

FACTORS ASSOCIATED WITH LOW PERCEIVED RISK OF DENGUE INFECTION IN SEREMBAN DISTRICT, NEGERI SEMBILAN: A CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Dengue fever is an infection caused by dengue virus that remains as a public health threat. Hence, this study aimed to determine the risk perception level of dengue infection at Seremban district that continues to battle with dengue epidemic. Additionally, we aimed to measure knowledge, attitude, and practice of the Seremban population in relation to their dengue risk perception level. **Methods:** This is an analytical cross-sectional survey using a validated questionnaire- Risk Perception, Attitude and Practice (RPAP). A pilot test was conducted on 35 samples, and data was analyzed prior to actual study. The subsequent population study was conducted between April 2021 to November 2021. Ethical approval was obtained before commencement, and each respondent's informed consent was taken prior to study inclusion. Statistical analysis was done using Rasch analysis and multiple logistic regression. **Results:** A total of 341 respondents were included in the population study. Rasch analysis result for reliability analysis showed a good psychometric property of the tool used. Majority of the respondents have low level of dengue risk perception (82.1%), attitude level (77.7%), and dengue prevention practice level (84.5%). There was no statistical difference upon comparison between those who live in dengue outbreak area and those from non-outbreak area, for all three constructs (RPAP). The bivariable and multivariable analysis done yielded three independent factors that contributed to the low level of dengue risk perception, namely, living in rented house, living in high-rise unit, and family history of dengue infection. **Conclusion:** The population of Seremban district has a low level of dengue risk perception that may reflect a low level of attitude and dengue preventive action. Hence, a more extensive health promotion and health education activity based on behavioral theory such as Health Belief Model need to be done to reinforce good attitude and good practice of dengue prevention.

Keywords: Dengue, risk perception, factors, vector-borne disease, Malaysia

INTRODUCTION

Dengue fever is an infection caused by dengue virus (DENV), a single strand RNA virus with a known four serotype (DENV 1–4) that belongs to the Flaviviridae family (Halstead, 2007), (King et al., 2012). Transmission of the disease is propagated by the resiliency and competent feature of its vector, namely *Aedes aegypti* and *Aedes albopictus*. The clinical presentation of the illness varies and remains a challenge to the medical personnel. Diagnosing criteria used for dengue infection are fever, lasting between 5 to 7 days accompanied by two or more symptoms: headache, retro-orbital pain, myalgia, arthralgia, rash, hemorrhagic manifestations, or leucopenia complemented with a positive dengue laboratory test (Shamala, 2015). Nonetheless, subsequent infection from other dengue virus serotype increases the risk of severe disease associated with hemorrhagic and hypovolemic complication leading to potential death (Liew et al., 2016), (Tee et al., 2009).

The burden of dengue fever disproportionately affects tropical and sub-tropical regions, but other unfamiliar regions do occasionally report number of outbreaks (Bouri et al., 2012), (Añez & Rios, 2013), (Saifullin et al., 2018). Thus, making dengue fever to be recognized as one of the world's emerging infectious diseases and possess a major public health concern (WHO, 2020). According to the World Health Organization (WHO) report, about 390 million dengue infections occur each year, with a rising number of dengue deaths globally (Bhatt, 2013). In Malaysia, the significant increase in the trend of dengue incidence has been seen whereby only 72 cases in 100,000 populations were recorded in 2001, but soaring to 361 cases in 100,000 populations by the year 2014 (Mudin, 2015). Although the current pandemic COVID-19 cases and national response has shifted all major illnesses from the limelight, study has demonstrated that dengue incidence continue to show an increment pattern when restriction of movement order was eased off, making it to be rampant again (Ong et al., 2021), (Rahim et al., 2021). Hence this strongly suggests human behavioral effect towards the transmission of disease.

At the moment, vector control and continuous surveillance are still the mainstay measures in dengue prevention (WHO, 2021). In view of non-curative treatment for dengue fever and potential effective vaccine is far from the sight, battling the arbovirus transmission requires different paradigm of approach that requires an integrated management through strong collaboration with local community (WHO, 2020). This is very crucial as literature has alluded that the rise of dengue incidences is a result of population growth, increased movement of individuals, rapid urbanization, limited financial and human resources, environmental changes and neglected (rural and slums) areas (Gubler, 2004). Nevertheless, the earlier work of this study corroborates with those findings hence attested this socio-ecological relationship.

