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Household Environmental Practice for Prevent and Control Dengue Fever toward One Health Framework in an Endemic Area of Central Region, Thailand

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Abstract

This research aimed to determine the household environment practice (HEP) among the community setting in the central region of Thailand for dengue prevention and control. For 422 household respondents in three villages with high dengue morbidity rates in Central Region of Thailand were systematically selected in this cross-sectional survey. The household representatives were interviewed using a structured questionnaire for measuring good HEP and household survey by entomologic indices. Univariate and Multivariate analysis were performed to investigate the predictive factors for HEPs. The results revealed that 72.7% of the respondents had a high level of knowledge. More than half (53.8%) of the participants had positive attitudes for HEP toward one health concept, respondents with a positive attitude, had good personal preventive behaviors, vector control management, social support, and good community participation were more likely to support HEPs (p-value < 0.001). The entomologic survey on House index, Container index, and Breteau index indicated that urgent prevention and control were required in three endemic areas. From the finding of this research recommend that the community at endemic areas should implement the one health training program which provides knowledge and practices on one health, encourage collaborations with all stakeholders, and promote multi-disciplinary approach.

Keywords: Dengue prevention and control; One Health; Household Environment Practice; Framework Development

1. Introduction

Dengue fever (DF) is a viral infection that is transmitted by bites of *Aedes aegypti* and *Aedes albopictus* mosquitos (Simmons *et al.,* 2012). More than 70% of the population at risk for dengue worldwide live in the WHO South East (Bhatia R, 2015). In Thailand, dengue has been a significant public health problem for 30 years in both urban and rural areas and has been remained the major public health problem and represents the foremost cause of hospitalization (World Health Organization, 2009; World Health Organization, 2012; Corbel *et al.,* 2013). From the data of Bureau

of Epidemiology (2015) found that the central region was the highest dengue endemic region in Thailand. In every year, Phatchaburi and Ratchaburi provinces, and Bangkok ranked top-five provinces that cause increasing of dengue burden in the central region of Thailand (Bureau of Epidemiology, 2015; Department of disease control, 2015).

In Thailand, dengue prevention and control strategies were transferred from the global ones by the Ministry of Public Health, Thailand. It was a dengue prevent and control program from religion level to community program but did not focus on its specificity, sustainability and lacked in coordination (Ministry of Public Health, 2016; Department of Disease Control, 2016; Department of Vector Borne Disease Control, 2016). Then, the recommended dengue prevention and control program must be integrated all stakeholders in the community at all level through the household environment practice (HEP) programs as critical methods by encouraging residents to take responsibility for control activity in households (Department of Disease Control, 2016; Department of Vector Borne Disease Control, 2016). World Health Organization (WHO) indicates that the HEPs should effective enough to prevent and control DF (Suwanbamrung *et al.,* 2010; Phuanukoonnon *et al.,* 2005). According to the past reports (Suwanbamrung, 2010; Phuanukoonnon *et al.,* 2005; Van Benthem *et al.,* 2002; Siqueira *et al.,* 2002; Siqueira *et al.,* 2004; Vanwambek *et al.,* 2006; Thammapalo *et al.,* 2008; Olajide KA, 2014; Suwannapong *et al.,* 2014), implementation of the HEP can be divided into four levels; personal preventive behavior, household environment practice, social support, and community participation through collective action. It was known that the effect of HEP based on the community participation was successful in dengue prevention and control (Department of Disease Control, 2006). People's practices in household and social support from the community vital to achieving behavior changes led to success in dengue prevention and control (Phuanukoonnon *et al.,* 2005; Poolthin *et al.,* 2014) without the context of one health approach. Hence, HEP with the one health concept should be proposed for implementing the dengue prevention and control in Thailand.

One health is a paradigm that encompasses the health of humans, animals, and their environment (Suwannapong *et al.,* 2014). Improvements of integration among disciplines and cross-sectoral collaboration, involving stakeholders at multiple levels are essential for implementation of the one health approach (Ronald Atlas *et al.,* 2010). Designing an interdisciplinary framework for a better understanding of complex health issues at the human-animal-ecosystem interface is a real challenge for researchers engaged in the one health approach. Implementation of the one health approach definitely calls for multi-stakeholder' approach with sustainability to develop its framework (Zinsstag, 2015; Charron, 2012).

However, knowledge, attitudes, and preventive behavior of HEP for dengue under the one health principle is somewhat limited. Therefore, the objective of this research was to determine the HEP promotes collective actions in the community for DF prevention and control in an endemic area of Central Region in Thailand.

