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Systematic review of knowledge, attitude, and practices regarding dengue in Malaysia

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ABSTRACT

Several studies had focused on assessing the relationship and description of the level of knowledge, attitude, and preventive practices (KAP) regarding dengue in Malaysia among different districts, different set of people living in rural, semi-urban, and urban areas over the years. This study reviewed the behavioral evidence, differences, and similarities of the KAP studies despite the use of different instruments for data collection and methodologies for the analysis of data. The search for the literature was conducted in January 2018 via the electronic database of PubMed, Scopus, Science Direct, EBSCOhost, ProQuest, and Google Scholar. Open access journals that were published between June 1986 and December 2017 were examined, focusing mainly on Malaysia as a country. Seventeen articles met the inclusion benchmarks. Most studies showed that the high level of knowledge influences good attitude and high preventive practices. Knowledge was mostly attributed to some socio-demographic factors. It is essential to compile the KAP studies regarding dengue which are done in different locations/districts of a country over the years, in order to project into the future on how to disseminate information to mitigate dengue infection and also to know the most influencing factors affecting it.

INTRODUCTION

Dengue fever (DF) is a viral infection that can be transmitted to human by the bite of infected *Aedes* mosquitoes and can also be transmitted to *Aedes* mosquitoes from a viremic human. *Aedes* species known to be transmitting the infection are *Aedes aegypti* and *Aedes albopictus* (Rudnick, 1965). DF is one of the major health concerns in Malaysia due to its seropositivity and seroprevalence among adults (Azami *et al*., 2011). DF can sometimes degenerate into dengue hemorrhagic fever (DHF) or dengue shock syndrome depending on the severity of the infection and the immunity of the viremic individual (Rothman, 2011). The fast expansion of the dengue virus is expected to increase based on some factors, such as modern dynamics of climate change, globalization, urbanization, trades and travels, socioeconomic status, viral evolution, ecological disturbance, lack of effective vaccines, and no specific treatment (Gubler, 2011). The need to assess community health behavior in order to understand knowledge, attitude, and practice (KAP) on dengue viral infection and its vectors was necessitated because of the increasing folds of the diseases on yearly basis in Malaysia. From 2000 to 2014, dengue cases increased from 7,103 to 108,698 (Mudin, 2015). The annual incidence rate increased more than 11 folds (31.6–361.1 cases per 100,000 people). KAP survey on dengue is an approach used to know the extent and impact of health programs in a particular domain and how people of the domain were informed. KAP studies regarding dengue can also be used as a baseline to motivate community participation in preventing and curtailing the DF and DHF (Benthem *et al*., 2002).

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Climate change, ecology of dengue vectors and human behavior

Malaysia has a typical tropical climate which is characterized by hot, humid, and rainy season throughout the year. Generally, the weather in Malaysia is bimodal: the Southwest monsoon season; April to September and the Northeast monsoon season; October to March. Temperature, rainfall, and relative humidity have been established to be contributing factors influencing the ecology of dengue vectors (Naish *et al*., 2014). The complete life cycle of dengue vector involves both terrestrial and aquatic habitats. The mosquito eggs and the adult belong to the terrestrial habitat while pupa and the larva belong to the aquatic habitat. The larval developmental time, larval survival, and adult reproduction depend on the mean temperature to complete their life cycle either in a short period of time or a long period of time (Marinho *et al*., 2016). High temperature reduces the extrinsic incubation period (Ewing *et al*., 2016). Thus, an increase in the rate of reproduction and the rate of transmission. Increase in humidity aids dengue vectors as it increases their feeding activities, the rate of survival, and egg development (Gubler *et al*., 2001). The rainfall has a direct influence on dengue vectors by creating artificial breeding sites in trash cans, plastics, and potholes. The inverse effect of the rainfall decreases the eggs and adult mosquitoes through erosion (Naish *et al*., 2014). Human behavior also influences the increase of dengue vectors directly by daily practices, such as indiscriminate dumping of refuse, low level of sanitation, storage of water without cover, and lack of preventive practices. According to Hairi *et al*. (2003), storage of water among rural communities in Kuala Kangsar district, Malaysia was more of tradition and culture despite the availability of pipe-borne water. Human behavior is known to be one of the controllable factors affecting dengue but it is difficult to control (Mudin, 2015) because community participation and cooperation is needed for effective preventive practices against the spread of dengue infection.

History of dengue and KAP studies in Malaysia

The first discovery of DF in Malaysia was in 1901 in Penang (Poovaneswari, 1993) and it was documented in 1902 (Lam, 1994). It has since then been a disease of concern throughout the nation. The first report of DHF was in 1962 which had the reported morbidity rate of 41 cases and mortality rate of 5. In 1973, there was a major outbreak of DHF which affects almost every part of the country (Poovaneswari, 1993), 1,487 cases and 54 deaths were reported. In 1974, DF and DHF became notifiable diseases, 2,200 cases were reported and 10 deaths (Mudin, 2015). In 1975, Malaysia government came with a plan under the vector-borne diseases control program in the sixth Malaysia plan which includes four strategies; anti-larva measure, anti-adult mosquitos' measure; health education, and enforcement of Destruction of Diseases Bearing Insects Act 1975. This Act gave birth to the first KAP study in Malaysia which was written by Dobbins and Else (1975), a study conducted in an urban Malay village and all other subsequent KAP studies which were reviewed in this article. There were also major outbreaks of dengue in 1978, 1982, 1990, and 1991 (Hairi *et al*., 2003). In 1993, "Program Bebas Denggi" or Dengue Free Program was introduced in Malaysian schools in order to inculcate the appropriate knowledge of dengue and preventive practices among the young generations.