As such, establishing the baseline understanding of the community's knowledge, attitude, and practices (KAP) as well as perceived risk towards dengue infection can help to define and address individual and community barriers to vector control implementation.

KAP survey on dengue done previously have demonstrated good level of knowledge and attitude, yet variable level of practices on dengue prevention (Hairi et al., 2003), (Rahman & Zamri, 2015). The insufficiency to undertake appropriate action to protect from dengue infection may stems from low level of perceived risk of the disease. Based on theory of Health Belief Model (HMB), preventive behavior occurs because of health perception i.e., an adoption of good practice occurs when one has high perceived risk of getting the disease. Likewise, those who perceived low susceptibility towards dengue will have a low practice on its prevention (Hairi et al., 2003). Additionally, HBM also illuminates that perceived severity of illness, perceived barrier, perceived benefit, cues to action and self-efficacy can predict the likelihood to change in behavior (Jones et al., 2015).

Considering, the entire discourse above, this study aimed to determine the risk perception level of dengue infection at a specific local district that continues to battle with dengue epidemic. Additionally, we aimed to measure the attitude, and practice of the Seremban population in relation to their dengue risk perception level. To the best of researcher's knowledge, there are hardly any study of such done during COVID-19 pandemic. Since mitigation of dengue occurrence can be expected with behavioral change of the individual and community, therefore understanding the current situation is utmost necessary. Ultimately the information obtained can be used to design and implement community-based interventions to reduce dengue burden.

METHODS

Study setting

This study was conducted in district of Seremban, the capital city of Negeri Sembilan. The ongoing development of Seremban district has certainly conformed to its status as part of the "Greater Klang Valley". The district is estimated to house a total number of 482,512 populations with an approximately 77.2% (372,917 people) live in the major town and city (Seremban, 2021). The number of dengue cases and outbreak for Seremban district reflects the overall pattern of epidemiology of dengue fever for the state of Negeri Sembilan, as more than 90% of the data contributed by it. Likewise, the same scenario is seen in all the states in Malaysia where the capital city or areas that are facing a rapid development suffer from high burden of dengue fever such as Petaling district and Hulu Langat district of Selangor.

Study design

This is an analytical cross-sectional study conducted from April 2021 till November 2021. Several modalities of sample recruitment were employed due to unforeseen circumstances of sudden surge of COVID-19 daily and cluster cases, that began in early May, that hinders conventional door-to-door household surveys. Due to the implementation of third national total lockdown and restriction of travel, the questionnaires were targeted at a place where crowds were allowed to gather, namely at community healthcare clinics, vaccination hall, and large hyper market.

Inclusion & exclusion criteria

Only adult (age above 18-year-old) completed the questionnaire following written consent, as approved by ethical committee. If more than one adult was present during the session, the researcher requested to engage with the adult most likely to be the breadwinner of the household. Non-Malaysian, those unwilling to give consent and unable to fill up the questionnaire were excluded.

Study instrument

The survey was adapted from a newly developed questionnaire that has been validated on general Malaysian population, in earlier phase of this research (Zamzuri 2021). The questionnaire was constructed based on the Health Belief Model theory, covering domain of risk perception, attitude and practice towards dengue. The analysis has yielded a good fit indices based on confirmatory factor analysis namely root mean square area of approximation (RMSEA) value of 0.061, standardized root mean square residual (SRMR) of 0.068, parsimonious normed fit index (PNFI) of 0.649, and goodness of fit index (GFI) of 0.996. The survey was piloted on 35 people before it was distributed to the samples. The questionnaire was bilingual, self-administered and of close-ended in design, that took approximately 15 minutes to be completed. Participants could opt to answer the survey using questionnaire form or using Google Sheet, an online platform. Each respondent was allocated with a unique identifier to ensure non-duplication and drop-out.

