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ORIGINAL ARTICLE

Assessment of Dengue Fever Knowledge and Preventive Practices among the General Population of Jeddah

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ABSTRACT

Objective: To assess the knowledge, health beliefs, and preventive practices against dengue fever (DF) in different dengue endemic districts of Jeddah, Saudi Arabia.

Methods: A cross-sectional study was conducted in three dengue-endemic districts of Jeddah, Saudi Arabia, April 1st to October 1st, 2018. Overall mean scores were calculated for knowledge, practices, and Health Belief Model (HBM) construct. Households and their residents having almost similar geographical, environmental, and socioeconomic status were randomly selected. A total score of 19 was possible in the knowledge section, and seven in the practices section. A score greater than the mean was considered adequate for knowledge and practices. Practices regarding DF prevention and control were assessed by asking questions as well as by observation against a checklist of household practices. We used a validated questionnaire to measure HBM construct and DF preventative behaviors, which was adapted from studies conducted in Pakistan, Malaysia, and Australia.

Results: Out of the total 241 individuals, around 146 (61%) had adequate DF knowledge with a mean score of 11.18 ± 3.26 and 124 (51%) had adequate practices with a mean score of 5.17 ± 1.80. Multivariate regression showed perceived mosquito control benefits (OR=1.857, 95% CI=1.078-3.199, p-value 0.026) and perceived barriers (OR=0.532, 95% CI=0.305-0.926, p-value 0.026) as significant predictors for adequate dengue knowledge. For dengue preventive practices the only predictor was their perception of mosquito control benefit (OR=1.864, 95% CI=1.109-3.134, p-value 0.019).

Conclusion: Overall, DF knowledge and practices were rather limited in selected dengue endemic districts of Jeddah. Health beliefs remain significant predictors of both knowledge and dengue prevention practices.

Keywords: Dengue Fever, Health Belief Model, Knowledge, Practice, Threat.

INTRODUCTION

Dengue Fever (DF), a mosquito-borne viral infection, is a growing threat to the health of many populations worldwide.[1] Almost 400 million people worldwide are affected by DF, with around two-fifths of the world's population at risk of developing it.[2,3] Factors augmenting the increase in incidence of dengue in tropical and temperate countries have been shown to include lack of knowledge about the disease, poor preventive measures being taken against vector spread, uncontrolled urbanization leading to changes in living conditions, and a greatly increased incidence of international travel, especially by pilgrims coming to the Kingdom of Saudi Arabia.[4]

The recent dramatically high global re-emergence of DF, with a high case fatality rate of around 3-5%, and considerable economic consequences means that more and more public health authorities are seeking ways to deal with it effectively.[5,6] An almost 30-fold increase in incidence has been witnessed during the last 50 years. [7] The first dengue case in our region was registered in Jeddah, Saudi Arabia, in 1994. Consequently, a dengue virus surveillance system was established.[7,8]

All initial efforts to control the spread of dengue were

focused solely on vector elimination. However, the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) soon realized that these efforts could ultimately only be successful when combined with effective community participation.[9] Prevention and control of dengue can be achieved by adopting proper and timely prophylactic measures.

The Health Belief Model (HBM), a widely used cognitive model for predicting health behaviors, posits that an individual's health behavior is determined by four main elements.[3] These include (i) the perception of the likelihood (susceptibility) of getting an infection, (ii) the perception of the seriousness (severity) of the illness, (iii) the perceived benefits of taking action to prevent the illness, and (iv) the perceived barriers in taking such action.[3,10] Additional constructs of HBM "cues to action" and "self-efficacy" are also used in some studies.[3]

Saudi Arabia is a major center for Muslim pilgrimage, with millions of pilgrims travel around the globe each year to come to Saudi Arabia. Because Jeddah is a major entry and transit point, the potential for the spread of infectious diseases in the region is high. [7,8,11] DF is one such disease. Because many DF cases in these pilgrims are missed, or, due to mild symptoms or inappropriate surveillance, go unreported not only is the pilgrim's health at stake, but his or her illness can pose a major threat to the health of local residents.[3,7,8,11]

Moreover, studies have also highlighted the influence of demographic factors, e.g. socioeconomic status, habits & living conditions, gender, and educational status, etc. as influencing the awareness, health beliefs, and preventive health behaviors of individuals. [7,10,12,13] Therefore, ascertaining the ways in which these factors influence behavior is an important element in putting together an effective disease control and prevention strategy.[3,7,14] The literature shows a naturally higher perceived risk in individuals who were experiencing or had experienced DF either directly or indirectly. Similarly, external factors like frequent educational or awareness campaigns, or reinforcement and information by means of the media tend to encourage individuals to engage in preventive behaviors.[3,12]

The aim of this study was thus to examine individuals' health beliefs, their knowledge about the perceived threat of dengue, and what the obstacles against introducing practices for prevention and control of disease in their homes were, if any, using the HBM constructs. Identifying these factors could help to devise disease control strategies for dengue, by guiding the design of dengue- targeted interventions, and better communication policies. In the same context, HBM could also help in the development of an effective educational program for the targeted population.

