Original Article

Predictors of Dengue Preventive Practices Based on Precaution Adoption Process Model among Health Care Professionals in Northwest of Iran

Samira Firooziyan[1,2], Roya Sadeghi[3], Maryam Sabouri[4], Azar Tol[3], Ehsan Rikhtehgar[5], Behrouz Fathi[2,6], *Mohammad Mehdi Sedaghat[1]

[1]Department of Medical Entomology and Vector Control, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
[2]Urmia Health Center, Disease Control Unit, Urmia University of Medical Sciences, Urmia, Iran
[3]Department of Health Education and Promotion, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran
[4]Department of Health Education and Promotion, School of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[5]Urmia Deputy for Health Affairs, Urmia University of Medical Sciences, Urmia, Iran
[6]Assistant professor, Health economics and management department, Public health school, Urmia, Iran

***Corresponding author:** Prof Mohammad Mehdi Sedaghat, E-mail: sedaghmm@tums.ac.ir

Abstract

Background: Dengue fever as a mosquito-borne disease, has rapidly spread due to climate change, globalization, and human behavior. Iran is prone to dengue fever, as its vector recently has been found in the country. This study aimed to assess predictors of dengue preventive practices based on Precaution Adoption Process Model (PAPM) factors in West Azerbaijan province, northwest of Iran.

Methods: This cross-sectional study conducted on 405 health professionals of communicable disease sector who were interested in study participation. Data-gathering instrument was an online researcher-made questionnaire consisting of demographic characteristics (11 items), questions based on PAPM, and dengue preventive practices (85 items). Content validity and reliability of the instrument, content validity ratio, content validity index, and Cronbach α were utilized, respectively. Descriptive, analytical, and regression analysis using SPSS and STATA were examined.

Results: Regression analysis revealed that awareness of appropriate actions for dengue prevention was a stronger predictor of preventive practice in borderline and appropriate categories ($\beta= 4.09$, $p< 0.001$) and ($\beta= 4.42$, $p< 0.001$), respectively. Among factors of PAPM, beliefs about precaution effectiveness and difficulty in borderline ($\beta= 1.04$, $p= 0.04$) and appropriate ($\beta= 1.12$, $p= 0.03$) groups had direct and significant relation with dengue preventive practice.

Conclusion: The highest mean score of beliefs about hazard likelihood and severity factor was related to dengue prevention. Therefore, theory-based interventions that address beliefs about precaution effectiveness and difficulty can lead to assistance in acting. To improve dengue preventive practices, a well-designed promotive intervention that addresses associated factors in a context-specific manner is essential.

Keywords: Preventive practices; Dengue fever; Precaution adoption process model (PAPM); Health professionals

Introduction

Dengue is a viral mosquito-borne disease endemic in tropical and subtropical regions, transmitted by the bite of *Aedes* mosquito vectors (*Aedes aegypti* and *Aedes albopictus*). Climate change, globalization and trade, urbanization, travel, and human behavior have led to the spread of dengue fever and its vectors to human communities (1–3).

Dengue is a rapidly spreading arboviral disease, its incidence has increased 30-fold over the past 50 years while the vectors *Ae. aegypti* and *Ae. albopictus* have expanded their

geographical distribution. The disease is now endemic in 128 countries across Africa, the Americas, the Eastern Mediterranean region with several outbreaks occurring in Pakistan, Yemen, and Saudi Arabia(4–5). A virus of the Flaviviridae family causes dengue. Four distinct, but closely related, serotypes of the virus cause dengue. The symptoms differ in younger children and those who have the disease for the first time (3, 6).

Presentation varies, ranging from no symptoms to a mild fever to severe dengue hemorrhagic fever and dengue shock syndrome may threaten human life (7). The ailment presents high fever accompanied by frequent headaches, nausea, skin rashes, enlargement of lymph nodes, pain behind eyes, severe muscular, bone and joint pains, epitaxis along with leukocytopenia *i.e.* reduction in white blood cells count. Dengue Fever (DF) is also characterized as bone break fever or bone crush fever due to severe pain in joints and bones (5). Mild DF causes fever above 40 °C, headache, rashes, eye pain, vomiting, swollen lymph nodes, and muscle and joint pain. DF in severe situation can cause ecchymosis, hematemesis, severe abdominal pain, nosebleeds and bleeding in the mouth, permanent nausea, pulmonary, cardiac and hepatic problems, hypertensive shock, and death. It to DF diagnose is difficult because of symptoms similar of many diseases with those of DF (8).