Section A: demographic data:

This section establishes the baseline characteristic of the respondents.

Section B: risk perception:

There are 12 items with 5-point Likert scale for this domain. Seven items have positive polarity while the remainder five have negative polar. To calculate overall score, the score for the negative polar items were reverse, and summation of all 12 items is calculated. Further categorization for 'high' level of risk perception and 'low' level of risk perception was determined using an arbitrary cut-off point (score of 40); -

Section C: attitude:

There are seven items, with 5-point Likert scale for this domain. All items are positively polar, and the total score is obtained through summation of all items score. The cut-off score is 24.

Section D: practice:

There are ten items, with 5-point Likert scale for this domain. All items are positively polar, and the total score is obtained through summation of all items score. The cut-off score is 34.

Data Analysis

Data collected from household survey form were entered into a Microsoft Excel 365 spreadsheet using double data entry, while data from Google Sheet were downloaded and combined together. Data were cleaned for duplicates while missing variable were removed. Subsequently the denominator was adjusted accordingly. The result of pilot study was assessed for item reliability by using Rasch measurement theory. All categorical variables were interpreted using frequency and percentage, while continuous categories were interpreted using mean and standard deviation (SD). The test for associations were conducted either by using chi-square test for categorical variable or Mann Whitney U-test for continuous variable. Multiple logistic regression was conducted by including all variables with p-value <0.25 from bivariable analysis. Predictors with p-value < 0.05 was considered as statistically significant.

Ethical Approval

This study has obtained ethical approval from Universiti Kebangsaan Malaysia (UKM) Research Ethics Committee (UKM PPI/111/8/JEP-2019-854) and was registered with National Medical Research Register (NMRR) (NMRR ID: NMRR-19-3909-51875 (IIR)). The respondents' informed consent was obtained prior to participation in this study.

RESULTS

A total of 376 respondents took part in this study, in which 35 of them were involved earlier in the pilot study. Table 1 depicted the baseline characteristics of the respondents in both phases. Although there were slight differences between the two groups, the distribution was comparable and more importantly they were recruited in Seremban district within the same time period. The median age of the groups was closely similar, majority of them were of Malay ethnicity, married, currently employed, owning their houses, and did not come from dengue outbreak area. It was also noted that both groups have lesser proportion of their respondents with either personal history or family history of dengue infection.

Table 2 demonstrated the psychometric reliability of the questionnaire by using Rasch measurement theory tested in the pilot study. The obtained Cronbach alpha values were of good magnitude that is 0.60, 0.88, and 0.96 for domain risk perception, attitude, and practice respectively. Nevertheless, other parameters measured such as in fit statistic, reliability coefficients, and separation indices for both item and person that are within normal range have showed an acceptable application of this questionnaire among Seremban's population.

Table 3 showed that more than two thirds of the respondents (n=280, 82.1%) in this study were categorized into having a low level of risk perception for dengue infection (cut-off points > 40). Similarly, the result also demonstrated a high proportion of respondents with low level of attitude and prevention practice with percentage of 77.7% (n=265) and 84.5% (n=288) respectively.

Table 4 showed the result of bivariable analysis for risk perception. Three out of 11 independent factors that were analysed showed a statistically significant result. Among them were house ownership (p= 0.011), type of residences (p= 0.013), and family history of dengue infection (p= 0.031). These factors than subsequently were included in the multivariable logistic regression analysis. The final result remains as significant predictors as shown in Table 5.

