

# Evaluation of the Hypothetical Constructs of Knowledge, Attitude, and Practices regarding Dengue in Selangor, Malaysia

**Alaba Ajibola Lamidi-Sarumoh**

Universiti Putra Malaysia <https://orcid.org/0000-0001-8077-3027>

**Shamarina Shohaimi** (✉ [shamarina@upm.edu.my](mailto:shamarina@upm.edu.my))

<https://orcid.org/0000-0003-0591-6627>

**Mohd Bakri Adam**

Universiti Putra Malaysia

**Mohd Noor Hisham Mohd Nadzir**

Universiti Putra Malaysia

**Emmanuel Segun Oguntade**

Universiti Putra Malaysia

**Nurul Akmar Ghani**

Universiti Putra Malaysia

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## Research article

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# Abstract

**Background:** Knowledge, attitude, and practice (KAP) on dengue are hypothetical constructs which are substantiated through the set of composed questions. KAP on dengue is one of the most economical and effective methods used to curtail the incidence of dengue fever because of the absence of efficient vaccines with considerable contraindications and certified chemoprophylaxis for the infection in the affected regions of the world. **Methods:** A cross-sectional study was carried out with the use of a validated structured bilingual questionnaire specifically to assess the KAP on dengue among population in Selangor, Malaysia. Exploratory factor analysis was used to examine the dimensionality and interdependence among the items of the questionnaire and partial least square path analysis (PLS-path analysis) was used to explore the weights of the indicative sub-constructs on the main constructs. **Results:** Items on knowledge about dengue fever and vectors were factored into six sub-constructs, items on attitudes towards dengue were factored into four sub-constructs and items on preventive practices against dengue were also factored into four sub-constructs. PLS-path analysis revealed the exact sub-constructs which had a low and negative impact on the main hypothetical constructs. **Conclusion:** Visualization of the structural system of KAP on dengue was presented. The results from this novel application gave an insight into the exact KAP on dengue that is insufficient among respondents. Also, this result can be of benefit to the planning of future community health campaigns and mediation strategies to reduce the risk of dengue virus infection.

## Background

Dengue virus infection (DVI) is one of the neglected tropical diseases which has exhibited a significant geographical expansion and high incidence rate in the last half-century. The fast expansion of the virus and the vectors are most common in the tropical and sub-tropical regions of the world (1). The serotypes of dengue were formerly known to be four but recent research has affirmed the existence of the fifth serotype (2). The disease and economic burden of DVI are overwhelming on all the affected regions of the world (3). Since the first discovery and documentation of dengue fever (DF) in Malaysia in 1901 and 1902 respectively (4,5), it has been a disease of public health concern throughout the nation. The high seropositivity and seroprevalence of DF among adults living in urban and rural settings have asserted the fact that the infection had spread across the nation (6).

In 2015, there were 120,836 reported cases of DF and 336 deaths across Malaysia which was the highest since the documentation of dengue cases. Selangor, a state located in West Peninsular Malaysia recorded 52.3% of the dengue cases. There was a reduction in reported cases of DF across the nation in the subsequent years from 2016 to 2018 (7) but Selangor continues to record more than 50% of the cases across the nation. This could be attributed to high mobility rate and dense population of Selangor which are possible risk factors of the spread of dengue (8). The aim of this study is to examine the exact knowledge, attitude, and practices (KAP) on dengue that is lacking or insufficient among individuals living in Selangor. Investigating the knowledge about dengue is an approach of assessing the awareness possessed by the target population in terms of understanding the dengue fever and vectors. Examining

the attitude towards dengue refers to consciousness and preconceived ideas towards dengue fever and vectors and investigating the preventive practices against dengue refer to the way in which knowledge and attitude are demonstrated through habitual actions (9). KAP on dengue is one of the most effective ways of curtailing the spread of DVI because of the absence of effective vaccines with considerable contraindications and certified chemoprophylaxis for the infection. Dengue KAP can be used as a means of revealing misconceptions or potential barriers in preventive practices. It can also help to create appropriate awareness in planning, eradication process, implement and evaluate mediation strategies. A study in Northern Thailand had shown that individuals with high knowledge had better preventive practices (10) and another study in the United States of America had shown the effectiveness of preventive practices against dengue vectors and involvement of the community which resulted in low morbidity rate and dengue vectors reduction (11,12).