METHODS

This cross-sectional study was conducted in three high dengue- endemic districts, namely Al-Safa, Al-Sharfia and Al-Bawadi, all in Jeddah, Saudi Arabia from April 1st to October 1st, 2018. Ethical approval for the study was granted by the Ethics Committee of the Ministry of Health and Directorate of Health Affairs Jeddah (H-02-J-002-A00584). In addition, informed written consent was taken from each participant or head of family involved.

Households and their residents having almost similar geographical, environmental, and socioeconomic status were randomly selected. The infrastructure, local area plan and town planning scheme was quite similar for the selected areas.

A total of 255 households were approached, whereas 14 (5.4%) heads of the family did not give their permission for data collection. Thus, finally samples were calculated from 241 households. A dengue information pamphlet written in the local native language was distributed among respondents after the interview. In addition, brief health educational sessions regarding DF were held. Visual aids like flip charts and life cycle specimens were used in these sessions. They gave the participants an opportunity to clarify their doubts and to pose questions about problems relating to DF and its management.

The samples of districts and participants were selected using a multistage stratified random sample method. Each district was divided administratively into sub-districts, which were numbered from 1-4. Two sub-districts were selected from each district using a simple random approach (a lottery method). For each sub-district, the list of streets/sectors was acquired from each respective municipality. Four sectors/streets were chosen from each sub-district, again using a lottery method. Then ten houses from each street/sector were systematically selected (i.e., every third house) for data collection, with a random start approach. A data collection team comprised of one male and two female trained members from the health department. Residents (one member of each household) of the selected houses willing to participate and aged 16 or more, were then interviewed. Visitors or guests from other cities were excluded from the study.

The questionnaire was developed after a careful review of the literature using HBM.[4,10,14-18] It was translated into Arabic by two bilingual professional translators who

understood the content and then back-translated by two other experts and compared to its original version. Minor adjustments were made after the pilot study.

The main outcome variable was derived by means of measuring and comparing the two domains of KAP (i.e. assessing knowledge and practices of study participants regarding DF) using HBM. Overall mean scores were calculated for participants' knowledge and practices, and their HBM construct. A total score of 19 was possible in the knowledge section, and seven in the practices section. A score greater than the mean was considered adequate for knowledge and practices. [5] Practices regarding DF prevention and control were assessed by asking questions as well as by observation against a checklist of household practices.

We used a validated questionnaire to measure HBM construct and DF preventative behaviors, which was adapted from studies conducted in Pakistan, Malaysia and Australia. [3,10,12,18] All items were rated on a five-point Likert scale from 1 - strongly disagree, to 5 - strongly agree. Negatively worded items in each scale were reversed for scoring, and the total score for each scale was calculated by adding up the response values to items for that scale. An average score for each sub-scale was calculated. The mean score for respondents' HBM construct was taken as a reference, and anyone scoring below it was categorized in as being in a low category. [3,10]

We assessed the way in which respondents perceived the benefits of adopting and following the suggested preventive measures to reduce the likelihood of their catching DF. Eighteen items in the questionnaire related to these perceived benefits, of which eleven referred to mosquito control, and seven to adopting self-protective behavior.

Cultural beliefs or prejudices that could discourage or dissuade study participants from engaging in mosquito control and self-protective behaviors, were measured by four items. The literature on HBM identifies lack of time and lack of effort as the main reasons for not following the procedures.[3,18] Two items covering these reasons were presented to participants. Participants' perceived risk of or susceptibility to catching DF was assessed by means of three items. Participants' perceptions regarding DF severity was assessed by five items. Perceived susceptibility and severity were evaluated together as perceived threat.[3]

Two items to assess self-efficacy were presented to participants. These were intended to measure the respondents' self-confidence and their willingness to adopt a behavior or take an action.

Data Analysis was done using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA). Overall mean scores of knowledge and practices were calculated. A Chi-square test was used to identify associations between dependent variables (dengue knowledge and preventive practices) with sociodemographic characteristics, HBM constructs and cues to action. All the significant variables in the bivariate analysis were included as covariates in a multivariate logistic regression model (using a backward stepwise (likelihood ratio method) to evaluate the predictors for adequate knowledge and practice on the part of respondents.