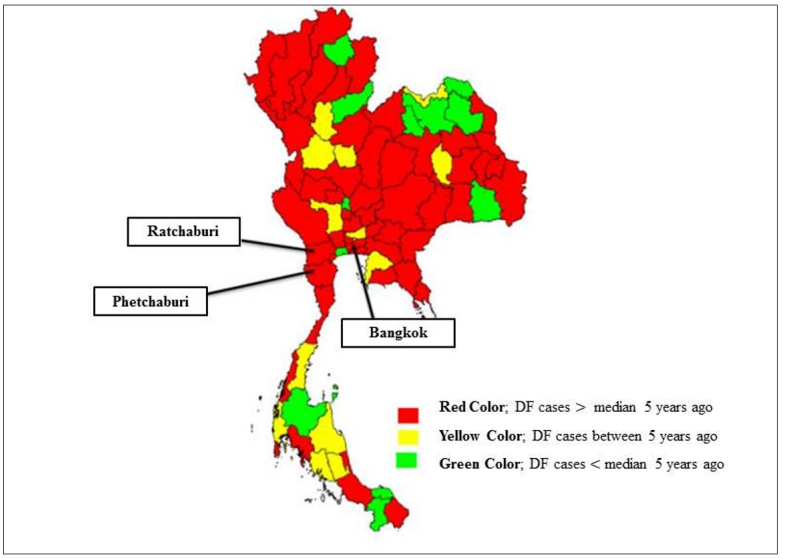
2. Materials and Methods

2.1 Study area

The study was conducted in three endemic areas of dengue with high morbidity rate in each of three (Phetchaburi, Ratchaburi, and Bangkok) provinces of Central Region of Thailand in 2015 (Figure 1). The criteria for selecting study sites include 1) selection of three provinces with high incidence rate, red color as Figure 1 in Central Region Thailand, 2) for each province, selection of three villages with the high dengue incidence area in 2015, and 3) the number of households in selected area should not be different among three provinces (Figure 2). Finally, three villages, in Ban Tanaosri, Tanaosri sub-district, Sanpheng district, Ratchaburi province as a representative of rural area, Raikoke sub-district, Ban Lad district, Phetchaburi province as a representative of a semi-urban area while RamSari village, Hua Mak sub-district, Bang Kapi district, Bangkok as a representative of an urban area.

2.2 Sample size and sampling technique

The sample size was calculated using a confidence interval of 95%, an acceptable error of 5%, and a proportion of low preventive behavior of 0.5. According to this method, a total of 422 household respondents were incorporated as subjects in this study. The systematic random sampling method was applied to select the three areas of household respondents by taking the first house in the center of the village as a random start. The total of household respondents participating the present study were 140, 141, and 141 subjects for Ratchaburi, Phetchaburi, and Bangkok provinces, respectively. The researcher picked a starting point at the center of village and sampled at every 5th household from that until reaching target sample size (shown in figure 2).