Table 1: Baseline Characteristic of Study Respondents

No	Variable	Pilot Study (N=35) n (%)	Population Study (N=341) n (%)
1.	Age (year)	37 (9) *	33 (12) *
2.	Gender		
	Male	31 (88.6)	126 (37.0)
	Female	4 (11.4)	215 (63.0)
3.	Ethnicity		
	Malay	28 (80.0)	292 (86.8)
	Chinese	0 (0.0)	17 (5.0)
	Indian	2 (5.7)	22 (6.5)
	Others	5 (14.3)	6 (1.8)
4.	Marital status		
	Single	9 (25.7)	152 (44.6)
	Married	26 (74.3)	189 (55.4)
5.	Education attainment		
	No tertiary education	31 (88.6)	196 (57.5)
	Has tertiary education	4 (11.4)	145 (42.5)
6.	Employment status		
	Employed	30 (85.7)	242 (71.0)
	Unemployed	5 (14.3)	99 (29.0)
7.	House ownership		
	Own house	22 (62.9)	252 (73.9)
	Rented	13 (37.1)	89 (26.1)
8.	Personal history of dengue fever		
	Yes	8 (22.9)	53 (15.5)
	No	27 (77.1)	288 (84.5)
9.	Family members had dengue fever		
	Yes	10 (28.6)	149 (43.7)
	No	25 (71.4)	192 (56.3)
10.	Dengue outbreak status in neighborhood		
	Outbreak	10 (28.6)	120 (35.2)
	No outbreak	25 (71.4)	221 (64.8)
11.	Type of residential		
	High rise	2 (5.7)	53 (15.5)
	Landed	33 (94.3)	288 (84.5)
* Median (IQR)			

Table 2: Psychometric analysis result of the questionnaire based on pilot study (N=35)

Domains	Risk Perception	Attitude	Practice
Reliability (Cronbach Alpha)	0.60	0.88	0.96
Item mean Infit Zstd	0.00	-0.20	0.00
Item mean Infit IMNSQ	0.98	1.00	0.99
Item Separation Index	4.80	1.80	1.72
Item Reliability	0.96	0.76	0.75
Person mean Infit Zstd	0.00	0.10	-0.10
Person mean Infit IMNSQ	1.01	1.20	1.03
Person Separation Index	1.26	1.17	2.38
Person Reliability	0.61	0.58	0.85

Table 3: Result of each domain risk perception, knowledge, attitude, and practice (n=341)

No	Construct	Median	Interquartile range	Low level n (%)	High level n (%)
1.	Practice	37.0	6.0	288 (84.5)	53 (15.5)
2.	Attitude	28.0	5.0	265 (77.7)	76 (22.3)
3.	Risk perception	44.0	7.0	280 (82.1)	61 (17.9)
<i>Cut-off value for risk practice; Low level (10 – 33); High level (> 34)</i> <i>Cut-off value for attitude; Low level (7 – 23); High level (> 24)</i> <i>Cut-off value for risk perception; Low level (12 – 39); High level (> 40)</i>					

Table 4: Bivariate analysis for outcome high risk perception (N=341)

No	Independent factor	Low risk perception		High risk perception		df	χ^2	<i>p-value</i>
		n	(%)	n	(%)			
1.	Age ^a	34 (12.0)		33 (13.0)		-	8877.0	0.629 ^b
2.	Gender							
	Male	24	19.0	102	81.0	1	0.183	0.770
	Female	37	17.2	178	82.8			
3.	Ethnicity							
	Malay	54	18.2	242	81.8	3	0.435	0.949 ^d
	Chinese	2	11.8	15	88.2			
	Indian	4	18.2	18	81.8			
	Others	1	16.7	5	83.3			
4.	Marital status							
	Single	23	15.1	129	84.9	1	1.419	0.257
	Married	38	20.1	151	79.9			
5.	Education							
	Has tertiary	26	17.9	119	82.1	1	0.001	1.000
	No tertiary	35	17.9	161	82.1			
6.	Employment status							
	Currently Employed	45	18.6	197	81.4	1	0.283	0.643
	Unemployed	16	16.2	83	83.8			
7.	House ownership							
	Renting	24	27.0	65	73.0	1	6.756	0.011 ^c
	Own house	37	14.7	215	85.3			
8.	Personal dengue history							
	Yes	11	20.8	42	79.2	1	0.351	0.560
	No	50	17.4	238	82.6			
9.	Family history of dengue							
	Yes	33	23.4	108	76.6	1	4.979	0.031 ^c
	No	28	14.0	172	86.0			
10.	Dengue outbreak status							
	Outbreak	23	19.2	97	80.8	1	0.206	0.659
	No outbreak	38	17.2	183	82.8			
11.	Type of residences							
	High-rise	16	30.2	37	69.8	1	6.464	0.013 ^c
	Landed	45	15.6	243	84.4			
^a median (inter-quartile range)								
^b Mann Whitney test								
^c Variables included in Multiple Logistic Regression								
^d Fisher's exact test								