Analytic approach of KAP regarding dengue studies

The exploration of the influence of risk factors of KAP studies regarding dengue may depend on the applicable instrument used for data collection from a particular population and the analytic approach. This study aimed to systematically review the relevant literature on KAP regarding dengue, focusing on Malaysia as a country; to converse the methodologies used; the structure of the instruments, and suggest future research direction. The rationale behind the aim of the review was to draw connection among the articles examined and also reveal the inconsistency of the instruments used for data collection. The KAP study of a particular area may differ from another area depending on education, experience, the location of the respondents, and exposure to information from mass media and social media. Methodology, instruments, and targeted population are also major elements influencing the results from KAP studies regarding dengue.

METHODS

Exploration approach

A literature search was conducted in January 2018 using the electronic databases of PubMed, Scopus, Science Direct, EBSCO host, ProQuest, and Google Scholar to obtain the information on KAP studies regarding dengue in Malaysia. The month and year of publications range from June 1986 to September 2017. The search was restricted to journal articles published in English language and open peer review with full-text. The five keywords used for the search were knowledge, attitude, practices, dengue, and Malaysia. The articles considered as part of the review were crosschecked through references and citations to ensure all relevant articles were included. Preferred reporting items for systematic reviews and meta-analysis (PRISMA) which had four-phase diagram flow was used for the exploration (Moher *et al*., 2010) as shown in Figure 1. Assessment of risk of bias for the articles reviewed was done using the Critical Appraisal Skill Program (CASP) (2014) for qualitative research with some modifications. Thus, evaluation of the strength and limitations of each article were established. The evaluation was done for both study and outcome level without consideration of data synthesis due to the difference in aims of the studies and results.

Selection benchmarks

The selected articles from the search results were considered based on three standards. First, for the purpose of substantial information, published articles that are easily accessible for peer reviews. Secondly, research studies that were solely done in Malaysia and its KAP regarding dengue. Finally, considerations were given to articles indicating the factors affecting KAP with the different statistical approach.

Words used interchangeably: Preventive practice and practices, occupational level and employment status, and participants and respondents.