The global burden of dengue is not well recognized, but its epidemiological patterns are affecting both human health and the health economy (3). Annually, about ~50 million dengue infections and ~500,000 individuals are hospitalized with dengue hemorrhagic fever mainly in Southeast Asia, the Pacific, and the Americas (9). Mortality and morbidity of severe dengue are reported at 20 percent approximately (10). There is no specific treatment for dengue fever for the infection, and management is only supportive care (6).

According to the WHO, dengue control is technically feasible with coordinated interna-tional technical and financial support for national programs (6). Preventive and vector control interventions aim to reduce dengue transmission, thereby decreasing the incidence of the infection and preventing outbreaks of the disease. Primary prevention includes wearing protective clothing to reduce skin exposure, using mosquito repellents, using mosquito traps and nets, installing screens on doors and windows, eliminating unnecessary container habitats that collect water, and covering water storage containers with a fine mesh. These actions presented the most effective factors in dengue prevention and control (3, 6, 9).

Public health system preparedness has a very important role to decrease morbidity and mortality of dengue fever, especially during epidemics. Knowledge, attitude and belief of health professionals are very crucial in this regard (11).

Precaution Adoption Process Model (PAPM) is a stage model of health behavior, which derives from social learning theory and the health belief model also the PAPM has been generally used for health behavioral change in different issues such as wearing seat belts, using condoms, weight management, preventing smoking and following treatment plans (12).

This model attempts to clarify how a person make a decision to take an action and how decision translate into action (13). The PAPM was chosen as a theoretical framework for this study because it offers a more detailed stage, especially the early stages from awareness to decision regarding health-related behaviors. Factors of PAPM consisted of awareness (Media messages about the hazard and precaution, communications from significant others, and personal experience with hazard), beliefs about hazard likelihood and severity, beliefs about personal susceptibility, beliefs about precaution effectiveness and difficulty, perceived social norms and assistance in acting (14).

In the Covid-19 pandemic, increasing dengue cases happened due to disruptions in the

pathogen-host-vector relationship reasoned by changes in individual behaviors in response to COVID-19. Lockdowns and social distancing policies could spread dengue in an endemic area. This situation could limit coverage of dengue preventive programs and delay the medical management of both diseases due to co-infection and misdiagnosis (15). It is well noted that medical staff and health workers working in health centers in endemic areas need regular training and consistent supervision to improve their knowledge of the prevention and care of dengue patients (16).

West Azerbaijan province is in the northwest of Iran with some points of entry, which makes the province susceptible to dengue fever. The points of entry in the province include Urmia International Airport, Razi Railway border, and five land border entry and exit points. For the first time, this study aimed to assess predictors of dengue preventive practices based on (PAPM) factors among health care professionals in West Azerbaijan Province in 2022.

Materials and Methods

This cross-sectional study was conducted on 405 health professionals through an online questionnaire. Health professionals employed in the communicable disease sector in health centers affiliated to West Azerbaijan Province and willing to study participants included in the study. Ethical approval was obtained from the Research Ethics Committees of the National Institute for Medical Research Development (IR.NIMAD.REC.1400.027). Online consent was obtained from respondents before participation in this study. All identities of the respondents were kept anonymous, and the information in this study was kept confidential. The self-administered questionnaire was in Persian, the national language of Iran. An explanation of the nature and purpose of the study was presented on the first page of the online instrument.

The questionnaire used in this study was a researcher-made with two parts. The first part consists of demographic characteristics and work-related variables; age, sex, marital status, job profile, work history, educational level, workplace, information about dengue disease, and the source of obtaining information related to dengue collected in this part of the questionnaire (1·items).

