



## RESEARCH ARTICLE

**REVISED** High vaccination coverage, inadequate knowledge and high vector density: Findings from a community-based cross-sectional study on Japanese Encephalitis in Yangon, Myanmar [version 2; peer review: 1 approved, 1 approved with reservations]

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**Abstract**

**Background:** Japanese encephalitis (JE) is a mosquito-borne disease with high case fatality and no specific treatment. Little is known about the community's (especially parents/guardians of children) awareness regarding JE and its vaccine in Yangon region, which bears the highest JE burden in Myanmar.

**Methods:** We conducted a community-based cross-sectional study in Yangon region (2019) to explore the knowledge and perception of parents/guardians of 1-15 year-old children about JE disease, its vaccination and to describe JE vaccine coverage among 1-15 year-old children. We followed multi-stage random sampling (three stages) to select the 600 households with 1-15 year-old children from 30 clusters in nine townships. Analyses were weighted (inverse probability sampling) for the multi-stage sampling design.

**Results:** Of 600 parents/guardians, 38% exhibited good knowledge of JE, 55% perceived JE as serious in children younger than 15 years and 59% perceived the vaccine to be effective. Among all the children in the 600 households, the vaccination coverage was 97% (831/855).

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report



report



report



report

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**Conclusion:** In order to reduce JE incidence in the community, focus on an intensified education program is necessary to sustain the high vaccine coverage in the community.

### Keywords

JE vaccine, knowledge and perception, community-based survey, caregiver's knowledge, SORT IT



This article is included in the **TDR** gateway.

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**REVISED Amendments from Version 1**

We have revised the title according to the reviewer's suggestion. We performed a more in-depth analysis to determine the socio-demographic characteristics associated with a good knowledge score and presented in the Table 3. We also performed an in-depth analysis to determine the good knowledge score with the child being vaccinated and presented in the Table 4. We added the explanation of the "Type of family" variable in the footnote of the Table 1. We removed the "Family members suffered JE" variable from Table 1 as the author group feels it does not add valuable information. We added detailed explanation of the sampling design and procedure in the method section. We have added a discussion explaining the higher coverage of vaccination in spite of the low level of knowledge and perception of JE disease and the JE vaccine. We stated the objectives clearly at the end of the introduction section. We have added the limitations and generalisability of the study in our revised manuscript.

**Any further responses from the reviewers can be found at the end of the article**

## Introduction

Japanese encephalitis (JE) is a zoonotic disease caused by Japanese encephalitis virus (JEV). JEV exists in a transmission cycle between mosquitoes, pigs and/or water birds and is transmitted to humans through bites from infected mosquitoes of the *Culex* species (mainly *Culex tritaeniorhynchus*)<sup>1</sup>. JE usually presents as acute encephalitis syndrome (AES) and is confirmed by serology.

JE is a disease of public health importance as billions of people are at risk of getting infected by JEV and children below 15 years are more susceptible<sup>1</sup>. A systematic review (2011) reported that 67,900 clinical cases of JE occur annually in 24 Asian and western Pacific countries despite the widespread availability of the vaccine, with approximately 13,600 to 20,400 deaths. While the overall incidence of JE is 1.8 per 100,000 per year in endemic countries, it is 5.4 among 1–15 year-old children<sup>2</sup>. The infection can lead to severe complications with high case fatality. There is no specific treatment to date. JE is not easily prevented by protection from mosquito control and mosquito bites. Hence, vaccination is the most effective form of prevention<sup>1</sup>. Globally, live attenuated SA 14-14-2 JE vaccine is the most commonly used JE vaccine. Vaccine efficacy is reported to be between 80% and 99% following single-dose vaccination and 98% or greater with two doses<sup>3</sup>.

In Myanmar, *Culex tritaeniorhynchus* is the main JE vector<sup>4</sup>. In 2012, there were only 14 confirmed JE cases, which increased to 151 in 2015 and more than 380 in 2016 and 2017, indicative of improved surveillance in the country<sup>5</sup>.

In 2017, the Expanded Programme on Immunization (EPI) under the Department of Public Health carried out a nationwide JE vaccination catch-up campaign supported by the GAVI, WHO, the United Nations Children's Fund and PATH. In November and December, nearly 14 million children (aged

nine months to 15 years) were targeted and vaccinated with the WHO live attenuated (SA 14-14-2) JE vaccine. Alongside the campaign there were extensive advocacy and sensitization sessions provided to schools and communities<sup>6</sup>. Since January 2018, immediately after the JE campaign, routine immunization in Myanmar has included JE live attenuated vaccine, given at the age of nine months together with the measles-rubella vaccine.

Adequate knowledge of JE and a positive perception of the JE vaccine are important for the adoption of preventive measures<sup>7</sup>. In addition, high coverage of the JE vaccine in populations at risk of disease is required to reduce the JE cases because JE vaccination would not provide herd immunity<sup>8</sup>. A study conducted in one township in northern Shan state in Myanmar (2018) showed the level of awareness of JE and its vaccine was low but the perception towards knowledge of JE was generally positive<sup>9</sup>. The vaccination coverage was 93% among 391 study participants.

Little is known about the community's (especially parents/guardians of children) awareness regarding JE and its vaccine in Yangon region, which bears the highest JE burden in the country<sup>6</sup>. This data, alongside vaccination coverage data for children, may help the regional vector borne disease control (VBDC) programme and EPI to develop a new coordinated strategic plan to successfully reduce JE transmission in Yangon region.

Therefore, in Yangon region, we aimed to describe the i) knowledge and perception of the parents/guardians of children (1–15 years old) towards JE disease and vaccine, and ii) JE vaccine coverage among 1–15 year-old children.

## Methods

### Ethical statement

The Ethics Review Committee, Department of Medical Research, Myanmar (Ethics/DMR/2018/102EA/2019/028) and the Union Ethics Advisory Group of the International Union against Tuberculosis and Lung Disease (The Union), Paris, France (EAG 04/19) approved the study. Written informed consent for participation in the survey was taken from the parents/guardians of children aged 1–15 years old and the consent process was approved by the ethics committees.

### Study design

This was a community-based cross-sectional survey involving primary data collection.

### Study setting

Myanmar is located in the Southeast Asia region, neighboring Laos to the east, Bangladesh to the west, Thailand to the southeast, the Republic of China to the north and northeast and India to the northwest. Myanmar has a population of 51 million with an urban:rural population ratio of 30:70. The country has 14 states and regions including Nay Pyi Taw council territory. It consists of 74 districts, 330 townships, 398 towns, 3065 wards, 13,619 village tracts and 64,134 villages<sup>10</sup>.