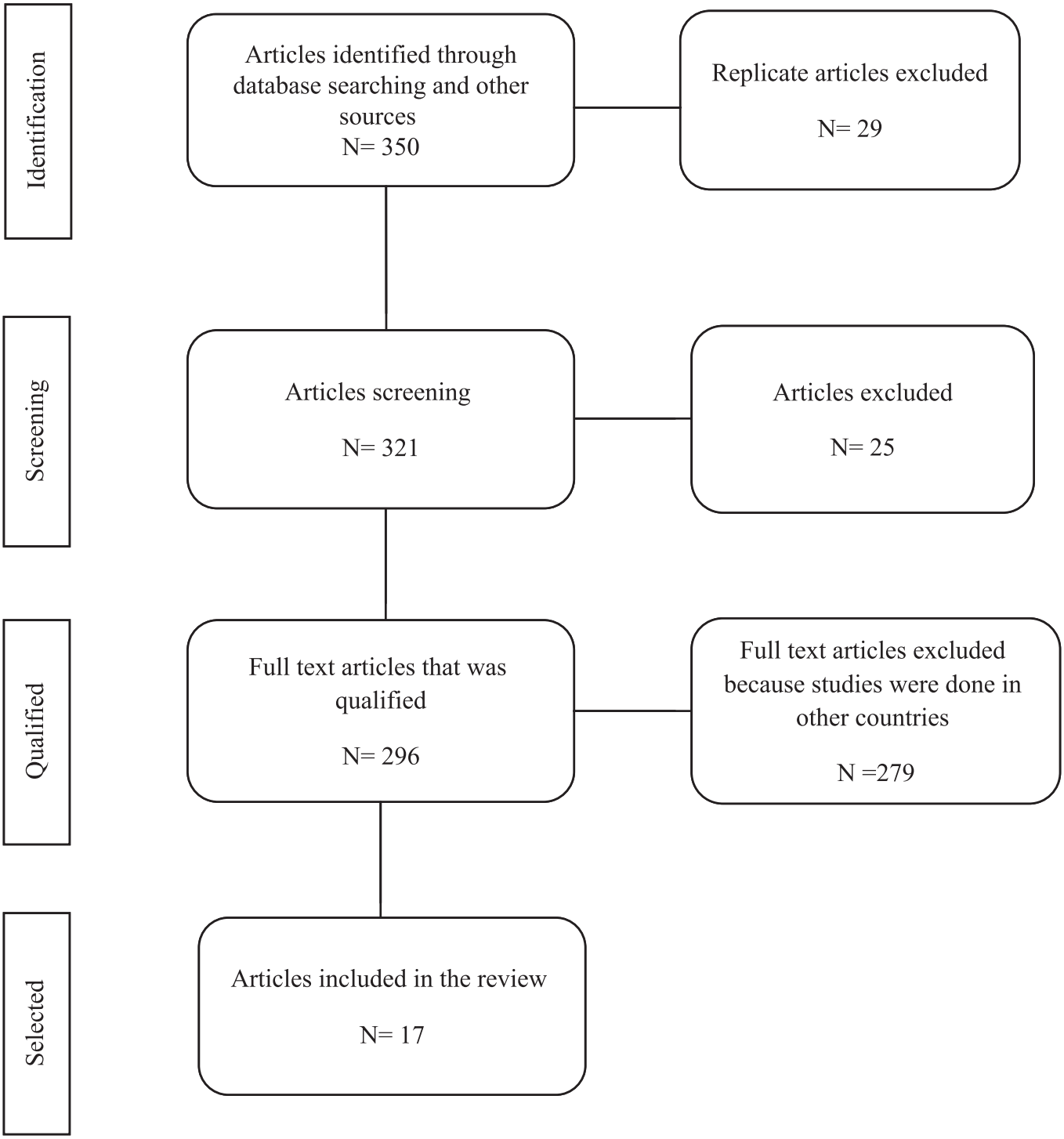

Figure 1. PRISMA flowchart of the literature search.

RESULTS

The exploration yields 321 studies without replicate and 296 of it were hypothetically appropriate. Further consideration of Malaysia as a country and perusal led to 17 studies strictly met the benchmark selection criteria. Table 1 shows the characteristics of the 17 studies of KAP regarding dengue in Malaysia.

Analytical approaches

All the selected articles were mostly cross-sectional studies. Descriptive statistics were used to summarize the socio-demographic variables and sources of information. Statistical significance of the different analytic approaches was considered at a p-value < 0.05. Fifteen of the studies used combinations of different analytical methods, such as bivariate and multivariate

Table 1. Studies considered in the review and their characteristics.

References	Study area/District	Data	Number of items for KAP constructs	Methodology	Basic findings	Comments
Ayyamani *et al.* (1986)	Jinjang North, Kampung Bahru, Sentul	Sources of information, Knowledge, attitude and practices	*Not specified	Descriptive statistics	Ethnicity was a factor influencing knowledge due to the language used on mass media to spread information.	Knowledge does not necessarily influence practices. Health education should be carried out in the most familiar language to the populace.
Hairi *et al.* (2003)	Kuala Kangsar	Sources of information, Socio-demographic variables, Knowledge, attitude and practices	Knowledge– 14 items Attitude – 13 items Practices - 9 items	Descriptive statistics, Chi-squared test and correlation analysis	Socio-demographic variables do not influence knowledge, attitude and practices. Knowledge and attitude were significantly related	Practices among rural communities were influenced by tradition and culture.
Rozita *et al.* (2006)	Kuala Lumpur	Sources of information, some socio-demographic variables, knowledge, attitude and practices	*Not specified	Descriptive statistics, Student t-test, one way ANOVA and correlation analysis	A weak correlation exists between knowledge and practices and there was no significant correlation between attitude and practices. Dengue history and Socio-economic status influence KAP.	Low knowledge leads to poor practices
Naing *et al.* (2011)	Seremban, Mantin town	Socio-demographic variables, knowledge on dengue, *Aedes* mosquitoes and practices	Knowledge– 17 items Practices – 10 items	Descriptive statistics, Student t-test, Chi-squared test and regression analysis	Age, educational level, Marital status, Occupation was significantly related to knowledge. Knowledge was positively significant to practices.	High level of knowledge yields positive and good practices
Al-Dubai *et al.* (2013)	Batu ,Setapak, Rawang, Hulu Kelang and Sungai Buloh	Sources of information Socio-demography, knowledge, attitude and practices	Knowledge—15 items Attitude—6 items Practices—11 items	Descriptive statistics, Chi-squared test, bivariate analysis, t-test and ANOVA	There was no significant association between knowledge score and socio-demographic factors excluding age and ethnicity. Attitude was significantly associated with the level of education and employment. Practices were associated with age, marital status, geographical area, and knowledge.	Knowledge and practices were significantly related
Leong (2014)	Rembau and Bukit Pelanduk, Negeri Sembilan	Sources of information, Socio-demographic variable, knowledge, attitude and practices	Knowledge- 10 items Attitude-6 items Practices- 7 items	Descriptive statistics and Chi-squared test.	Knowledge was associated with age, ethnicity and level of education. Attitude was associated with ethnicity and level of education Practice was also associated with ethnicity and marital status	Attitude and knowledge were significantly related
Al-Zurfi *et al.* (2015)	Cheras, Kuala Lumpur	Socio-demographic variables, knowledge, attitude and practices	Knowledge- 15 items Attitude- 10 items Practice- 11 items	Descriptive statistics, logistic regression and t-test	The mean score of knowledge increased after the health education intervention program.	Good knowledge will prompt a positive attitude and good practices.