RESULTS

Of 241 households 80 (33.2%) were from Al-Safa, 80 (33.2%) were from Al-Sharfiah and 81 (33.6%) from Al-Bawadi. The mean age of participants was 34.8 ± 13.5 years, with a majority of males 154 (63.9%). Around 163(68%) participants were Saudi nationals (Table 1).

Overall mean knowledge and practice scores were 11.18 ± 3.26 and 4.17 ± 1.80, respectively. The mean perceived threat score was higher in perceived severity (3.93 ± 0.68) as compared to perceived susceptibility (2.01 0.58). The mean score of external cue to action were higher (3.91 ± 0.61) as compared to internal cue to action (3.85 ± 0.64). (Table 2)

There were 146 (61%) participants with adequate dengue fever knowledge. However, adequate preventive practice was noted in around 124 (52%) participants.

A significant association of self-protection was found with knowledge (p-value 0.049) and practices (p-value 0.035). Similarly, significant association of mosquito control was found with knowledge (p-value 0.037) and practices (p-value 0.018) as well. Participants having low adequate knowledge of perceived barriers were significantly higher as compared to participants having high adequate knowledge of perceived barriers, i.e. 105 (65.2%) and 41 (51.2%) respectively, p-value 0.037.(Table 3)

Table 4 demonstrates a regression analysis model to highlight the factors predicting adequate knowledge and DF prevention practice after controlling for age and gender. Multivariate regression analysis demonstrated that individuals who perceived mosquito control benefits to be more important had around two times more knowledge and showed a higher level of anti-DF activities (OR=1.85, p-value 0.026 and OR=1.86, p-value 0.019 respectively) as compared to those who think the benefits of these are lower (Table 4). However, individuals with high perceived barriers against anti-DF actions had a significantly negative association with adequate knowledge (OR = 0.532, p-value 0.026) as

Table 1: Demographic profile of participants (n=241)

Variables		n (%)
Gender	Male	154 (63.9%)
	Female	87 (36.1%)
Marital status	Single	24 (9.9%)
	Married	207 (85.8%)
	Divorced	6 (2.4%)
	Widow	4 (1.6%)
Education	No formal education	13 (5.4%)
	Primary / Intermediate	13 (5.4%)
	High school/ Diploma/ Bachelors	207 (85.8%)
	Masters/ PhD	8 (3.3%)
Nationality	Saudi	163 (67.6%)
	Non-Saudi	78 (32.4%)
Location of house (District)	Al-Safa	80 (33.2%)
	Al-Sharfiah	80 (33.2%)
	Al-Bawadi	81 (33.6%)

Table 2: Overall knowledge, practices and average HBM construct scores

Subscale	Subgroup	No. of items	Mean ± SD
Overall Knowledge score		19	11.18 ± 3.26
Overall practice score		7	5.17 ± 1.80
Perceived threat	Perceived susceptibility	3	2.01 ± 0.58
	Perceived severity	5	3.93 ± 0.68
Perceived benefits	Self-protective behavior	7	2.25 ± 0.42
	Mosquito control	11	2.05 ± 0.44
Perceived barriers	Time and efforts	4	3.68 ± 0.82
Perceived self-efficacy		2	4.00 ± 0.60
Cue to action	Internal	1	3.85 ± 0.64
	External	2	3.94 ± 0.61

shown in Table 4. In other words, the less knowledge people had about DF, the less likely they were to take any action against it.

The major sources of DF information include social media or informative billboards 106 (44%). Health education sessions 60 (24.9%) provided by health care professionals either at primary health care centers, or through campaigns targeted at households, proved to be an important source of education. There was no statistically significant difference between respondents' sources of information in different districts (p-value 0.224).

DISCUSSION

The findings of this household survey have provided an insight into the factors associated with DF knowledge and preventive practices amongst their various populations. As DF is re-emerging in a few local high-risk areas, it was of considerable importance that the level of knowledge and practices based on resident's beliefs should be assessed, in order to construct adequate measures to counter the spread of the disease.

