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Original Research Article

Validity and reliability of an instrument assessing the associated factors for preventive behavior towards dengue

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ABSTRACT

Background: Dengue is one of the most important vector-borne diseases in Malaysia. Government efforts alone are not sufficient in preventing the disease if people continue to allow the widespread mosquito breeding in their housing compound. Individual or community behavior is an important factor in the prevention of dengue. However, there is no standard instrument to measure the associated factors of dengue preventive behavior. This study commenced to validate and assess the reliability of a newly developed instrument for the constructs measuring factors associated with dengue preventive behavior.
Methods: A total of 327 respondents involved in this pilot study, which is a preliminary study to a larger scale study. Exploratory factor analysis (EFA) was employed to explore underlying constructs of the latent variables.
Results: From the EFA, 10 factors (knowledge regarding dengue, behavior toward dengue prevention, fear and awareness toward dengue, motivation to adopt preventive behavior, medical practices for dengue fever, cooperation in dengue prevention, perceived susceptibility of dengue, perceived severity of dengue, perceived benefit from practicing dengue preventive behavior, and perceived barrier toward dengue preventive behavior) emerged contributing 63.1 percent of the total variance with the reliability of 0.791.
Conclusions: The questionnaire is valid and reliable to measure the associated factors of preventive behavior toward dengue.

Keywords: Dengue, Preventive behavior, Reliability, Validity

INTRODUCTION

Dengue is one of the most important vector-borne diseases. Naturally, *Aedes aegypti* breed in areas near human settlements. This domestic habitat of the mosquito expose human to the risk of mosquito bites and consequently dengue virus which may lead to dengue fever. Human activities in daily live such as the need to keep water for erratic water supply, condition of the house like a clogged roof or the shrubbery yard, unplanned landfills, beside improper disposal of containers that can hold water also indirectly provide a breeding ground for mosquitoes. These show how mosquito breeding closely related to human behavior, besides suggesting an important role of a community in controlling mosquito breeding by keeping the cleanliness of their settlement.[1,2]

Despite the importance of keeping the house free from container that can serve as breeding site for *Aedes* mosquito, this activity remain low among individual or community. Many studies show low prevalence of good

attitude towards dengue prevention, and this is supported with the high prevalence of dengue.[3-6,11]

Behavior toward dengue prevention is associated with various factors. This study however focused on psychosocial factors, factors or components from the Health Belief Model (HBM), and general knowledge on dengue. Psychosocial factors are close relations between the psychological aspects of the individual with the social environment. It also mean a combination of internal factors of the individual, which involves the mind, thoughts, emotions, feelings, and behaviors with social factors such as interaction and relationships with others, the environment, culture and tradition, and the role and tasks. Psychosocial factors may play a role in health behavior either singly or combined in groups. The factor(s) may also impact directly or indirectly on health behavior. Examples of psychosocial factors are fear, anger, motivation, self-satisfaction, and so on.[12,13] In this study, fear and awareness toward dengue, medical practice for dengue fever, motivation in adopting dengue preventive behavior, and cooperation in dengue prevention were the psychosocial factors considered.

Meanwhile, four main components from the HBM adopted were perceived susceptibility toward dengue, perceived vulnerability of dengue, perceived benefit from practicing dengue preventive behavior, and perceived barrier to practice dengue preventive behavior.[14] For general knowledge regarding dengue, question on dengue vector, dengue virus, breeding sites of dengue vector, active biting time of dengue vector, symptoms of dengue, and practices that can prevent dengue were asked.

Dengue preventive behavior is defined as behavior that can prevent dengue by eliminating Aedes breeding sites; for examples like cleaning the house from water collecting containers, checking the drains and clogged rain channels, sweeping and burying empty tins, coconut shells or old tires in the backyard, and examining and changing the water in flower pots base inside or outside the house.[15,16]

This study is commenced to assess the validity and reliability of a newly developed questionnaire which used to investigate the factors associated with dengue preventive behavior among the community of Kinta, Perak (one of the states in Peninsular Malaysia).

METHODS

Questionnaire

The questionnaire was developed to measure factors associated with preventive behavior towards dengue. A total of 50 items were generated covering knowledge regarding dengue, behavior toward dengue prevention, and the factors associated. The items were either in the form of statement or inquiry, which were phrased using a typical 4-point Likert scale ranged from strongly disagree (1) to strongly agree (4).