Table 5: Multiple logistic regression for low-risk perception (N=341)

Variable	Crude Odds Ratio	B	S.E.	Wald	df	p-value	Adjusted Odds Ratio	UL CI	LL CI
House ownership									
Renting	2.145	0.693	0.305	5.158	1	0.023	1.999	1.100	3.635
Own house	1								
Residence type									
High rise	2.335	0.712	0.350	4.125	1	0.042	2.038	1.025	4.050
Landed	1								
Family history of dengue infection									
Yes	1.877	0.591	0.240	4.148	1	0.042	1.806	1.022	3.189
No	1								

DISCUSSION

The initial pilot study was conducted to ensure the reliability of the tool that can be used in Seremban setting, although it was developed and validated regionally in Malaysia. Rasch analysis was used as it has a robust measurement for reliability that does not rely solely on Cronbach alpha value. Item fit measure, person fit measure, the separation indices for item and person, as well as both item and person reliability indices will ensure a thorough assessment of the questionnaire (Bond & Fox, 2015), (Abdul Aziz, 2010). Nevertheless, the use of adequate sample size in pilot testing, around 10% of the sample population showed that it is reliable for conducting the actual study (DeVellis, 2016).

Identifying the level of risk perception to a certain illness is essential as it has a profound effect towards behavior change and modification (Ferrer & Klein, 2015). This has been postulated as one of the key components in Health Belief Model (HBM) theory, for which the autonomy in health decision-making is the result of individual weighing risk for consequences with benefits of action (Becker, 1974), (Rosenstock, 1974). In this study, we found that three independent factors have significant associations with a low level of dengue risk perception based on both

bivariable analysis and multivariable analysis, namely those living in rented houses, in a high-rise residence, and have family history with previous dengue infection.

The results of this study found that the home ownership status, i.e. the renting occupants, had double the odds to obtained a 'low' level of risk perception. This may be because the occupants who rent usually stay for a much shorter period as compared to those who own the house (Mohd-Rahim et al., 2019). Therefore, they may feel that the risk of infection is lower than that of residents who own their own homes and stay for longer. Such findings are seen in previous studies which found that home rentals occupants have more health effects either physically or mentally due to lack of self-awareness to disease (Pledger et al., 2019), (Turunen et al., 2017). Apart from that the examples of tenants who stay for a short period are students from higher education institutes due to the insufficiency of institutional accommodation (Ghani, & Sulaiman, 2021, 2020). Previous regional data has shown that such area has a significant high risk for dengue transmission to occur (Mohammed et al., 2019). This is in line with a study conducted in Vietnam that depict more likelihood of the student-tenant to be infected by dengue disease than residents who own their own homes (Toan et al., 2015).

Conversely, type of house was also a significant predictor for the low level of risk perception in this study. To the best of our knowledge, this is possibly the first evidence looking into the relationship of this factor. We found that those who are living in the apartment or high-rise building have a lower risk perception than those who live in a landed residence (twice likely). Such finding corroborated with earlier nationwide study (Wong et al., 2014), with total number of respondents of 1,400 reached through telephone survey, and a local study that employed geospatial (GIS) analysis using a decade of dengue data recorded in Klang Valley (Nellis et al., 2021). This could be the result of dense population per unit square area in the high rise residence, that concurrently reported a high incidence of dengue cases (Istiqamah et al., 2020), (Tee et al., 2019). Thus, it reflects the low perceived risk score, and this should trigger an alarm to health authority to plan an aggressive health campaign to spark their interest towards reducing risk of dengue infection.

Apart from that, the results of this study found that family history have doubled the odds to get a 'low' level of risk perception. The finding is in line with studies conducted in Ethiopia (Degife et al., 2019) and in the Curaçao archipelago (van Goudoever et al., 2021). It suggested that when a family member was infected with dengue fever, the other member on the contrary feels safer from the infection.