Continued

References	Study area/District	Data	Number of items for KAP constructs	Methodology	Basic findings	Comments
Hamid *et al.* (2015)	National Defense University of Malaysia	Sources of information demographic variables, Knowledge, attitude and practices	Knowledge- 50 items Attitude -2 items Practices -13 items	Descriptive statistics	There was a misconception of knowledge about dengue and attitude toward it among the military cadet.	Good knowledge does not translate to good practices. More educational programs to increase practices need to be encouraged
Chandren *et al.* (2015)	Peninsular Malaysia	Socio-demographic variables, knowledge, theoretical construct of health belief and practices	Knowledge- 43 items Health belief- 4 items Practices-17 items	Descriptive statistics, Chi-squared test, and logistic multivariate analysis	Knowledge about dengue, perceived barriers for implementing dengue prevention, fogging frequency and perceived susceptibility to dengue fever are the factors significantly affecting preventive practices. Level of education, occupation, type of houses influences the knowledge score.	Socioeconomic status affects knowledge about dengue which in turn affects preventive practices.
Lugova and Wallis (2016)	National Defense University of Malaysia	Socio-demographic characteristics, knowledge, attitude and practices	Knowledge- 17 items Attitude-10 items Practices -11 items	Descriptive statistics, Chi-squared test, and logistic multivariate analysis.	Staffs have good knowledge on dengue and a better attitude than the students. The level of knowledge has a significantly positive association with house-hold income, age and education. Good attitude was associated with non-Malay, income and education. Good preventive practices were independently and significantly associated with knowledge and attitude.	Campaign programs on dengue should target students, young staffs, people with lower income and lower level of education.
Mahyiddin *et al.* (2016)	Ampang, Selangor	Sources of information, socio-demographic variables, knowledge and practices	Knowledge –26 items Practices – 13 items	Descriptive statistics and correlation analysis	There was no correlation between knowledge and practices	Some confounding factors are responsible for low practices
Aung *et al.* (2016)	Terengganu	Socio-demographic variables, Knowledge, attitude and practices	Knowledge –13 items Attitude – 12 items Practices – 16 items	Descriptive statistics and multiple regression analysis	Age and educational level were significantly related to preventive practices. Knowledge and attitude was significantly associated practices	Socio-demographic variables influence knowledge, attitude and practices
Azfar *et al.* (2017)	Sepang, Selangor	Sources of information, Socio-demographic variables, Knowledge, attitude and practices	Knowledge –14 items Attitude – 6 items Practice – 19 items	Descriptive statistics, t-test, ANOVA and Chi-squared test	Age, marital status , occupation and income were significantly related to knowledge score	There was no significant association between the level of knowledge and preventive practices
Hanim *et al.* (2017)	Kuantan, Pahang	Socio-demographic variables, knowledge, attitude and practices	Knowledge –18 items Attitude – 6 items Practice – 7 items	Descriptive statistics, simple and multiple logistic regression	There was no association between socio-demographic factors with the level of knowledge and attitude. Knowledge and attitude were not significantly related	There was a gap between knowledge and practices as good attitude was absent

Continued

References	Study area/District	Data	Number of items for KAP constructs	Methodology	Basic findings	Comments
Firdous *et al*. (2017)	Dewan Bandaraya,Ipoh community.	Socio-demographic variables, knowledge, attitude and practices	*Not specified	Descriptive statistics and Chi-squared test	The relationship between socio-demographic factors and knowledge was Insignificant. There was a significant relationship between socio-demographic factors with attitude and practices	The increase of attitude towards dengue infection is needed in the community due to their health perspective.
Yussof *et al*. (2017)	Terengganu, Malaysia	Socio-demographic variables, knowledge attitude practices	Knowledge -13 items Attitude – 12 items Practices – 16 items	Descriptive statistics, simple and multiple regression analysis	Age, educational level, marital status, geographical area, knowledge score, and attitude were significantly associated with good preventive practices	Knowledge has a direct influence on good preventive practices
Kamel *et al*. (2017)	Sepang, Selangor	Socio-demographic variables, knowledge attitude practices	Knowledge -10 items Attitude – 6 items Practices -10 items	Descriptive statistics and Chi-squared test	Good knowledge was significantly related to good attitude. Attitude was not significant with practices	Knowledge and practices have a direct association but good knowledge does not necessarily translate to good practices-

*Not specified means that the number of items used to measure the constructs of the KAP regarding dengue was not specified in the article.

methods to achieve the objectives of their studies at varying degrees. Some of the studies only consider knowledge and practices (Mahyiddin *et al*., 2016; Naing *et al*., 2011) but knowledge about DF was differentiated from knowledge about *Aedes* mosquitoes, while some studies joined the construct of attitude and practices together as a single entity (Ayyamani *et al*., 1986). Among some of the studies, practices were used as the dependent variables, while socio-demographic variables and knowledge were the independent variables (Naing *et al*., 2011). The data collected by Lugova and Wallis (2016) were found to be negatively skewed after the test of normality, so interquartile range was used for the data description. Five of the studies used logistic regression models to analyze the data collected. Table 2 shows the summary of the analytical approaches used by different authors.