In the second part of the questionnaire items were based on PAPM factors including staging definition, awareness of disease symptoms, types of disease transmission, prevention, breeding places of vectors and vector control, beliefs about personal susceptibility, beliefs about hazard likelihood and severity, beliefs about precaution effectiveness and difficulty, perceived subjective norms and assistance in carrying out an action related to dengue prevention and items of preventive practices (85 items). The range score of this part of the questionnaire was zero to 24 and scoring was based on a five-point Likert from absolutely agree to absolutely disagree (0–4) and a three-point Likert as yes, no, or do not know. Based on achieved scores in the PAPM questionnaire, the total score was divided into three parts inappropriate, borderline, and appropriate. This classification was performed based on zero to 100. This instrument was developed through literature review and experts' opinions. At first, one hundred questions related to dengue preventive practices were developed. Ten experts in medical entomology and vector control, and health education and promotion revised this version. In the second stage, a revised instrument based on five- and three-point Likert was developed.

To assess the content validity of the revised instrument, qualitative and quantitative methods were used. In the qualitative method, experts were asked to evaluate using appropriate words and scoring the items. Feedback was gained then a final revised instrument was developed. To assess content and the validity of the instrument, Content Validity Ratio (CVR)

and Content Validity Index (CVI) were utilized. CVR upper than 0.62 and 0.79 based on ten experts' opinions were approved, respectively (17). To assess face validity, thirty health professionals filled out the questionnaire and evaluated the instrument in terms of proper words, grammar, simplicity, and understanding. In this assessment, CVR were calculated at 0.97. Reliability was confirmed using Cronbach α (0.7) (18).

The study questionnaire was completed by thirty eligible health care professionals with two weeks interval and α was calculated at 0.89 in total. Reliability of staging definition, awareness about dengue, beliefs about personal susceptibility, beliefs about hazard likelihood and severity, beliefs about precaution effectiveness and difficulty, perceived subjective norms and assistance in carrying out an action related to dengue prevention, and items of preventive practices were calculated 0.73, 0.74, 0.71, 0.87, 0.93, 0.77, 0.87, 0.74, and 0.78 respectively. Descriptive, analytical such as Kruskal-Wallis H test and Mann-Whitney U (using a nonparametric test based on the abnormality of data) and regression analysis using SPSS version 25 and STATA was performed at a significant level that was set less than 0.05.

Results

Study results presented that 48.4 percent (n= 196) were in the age range 36–45 with mean years old. The mean ± standard deviation age of the participants was 38.5±7.4. About half (49%) of the participants have 11–20 years of work history. More than half of the study participants were female (53.8%, n= 218). Among demographic variables, education level revealed significant relation with dengue preventive practices (p= 0.03) (Table 1).

Figure. 1 represented 85.9 percent of the participants who had heard about dengue and 67.9 percent of the participants who decided to adopt dengue prevention practices (Fig. 1).

The mean prevention practices score of participants was 20.03±2.48 out of 24. Among factors of PAPM, beliefs about hazard likelihood and severity (20.40±3), and beliefs about precaution effectiveness and difficulty (17.93 ±2.92) had higher mean and SD. Awareness about the definition of vector breeding places among types of awareness including disease symptoms, types of the disease transmission, prevention, and vector control was higher (5.72±2.64) out of 24 (Table 2).

After assessing normality of data, regression analysis using inter method variables evaluated by the Uni variate method, variables with sig< 0.1 enter the analysis, and others are excluded (Table 3).

Results of regression analysis revealed that awareness of appropriate actions for dengue prevention was a stronger predictor of dengue preventive practices in borderline and appropriate categories (β= 4.09, p< 0.001) and (β= 4.42, p< 0.001), respectively. Among factors of PAPM, beliefs about precaution effectiveness and difficulty in borderline (β= 1.04, p= 0.04) and appropriate (β= 1.12, p= 0.03) categories had direct and significant relation with dengue preventive practices, respectively (Table 4).