This could be possible as they perceived to have a high degree of self-resistance to infection, as evidence from not getting the infection at that point of exposure. Nevertheless, a study conducted in Ecuador also found that the history of family members who had been infected by dengue fever lead them to have a low risk threat of contracting dengue infection, thus subsequently spend lesser amount of resources on disease prevention compared to groups with no family history (Heydari et al., 2017).

The association between these family factors may also stem from the individual's observation towards those affected by the disease. For example, if the complications of the disease are seen to be mild or no imminent death threat to those family members affected, then the individual will feel a lower level of risk perception. Studies have proven such association between the level of terminal complications that may be encountered in the future and the perception of risk. For diseases such as cancer, that is known to cause mortality, will be more fearful to individual if any family member had it (Walter & Emery, 2006). However, the reverse is noted in the case of common diseases such as diabetes, thus creating a sense of complacency or denial to others (Acheson et al., 2010). This finding was also supported by a large-scale study, with a total of 4,703 respondents that found individuals who were at high risk (because they had been faced in a family) had a 'low' level of risk perception to get the disease (Brawarsky et al., 2018).

Age was not a significant predictor of low level of dengue risk perception for dengue infection in this study. This could mean that the older population of Seremban has grown enough knowledge to the risk of dengue illness as they are the group of people with higher susceptibility towards severe dengue complications and can lead to a poor prognosis (Lin et al., 2017), (Huang et al., 2017). Additionally, a study in the neighboring country, Indonesia, also suggested that older respondents (> 60 years) tend to have better dengue preventive behavior as compared to younger age groups because of this negative health impact of the disease (Rakhmani et al., 2018). Such finding does not limit to dengue fever or any infectious disease, as higher perceived disease risk has been reported for many health and safety risk among older population than their counterpart (Bonem et al., 2015).

Apart from that, the study did not reveal any significant association between education level as well as employment level with the low level of dengue risk perception. This perhaps due to the availability of dengue information within fingertips reach as a result of technological advancement. As such it has helped anyone to obtain necessary information about dengue illness regardless of one's education or employment status.

Strength and Limitation

There are couple of strengths in this study. First, the use of validated questionnaire which was done meticulously using dual statistical approaches before. Importantly, this questionnaire was developed based on local population where dengue is nevertheless endemic and share similar environmental background. Additionally, pilot testing done before embarking this study has demonstrated the validity and reliability of the tool. Secondly, the sample size for the study was sound and adequate. This is very important to ensure the internal validity of the outcomes measured. Furthermore, the integration of technology such as Google Form when conducting the survey to those who prefer non-contact interaction has resulted in zero missing data and helped to minimize tabulation error by the researchers. Therefore, it is a time saving and cost-effective method.

On the other hand, several limitations are worth to be highlighted from this study. The main limitation arises from the target population of the respondents. Although all the samples reside in Seremban district, those who responded were mainly from younger age group. This is inevitable especially during the period of COVID-19 pandemic where the older age group has the highest risk for infection and mortality, thus limiting contact with strangers is life-saving (Wahil et al., 2021). Secondly, the location for data collection may have skewed towards some group of respondents. For example, data collection around health clinic and vaccination center might have incidentally enrolled respondents with good health seeking behaviors that could be the potential confounder in this study. Apart from that, a self-administered questionnaire may open to potential misunderstanding of the item and leads to some information bias because clarification cannot be made.

CONCLUSION

The study showed that majority of Seremban population has a low level of dengue risk perception as well as the attitude and prevention practice. This finding is important because a high level of risk perception will be beneficial and have a profound effect to protect oneself from the illness by taking necessary protective measure. Information regarding the significant predictors obtained from this study, such as family history of previous dengue infection, those who live in a high-rise residence, and those who are renting the house need to be utilized in the public health promotion and health education campaign to increase the awareness of dengue illness in Seremban area. Application of HBM that has been validated in behavioral change may ultimately improve risk perception, attitude, and subsequently practice for dengue prevention by individual and the community in Seremban district.

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Conflicts of Interest

The authors declare no conflicts of interest.

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