Yangon is the economic capital of Myanmar with four districts, 46 townships, 743 wards and 628 village tracts. The population of Yangon region is the highest in size when compared with other states and regions in the country. The urban:rural population ratio is 70:30<sup>10</sup>.

**Study population**

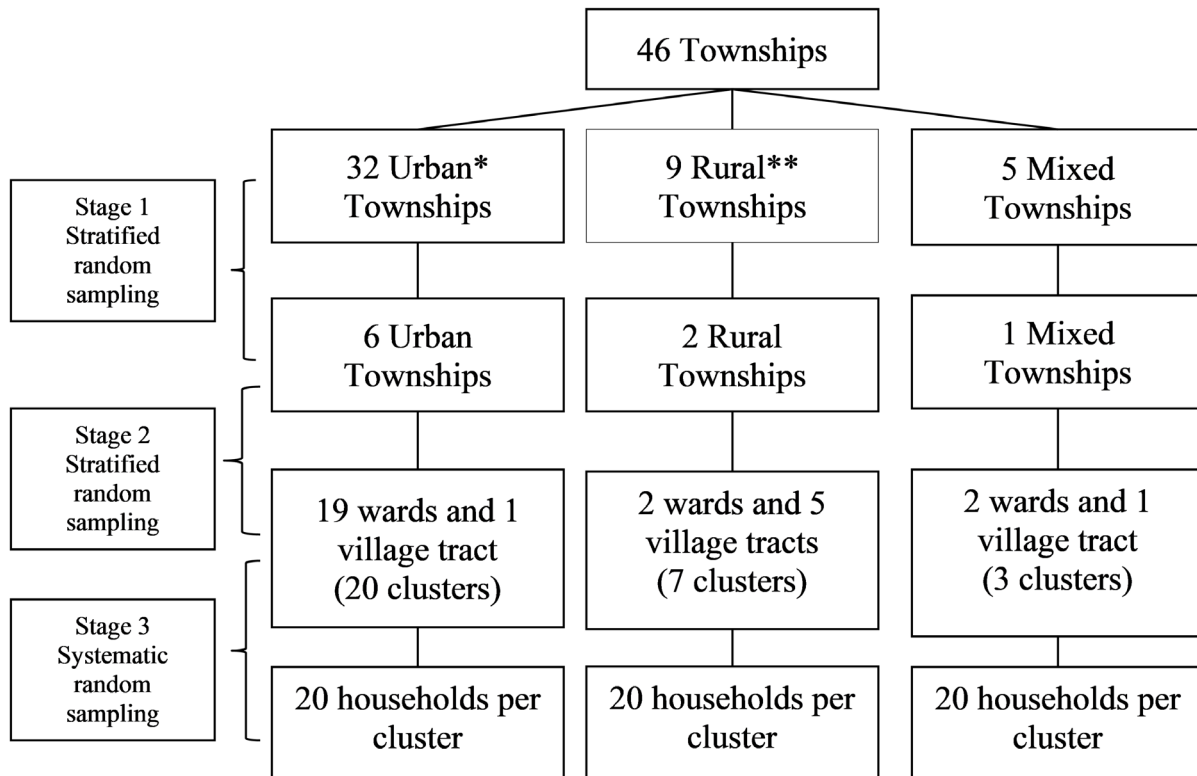
The study population included parents/guardians of children (1–15 years old) living in Yangon region for the first objective and children (1–15 years old) for the second objective (February to June 2019).

**Sample size and sampling procedure**

For the first two objectives, assuming that the prevalence of community awareness of JE and its vaccination among parents/guardians of children (1–15 years old) and vaccination coverage of children (1–15 years old) in Yangon being 50% with 5% precision at 95% CI, the calculated sample size was 384. Assuming a non-response rate of 5% and a design effect of 1.5, the final sample size was 600 households with children (1–15 years old) We used the conservative assumption of 50% prevalence as there is no previous data on community awareness and vaccination coverage in Yangon region and 5% non-response rate based on field experience.

We used three stage random sampling to sample the 600 households with children (1–15 years) from 30 clusters (ward or

village tract) in nine townships in Yangon region (see **Figure 1** and **Figure 2**). In the first two stages, we used stratified random sampling and in the third stage, we used systematic random sampling. First, we randomly selected the nine townships from 46 townships maintaining a selection ratio of 1:5 in each strata (six predominantly urban, two predominantly rural and one mixed township) after stratifying them into urban (more than 70% urban population), rural (less than 30% urban population) and mixed (between 30% to 70% urban population) based on the classification used in population census in Myanmar<sup>10</sup>. Then, in the second stage, thirty clusters were proportionately selected from six predominantly urban townships (20 clusters), two predominantly rural townships (7 clusters) and one mixed township (3 clusters) randomly after stratifying them into wards and village tracts in each selected township. Within each township, trained field assistants went directly to the general administration department for a list of the households and map of the selected wards/village tracts. The trained field assistants conducted systematic random sampling to select 20 households with children aged 1–15 years old within each cluster. The trained field assistants chose a random starting point using the map and then selected the first household. Then, they went to next household using the sampling interval until the required sample size was reached. Sampling interval was calculated by dividing the total number of household in the selected wards or village tracts by the required sample size for that selected wards or village tracts. If the selected household did not have any



**Figure 1.** Multi-stage random sampling (three stage) to select households with 1–15 year-old children in the Japanese encephalitis survey, Yangon region, Myanmar (2019). \*Predominantly urban (>70% urban population); \*\*Predominantly rural (>70% rural population).



**Figure 2.** Randomly selected nine townships for the Japanese encephalitis survey, Yangon region, Myanmar (2019).

children aged 1–15 years old, field assistants went to the next adjacent household with a child in this age range. If the selected house was locked or there was no parent or guardian, field assistants followed the same procedure as above. In case the selected house was an apartment building, we selected one household randomly. We interviewed the parent or guardian of the child available at the time of survey, preferably the mother. There were no non-responses..

#### Data collection and tools

During February-June 2019, at the selected households, field assistants conducted face to face interviews with parents/guardians using a pretested structured questionnaire (see Annex 1 and Annex 3, *Extended data*)<sup>11,12</sup>. The field assistant asked the questions verbally to the participants and completed the questionnaires. The structured questionnaires were tested during a pilot survey and were revised according to feedback received during the pilot survey.