## **Methods**

### **Study design and setting**

A cross-sectional survey was conducted in Selangor, Malaysia. The state has the surface area of 8,104 km<sup>2</sup>, an equivalent of 3129 sq. mi. In 2017, Selangor has a population of 6.39 million and Malaysia has an approximate population of 31.19 million which makes Selangor approximately 20.1% of the population of Malaysia. The rationale behind the cross-sectional intercept survey was to achieve a true response and hard-to-reach people living in urban areas. Studies had shown that the intercept survey method is a means of assessing the hard-to-reach province of urban areas and it also has a higher response rate compared to other methods of survey (13). Construct validity and reliability test of the questionnaire was conducted separately through a pilot study among the target population prior to the final data collection. Data were collected from May 2018 to October 2018 at train stations and shopping malls at different periods of time.

### **Sampling and sampling size**

In order to obtain a sample size with a robust statistical power and incorporation of diseases prevalence for sensitivity and specificity, sample size calculation from Buderer, 1996 (14) was adopted. The prevalence of dengue fever in Selangor in the year 2017 was calculated to be 0.007, thus, the required minimum sample size is 550 participants. Incomplete questionnaires were excluded during data entry and cleaning. A total of 560 individuals provided fully completed questionnaires.

### **Study instrument**

The questionnaire consists of three main sections: the first part of the questionnaire which represents the hypothetical construct of knowledge about dengue has 30 items, the second part which represents the

hypothetical construct of attitude towards dengue has 13 items and the third part presents hypothetical construct of preventive practices against dengue with 14 items. The Cronbach's alphas of each construct of the questionnaire were 0.72, 0.70 and 0.61 respectively which was a satisfactory scale on internal consistency (15). The validated pre-tested questionnaire was administered to the respondents who volunteered to participate in the survey.

## Statistical calculations

Exploratory factor analysis (EFA) was used to examine the dimensionality and complex interdependence among each construct of the KAP questionnaire. Convergence validity was further used to affirm the degree of relationship between the items and accordingly, sub-constructs were designed. The construct of knowledge on DF and vectors were factored into six sub-constructs, the construct of attitude towards DF and vectors was factored into four sub-constructs and the construct of preventive practices against DF was also factored into four sub-constructs. Partial least square path analysis (PLS-path analysis) was used to explore the data. The statistical analyses were performed with two software namely IBM SPSS Statistics software Version 23.0 (SPSS; Armonk, NY, IBM Corp., 2015) and R Programming Language (/R/win-library/3.5).

## Hypothetical constructs and definition of sub-constructs

Let  $X_1, X_2, \dots, X_n$  be the manifest variables or items which are used to indirectly measure the approximate representation of the sub-constructs such that each response to an item  $x_i$  is 1 or 0 (1 for the correct answer and 0 for the wrong answer) and  $n$  = number of questions. Each hypothetical construct (KAP) was considered to be caused by the formation of the sub-constructs (cause-effect relationship). Table 1 illustrates the definition of sub-constructs.

Based on the definition of preventive practices against dengue infection and vectors, which are the ways some target population demonstrates attained knowledge and preconceived ideas through actions, the KAP on dengue model was constructed on two simple theories: 1) Better knowledge influence better attitude and 2) Better knowledge and attitude influence better preventive practices.

Attitude

= f Knowledge..... (2.4.1)

Practices

= f Knowledge, Attitude..... (2.4.2)

The ellipses represent the inner models showing the relationship between the main hypothetical constructs. The rectangles are the outer model showing the relationship between each construct and its indicative sub-constructs which form blocks for each of the hypothetical constructs (KAP). The black arrows labeled 1, 2, and 3 represents the relationship between the structural model (inner model) and the unlabeled arrows represent the relationship between the indicative sub-construct and the main construct which is referred to as the measurement model (Figure 1).