Table 1. Characteristics analysis of participants in this study (n= 405)

Variables	Groups	Number (%)	Mean Rank	P value
	21–35	140 (34.6)	211.27	
Age (yrs.)	36–45	196 (48.4)	195.66	0.35
	above 45	69 (17)	207.09	
Sex	Female	218 (53.8)	203.44	
	Male	187 (46.2)	202.48	0.92
Marital status	Married	349 (86.2)	201.76	
	Unmarried	56 (13.8)	210.71	0.55
	Health workers	106 (26.2)	194.77	
Job profile	Health professionals	225 (55.6)	203.13	0.58
	Doctor	60 (14.8)	211.23	
	Another job	14 (3.5)	227.93	
	Up to diploma	8 (2)	259.06	
Level of education	Diploma	78 (19.3)	180.85	0.03
	Academic degree	319 (78.8)	207.01	
	1–10	152 (37.6)	209.69	
Work history(yrs.)	11–20	201 (49.6)	198.99	0.53
	Above 20	52 (12.8)	195.22	
	Urmia	308 (76)	199.52	
	Piranshahr	16 (4)	213.44	
City	Poldasht	12 (3)	209.04	0.79
	Mako	18 (4.4)	221.89	
	Another cities in the province	51 (12.6)	212.66	
	Rural Health Center	290 (71.6)	204.43	
Workplace	Urban Health Center	100 (24.7)	194.09	0.31
	Another health sites	15 (3.7)	234.77	
Have information about dengue disease	Yes	324 (80)	206	0.27
	No	81 (20)	191	
	Continuous education	32 (7.9)	146.50	
	Academic education	75 (18.5)	172.73	
Source of information	Media	56 (13.8)	173.75	0.23
	Workshop	161 (39.8)	157	

*T test for quantitative variables and ANOVA for more than two sample groups

Table 2. Descriptive analysis of PAPM factors and dengue preventive practices (n= 405)

Variables	Groups	Mean± (SD)	Minimum Maximum
Staging definition		2.55±1.46	(0, 5)
Awareness	Disease symptoms	4.72±1.64	(0, 6)
	Type of Transmission	2.63±1.35	(0, 5)
	Prevention	3.59±1.25	(0, 5)
	Breeding places	5.72±2.64	(0, 9)
	Control actions	3.51±1.01	(0, 4)
Beliefs about personal susceptibility		11.23±2.24	(0, 16)
Beliefs about hazard likelihood and severity		20.40±3.95	(0, 24)
Beliefs about precaution effectiveness		17.93±2.92	(3, 20)
Beliefs about precaution difficulty		8.87±3.90	(0, 20)
Perceived subjective norms		15.89±3.83	(4, 20)
Assistance in carrying out the action		13.23±3.35	(6, 20)
Preventive practices		20.03±2.48	(0, 21)

Table 3. Multivariate regression analysis of preventive practices among the study participants (n= 405)

Variables	Groups	B*	ICC** 95%		P value
			Lower Bound	Upper Bound	
	21–35	-	-	-	-
Age (yrs.)	36–45	0.26	-0.3	0.84	0.36
	> 45	0.25	-0.55	1.06	0.53
Sex	Female	-	-	-	-
	Male	0-.02	-0.59	0.54	0.93
Marital status	Married	-	-	-	-
	Unmarried	0.32	-0.4	1.05	0.38
	Up to diploma	-	-	-	-
Level of education	Diploma	-1.65	-3.48	0.18	0.07
	Academic degree	-0.43	-2.34	1.48	0.65

*Linear regression coefficient
**Intraclass Correlation Coefficient

Table 4. Multivariate regression analysis of preventive practices among study participants (n= 405)