The questionnaire consisted of four sections. The first section highlighted the socio-demographic information. The second section was comprised of 12 questions that assessed the knowledge of participants about JE disease and prevention (including vaccination). The third section assessed perception. The fourth section included information about vaccination status of the children. If the selected household had more than one child aged 1–15 years old, we asked the parent/guardian

about the vaccination status of all the children in this age range. Vaccination status was based on parents' or guardians' recall. Field assistants also asked about the presence or absence of a vaccination card.

#### Data management and analysis

Data from the survey forms were double-entered and validated using EpiData entry software (version 3.1, EpiData Association, Odense, Denmark). Data were analyzed using STATA (version 12.1, STATA Corp., College Station, TX, USA). There were no missing data in the study.

We provided weighted estimates as the analyses were weighted (inverse probability sampling) for the multi-stage sampling design. We used frequency and proportion to summarize the characteristics of the study participants. We assigned a knowledge score to each participant based on the number of correct or appropriate responses. Each appropriate answer was assigned one point and incorrect responses or "do not know" were assigned zero points. The scores were further dichotomized into poor or good (0–6 as poor and 7–12 as good). No overall score was calculated for perception. Vaccine coverage was calculated by the number of children that received JE vaccination (either during campaign or routine immunization) divided by the total number of children and presented as proportion and 95% confidence interval (CI). Odds ratios with 95% CI were estimated to determine the socio-demographic characteristics



associated with good knowledge score and vaccination status using logistic regression. The characteristics with a p value of less than 0.2 in the unadjusted analysis were included in the multiple logistic regression.

## Results

The socio-demographic characteristics of 600 parents/guardians are presented in Table 1<sup>13</sup>. Among them, 1% were aged ≤ 20 years, 4% were aged >60 years and 74% were female. A total of 50% had a high school or graduate level education and 29% had a monthly family income of more than \$285 USD.

### Knowledge and perception

Overall, 37.6% exhibited good knowledge of JE. We have depicted the knowledge of respondents regarding cause, transmission, symptoms, prevention and treatment in Table 2. Among 600 parents/guardians, 49.3% had correct knowledge that JE is a fatal disease. Although 65.3% knew that the JE vaccine was available locally, only 26.8% correctly answered that vaccination is the most effective means to protect against JE.

It was found that 23% did not know the symptoms of JE, 16% responded incorrectly that JE has specific treatment and 58.8% responded that they did not know whether there is a treatment for JE or not. Participants responded that they used mosquito nets (31.3%), mosquito coils (14.1%) and spray or fumigation methods (10.7%) to avoid mosquito bites.

Over half (55%) of participants perceived JE as serious in children younger than 15 years, 59% perceived the vaccine to be effective and 25% perceived JE to be harmful for pig farmers (Figure 3). Health care staff (25%) and television (17%) were the main sources of information about JE disease (Figure 4). The source of information on JE routine vaccination or campaigns was from school (35.1%), health worker visits (33.1%), announcements made using microphones in the neighborhood (13.9%) and volunteer visits (5.3%). The main vector of JE, *Culex tritaeniorhynchus*, had the highest proportion (41.2%) from entomological survey done in selected two townships out of nine townships in Yangon region.

### Vaccine coverage

Among all the children in the 600 households (n=855), 831 were vaccinated. The vaccination coverage was 97.2% (95% CI: 95.9-98.1). Of 831 vaccinated children, 423 (50.9%) were cross-checked through a vaccination card. Of 831 children, 516 (62.1%) received the vaccination during the JE campaign, 234 (28.2%) during routine immunization and 67 (7.8%) received the vaccine twice during both campaign and routine vaccination. Among the 24 children that did not receive vaccination, the main reasons were: parents or guardians did not realize the importance of JE vaccination (n=4), the child was sick at the time of immunization (n=3), the parents/guardians did not know about the JE vaccination (n=2) and travel (n=6).

### Factors associated with good knowledge score (≥7) and vaccination status

High level of education was the only variable significantly associated with good knowledge of JE (≥7). (Table 3). Good

knowledge among respondents was significantly associated with the child being vaccinated (see Table 4). There was no association between socio-demographic characteristics of respondents and vaccination status.

**Table 1. Socio-demographic characteristics of participants \* in the Japanese encephalitis survey, Yangon region, Myanmar (2019)\*\*.**

Variable	N	(%)***
<b>Total</b>	<b>600</b>	<b>(100.0)</b>
<b>Age in years</b>		
<=20	6	(1.0)
21–40	293	(48.8)
41–60	280	(46.6)
>60	21	(3.6)
<b>Sex</b>		
Male	155	(25.9)
Female	445	(74.1)
<b>Education level</b>		
Graduate	138	(22.9)
High School	165	(27.4)
Middle School	163	(27.2)
Primary School	105	(17.6)
Can read and write	24	(3.9)
Illiterate	5	(1.0)
<b>Occupation</b>		
Government staff	29	(4.9)
Private employee	186	(30.9)
Own business	150	(24.9)
Dependent	215	(35.9)
Others	20	(3.4)
<b>Type of family*</b>		
Nuclear	342	(56.2)
Extended	258	(43.8)
<b>Family income per month (USD)*</b>		
&95	8	(1.3)
95 – 189	101	(16.8)
190 – 285	316	(52.7)
>285	175	(29.2)

JE, Japanese encephalitis; USD, United States dollar; one USD = 1525 Myanmar Kyats. \*Parent or guardian of the 1–15 year-old children available at time of survey, preferably mother. \*\*Weighted estimates given taking into account the sampling design. \*\*\* Column percentage. \*Nuclear: family which has father or mother with their children. Extended: family which has either grandfather, grandmother, uncle, or aunty in addition to the members in the nuclear family.