The overall adequate knowledge level in this current study was quite satisfactory when compared to Al-Zurfi et al. study. [19] However, when compared to the residents of Malaysia [12] and Hong Kong [20] where it was higher than 75%, our results were not satisfactory, although it was better than those revealed by some regional studies. [3,5] It is possible that the higher scores achieved in our study may be attributed to repeated dengue awareness campaigns in the high-risk areas which were selected for our study. It also appeared that the demographic characteristics of our study participants, for instance, their age, educational or marital status, were not significantly associated with dengue knowledge and practices. Conversely, in some

Table 3: Univariate analysis for association of knowledge and practice with demography and HBM constructs (n=241)

Variables		Knowledge		*p* value	Practice		*p* value
		Adequate n (%)	Inadequate n (%)		Adequate n (%)	Inadequate n (%)	
Gender	Male (n=154)	95 (61.7)	59 (38.3)	0.640	82 (53.2)	72 (46.8)	0.458
	Female (n=87)	51 (58.6)	36 (41.4)		42 (48.3)	45 (51.7)	
Nationality	Saudi	101 (62.0)	62 (38.0)	0.526	85 (52.1)	78 (47.9)	0.755
	Non Saudi	45 (57.7)	33 (42.3)		39 (50.0)	39 (50.0)	
Educational Status	No formal education	5 (38.5)	8 (61.5)	0.172	4 (30.8)	9 (69.2)	0.334
	Primary /Intermediate	6 (46.2)	7 (53.8)		9 (69.2)	4 (30.8)	
	High school / University	128 (61.8)	79 (38.2)		107 (51.7)	100 (48.3)	
	Masters/ PhD	7 (87.5)	1 (12.5)		4 (50.0)	4 (50.0)	
District	Al-Safa	51 (63.7)	29 (36.3)	0.752	45 (56.3)	35 (43.8)	0.447
	Al-Sharfiah	48 (60.0)	32 (40.0)		37 (46.3)	43 (53.8)	
	Al-Bawadi	47 (58.0)	34 (42.0)		42 (51.9)	39 (48.1)	
Perceived barriers	Low	105 (65.2)	56 (34.8)	0.037	81 (50.3)	80 (49.7)	0.615
	High	41 (51.2)	39 (48.8)		43 (53.8)	37 (46.3)	
Perceived benefits (self-protection)	Low	88 (56.1)	69 (43.9)	0.049	73 (46.5)	84 (53.5)	0.035
	High	58 (69.0)	26 (31.0)		51 (60.7)	33 (39.3)	
Perceived benefits (mosquito control)	Low	77 (55.0)	63 (45.0)	0.037	63 (45.0)	77 (55.0)	0.018
	High	69 (68.3)	32 (31.7)		61 (60.4)	40 (39.6)	
Perceived threat	Low	52 (55.9)	41 (44.1)	0.240	49 (52.7)	44 (47.3)	0.761
	High	94 (63.5)	54 (36.5)		75 (50.7)	73 (49.3)	
Cues to action (external)	Low	18 (45.0)	22 (55.0)	0.027	19 (47.5)	21 (52.5)	0.584
	High	128 (63.7)	73 (36.3)		105 (52.2)	96 (47.8)	
Cues to action (internal)	Low	36 (53.7)	31 (46.3)	0.177	37 (55.2)	30 (44.8)	0.467
	High	110 (63.2)	64 (36.8)		87 (50.0)	87 (50.0)	
Self-efficacy	Low	108 (59.3)	74 (40.7)	0.489	92 (50.5)	90 (49.5)	0.622
	High	38 (64.4)	21 (35.6)		32 (54.2)	27 (45.8)	

other previous regional studies, these socio-demographic characteristics were shown to have significant bearing on adequate knowledge and practice. [3,21] A study conducted in Pakistan reported evidence of better practices in individuals with higher levels of literacy. [3] However, other studies conducted in Latin America and Pakistan parallel our study findings, showing no relation between higher literacy levels and the adoption of adequate dengue preventive practices. [15,22]

In our study, a moderate positive correlation between knowledge and practices consistent with the findings of various previous studies.[12,23,24] was demonstrated. This result is, however, in contrast with the results of studies conducted in some other parts of the world, where a weak association was reported. [10,13]

Some individuals consider themselves susceptible and believe that having contracted a disease like DF, they may have to confront further severe health consequences. Such individuals tend to be more active in seeking better disease-related information. [3] Similarly, the literature shows that individuals who are aware of the threat of contracting the disease also tend

Table 4: Multivariate logistic regression analysis predicting factors for DF adequate knowledge and practice (n=241)