Correlation

Hairi *et al*. (2003) used correlation analysis to examine the association between socio-demographic characteristics and KAP regarding dengue in four villages of Kuala Kangsar of state of Perak in June 2002. The result from the study showed that the socio-demographic variables were not significantly associated with knowledge, attitude, and practices but cross tabulation showed that there was a significant association between knowledge and attitude but no significant association between knowledge and practices. Furthermore, there was no significant association between attitude and practices. Rozita *et al*. (2006) also used correlation analysis to observe the relationship between knowledge and practice; knowledge and attitude; attitude and practice in a study conducted in Kampung Datok Keramat, Kuala Lumpur. The results showed that there was a weak positive relationship between knowledge and practice but there was no significant relationship between knowledge and attitude; attitude and practices. Another KAP study conducted by Mahyiddin *et al*. (2016) among the residents living in a low-cost flat, Pandan Indah Ampang, Selangor also used correlation analysis to examine the relationship between knowledge score on dengue and preventive practices score. The result showed that there was no correlation between knowledge and practices of the respondents.

Student's t-test

Rozita *et al*. (2006) used Student's *t*-test to compare mean scores of knowledge, attitude, and practices between gender (male and female), ownership of house (owned and rent), education (no formal education and secondary/tertiary), and dengue history (yes and no) of respondents in Kampung Datok Keramat, Kuala Lumpur. The results of the study showed that there was a significant difference between the mean score of knowledge of those who had dengue history compared to those who never had DF in the past. The mean score of knowledge and attitude of those who had a formal education was significantly different from those without formal education. Gender of the respondents also showed a significant difference as the female respondents had a better attitude than the male respondents. Finally, there was a statistically significant difference between the preventive practices of the respondents who were financially buoyant enough to own a house and those who rented houses. Al-Zurfi *et al*. (2015) used a *t*-test to reveal the difference in knowledge score of some students of Alam Shah Science School, Cheras before and

Table 2. References and analytical approaches.

References	Descriptive statistics	Correlation Analysis	Student's *t*-test	ANOVA	Chi-squared test	Regression Analysis	Logistic regression
Ayyamani *et al*. (1986)	✓						
Hairi *et al*. (2003)	✓	✓			✓		
Rozita *et al*. (2006)	✓	✓	✓	✓			
Naing *et al*. (2011)	✓		✓		✓	✓	
Al-Dubai *et al*. (2013)	✓		✓	✓	✓		
Leong (2014)	✓				✓		✓
Al-Zurfi *et al*. (2015)	✓		✓				✓
Hamid *et al*. (2015)	✓						
Chandren *et al*. (2015)	✓				✓		✓
Lugova and Wallis (2016)	✓				✓	✓	✓
Mahyiddin *et al*. (2016)	✓	✓					
Aung *et al*. (2016)	✓					✓	
Azfar *et al*. (2017)	✓		✓	✓	✓		
Hanim *et al*. (2017)	✓						✓
Firdous *et al*. (2017)	✓				✓		
Yussof *et al*. (2017)	✓					✓	
Kamel *et al*. (2017)	✓				✓		

after an interventional Correlation Analysis education program. The conclusion of the study was that the knowledge score of students increased after the health education program. Azfar *et al*. (2017) in a study conducted in the semi-urban community of Sepang, Selangor used a *t*-test to show that there was a significant difference between the level of knowledge of married and single, government workers and unemployed, the respondent with higher income and lower income.

Analysis of variance (ANOVA)

Rozita *et al*. (2006) used analysis of variance (ANOVA) to test the difference of knowledge, attitude, and practice among the three different locations in Kampung Datok Keramat, Kuala Lumpur, the findings revealed that the mean practice score of the locations showed a significant difference, while the knowledge and attitude of the locations show no significant difference, this implies that preventive practices against DF are different from one location to another. An ANOVA done by Azfar *et al*. (2017) has shown that age group is a significant factor affecting the level of knowledge.