**Table 2. Knowledge of participants \* regarding cause, transmission, symptoms, prevention and treatment in the Japanese encephalitis survey, Yangon region, Myanmar (2019) \*\*.**

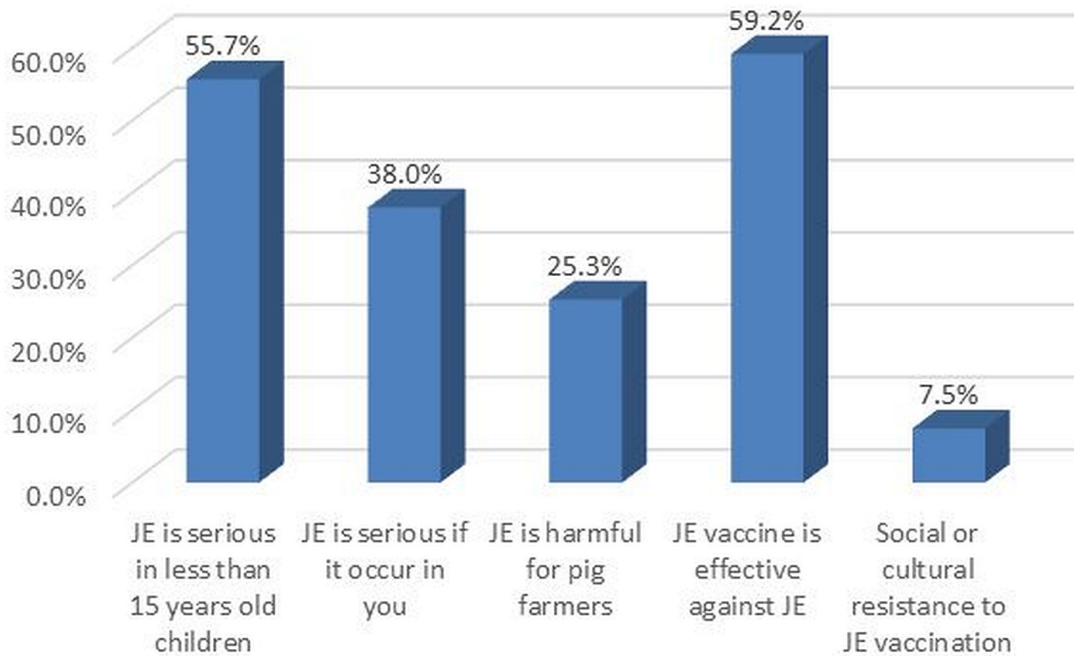
Question	Response	Total	
		n	(%) ***
<b>Total</b>		<b>600</b>	<b>(100.0)</b>
Have you ever heard about JE?	Yes	409	(68.2)
What is the cause of JE?	Virus	99	(16.5)
How does the disease get transmitted?	Mosquito	237	(39.5)
What are the common symptoms of JE?	High fever and convulsion	189	(31.5)
Is JE prevalent in children under 15 years?	Yes	264	(44.0)
Where does JE mostly prevail?	Rural areas and paddy fields	114	(19.0)
Are pigs the amplifier host?	Yes	129	(21.5)
Is JE a fatal disease?	Yes	296	(49.3)
Is there any specific treatment for JE?	No	151	(25.2)
Is JE a preventable disease?	Yes	331	(55.2)
Is the JE vaccine available locally?	Yes	392	(65.3)
How can one protect against JE?	JE vaccine	161	(26.8)

JE, Japanese encephalitis.

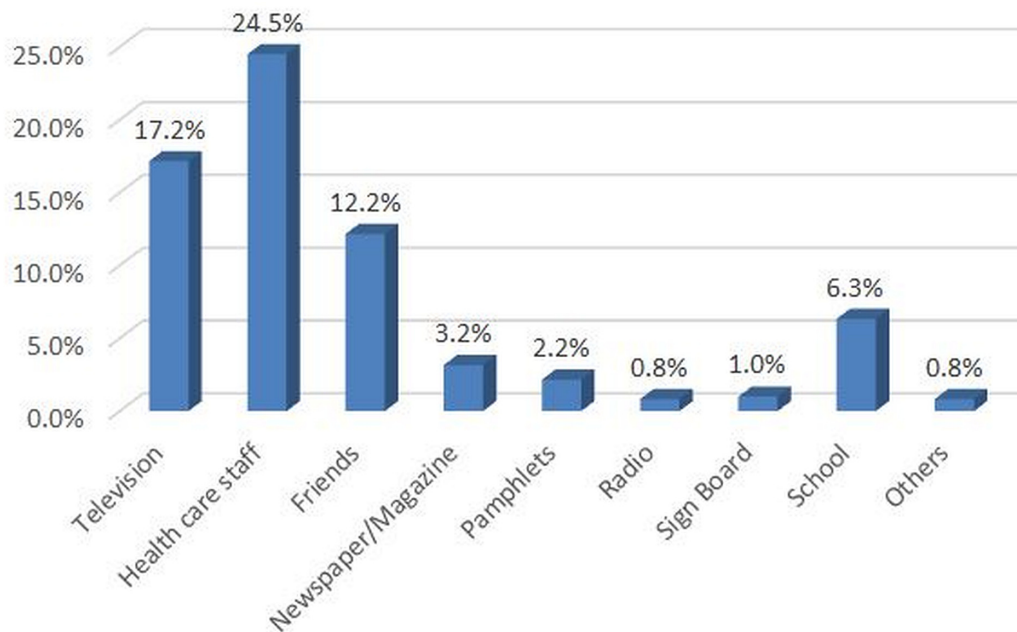
\*Parent or guardian of the 1–15 year-old children available at time of survey, preferably mother.

\*\*Weighted estimates given taking into account the sampling design.

\*\*\* Column percentage.



**Figure 3. Perception of participants\* in the Japanese encephalitis survey, Yangon region, Myanmar (2019) \*\*.** The variable "JE is serious if it occur in you" was included because sometimes adults think that some kinds of mosquito borne diseases such as Japanese encephalitis and Dengue are more serious in children and not serious when those diseases occur in them. Researchers in this study wanted to know whether participants had these perceptions. JE, Japanese encephalitis. Y axis as percentage (responded 'yes'). \*Parent or guardian of the 1–15 year-old children available at time of survey, preferably mother. \*\*Weighted estimates given taking into account the sampling design.



**Figure 4. Source of information of participants\* about Japanese encephalitis in the Japanese encephalitis survey, Yangon region, Myanmar (2019)\*\*.** Y axis as percentage (responded 'yes'). \*Parent or guardian of the 1–15 year-old children available at time of survey, preferably mother. \*\*Weighted estimates given taking into account the sampling design.

**Table 3. Factors associated with good knowledge ( $\geq 7$  score) of JE among respondents in Yangon region, Myanmar (2019)\*\***

Variables	Good knowledge of respondents					
	Crude OR	95% CI	Adjusted OR	95% CI	P value	
<b>Sex</b>	Male	1		1		
	Female	1.371	0.859 – 2.189	1.288	0.765 – 2.170	0.340
<b>Education</b>	Low level	1		1		
	High level	1.980	1.333 – 2.942	2.332	1.532 – 3.550	<0.001*
<b>Occupation</b>	unemployed	1		1		
	employed	0.759	0.509 – 1.131	0.623	0.394 – 0.985	0.043*
<b>Family Type</b>	extended	1		1		
	nuclear	1.394	0.928 – 2.093	1.443	0.956 – 2.178	0.080
<b>Income</b>	$\leq 189$ USD	1		1		
	>189 USD	1.011	0.622 – 1.644	0.932	0.563 – 1.543	0.786

JE, Japanese Encephalitis; CI- Confidence Interval;

\* Statistically Significant; \*\*Weighted estimates given taking into account the sampling design

## Discussion

In this region-wide survey on JE and its vaccine coverage in Yangon, Myanmar, the majority of parents or guardians did not have good knowledge of JE. Perception of the seriousness of JE disease was poor in half of participants. Vaccination coverage was excellent.