## Results

# Partial least square path analysis

Evaluating a PLS-Path model requires two stages: assessment of the structural model and the measurement model. The measurement models in this context are based on formative indicators (mode B), therefore, it requires comparison of the outer weights to define the influence of the sub-constructs on the main constructs; correlation of “loadings” are not required (17). Essentially, the evaluation of formative measurement model is based on weights of the indicators (18).

## The structural model

From the formulated model in equation (2.4.2), the relationship between knowledge and attitude to practices has a direct effect of 0.1543 and  $-0.2269$  respectively which implies that there is a positive 15% effect of knowledge on practices and negative 23% effect of attitude on practices. The relationship between knowledge and attitude has a direct effect of  $-0.2281$  (Figure 2). Among the hypothetical variables of the structural model, the relationship between knowledge and practices has an indirect effect which makes the total effect of the relationship to be 0.2060. The total effect of knowledge on attitude and attitude on practices remains the same as the direct effect because there were no indirect effects existing between both relationships (Table 2).

## The measurement model

The weights of the indicative sub-constructs on knowledge showed that three indicative sub-constructs (PST, PBS and SD2) are having negative impact on the main construct which implies that the knowledge on primary and secondary transmission (PST), knowledge on possible breeding sites of dengue vectors (PBS) and knowledge on severity of dengue fever and vectors (SD2) are inadequate among the respondents. Among these negative sub-constructs in descending order, SD2 has the highest negative value of  $-0.4024$ , followed by PST,  $-0.3743$  and PBS which has the value of  $-0.0138$ . Among the positive sub-constructs, signs and symptoms (SAS) had the highest impact of 0.5364, followed by elimination and biting time (EBT), 0.3819 and SD1 which has the value of 0.3280. The positive sub-

constructs showed that knowledge of signs and symptoms of dengue fever is the most conversant of knowledge about dengue among the respondent (Figure 3A).

From Figure 3B, the weights of the indicative sub-constructs on attitude showed that two indicative sub-constructs (EDV and SAP) are having a negative effect on the main construct which implies that the attitude towards the elimination of dengue vectors (EDV) and attitude towards severity and prevention of dengue fever (SAP) are poor among the respondents. Between the two negative sub-constructs, EDV has a higher negative value of  $-0.9682$  than SAP which has a negative value of  $-0.0599$ . Concerning the two positive sub-constructs, attitude towards infection and re-infection ( $0.2175$ ) was better than the consciousness of being infected ( $0.0185$ ).

The weights of the indicative sub-constructs on practices showed that one indicative sub-construct (EAM) is having a negative impact on the main construct which implies that practices on the elimination of adult mosquitoes' is not sufficient among the respondents. Among the three positive sub-constructs, preventive practices of protection from mosquitoes bites (PMB) has the highest value of  $0.7224$ , followed by protective practice (PPT) which has the value  $0.4030$  and elimination of larval mosquitoes' ( $0.2156$ ). This result revealed that the most common preventive practices against dengue among the respondents to be the protection against mosquitoes' bites (Figure 3C).

## Discussion

Considerations were given to some vital points before the final interpretation and conclusion of the results from formative measurement (19): 1) Multi-collinearity among the indicators; 2) Numbers of indicators and non-significant weights; 3) Co-occurrence of negative and positive indicator weights; 4) Absolute versus relative indicator contributions; 5) Nomological network effects and construct portability and 6) The choice of technique. Points 1 to 4 was given consideration in this study because the methodology was adopted for exploration purpose and not for validation. The application of PLS-path analysis to KAP on dengue was used solely to explore the effect (weights) of each sub-constructs on the main constructs. The results from the exploration (structural model and measurement model) do not allow further steps to formulate a model for prediction because of the low and negative relationship between the main constructs and sub-constructs.