Chi-Squared test

A KAP study regarding dengue carried out in Seremban district, Malaysia by Naing *et al*. (2011) showed that there was a significant association between knowledge score of dengue and age, educational level, marital status, and occupation. Practice score was significantly associated with age, educational level, and knowledge score of dengue. Al-Dubai *et al*. (2013) used chi-square to establish that there was an association between some of the socio-demographic variables and knowledge of dengue; age and ethnicity were significantly associated with knowledge, knowledge was significantly associated with attitude and practices, attitude was significantly associated with educational and occupational status, while practices were significantly associated with age, marital status, geographical area, and knowledge. Leong (2014) also used cross tabulation and chi-square to show that knowledge and attitude are related variables but there was no significant association between knowledge and practice; attitude and practices. Chandren *et al*. (2015) conducted a study among 16 randomly selected Orang Asli villages from eight states in Peninsular Malaysia; chi-square was used to show that living condition, type of house, occupation, and average monthly income were associated with knowledge on dengue. Lugova and Wallis (2016) used chi-square to evaluate the difference between the level of KAP regarding dengue among students and staff in National Defense University of Malaysia, Kuala Lumpur. The result revealed that staff have better KAP regarding dengue than students. Chi-square analysis of the study conducted in Sepang, Selangor revealed that there exist no association between the level of knowledge and preventive practices against dengue (Azfar *et al*., 2017). Firdous *et al*. (2017) used categorical analysis and chi-square test to examine the significant relationship between socio-demographic factors and KAP regarding dengue in a study conducted in Dewan, Bandaraya, Ipoh community. The results showed that there was no significant association between socio-demographic factors and knowledge but there was a significant association between socio-demographic factors and attitude and there was also a significant association between socio-demographic factors and practices, most importantly the level of education influences high preventive practices. Kamel *et al*. (2017) evaluated the association between knowledge, attitude, and practice in a study conducted in the community of Taman Salak Baiduri Sepang, Selangor with the use of cross-tabulation and chi-square. The result showed that there was a significant association between knowledge and attitude, while there was no significant association between attitude and practices.

Regression Analysis

Mean score on practices on dengue was used as the dependent variable; a stepwise method of elimination was applied to discover the non-significant variables and the multivariate regression analysis indicated that only knowledge on dengue was positively significant with preventive practices (Naing *et al*., 2011). Aung *et al*. (2016) in a study conducted among a rural

population of Terengganu, Malaysia used multiple regression models to reveal the factors associated with preventive practices against dengue to be age, level of education, knowledge, and attitude. In a regression analysis, Lugova and Wallis (2016) showed that knowledge on dengue and attitude towards dengue was significantly associated with preventive practices on dengue. A KAP study on dengue was conducted by Yussof *et al*. (2017) in a dengue hot spot area in Universiti Sultan Zainal Abidin (UniSZA) Terengganu among students, multiple regression model was used to evaluate significant factors associated with preventive practices against dengue. Socio-demographic factors such as age, level of education, marital status, geographical areas, and duration of living in the survey area were factors revealed to be influencing practices against dengue. After the adjustment for confounding variables, knowledge and attitude are significantly related to preventive practices and the simple regression analysis result also showed that practice score and knowledge score are significantly related.

Logistic regression

Logistic regression has been extensively applied to KAP regarding dengue studies to discover the most influencing independent variable of preventive practice. With logistic regression, Leong (2014) was able to establish that knowledge was related with age, ethnicity, and educational level; and attitude was related with ethnicity and educational status, while practices were associated with ethnicity and marital status in a study carried out in Rembau and Bukit Pelanduk, Sembilan. Al-Zurfi *et al*. (2015) used simple logistic regression to assess the association of knowledge and race; knowledge and socioeconomic status; knowledge and residential areas. The result from the study showed that there was no significant association between knowledge and all the socio-demographic factors. Chandren *et al*. (2015) used a multivariate logistic regression model to reveal the factors that were mostly affecting preventive practices of dengue among Orang Asli in Peninsular Malaysia to be knowledge on dengue, perceived barrier, the frequency of fogging, and perceived susceptibility. Lugova and Wallis (2016) used a logistic regression model to examine the factors independently affecting preventive practices, the results showed that knowledge and attitude are independently associated with good preventive practices. Hanim *et al*. (2017) conducted a KAP regarding dengue study among adult residents of Felda Sungai Pancing Timur, Kuantan, Pahang, multiple logistic regression analysis was used to show that socio-demographic factors have no influence on the level of knowledge and attitude towards dengue. Simple logistic regression was also used to show that there was no association between knowledge score of dengue and attitude score of the respondents.