Variables		Groups	Grouping by score	B*	ICC** 95%		P value
					Lower Bound	Upper Bound	
Staging definition		1	(0,1)	-	-	-	-
		2	(2)	0.19	-0.51	0.89	0.59
		3	(3–5)	0.27	-0.37	0.92	0.4
Awareness	Disease symptoms	1	(0–4)	-	-	-	-
		2	(5)	0.01	-0.57	0.61	0.94
		3	(6)	0.03	-0.56	0.62	0.91
	Type of Transmission	1	(0–1)	-	-	-	-
		2	(2)	0.06	-0.62	0.75	0.84
		3	(3–5)	-0.15	-0.82	0 .50	0.64
	Prevention	1	(0–3)	-	-	-	-
		2	(4)	0.13	-.35	0.63	0.58
		3	(5)	-0.2	-.81	0 .41	0.52
	Breeding places	1	(0–4)	-	-	-	-
		2	(5–7)	0.03	-0.52	0.59	0.9
		3	(8–9)	0.33	-0.29	0.96	0.29
	Control actions	1	(0–1)	-	-	-	-
		2	(2–3)	4.09	2.91	5.27	0.001
		3	(4)	4.42	3.24	5.60	0.001
Beliefs about personal susceptibility		1	(0–10)	-	-	-	-
		2	(11–12)	0.33	-0.17	0.84	0.19
		3	(13–16)	0.16	-0.47	0.81	0 .60
Beliefs about hazard likelihood and severity		1	(0–17)	-	-	-	-
		2	(18–23)	0.34	-0.32	1.01	0.31
		3	(24)	0.36	-0.49	1.21	0.40
Beliefs about precaution effectiveness		1	(3–15)	-	-	-	-
		2	(16–19)	1.04	0.32	1.75	0.004
		3	(20)	1.12	0.38	1.86	0.003
Beliefs about precaution difficulty		1	(0–7)	-	-	-	-
		2	(8–9)	0.87	-0.50	0.67	0.77
		3	(10–20)	0.27	-0.25	0.81	0.30
Perceived subjective norms		1	(4–14)	-	-	-	-
		2	(15–18)	0.04	-0.51	0.61	0.86
		3	(19–20)	-0.33	-1.006	0.34	0.33
Assistance in carrying out the action		1	(6–11)	-	-	-	-
		2	(12–14)	0.42	-0.11	0.96	0.12
		3	(15–20)	0.22	-0.38	0.84	0.46

*Linear regression coefficient
**Intraclass Correlation Coefficient

345
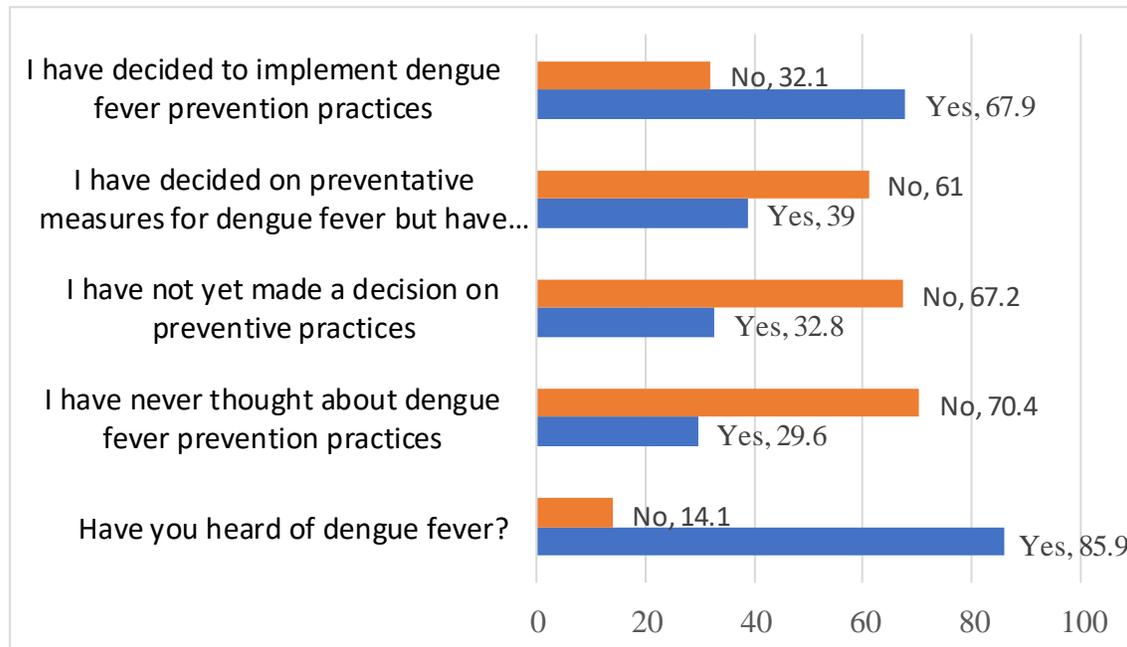
Fig. 1. Percentage stages of change of dengue prevention practices

Discussion

Dengue is one of the most important arthropod-borne viral diseases with widespread distribution in the tropics and subtropics (3). Iran is at risk of transmission of DF disease due to the presence of the main vector *Ae aegypti*, changing rainfall and floods pattern that increases *Aedes* mosquito larvae habitats, as well as the spread of DF in some countries of the region, including Pakistan and Yemen (19).