## Strengths and limitations

Data were robust as double entry and validation minimized data entry errors. Only one attempt was made to visit each household, which may impact the generalizability of the results as the households with parents and guardians who were working during the survey visit might be missed. Half of parents/



**Table 4. Respondent level factors associated with vaccination against JE among children in Yangon region, Myanmar (2019)\*\*.**

Variables		Vaccination of children (yes)				
		Crude OR	95% CI	Adjusted OR	95% CI	P value
Knowledge	Poor	1		1		
	Good	3.500	0.943 – 12.981	3.978	1.220 – 12.964	0.022*
Age (year)	≤20	1		1		
	21 to 40	6.310	0.578 – 68.791	5.744	0.669 – 49.264	0.111
	41 to 60	5.470	0.457 – 65.446	6.415	0.591 – 69.526	0.126
	>60	-	-	-	-	-
Occupation	unemployed	1		1		
	employed	2.195	0.663 – 7.266	2.583	0.678 – 9.832	0.164

JE, Japanese Encephalitis; CI- Confidence Interval

\* Statistically Significant \*\*Weighted estimates given taking into account the sampling design

guardians did not produce a vaccination card (JE routine immunization or campaign) and recall bias cannot be ruled out. However, as JE vaccination is through an injection (subcutaneous) at a specific site (in the right upper arm) and the vaccination campaign was implemented only once in 2017, we do not think this is a serious limitation.

#### Key findings and comparison with other studies

We found that parents/guardians had poor knowledge of JE. This finding is similar to the study conducted in a slum of Kolkata by Dasgupta *et al.* (2016), which showed that 56.7% of mothers had poor knowledge<sup>14</sup>. Our study showed that 39.5% of participants knew that JE is caused by mosquito bites, which is higher than the 25.6% reported by Dasgupta *et al.*<sup>14</sup>. In our study, the majority of participants showed a lack of knowledge about treatment of the disease, which is similar to a study from India (2015) by Ahmad *et al.*<sup>7</sup>.

More than half of the participants perceived JE as serious in children younger than 15 years old, but they did not perceive pig farming as contributing to the threat of JE. This is similar to the study in India, where respondents did not perceive pig farming as contributing to the threat of JE<sup>15</sup>. Possible reasons for poor knowledge and perception of participants was that communities did not think of JE as a possible threat like other vector-borne diseases such as dengue and malaria. In our study, high level of education had significant association with good knowledge and good knowledge of JE had significant association with vaccination of the child which is similar to a study by Dasgupta *et al.*<sup>14</sup>.

In our study, although only 55.2% of participants knew that JE is a preventable disease and 65.3% knew the most effective means to protect JE (vaccination), almost all parents/guardians vaccinated their children. Vaccination program against JE was

started by EPI because of increased number of JE cases and death. To avoid death by JE, almost all parents/guardians got their children vaccinated even they did not know well about the nature of JE. It reflects their reliance on existing health care delivery systems and EPI. JE vaccine coverage was high in this study and an effective JE vaccination catch-up campaign by EPI might have contributed to the high vaccine coverage. That might be the reason for high coverage of vaccination in spite of low level of knowledge and perception about JE disease. Coverage is similar to the study from the district of Ambala, Haryana in north India, which demonstrated a high level (93.9%) of JE vaccine coverage in the study area<sup>16</sup>. Similarly, JE vaccine coverage in Hsipaw Township, Northern Shan State, Myanmar was 93.0% in 2018<sup>9</sup>.

The most important vector is *Culex tritaeniorhynchus*, which feeds on vertebrate hosts, primarily pigs in preference to humans<sup>17</sup>. Adult mosquito of *Culex tritaeniorhynchus* can spread JEV were collected from our entomological survey done in selected two townships out of nine townships in Yangon region which is similar with an entomological and vector bionomics study of JE transmission done in four villages of Letpadan Township, Bago region (Myanmar), showing a high proportion (69.8%) of *Culex tritaeniorhynchus* in areas with high pig farming<sup>18</sup>.

#### Implications

JE cases in Yangon region have declined in 2018 and 2019 compared to earlier years. In January – August 2019, there were only 244 AES cases and 12 confirmed JE cases<sup>19</sup>. To sustain this decline, high vaccination coverage, health education on JE and effective vector control activity should be maintained. There is a possibility that the high coverage may not be maintained in the long term. This is because within 16–20 months of JE campaign, many were not aware of JE or its vaccine. Hence, steps should be taken in this direction.

Authorities should encourage retention of cards or records of vaccination so unvaccinated children can be identified and vaccinated in future.

## Conclusions

JE vaccination coverage was excellent in Yangon region, Myanmar, despite the majority of parents/guardians having poor knowledge and perception of JE disease, its prevention and vaccination. In order to reduce JE incidence in community, a focus on an intensified education program is necessary to sustain the high vaccine coverage in the community.

## Data availability

### Underlying data

Figshare: Annex 2. <https://doi.org/10.6084/m9.figshare.10548623.v1><sup>13</sup>.

### Extended data

Figshare: Annex 1. <https://doi.org/10.6084/m9.figshare.10552088.v1><sup>11</sup>.

Figshare: Annex 3. <https://doi.org/10.6084/m9.figshare.11458437.v1><sup>12</sup>.

Data are available under the terms of the [Creative Commons Zero “No rights reserved” data waiver](#) (CC0 1.0 Public domain dedication).

## Acknowledgements

We acknowledge the regional health department, Vector Borne Disease Control Program, Expanded Programme on Immunization, staff in medical entomology research division, the township administrative offices and basic health staff in Yangon for their support while collecting data.