The construction and generation of the items in the questionnaire were based on the results of previous studies on community involvement in dengue prevention and research on knowledge, attitude and practice (KAP) in controlling dengue. Besides, it also adopted the studies on dengue using the HBM as the basic framework. Moreover, the findings of the study based on psychosocial factors were also adopted and adjusted as this factor is an important factor but yet it is rarely found in dengue studies.[17-24]

Field work

This cross sectional study was conducted from March to October 2013. A total of 327 respondents were recruited to participate in this study. The respondents were from three health clinics in Perak, one of the states in Malaysia, and all of them gave written consent to participate in this study. Among the inclusion criteria for the respondents were age of 18 years old and more, and can read and write well. The sample size required for the verification of a questionnaire is based on the ratio of the number of items in a questionnaire to the ratio of the number of respondents, 1:5 (minimum).[25-27]

Each respondent received a set of self-administered questionnaire and they have answered all the questions in the form. To ensure the completeness of the questionnaire, two trained data collectors distributed the questionnaire forms, checked and collect them back. The response rate was 100 percent, and it took around 10-15 minutes for the respondents to complete the questionnaire. All respondents had given their agreement to participate in the study by signing the written consent form. The respondents however were free to discontinue their participation at any time.

Statistical analysis

The content validity of the questionnaire was first assessed by the experts from the public health field including epidemiologist and personnel from the vector borne diseases control unit. The experts assessed the relevancy of the 50 items asked in the questionnaire. Three items were irrelevant so they were excluded from the final version of the questionnaire. Next, all 47 relevant items which were continuous variables underwent exploratory factor analysis (EFA) to determine the underlying construct for the latent variables besides determining the construct validity and reliability of the instrument, and filtering out items having lower factor loading or a cross loading.[28-31] The extent to which a variable has a relationship with other variable is determined by factor loading. Factor loading for a variable is a measure of the contribution of the variable to a factor where the factor load on, i.e. a variable with a

higher factor loading indicates that the variable is more appropriate to measure the factor.[32]

Factor analysis was conducted according to the following order; data cleaning, factor extraction, factor rotation, results interpretation.[29,33] Initially, data normality was determined. Then, the variable or items in the questionnaire were extracted using the principal component analysis. The extraction is carried out on the basis that factor analysis based on a common factor model which is the theoretical model. This model assumes that the observed variables are influenced by underlying common and unique factors, which have determined the correlation pattern. Factors were extracted so that there is a considerable variance contribution in the correlation matrix.[25,30,32] Principal component analysis was chosen as the extraction method for this study as it is suitable to extract maximum variance of the data on each component so that a large number of variables can be reduced to a small number of components or factors.[30]

Following extraction, all items underwent exploratory factor analysis were rotated from each other. The main goal is to get a simple structure which ensures that each variable is below the minimum number of factors, but at the same time maximizing the number of variables with a high factor loading under each resulting factor. This is because a simple structure factor may distinguish one group of variables that are correlated with each other.[30,34] For this study, Varimax rotation was selected based on its advantages in producing factors that are independent and separated from each other, thus facilitating interpretation.[35] From the rotation, the variables were arranged under a number of factors.

Total numbers of factors that are appropriate or needed to be retained were finally determined. For this study, determination of the number of factors to be retained is based on two criteria; Kaiser's criteria, and observations of the curve on the Scree plot.[32,36] For Kaiser's criteria, factors that were retained are the factors with the Eigen values greater than one. Meanwhile, Scree test involves checking and finding natural bent or cut-off point where the curve flattened. Scree plot is a graph drawn by Eigen values and factors. The number of factors beyond the inflexion point (the point which the curve started to flatten) is the number of factors to be retained.[30,32,37,38] For this study, all data entry and analysis were performed using the Statistical Packages for Social Science (SPSS) version 18.0 (IBM SPSS Statistics 2012).