This study aimed at assessing predictors of dengue preventive practices based on PAPM factors among health care professionals in West Azerbaijan Province. It is important to note that there was a limited study about dengue and health education and promotion models/ theories which affected to discuss results of the present study in PAPM factors.

Among socio-demographic factors, the only level of education had a significant and direct relation with dengue preventive practices. This result was in the line with Wong et al. (20), their results approved that religion, level of education, and the job had a significant as-

sociation with dengue preventive practices. Chanyasanha et al. (21) reached a similar conclusion; they revealed that age, religion, family income, education, knowledge, and attitude were associated with preventive practices (21). The present study confirmed the findings of the study results of Guard et al. (22) about the significant association of knowledge, attitude, and preventive practice (KAP) regarding dengue infection among community residents in endemic areas. This result demonstrated that knowledge and awareness among different educated individuals could vary. It seems that health promotion activities should purpose at raising awareness at the community level on the importance of combining mosquito bite prevention with the elimination of breeding sites in and around high-density residence locations (23).

The present study confirmed that awareness about the appropriate breeding places of vectors had the highest mean score in comparison with other related awareness; this finding is directly in line with previous findings with

346

Sarfraz et al. study (24). From the results, awareness of appropriate actions for dengue prevention was a stronger predictor of dengue preventive practices in borderline and appropriate categories respectively. This finding ties well with Wong et al. (20), showing the importance of sufficient information of participants about dengue, many people had adequate knowledge of dengue fever and mosquitoes, but understanding of the important relationships among mosquitoes, human behavior, and disease transmission was sub-optimal. Results of a qualitative assessment of community beliefs and practices about dengue revealed that participants had suffered from DF and were identified through the surveillance system. Also, participants with previous dengue diagnosis were more concerned about risk of the disease, had better knowledge about disease prevention (25).

In another study, Shuaib et al. (26) demonstrated that individuals well informed regarding taking self-protection actions using dengue prevention methods. One of the most important measures in dengue virus transmission reduction is the interruption of host-mosquito contact. Individuals should cover the limbs by wearing full length pants, trousers, and full sleeved clothes. Mosquito repellents or lotions as conventional measures must be utilized to protect and avoid mosquito biting during daytime hours. Furthermore, coils, electric vapor mats, trap lights, insecticide treated nets and curtains and so forth should be used to prevent direct contact with mosquitoes (5).

Among factors of PAPM, beliefs about precaution effectiveness and difficulty in borderline and appropriate categories had direct and significant relation with dengue preventive practices. In accordance with our findings, Siddiqui et al. (27) showed that providing health messages in interventional programs considering regular environmental sanitation can be helpful and would benefit in reducing the number of dengue mosquito vectors in residential places.

It seems practical and sustainable efforts are a necessity to tailor behavioral changes in health education and promotion interventions through appropriate mass media and community clean-up campaigns among communities to dengue control in endemic areas.

This study had some limitations. Although this study tried to sample to reflect the characteristics of health care professionals employed in health centers of West Azerbaijan Province, the study findings cannot be generalized to all health care professionals in Iran. Furthermore, the study findings showed important associations among study variables, but the findings obtained from cross-sectional survey data with self-reported instruments cannot clarify causal-effect relationships between PAPM factors and the variables. This study had a novelty that explained predictors of dengue preventive practices based on PAPM factors among health professionals.

Conclusions

Based on study results, the highest mean score of beliefs about hazard likelihood and severity factor related to dengue prevention, providing theory-based interventions that address beliefs about precaution effectiveness and difficulty related to assistance in acting might be beneficial. To improve dengue preventive practices, well-designed promotive intervention programs that address the associated factors in a context-specific manner are essential. Practical efforts should be conducted to raise awareness about dengue transmission and develop community-based sustainable vector control programs involving both the public and private sectors.

Acknowledgements

Ethical considerations

The study was approved by the Ethical Committee of the National Institute for Medical Research Development (NIMAD), Tehran, Iran, ethic no. IR.NIMAD.REC.1400.027.

Conflict of interest statement

The authors declare there is no conflict of interests.

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