*Disclaimer: The views expressed in this paper are of the authors and do not represent the views of the authors' organizations.*

## References

- World Health Organization WHO: **Japanese encephalitis, Immunization, Vaccines and Biologicals, estimate of the global disease burden.** 2015; (accessed on Sep 20, 2019).  
[Reference Source](#)
- Campbell GL, Hills SL, Fischer M, *et al.*: **Estimated global incidence of Japanese encephalitis: a systematic review.** *Bull World Health Organ.* 2011; **89**(10): 766–74, 774A–774E.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- World Health Organization: **Japanese encephalitis/live attenuated vaccine.** 2006; (accessed on May 20, 2006).  
[Reference Source](#)
- World Health Organization: **The sixth BI-regional meeting on Prevention and control of Japanese encephalitis.** Bangkok, Thailand, 2014.  
[Reference Source](#)
- Central Epidemiology Unit: **Monthly Epidemiology Bulletin.** 2018.  
[Reference Source](#)
- Vector Borne Disease Control Unit: **Annual VBDC report.** NayPyiTaw, Myanmar, 2014.
- Ahmad A, Khan MU, Gogoi LJ, *et al.*: **Japanese Encephalitis in Assam, India: Need to Increase Healthcare Workers' Understanding to Improve Health Care.** *PLoS One.* 2015; **10**(8): e0135767.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Hegde NR, Gore MM: **Japanese encephalitis vaccines: Immunogenicity, protective efficacy, effectiveness, and impact on the burden of disease.** *Hum Vaccin Immunother.* 2017; **13**(6): 1–18.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Thinn T, Lin TP, Thauung Y, *et al.*: **Awareness, Perception and Vaccination of Japanese Encephalitis Vaccine among Care Givers in Hsipaw Township, Northern Shan State.** 2018; (accessed on Sep 20, 2019).  
[Reference Source](#)
- Ministry of Immigration and Population: **The 2014 Myanmar Population and Housing Census.** NayPyiTaw, 2015.  
[Reference Source](#)
- Shewade HD: **Annex 1.** *figshare.*  
<http://www.doi.org/10.6084/m9.figshare.10552088.v1>
- Shewade H: **Annex 3.** *figshare.* 2019.  
<http://www.doi.org/10.6084/m9.figshare.11458437.v1>
- Shewade HD: **Annex 2.** *figshare.*  
<http://www.doi.org/10.6084/m9.figshare.10548623.v1>
- Aparajita D, Atanu D, Bobby P, *et al.*: **Perception of Prevention of Japanese Encephalitis with Emphasis on its Vaccination Programme: A Community Based Study In a Slum of Kolkata.** *Int J Public Heal Res.* 2017; **7**(2): 845–851.  
[Reference Source](#)
- Chaturvedi S, Sharma N, Kakkar M: **Perceptions, practices and health seeking behaviour constrain JE/AES interventions in high endemic district of North India.** *BMC Public Health.* 2017; **17**(1): 645.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Kumar D, Singh AJ: **Response of Various Stakeholders towards Newly Introduced Japanese Encephalitis Vaccine in a North Indian State.** *J Vaccines.* 2014; 1–4.  
[Publisher Full Text](#)
- Gupta N, Rao PV: **Transcriptomic profile of host response in Japanese encephalitis virus infection.** *Virology.* 2011; **8**: 92.  
[PubMed Abstract](#) | [Publisher Full Text](#) | [Free Full Text](#)
- Mya MM, Lin Z, Min Hein ZN, *et al.*: **Vector bionomics of Culex species responsible for Japanese Encephalitis transmission in 4 villages of Letpadan Township Bago region, Myanmar.** *Myanmar Heal Res J.* 2017; **48**: 37–39.
- Central Epidemiology Unit: **AFP surveillance Indicators by State and Region, Fever with Rash Surveillance.** 2019.  
[Reference Source](#)

# Open Peer Review

Current Peer Review Status:  

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Version 2

Reviewer Report 03 August 2020

<https://doi.org/10.5256/f1000research.27677.r66013>

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**Pravin Deshmukh**

ICMR - National Institute of Virology, Pune, India

**Babasaheb V. Tandale** 

ICMR-National Institute of Virology, Pune, Maharashtra, India

Comments on the revised manuscript:

1. As this study was aimed at estimation of awareness level and vaccination coverage level, the power of the study may not be adequate to consider the additional analyses using multiple logistic regressions and reporting of odds ratios. Therefore, authors may consider the power calculation retrospectively and report the same if appropriate based on power calculation.
2. The revised version also retained aim to describe awareness and coverage only. Authors may either change aim if the study has enough power to undertake associations and comparisons for identifying associated variables and risk factors by using multivariate analysis. Otherwise, the analytical component may be dropped from the results, if not appropriate and not enough power.
3. In Table 3 and 4, it would be important to provide the actual numbers along with percentages so as to verify the findings by the readers.
4. First chi square ( $\chi^2$ ) association may be reported for table 3 and 4, if significant, then odds ratios may be indicated if the study power is adequate for the same.
5. High and low education has neither been defined in methods nor in foot note in table 3. It is also not clearly categorised in supplemental file associated with the manuscript.

## References

1. Kyaw P, Shewade H, Kyaw N, Hnin Phyo K, et al.: High vaccination coverage, inadequate knowledge and high vector density: Findings from a community-based cross-sectional study on

Japanese Encephalitis in Yangon, Myanmar. *F1000Research*. 2020; **9**. [Publisher Full Text](#)

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Epidemiology of virus diseases causing outbreaks.

**We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.**

Author Response 03 Sep 2020

**Pyae Phyo Kyaw**, Ministry of Health and Sport, Myanmar, Yangon, Myanmar

Comment 1. As this study was aimed at estimation of awareness level and vaccination coverage level, the power of the study may not be adequate to consider the additional analyses using multiple logistic regressions and reporting of odds ratios. Therefore, authors may consider the power calculation retrospectively and report the same if appropriate based on power calculation.

Response: Thank you for this comment. In the initial draft that was submitted, we did not perform regression analysis. We conducted an association between socio-demographic characteristics of parents/guardians with their knowledge level, and an association between knowledge level of parents/guardians with vaccination status of the children as a secondary analysis after a suggestion by one of the reviewers. We did not conduct post hoc or retrospective power analysis because power calculation after the data collection and effect size being observed do not usually provide true power for detecting statistical significance, and confidence intervals are more informative retrospective power calculations. Retrospective power calculation may inform for sample size calculation of future study but has little value for the current study. In addition, the practical significance by presenting effect size and 95% confidence interval are more informative than emphasizing on p-value and statistically significant. Hope you can agree with our stance on this.

Comment 2. The revised version also retained aim to describe awareness and coverage only. Authors may either change aim if the study has enough power to undertake associations and comparisons for identifying associated variables and risk factors by using multivariate analysis. Otherwise, the analytical component may be dropped from the results, if not appropriate and not enough power.