RESULTS

Socio demography and socioeconomic background of the respondents

The mean age of respondents was 34.61 (SD 11.92, range 18-74) years. Most of them were married, Muslim and Malay. Nearly half of them finish their high school, while others graduated from university, finish primary school, and only 2.8% did not attend any school. In terms of employment, the private sector is the key employment sector, followed by other sectors, with the mean wage of MYR1000-2999 per month. More than half of the respondents lived near the health facility, and the rest within the range of 1 to 10km from it (Table 1).

Table 1: Sociodemographic and socioeconomic distribution of the study respondents, n=327.

Characteristics	Number	Percentage
Age (years old)		
18 - 30	83	25.4
31 - 40	112	34.3
41 - 50	90	27.5
>50	42	12.8
Gender		
Male	126	38.5
Female	201	61.5
Religion		
Muslim	165	50.5
Buddhism	50	15.3
Hind	60	18.3
Christian	39	11.9
Other	13	4.0
Ethnicity		
Malay	164	50.2
Chinese	73	22.3
Indian	85	26.0
Other	5	1.5
Marital status		
Bachelor	122	37.3
Married	181	55.4
Divorced	24	7.3
Highest education level		
Did not attend school	9	2.8
Primary school	22	6.7
Secondary school	150	45.9
University or college	146	44.6
Occupation sector		
Government	65	19.9
Private	151	46.2
Self employed	40	12.2
Housewife	46	14.1
Other	25	7.6
Monthly income		
<RM1000	78	23.9
RM1000-RM2999	138	42.2
RM3000-RM4999	69	21.1
≥RM5000	20	6.1
No income	22	6.7
Distance from health facility		
<1km	65	19.9
1km - 5km	173	52.9
5.1km - 10km	63	19.3
>10km	26	8.0

Validity and reliability

Initially, the items with low communalities (<0.5) were dropped out one at a time where the item with the lowest communality dropped out first and the analysis was rerun. Next, item that cross load with another item was also dropped out. Three item were found to cross load where the item show high loading in two factors. Item 'Putting Abate into the water made me feel unsafe to use the water' loaded on two factors; cooperation and perceived benefit, item 'Wearing long sleeves especially during daytime is uncomfortable for me' loaded on perceived benefit and perceived barrier, and item 'Dengue is an unimportant disease for me' loaded on awareness and perceived susceptibility. Meanwhile, four items have low communality; 'Practicing activities those can prevent dengue are not important to me', 'I have no time to engage in dengue prevention activities', 'Cleaning the house is very difficult for me', and 'Dengue prevention is solely the health personnel's responsibility'. Therefore, these items were excluded from the final analysis.

The exclusion and dropping out the low communality or cross-loaded items left 40 items for the final run of EFA. From the EFA, the items were best categorized under ten factors. The cumulative variance contribution for these factors is 63.1 percent. The first factor which measured the fear and awareness of dengue among the community contributed 19.6 percent variance, followed by other factors. Factors retained were the factors with the Eigen value more than 1 (Table 2). Apart from the Eigen value, Scree plot was also referred to for the determination of factors to be retained (Figure 1). From the figure, the curve started to flatten upon the tenth factor. The construct validity of the component was also achieved by considering the factor loading of each item which is more than 0.5 (Table 3). In the table, all items were listed based on their factor loading. All items retained have a minimum factor loading of 0.5.

The internal reliability of the instrument which was measured by the Chronbach's alpha value was achieved where each factors recorded the value of more than 0.7 with the average of 0.791 for all components. Besides, the item total correlation for each item is satisfied (more than 0.5) except for one item 'For a fever, seeing a doctor did not give any benefit to me' (0.496). The item was however retained since the factor loading is satisfactory, and the value of item total correlation is just slightly below the border line (Table 3).

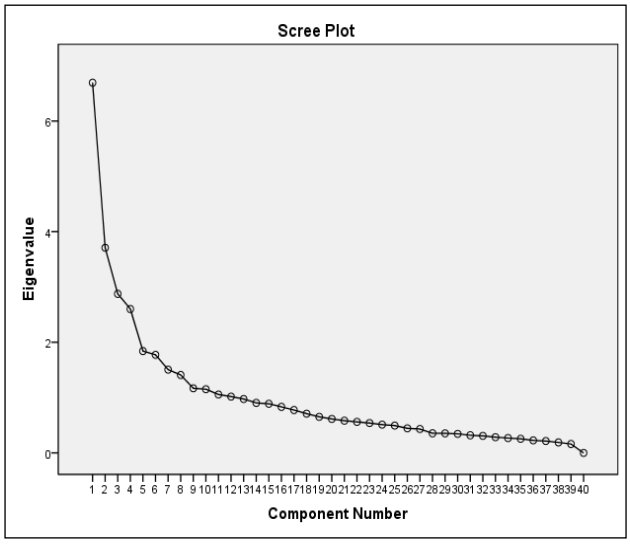

Figure 1: Scree plot for the 40 items underwent the final run of EFA.