Questionnaire, scoring method, and categorization of the latent constructs

Hairi *et al*. (2003) assessed knowledge with 14 items, attitude with 13 items, and practices with 9 items. The composite scoring system was used and categorization of knowledge, attitude, and practices as regard dengue was done into two basic levels; good and poor with an arbitrary cut-off. Rozita *et al*. (2006) categorized knowledge, attitude, and practices on dengue into "good" and "moderate to poor" with an arbitrary cut-off of 75% of each score of the construct of KAP. The correct answer was given a point and summed for each construct. The items used for measuring the construct were not detailed in the article. The questionnaire used by Naing *et al*. (2011) measured the construct of knowledge about DF with 14 items and construct of knowledge about *Aedes* mosquitoes with three items, while practices were measured with 10 items. A composite scoring method was used. A good knowledge about dengue was categorized based on scores ranging from 10 to 14, a good knowledge of *Aedes* mosquitoes: score of 2 and 3, good practices: scores ranging from 5 to 10 and otherwise. In the study carried out by Al-Dubai *et al*. (2013), knowledge was measured with 15 items, the attitude was measured with 6 items, and practice was measured with 11 items. The global composite scoring method was used to code the right answer to be 1 and wrong answer to be 0. The median score of knowledge was used as a scale to categorize the construct into two groups; knowledgeable and non-knowledgable. Scores greater than 11 were categorized as knowledgeable and knowledge scores ≤ 11 were categorized as non-knowledgable. Leong (2014) used a questionnaire that measures knowledge with 10 items, attitude with 6 items, and practices with 7 items. Leong also made use of the global composite scoring method by coding each correct answer as 1 and wrong answer as 0. Knowledge score ≥ 7 was categorized as good knowledge and otherwise; attitude score ≥ 4 was categorized as good attitude; practices score ≥ 4 was categorized as good practices and otherwise. Al-Zurfi *et al*. (2015) measured knowledge with 15 items, attitude with 10 items, and practices with 11 items. Coded the correct answer as 1 and 0 for the wrong answer to obtain each score for knowledge, attitude, and practices. Categorization into good knowledge, good attitude, and good practices were done by an arbitrary cut-off score ≥ 12, ≥ 8, and ≥ 6, respectively. The scores less than the arbitrary cut-off were categorized as moderate and poor.

Knowledge and awareness of dengue were measured with 50 items, attitude with 2 items, and practices with 13 items. No arbitrary cut-off for categorization of the constructs and no scoring method were used in their analysis (Hamid *et al*., 2015). The results and conclusions were based on descriptive statistics.

An improved shift from the construct of attitude to health belief model (HBM) by Chandren *et al*. (2015) with knowledge of dengue and preventive practices gave the KAP regarding dengue study a distinguished approach. Knowledge of dengue was measured with 43 items, HBM has four different sub-construct, such as perceived severity, perceived susceptibility, perceived barrier and self-efficacy, and cue to action. The first three sub-constructs were measured on 1–10 point scale, self-efficacy was measured on two point scale while cueing to action (density of the mosquitoes in the neighborhood) was also measured with 1–4 point scale based on respondent's discretion and finally, preventive practices were measured with 17 items.

Lugova and Wallis (2016) used 17 items to evaluate knowledge on dengue, 10 items for attitude towards dengue, and 11 items for preventive practices. For knowledge, the correct answer was coded 1, incorrect and "not sure" options were coded as 0. Five-point scales were used to measure attitude ranging from 0 to 4. Practices options were either yes or no, yes was coded as 1 and no as 0. Knowledge, attitude, and practices were categorized

into two different levels; good and moderate to poor. Scores >75% were considered as good and scores <75% was considered to be "moderate to poor." Mahyiddin *et al*. (2016) used 26 items to measure knowledge and 13 items to measure practices, the questionnaire was adapted from Yboa and Labrague (2013). The correct answers were coded as 1 and the wrong answers as 0. Arbitrary cut off was used as a standard to categorize knowledge into five different levels; 0–5 as poor knowledge, 6–10 as fair knowledge, 11–15 as moderate knowledge, 16–20 as good knowledge, and 21–26 as excellent knowledge. Preventive practices were also categorized into five different levels; not at all (1–1.50), limited extent (1.51–2.50), moderately extent (2.51–3.50), great extent (3.51–4.50), and very great extent (4.51–5.00). Aung *et al*. (2016) used 13 items to measure knowledge; 12 items to measure attitude, and 16 items to measure practices. The knowledge score was categorized into three different levels; high knowledge (129–108), moderate knowledge (107–86), and low knowledge (85–43) by summing the rating scale. Five-point scales were employed to measure attitude which was also categorized into three different levels; good attitude (60–48), neutral attitude (47–36), and poor attitude (35–12). Practice score was categorized into two levels; good practice (32–24) and poor practices (23–16).

Azfar *et al*. (2017) used 14 items to assess knowledge, 6 items to assess attitude, and 10 items to assess practices. For the knowledge, the correct answer was coded as 1 and the wrong answer as 0. Bloom's cut off point was used to categorize knowledge score into three different levels; high knowledge (12–14), moderate knowledge (9–11), and low knowledge (0–8) which was an adapted method from Ahmed and Taneepanichskul (2008). Practice score was also categorized into three different levels, namely limited practice, moderate practice, and extensive practice using the Bloom's cut-off and summation of the rating scale. In the KAP study done by Firdous *et al*. (2017), the items used to measure knowledge, attitude, and practices were not specified. The scoring method was also not declared but the categorization of the construct was done base on three levels; low, medium, and high. Yussof *et al*. (2017) evaluated knowledge with 13 items, attitude with 12 items, and practices with 16 items. Reverse score rating was used to categorized knowledge score into three different levels; high knowledge (0–21), moderate knowledge (21–43), and low knowledge (44–86) by coding the correct answer as 0, wrong answer as 1, and "don't know" as 2. Attitude score was categorized into two levels with a summation of the rating scale; good attitude (48–60) and bad attitude (36–47) and practices score was also categorized into two levels by summing of the rating scale; good practice (32–48) and bad practice (16–31).