In order to verify the rationality of the explored results, multicollinearity among the indicative sub-constructs was tested. This was done to ensure that one sub-construct is not suppressing another. The variance inflation factor (VIF) among the sub-constructs of the KAP were all quite satisfactory ( $< 3$ ). The VIF greater than  $3.3$  indicates high multi-collinearity (20). The number of indicative sub-constructs for each main hypothetical construct were moderate. Bivariate correlation tests were used to check the suppressor effects between indicative sub-constructs and indicators was also satisfactory and finally, acknowledgment of the relatively small contributions of the sub-constructs to the main hypothetical constructs during the interpretation of the result.

## Conclusions

The structural system of KAP on dengue model was visualized and the actual knowledge about dengue, attitude towards dengue and preventive practices against dengue that was inadequate among the respondents were revealed.

## List Of Abbreviations

DVI: Dengue virus infection; DF: Dengue fever; KAP: Knowledge, attitude, and practices; PLS-path analysis: Partial least square path analysis.

## Declarations

## Ethical approval and consent participate

This study ethical consent was approved by the Medical Research and Ethics Committee of the Ministry of Health, Malaysia in a written procedure before the commencement of the pilot study and research data collection. The volunteered participants provided consent when they agreed to participate in the study.

## Consent for publication

Not applicable.

## Availability of data and materials

Datasets used for this study are available from the corresponding author based on a valid request (SPSS file or Microsoft Excel file). PLS-path analysis R programming codes can be found in a published article and a book respectively (16,17).

## Competing interest

None declared.

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# Authors' contribution

Appropriateness and conceptualization of the novel methodological approach to explore KAP study on dengue were studied by L-SAA. The research was supervised by SS, MBA, and MNH. Data collection, data entry and cleaning, and preliminary statistical analysis were done by OSE and NAG. The original draft, proofreading, and editing were done by L-SAA and SS.

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## Tables

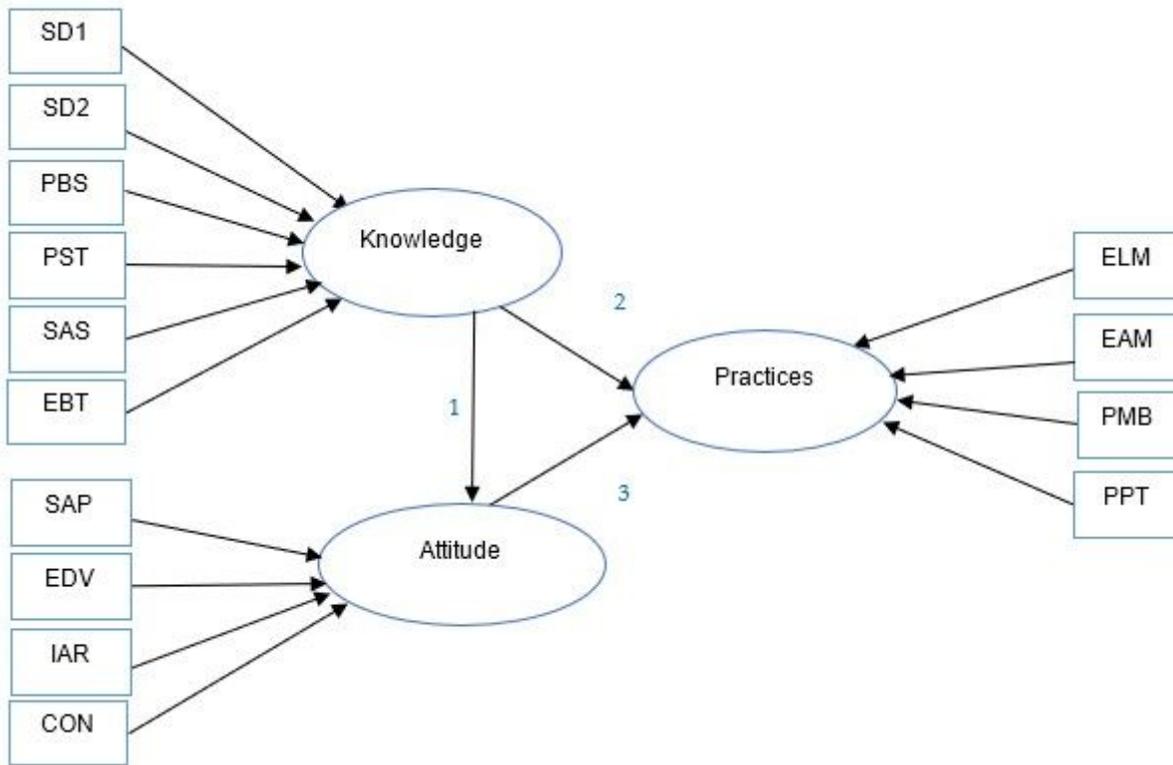
**Table 1:** Hypothetical constructs and definition of sub-constructs