Variable	Correlation Coefficient (B)	Standard Error (SE)	df	Sig (p value)	Exp (B) (Odds Ratio)	95 % Confidence Interval (CI)	
						Lower	Upper
Knowledge Predictors							
Perceived Benefits (mosquito control)	0.619	0.278	1	0.026	1.857	1.078	3.199
Perceived Barriers	-0.632	0.283	1	0.026	0.532	0.305	0.926
Constant	0.397	0.193		0.040	1.488		
Practice Predictors							
Perceived Benefits (mosquito control)	0.623	0.265	1	0.019	1.864	1.109	3.134
Constant	-0.201	0.170		0.238	0.818		

to be more highly motivated to adopt precautionary measures. [3] Surprisingly, the present study results were not consistent with these findings, as no significant association between perceived threat and knowledge or practice of the participants was observed. Our results were supported by the study by Wong et al. [13] who found that perceived severity was not a significant predictor of adequate knowledge. This may be because it appeared that our study participants did not consider DF a life-threatening disease as no DF-related deaths have been reported in the recent past. This highlights the efficacy of the policies and control measures against the spread of DF already undertaken by the Ministry of Health.

A review of studies which have used an HBM theoretical framework found that the domains of perceived benefits (self-protection & mosquito control) were predictive of DF preventive health behaviors. [13,18] Our study results were similar to the findings of these earlier studies, in which regression analysis highlighted perceived benefits as a significant predictor of adequate DF knowledge and preventive practices. Perceived obstacles can serve as demotivator in practicing preventive measures, which in turn may deter an individual's behavioral intention to practice. This can ultimately lead to an increase in DF incidence. [18] A study conducted in Malaysia demonstrated that the participants with lower expectations of obstacles and difficulties were significantly associated with higher dengue prevention knowledge and practices. [13] Similar findings were also recorded in our study, in which perceived barriers were shown to be significantly associated with knowledge, but not with practices.

In including the additional concept of HBM in our study, we were searching for cues to action that could help to change an individual's behavior. [18] Our results showed that participants who were keen to learn about the disease from a health care professional or the media, were more likely to adopt preventive practices. This highlights the importance of health education sessions by health care professionals, not only in the awareness campaigns themselves, but also during patients' consultations with a doctor. [15,18] Electronic (especially social) media and print media were also identified as main sources of information. Our findings suggested that repeated health education sessions, along with social media reminders, can be used very effectively to promote dengue awareness among the general population. The findings of the studies conducted in Pakistan [3] and Cuba [24] contrasted with these findings, where the role of health care professionals was limited in creating awareness regarding DF. Surprisingly, in contrast to the studies conducted by Siddiqui et al. [3] and Wong et al. [13] where the construct of self-efficacy was associated with adequate knowledge and practice, in our study self-efficacy showed no significant association with these two parameters.

Health education programs have been shown to play an important role in promoting and advocating behavior change. [8] Community awareness and a basic understanding of what DF is, how it is caused, and the perceived severity, susceptibility, benefits and, barriers construct of HBM, beliefs and practices prevailing in the target susceptible community, all have an impact on its prevention and control. [3] Thus, HBM constructs can be integrated as ways of motivating for the adoption of preventive practices against DF. Although HBM is a conceptual guiding framework focusing on health behavior intervention, [24] it has some limitations. One such limitation is that it does not account for environmental factors which may prevent an individual from practicing the desired behaviors. The emotional component of an individual's behavior is also not taken into consideration in HBM. Our study also had these HBM-related limitations.

CONCLUSION

Our study concludes that, overall, DF knowledge and preventive practices in selected dengue-endemic districts of Jeddah were rather limited. Having adequate knowledge of the disease leads to satisfactory dengue preventive practices. Health beliefs remain significant predictors of both knowledge and dengue prevention practices. Our findings suggested that anti-DF campaigns could profitably integrate HBM constructs to encourage the adoption of preventive practices against dengue. Our study showed that including these in public messages could potentially increase individuals' understanding of the perceived threat of acquiring the disease as well as their individual roles in preventing it.

ETHICAL APPROVAL: Ethical approval for the study was granted by the Ethics Committee of the Ministry of Health and Directorate of Health Affairs Jeddah (H-02-J-002-A00584).

AUTHORS' CONTRIBUTION: AJA: Conceptualization/ Designed the study /basic concept, contributed to the writing of the manuscript and assisted the interpretation of results.
HBU: Wrote the first draft, designed the study, analysis and interpretation of data, and designed the methodology, literature review. MMA: Conceptualization, Designed the methodology and proof reading. NM: Concept, Proof reading and data analysis. SAA: Supervision, Contributed to the writing of the manuscript, proof reading. OA: Data analysis, proof reading. NAO, SMA, MAJ, EAM & AAG: Literature review, Supervision, data collection, proof reading. FA & RA: Data collection, literature review, proof reading.

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