Table 2: Factor analysis for the items with principal component method and after rotated component matrix.

Factors	Eigen value	Variance contributed, %	Cumulative percentage of variance contributed, %	Number of item
Fear and awareness toward dengue	10.18	19.6	19.6	6
Perceived benefit from dengue preventive behavior	5.15	9.9	29.5	4
Behavior in dengue prevention	2.86	5.5	42.5	4
Perceived barrier towards dengue prevention	2.10	4.0	46.5	4
Medical practices	1.76	3.4	49.9	3
Motivation to practice dengue preventive behavior	1.61	3.1	53.0	3
Perceived susceptibility toward dengue	1.57	3.0	56.0	3
Cooperation in dengue prevention	1.33	2.6	58.6	4
Perceived vulnerability of dengue	1.30	2.5	61.1	3
Knowledge regarding dengue	1.26	2.0	63.1	6

Table 3: Reliability criteria for the items.

Factors and items	Factor loading	Mean (SD)	Item-total correlation	Chronbach's alpha
Fear and awareness toward dengue				**0.839**
Dengue fever is extremely dangerous and can be fatal if not treated	0.556	3.40(0.95)	0.623	
It is an individual responsibility to clean the house and surroundings so that it is free from Aedes breeding sites	0.662	3.44(0.86)	0.589	
It is an individual responsibility to look for and eliminate mosquito breeding sites	0.516	3.23(0.96)	0.551	
I am afraid of dengue fever	0.723	3.35(0.83)	0.629	
Dengue fever can cause death	0.773	3.47(0.81)	0.674	
I eliminate mosquito breeding sites because I am afraid of getting dengue fever	0.727	3.45(0.78)	0.621	
Knowledge regarding dengue				**0.785**
Tick the cause or causes of dengue fever	0.756	0.27(1.03)	0.581	
Tick the vector for dengue virus	0.723	2.57(1.06)	0.608	
Tick usual breeding site of mosquitoes that cause dengue fever	0.675	2.46(1.05)	0.637	
Tick the biting time for the mosquitoes that cause dengue fever	0.724	2.51(1.15)	0.654	
Tick the symptoms of dengue fever that you know	0.780	2.81(0.94)	0.764	
Tick practices that can prevent or control the spread of dengue fever	0.642	2.18(1.04)	0.612	
Perceived benefit from dengue prevention				**0.910**
Cleaning the residential areas off container that can hold water	0.830	3.43(0.76)	0.800	
Cleaning the drains around the house so that mosquitoes cannot breed	0.838	3.33(0.84)	0.819	
Disposing the used tires	0.812	3.20(0.92)	0.797	
Seek treatment if there is sign(s) and symptom(s) of dengue fever	0.826	3.06(0.92)	0.770	
Behavior toward dengue prevention				**0.820**
Within a month, how often do you check the drains and clogged rain channels around your house?	0.721	2.51(0.91)	0.744	
Within a month, how often do you clean your home environment?	0.756	2.49(0.96)	0.886	
Within a month, how often did you rake and bury empty tins, food and beverage containers, or old tires around your house?	0.652	2.26(1.02)	0.690	
Within a month, how often did you change the water inside the base of your flower vases in and outside your house?	0.614	2.52(0.96)	0.888	
Perceived barrier toward dengue prevention				
It is hard for me to see a doctor if I get a fever	0.644	3.13(0.89)	0.621	
It is hard for me to check the mosquito larvae in around my house	0.570	3.04(0.88)	0.540	
It is hard for me to use mosquito nets when sleeping	0.789	2.95(0.88)	0.670	
It is hard for me to use repellent or insecticide spray to kill mosquitoes	0.812	2.70(0.92)	0.563	
Medical practices for dengue fever				**0.77**
If my fever worsen, then only I will go to the clinic	0.621	3.22(0.78)	0.500	
I prefer buying medicine at pharmacies or taking existing medicine at home rather than going to a clinic if I get a fever	0.616	3.52(0.79)	0.565	
For a fever, seeing a doctor did not give any benefit to me	0.669	2.94(0.91)	0.496	
I just have to take my own medicine if I get fever	0.638	3.12(0.87)	0.513	