Kamel *et al*. (2017) used 10 items to assess knowledge, 6 items to assess attitude, and 10 items to assess practices. The correct answer was coded as 1 and the wrong answer as 0. Knowledge score, attitude score, and practice score were all categorized into two different levels with the median score as the scale; good knowledge and practices (7–10), poor knowledge and practices (0–6), good attitude (3–6), and poor attitude (0–2). Hanim *et al*. (2017) evaluated knowledge with 18 items, attitude with 6 items, and practices with 7 items. Categorization into two levels (good and poor) was done using mean cut-off point.

Risk of bias of the selected articles

CASP (2014) checklist for the qualitative study consists of 10 items. Number 6 of the checklist was modified to conform to the feature of evaluating studies involving self-administered questionnaires. Virtually, all the studies considered had a low risk of bias from number 1 to 5 of the checklist, except for two articles (Aung *et al*., 2016; Yussof *et al*., 2017) which only explained the importance of KAP studies regarding dengue without clearly stating the goal of the study. Out of the 17 literature reviewed, only six of the literatures gave importance to construct validity and reliability of the questionnaire which makes them a low risk of bias in terms of instrument used for the study. Seven of the literatures were unclear of the potential bias because of the results of the questionnaires were only presented in the article while the remaining four articles did not give consideration to content validity and reliability of the questionnaires used for the study. On ethical issues, seven of the studies stated the ethical clearance for studies while 10 of literatures had a high risk of bias based on ethical considerations because there was no clear statement of ethical clearance in the articles. Fifteen of the reviewed literatures had a low risk of bias on the intensity of the data analysis. Ayyamani *et al*. (1986) and Hamid *et al*. (2015) used only descriptive statistics to present result without any statistical test of significance. Finally, in terms of clear statements of findings of the study, contribution and value of the research to the society, all the literature considered had a low risk of bias. Table 3 shows the summary of the risk of bias of the literature considered.

DISCUSSION

With upward trend of dengue infection in Malaysia for more than a decade (2000–2015; 7,103 cases to 120,836 cases) and the downward trend experienced from 2015 to 2017 (120,836–82,840 cases), Malaysia still needs to increase effort on more health campaign programs to educate the populace about prevention of dengue infection. Human behaviors are known to play a significant role in the continuing existence of dengue vectors and transmission of the virus (Higa, 2011) because dengue vectors depend on the human environment to feed and reproduce. Study from other country had also confirmed that higher level of education influences better chance of awareness and preventive measure against dengue vectors (Dhimal *et al*., 2014) in Nepal, this implies that there should be more focus on people with low socioeconomic status because people with higher economic status are less likely to be infected by dengue due to their choice of living environment and condition (Mondini and Chiaravalloti Neto, 2007). All the reviewed articles recommended that effective dengue prevention and control programs need to be put in place to curtail the spread of the viral infection.

Strength and limitation of studies

Various statistical analytical approaches have been used to determine the KAP on dengue among different sets of people in different locations and the possible influence of socio-demographic factors on KAP regarding dengue in Malaysia (Table 2). No predictive model has been formulated on KAP regarding dengue studies. In general, an appropriate sampling procedure and the large sample size of data will increase the

Table 3. Risk of bias summary.

Risk of bias assessment \ References	Ayyamani *et al.* (1986)	Hairi *et al.* (2003)	Rozita et al. (2006)	Naing *et al.* (2011)	Al-Dubai *et al.* (2013)	Leong (2014)	Al-Zurfi *et al.* (2015)	Hamid *et al.* (2015)	Chandren *et al.* (2015)	Lugova and Wallis (2016)	Mahyiddin *et al.* (2016)	Aung *et al.* (2016)	Azfar *et al.* (2017)	Hanim *et al.* (2017)	Firdous *et al.* (2017)	Yussof *et al.* (2017)	Kamel *et al.* (2017)
Clear statement of the aim of study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Methodology appropriateness	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Design appropriateness to achieve aim of study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sampling procedure appropriateness	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data collection procedure and quality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Content and construct validity with the reliability of the instrument	V	V	V	V	No	No	No	No	Yes	V	Yes	Yes	Yes	V	V	Yes	Yes
Ethical issues and considerations	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	No
Intensity of the data analysis	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clear statements of findings of the study	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Contribution and value of the research to the society	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

"Yes" indicates a low risk of bias, "No" indicates a high risk of bias, and "V = Vague" indicates lack of information and uncertainty over the probable bias.

precisions of results. The variability of questionnaires, scoring method, sample size, arbitrary cut-offs restricts results from one study to another from being generalized. Reliability, content, and construct validity of the questionnaire should be carefully examined appropriately.

CONCLUSION

Clear evidence which showed that socio-demographic variables influence KAP regarding dengue has been proven. It is important to harmonize and validate the content of all the structured questionnaires in order to reduce the variability of results based on the questionnaire used for data collection. Finally, integration of qualitative and quantitative modeling approach to KAP studies can aid in projecting the impact of socio-demographic factors on future KAP regarding dengue studies.

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