Due to technical limitations, Table 1 is only available as a download in the supplemental files section.

**Table 2:** Direct and indirect relationships between the main hypothetical constructs

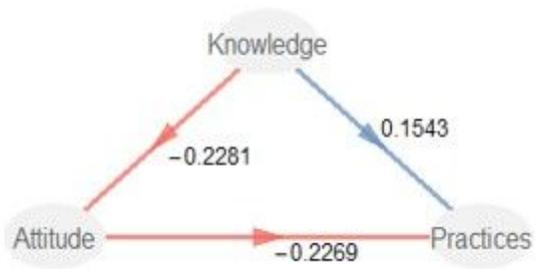
Relationships	Direct	Indirect	Total
Knowledge →Attitude	-0.2280850	0.00000000	-0.2280850
Knowledge →Practices	0.1542756	0.05175259	0.2060282
Attitude →Practices	-0.2269004	0.00000000	-0.2269004

## Figures



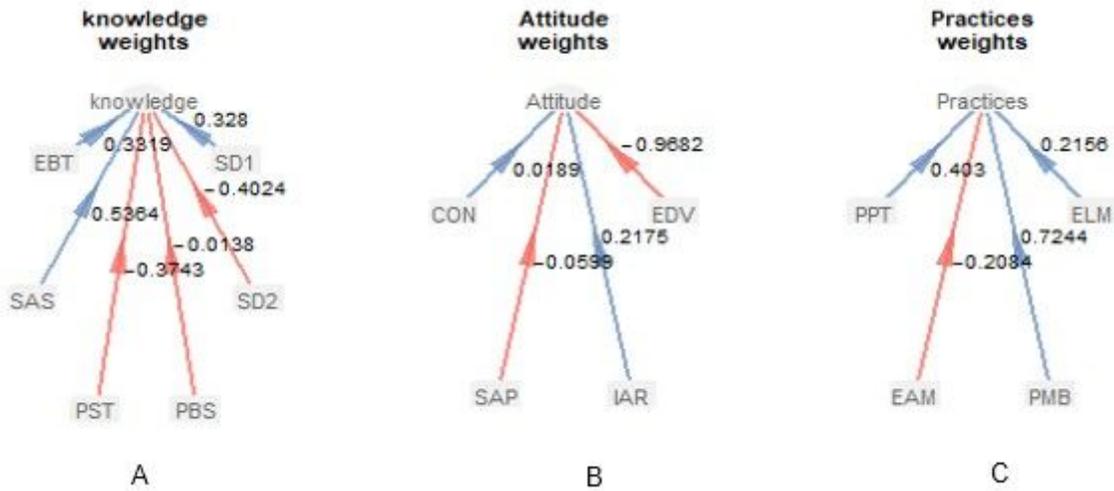
**Figure 1**

Path diagram depicting the knowledge, attitude, and practices on dengue model (Adapted from (16))



**Figure 2**

Structural model showing the relationship between the main hypothetical constructs.



**Figure 3**

Measurement model depicting the weights of each indicative sub-construct on the main construct (the red arrows signifies the negative influence of the sub-construct on the main construct while the blue arrow signifies positive influence).

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table1.jpg](#)