14.0)	
Severe	2 (1.3)	0 (0.0)	
Death	0 (0.0)	0 (0.0)	
Maximum cost of vaccine per dose			0.046*
≤ 500 Baht	19 (12.7)	12 (24)	
501-1000 Baht	63 (42)	12 (24)	
1,001-2,000 Baht	53 (35.3)	18 (36)	
2,001-3,000 Baht	6 (4)	1 (2)	
3,001-4,000 Baht	5 (3.3)	2 (4)	
4,001-5,000 Baht	4 (2.7)	5 (10)	

DISCUSSION

Travel to Asia has been steadily increasing in recent decades, exposing a growing number of travelers to the potential risk of JE (W. T. Organization, 2023). To the best of our knowledge, this is the first cross-sectional study examining JEV acceptance among both Thais and Western travelers conducted in a JE endemic country. Of the 200 participants in this research, the overall acceptance rate was 80.7% among Thai participants and 84% among Western participants, indicating a high level of acceptance compared to previous JE acceptance studies conducted in non-JE endemic countries, including the United States, the United Kingdom, and Switzerland, whose reported acceptance rates ranged from 0.2% to 28.5% (Deshpande *et al*, 2014; Hatz *et al*, 2009; Mills *et al*, 2021; Walker *et al*, 2015). Studies focusing on JEV acceptance among the adult population in Thailand remain limited. However, Thai participants demonstrated a similar acceptance rate when compared to other vaccines, such as the COVID-19 vaccine, where acceptance rates varied between 41.8% and 99% (Onwan *et al*, 2022). Several factors can contribute to an increase in vaccine acceptance rates. Previous research has shown that the COVID-19 pandemic has increased global awareness of diseases, leading people to become more engaged in self-care and disease prevention, including vaccination (Onwan *et al*, 2022). While lack of JE infection knowledge showed the mean attitude score toward JE infection was similar in both groups (p-value 0.205). In our research, we discovered that 87.3% of Western travelers and 80% of Thai travelers demonstrated a positive attitude towards the JE vaccine. This positive attitude towards JEV significantly contributed to the high rate of acceptance observed.

In the Southeast Asia region, although JE vaccination has been implemented in National Immunization Programs (NIP) in

Southeast Asian countries, resulting in a significantly reduced number of reported cases, sporadic cases have been reported since the twentieth century (W. H. Organization, 2023; Yun and Lee, 2014). The incidence rate of JE infection among local populations and international travelers has remained relatively low. However, the severe consequences of the disease, including morbidity, mortality, and progression to encephalitis, in older local adults and international travelers who have not received the JEV, continue to be a significant concern, as there have been reports from Australia and South Korea (Outbreak New, 2023; Van DH *et al*, 2019). In our study, it is evident that a significant number of participants lack knowledge about JE infection. Healthcare providers, particularly Travel Medicine specialists, play an important role in bridging this gap by raising awareness, distributing, and promoting information about JE infection and vaccination to the wider public.

The price of the JEV is one of the main reasons contributing to the low reception of JE vaccination among both Thais and international travelers. This hypothesis was supported by studies conducted among Australian and U.S. travelers, which identified the high cost of the JE vaccine as a potential barrier to JE vaccine uptake (Lammert *et al*, 2016; Mills *et al*, 2021; Wirawan, 2021). The results of this study showed that the preferred JEV price was set at less than 57 USD per shot for all participants. Vaccine prices may indeed depend on income, as the majority of individuals in both groups have monthly incomes exceeding 830 USD. This aligns with the recognition of cost considerations as a significant factor in vaccine acceptance.

The study design being cross-sectional with convenience sampling conducted in travel medicine centers in Thailand may introduce some limitations. Firstly, there could be a selection bias as most travelers

attending these clinics may already have a greater intention to seek vaccination, potentially leading to higher acceptance rates and more positive attitudes towards vaccines compared to the general population. Additionally, the study's findings may not be fully representative of all travelers, especially those who do not visit travel medicine centers or have different demographic characteristics. Secondly, the relatively small number of participants in both groups raises concerns about the generalizability of the findings and increases the risk of selection bias. Future research should collect more data from participants who travel in public areas of Thailand, especially in popular destinations like Khaosan Road, Pattaya, Phuket, and Chiangmai, etc. This study would be notable strengths in addressing knowledge gaps. Consequently, travel medicine specialists and general medical practitioners could leverage this information to disseminate JE knowledge, raise awareness, and promote JE immunization among the public.

In conclusion, the acceptance rate among Thais and Western travelers in JE endemic countries were approximately 80%. Several factors influenced the intention to receive the JEV among Thais and Western travelers, including vaccine type, country of manufacturing, vaccine efficacy, and prices. The identified affordable price for the JEV for all participants was less than 57 USD per shot.

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