Response: Thanks for your comment. The primary aim of the study is still to describe the awareness and vaccination coverage as there is no study report this in region. We also decided to keep the regression analysis as a secondary analysis. I added objective three. (line no: 44-47)

Comment 3. In Table 3 and 4, it would be important to provide the actual numbers along with percentages so as to verify the findings by the readers.

Response: Thank you for this comment. As the OR and adjusted OR are outputs of weighted analysis, if we provide the number percentage (unweighted), it may not match with the weighted OR and adjusted OR. Hence we have avoided this. We hope this is fine. It is impossible to provide actual numbers along with percentages for the logistic analysis.

Comment 4. First chi square ( $\chi^2$ ) association may be reported for table 3 and 4, if significant, then odds ratios may be indicated if the study power is adequate for the same.

Response: Thanks for this comment. We estimated odds ratios using logistic regression to estimate the association between parent characteristics and good knowledge. We did not perform chi-square test to avoid multiple testing issue. The crude / unadjusted logistic regression p value is similar to the chi-square p value. If crude / unadjusted p value  $<0.2$ , the variable was included in the logistic regression model. This way our model is parsimonious.

Comment 5. High and low education has neither been defined in methods nor in foot note in table 3. It is also not clearly categorized in supplemental file associated with the manuscript.

Response: Thanks for your comment about education level. High level education contains graduate and high school. Low level education contains middle school, primary school, can read and write and illiterate. It is stated in foot note of table 3. (line no:227-228)

**Competing Interests:** No competing interests were disclosed.

Reviewer Report 01 July 2020

<https://doi.org/10.5256/f1000research.27677.r66014>

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**Jing An** 

Department of Microbiology, School of Basic Medical Sciences, Capital Medical University, Beijing, China

The revisions are accepted. I have no further comments to make.

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Interaction between viruses and hosts; Mosquito-borne flavivirus; Vaccine

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

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Version 1

Reviewer Report 29 May 2020

<https://doi.org/10.5256/f1000research.23924.r63433>

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**Babasaheb V. Tandale**

ICMR-National Institute of Virology, Pune, Maharashtra, India

**Pravin Deshmukh**

ICMR - National Institute of Virology, Pune, India

- The manuscript is composed well and has been presented in a very simple way making it very easy to understand by the readers. As indicated by the other reviewer, more in-depth analysis and comparison to explain the similarities and differences in knowledge and perception of JE disease and JE vaccine may be considered along with the explanatory variables for coverage of JE vaccination. The comparisons would thus help identify the important aspects that could be targeted for improvements.
- The sampling design could be better explained with sampling ratios planned at different phases of sampling.
- Vector distribution / density has been indicated in title, however it is not dealt in abstract, objectives, methods and results. Therefore, this aspect may be dropped from title also. It could be mentioned in discussion section as the secondary data and indicated for its importance for understanding of study findings.
- The higher coverage of vaccination in spite of low level of knowledge and perception of JE disease and JE vaccine is difficult to understand. It may be highlighted and discussed in details.
- The objectives may be clearly mentioned at the end of background section.
- The potential sources of bias in selection, verification of information and interpretation of



information given by respondents needs to be critically appraised and discussed. The confounders also need to be addressed properly.

- The verification of vaccination card for ascertaining vaccination recall needs to be addressed with efforts made for data quality.
- The sample size and statistical analysis plan could be included with specific details on the basis of assumptions and proposed analysis. The sample size estimation could have been based on reported coverage of vaccination to be 93% in small survey findings earlier. The weighting approach needs to be provided clearly with its application in crude/unadjusted and adjusted/corrected coverage.
- The survey currently presented is mostly descriptive in nature and needs to be made analytical with comparisons that could be made and presented.
- The questionnaire validity may be presented with variable responses for similar aspects.
- Non-responses and its handling in analysis may be included.
- The baseline characteristics of respondents may be compared with good or bad knowledge, acceptable perception or otherwise and vaccinated and unvaccinated.
- Limitations of study may be discussed with interpretations based on the same.
- Generalisability of study findings may be considered and discussed.

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Partly

**Are the conclusions drawn adequately supported by the results?**

Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Epidemiology of virus diseases causing outbreaks.

**We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.**

Author Response 25 Jun 2020

**Pyae Phyoo Kyaw**, Ministry of Health and Sport, Myanmar, Yangon, Myanmar

1. The manuscript is composed well and has been presented in a very simple way making it very easy to understand by the readers. As indicated by the other reviewer, more in-depth analysis and comparison to explain the similarities and differences in knowledge and perception of JE disease and JE vaccine may be considered along with the explanatory variables for coverage of JE vaccination. The comparisons would thus help identify the important aspects that could be targeted for improvements.

Response: Thank you for your suggestion and we performed more in-depth analysis to determine the socio-demographic characteristics associated with good knowledge score and presented in the table-3. (line 218-234) We also performed an in-depth analysis to determine the good knowledge score with the child being vaccinated and presented in the table-4. (line 239-244)

2. The sampling design could be better explained with sampling ratios planned at different phases of sampling.

Response: We added a detailed explanation of the sampling design and procedure in the method section. (line 81-105)

3. Vector distribution / density has been indicated in title, however it is not dealt in abstract, objectives, methods and results. Therefore, this aspect may be dropped from title also. It could be mentioned in discussion section as the secondary data and indicated for its importance for understanding of study findings.

Response: We have revised the title according to your suggestion.

4. The higher coverage of vaccination in spite of low level of knowledge and perception of JE disease and JE vaccine is difficult to understand. It may be highlighted and discussed in details.

Response: We have added a discussion in the revised manuscript. (line 276-282)

5. The objectives may be clearly mentioned at the end of background section.

Response: We revised the paragraph at the end of introduction section and stated the objectives clearly. (line 42-44)

6. The potential sources of bias in selection, verification of information and interpretation of information given by respondents needs to be critically appraised and discussed. The

confounders also need to be addressed properly.

Response: We have discussed the potential for recall bias as half the respondents could not produce the immunization or JE campaign card (for details see line 251-258). We performed more in-depth analysis to assess factors associated. (line 145-148) (line 218-226)

7. The verification of vaccination card for ascertaining vaccination recall needs to be addressed with efforts made for data quality.

Response: We were able to verify 50% of the vaccinated children with their vaccination card. We acknowledged that the respondents who did not have vaccination card would subject to recall bias. (line 254-255)

8. The sample size and statistical analysis plan could be included with specific details on the basis of assumptions and proposed analysis. The sample size estimation could have been based on reported coverage of vaccination to be 93% in small survey findings earlier. The weighting approach needs to be provided clearly with its application in crude/unadjusted and adjusted/corrected coverage.