Motivation to practice dengue preventive behavior				**0.823**
I will only cooperate in dengue prevention activities if I were rewarded	0.789	2.24(1.03)	0.663	
I need the authorities to give out instructions to clean the house, then only will I cooperate	0.808	2.01(1.01)	0.738	
I need a continuous support from the government in order to clean the house from mosquito breeding site	0.802	2.37(1.03)	0.636	
Perceived susceptibility				**0.843**
The probability of me getting dengue is lower compared to other people from the same age as mine	0.794	3.06(1.05)	0.849	
My immune system is strong therefore I would not get dengue	0.821	3.33(0.95)	0.849	
The probability of me getting dengue next year is low	0.794	3.39(0.92)	0.686	
Cooperation in preventing dengue				**0.694**
How often do you join the health personnel when they perform dengue control activities?	0.792	2.83(0.91)	0.532	
How often did you join your neighbors in cleanliness activities to clean up the house and drains surrounding your house?	0.805	2.90(0.91)	0.555	
I give permission to the health workers who want to check mosquito breeding places in or outside the house	0.721	2.93(0.98)	0.581	
When there is an announcement on fogging activity is going to be held, I took a precaution step like covering the food and beverage and opening all windows in the house to allow the fume to get in	0.702	2.87(0.80)	0.543	
Perceived vulnerability of dengue				**0.591**
If left untreated, dengue fever will get worse	0.712	2.71(0.95)	0.612	
Dengue fever is associated with dengue hemorrhagic fever	0.674	2.46(0.91)	0.635	
When getting dengue, it can be treated easily	0.593	2.67(0.82)	0.596	

DISCUSSION

The present study is an attempt to validate the psychometric properties of a questionnaire assessing the factors associated with behaviour toward dengue prevention among the community in Kinta, Perak, Malaysia. The selected scales showed acceptable and satisfactory internal consistencies. Cronbach's alpha coefficient for the components produced from the analysis was 0.791 confirming the adequacy of the internal consistencies of these scales. Ten factors clearly emerged after the rotation during the exploratory factor analysis.

Although the Scree test may work well with strong factors, it suffers from subjectivity and ambiguity, especially when there are either no clear breaks or two or more apparent breaks. Therefore the other criteria were considered when determining factors to be retained. In this study, number of factors to be retained by using Kaiser's criteria apart from the Scree test.[30,38]

Statistics scholars prefer internal reliability values of 0.70 or greater as an indication that a test is sufficiently reliable for measuring structures of an instrument. In this study, the internal reliability value of the questionnaire reflected by the Cronbach's alpha values ranging from 0.59 to 0.91, (mostly between 0.6 and 0.7), with the average of 0.791 showed that the questionnaire could be considered a reliable tool to measure the factors associated with behaviour towards dengue prevention. This value is comparable to the values obtained from validation studies on knowledge attitude and practice (KAP) in Malaysia.[3] Besides, corrected item-total correlations which are the correlations between scores on each item and the total scale scores are also important in determining reliability of an instrument.[39] For the instrument assessed, all items achieved the accepted value except for one item.

From this study, it is appeared that psychosocial factors play an important role in determining behaviour towards dengue prevention with one of the factors (fear and awareness toward dengue) contributed the highest variance compared to other factors. Psychosocial is rarely been explored in dengue studies despites its importance. From this study it is evident that this factor is a vital component to be explored and assessed together with other factors to get clearer picture on the determinants of preventive behaviour.

CONCLUSION

The questionnaire assessed in this study proved to be a valid and reliable tool to measure the factors associated with preventive behaviour towards dengue. This questionnaire is suitable to be used in studies related to dengue prevention and could be adopted to suit other community health related studies.

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