Response: We agree that we should have calculated the sample size based on a previous estimate. But we decided to assume a coverage of 50% that would give a maximum sample size. We have added a detailed description on sample size calculation and statistical analysis in the revised manuscript. We provided weighted estimates as the analyses were weighted (inverse probability sampling) for the multi-stage sampling design, this was done both for the descriptive and analytical calculations (line 82-89, 136-137)

9. The survey currently presented is mostly descriptive in nature and needs to be made analytical with comparisons that could be made and presented.

Response: We performed more in-depth analysis to determine the socio-demographic characteristics associated with good knowledge score and presented in the table-3. (line 218-240) We also performed an in-depth analysis to determine the good knowledge score with the child being vaccinated and presented in the table-4. (line 239-244)

10. The questionnaire validity may be presented with variable responses for similar aspects.

Response: Thank you for the comment. Unfortunately, we do not have information on questionnaire validity.

11. Non-responses and its handling in analysis may be included.

Response: There was no non-responses in our study because we went to the household using the sampling interval until the required sample size was reached. We added this information in the revised manuscript. (line 104-105)

12. The baseline characteristics of respondents may be compared with good or bad knowledge, acceptable perception or otherwise and vaccinated and unvaccinated.

Response: We have added results on the association between the baseline characteristics of respondents with knowledge level and vaccination status. (line 218-240)

13. Limitations of study may be discussed with interpretations based on the same.

Response: We have added this discussion in our revised manuscript. (line 250-258)

14. Generalisability of study findings may be considered and discussed.

Response: We have added this discussion in our revised manuscript. (line 250-258)

**Competing Interests:** No competing interests were disclosed.

Reviewer Report 27 April 2020

<https://doi.org/10.5256/f1000research.23924.r62066>

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Jing An 

Department of Microbiology, School of Basic Medical Sciences, Capital Medical University, Beijing, China

The authors here conducted a set of survey data to reflect the public awareness on JEV in community. A great deal of data collection was presented. These contribute to show the significant progresses of the JE campaign in Yangon. However, there are several questions to be answered.

Some Comments:

1. The whole article was simple as a scientific research. More in-depth analysis of data is recommended. More comparison should be conducted to reflect the details in multi-aspects. For example, "parents/guardians had poor knowledge of JE" is sentenced. Since the details of the guardians were investigated, the correlation should be conducted, like with age? or occupations? or else? or none. Besides, are there any differences in awareness between urban and rural places?...
2. To fully reflect the effect of public awareness in Yangon, authors should not choose nine townships randomly. Especially the locations are concentrated. The choices need to be more meaningful, like the widest vector distribution ones, the most severely suffered ones. OR, at least, the details of these nine townships should be presented, like incidence cases.
3. The complex relationship between JEV and congeneric members, like DENV and ZIKV,

is widely proposed. Since dengue is prevalent locally, the vaccination against Flavivirus members or infections should be also considered in the questionnaire.

4. In table 1, (1) is single parent family excluded? (2) what does "Do not know family members suffered JE" exactly mean? do not know the symptoms or do not know the children's conditions?

5. "23% did not know the symptoms of JE" is sentenced. So, how will these parents know their kids are not suffered from JE? Is the "0" morbidity presented by parents credible?

**Is the work clearly and accurately presented and does it cite the current literature?**

Yes

**Is the study design appropriate and is the work technically sound?**

Partly

**Are sufficient details of methods and analysis provided to allow replication by others?**

Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**

Partly

**Are all the source data underlying the results available to ensure full reproducibility?**

Yes

**Are the conclusions drawn adequately supported by the results?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Interaction between viruses and hosts; mosquito-borne flavivirus; vaccine

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 25 Jun 2020

**Pyae Phyo Kyaw**, Ministry of Health and Sport, Myanmar, Yangon, Myanmar

1. The whole article was simple as a scientific research. More in-depth analysis of data is recommended. More comparison should be conducted to reflect the details in multi-aspects. For example, "parents/guardians had poor knowledge of JE" is sentenced. Since the details of the guardians were investigated, the correlation should be conducted, like with age? or occupations? or else? or none. Besides, are there any differences in awareness between urban and rural places?...

Response : Thank you for your suggestion and we performed more in-depth analysis to determine the socio-demographic characteristics associated with good knowledge score and presented in the table-3. (line 218-234) We also performed an in-depth analysis to determine the good knowledge score with the child being vaccinated and presented in the table-4. (line 239-244)

2. To fully reflect the effect of public awareness in Yangon, authors should not choose nine townships randomly. Especially the locations are concentrated. The choices need to be more meaningful, like the widest vector distribution ones, the most severely suffered ones. OR, at least, the details of these nine townships should be presented, like incidence cases.

Response : We believe that random selection of township would provide generalizable information for the Yangon region. If we selected based on the incidence rate of JE cases or vector distribution, the knowledge, perception and vaccination coverage would not be representative to the population in Yangon. We hope this is fine. (line 78-90)

3. The complex relationship between JEV and congeneric members, like DENV and ZIKV, is widely proposed. Since dengue is prevalent locally, the vaccination against Flavivirus members or infections should be also considered in the questionnaire.

Response: In Myanmar, we have no vaccination programme against Dengue and Flavivirus infections and we did not have the opportunity to explore about this.

4. In table 1, (1) is single parent family excluded? (2) what does "Do not know family members suffered JE" exactly mean? do not know the symptoms or do not know the children's conditions?

Response:

(1) Single parent family was not excluded, considered under nuclear family. In type of family, Nuclear family means family which has father or mother with their children. Extended family means family which has either father, mother or grandfather, grandmother or uncle, aunty with children. We added this in the footnote of the table. (line 159-161)  
(2) "Do not know family members suffered JE" means parents/guardians did not know their children have previous history of infection with JE virus. (We removed that variable from table-1 as the author group feels it does not add valuable information)

5. "23% did not know the symptoms of JE" is sentenced. So, how will these parents know their kids are not suffered from JE? Is the "0" morbidity presented by parents credible?

Response: The answer by the participant to the question on JE morbidity by asking whether the family member suffered JE before was based on the clinic or hospital record. So it is possible that the participant can report whether or not their children suffered JE even they did not know the symptoms of JE. Anyway, I removed that variable from table 1 as the author group feels it does not add valuable information.

**Competing Interests:** No competing interests were disclosed.



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