Source: Department of Disease Control, Ministry of Public Health, Thailand, 2015

Figure 1. Research sites at Phetchaburi, Ratchaburi and Bangkok

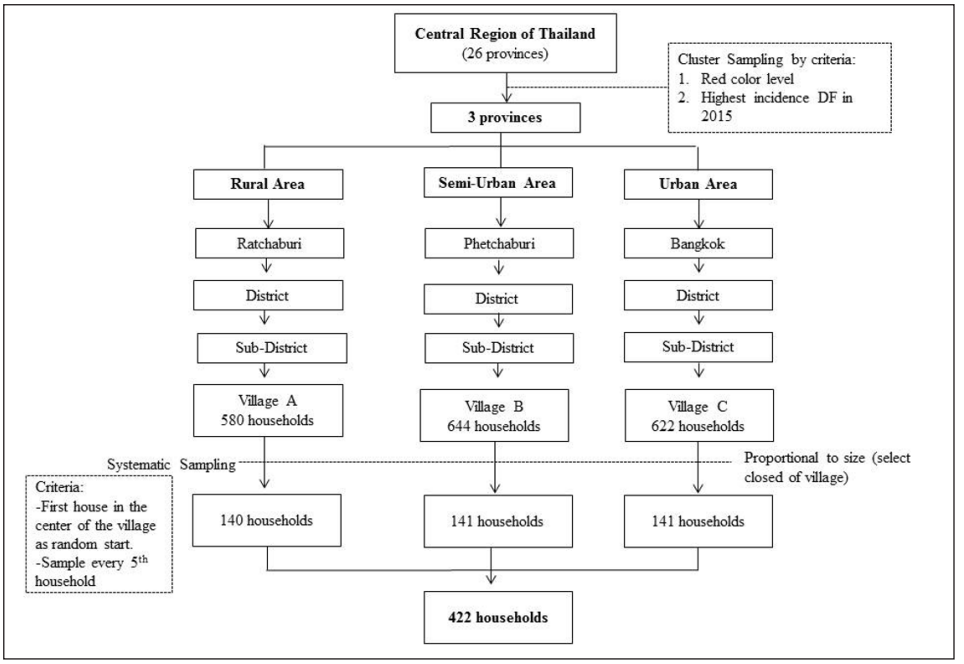


Figure 2. Procedures of multi-stage cluster random sampling

2.3 Data collection tools

The data collection tools in this study was the one health knowledge, attitudes and practices (KAP) survey for collecting the data from the household respondents. The survey questionnaire comprised 61 questions of following 4 parts: (i) socio-demographic characteristic; (ii) knowledge of DF based on HEP by one health principle relating to DF vector, transmission, risk groups, signs and symptoms, prevention and control, severity, preventive behavior, household environment practice by one health principle (Suwanbamrung, 2005; Siqueira, 2004), (iii) attitude towards DF on HEP based on the one health principle by a 5-point Likert scale covering preventive behavior, social support and stakeholders, and community participation through collective action (Thammapalo, 2005; Olajide, 2014). and (iv) preventive behavior related to HEP by the one health principle covering four level of HEP about personal preventive behavior, vector control management, social support, and community participation through collective action level. The reliabilities for knowledge, attitude and preventive behaviors were 0.74, 0.75, and 0.81, respectively.

2.4 Ethical consideration

This research was approved by the ethics committee of the Ethical Review Committee, Mahidol University with certificate approval number 2016/432.2311 and MU-SSIRB number was 2016/479(B1). The research questionnaires and informed consent were written in Thai language. The researcher explained and showed the approval letter to authorized person included household representative, community-stakeholders such as village health volunteers, health staff of Ratchaburi, Phetchaburi, and Bangkok provinces. Data collection were kept confidentially and destroyed after the completion of the study.

2.5 Data collection procedure

After received an ethical permission from the Mahidol University Ethical Committee, the pre-test questionnaire study was conducted to confirm the test validity and reliability of the data. The KAP survey through the face-to-face interview, household environment surveys and entomologic surveys were conducted in three endemic areas. The key findings obtained from the quantitative questionnaire was descried Village's KAP on HEP.

2.6 Data analyses

All the data were computed and verified by the Epi-data. The percentages, means or medians, standard deviations or quartile deviations are presented as appropriate. Association between preventive behaviors related to household environment practice based on one health principal measures with socio-demographic characteristics, knowledge, attitudes, and household environment practice level was determined by the Chi-square test. Associations between the preventive behaviors and the independent variables while simultaneously controlling for other confounding factors was determined by the multiple logistic regression analysis. All the statistical analysis was performed by the SPSS software version 21.

3. Results and discussion

3.1 Socio-demographic characteristics

A total of 422 household representatives comprised 140 respondents from the rural, 141 from the urban, and 141 from the semi-urban area were interviewed through the questionnaire. The respondents were representative of the households, who were responsible for household sanitation, at between 20 to 60 years old, and Thai nationality. Of the respondents, 72.5% were female and 79.4% were married. The major age-group, religion, education level, and occupation of the respondents were at between 46 and 55 years old (28.7%), Buddhism (55.2%), primary school level (52.4%), and employee (43.7%), respectively. Only 6.9% of the respondents were village health volunteers. Concerning to total family income of respondents, 58.1% of the family had

income of less than 15,000 Baht per month. For the duration stay of respondents, 44.1% of them were less than 24 years. Most of the respondent (82.0%) had not taken the training of dengue knowledge program for last 12 months. In part of family history about dengue fever infection, it was found that 78.7% of the respondents had never been infected with dengue and 14.5% of them were infected with dengue from their family members.

3.2 Level of knowledge, attitude, and preventive behavior related to the One Health principle based on HEP

Level of knowledge of the respondents about one health based on HEP were divided into three levels as low, moderate, and high knowledge level according to the correct answers by the frequency and percentage using Bloom's classification (1956). Most of the respondents (72.7%) were categorized into the high knowledge level. This finding was consistence with several previous studies (Aung *et al.,* 2016; Al-Dubai *et al.,* 2013; Makornkan *et al.,* 2015; Sayavong *et al.,* 2015) found that knowledges of the respondents were the high level on prevention and control of household

Table 1. Level of KAP of household respondents related to One Health based on Household Environment Practice

Indicators and levels	**Number** (n=422)	**Percentage** (%)
Knowledge Level*		
Low (<8 marks)	16	3.8
Moderate (8-12 marks)	99	23.5
High (>12 marks)	307	**72.7**
Attitude Level**		
2nd of HEP: Vector control management (5questions)		
Positive (≥ median)	270	**64.0**
Negative (< median)	152	36.0
3rd of HEP: Social-support (8 questions)		
Positive (≥ median)	238	**56.4**
Negative (< median)	184	43.6
4th of HEP: Community participation (1 question)		
Positive (≥ median)	340	**80.6**
Negative (< median)	82	19.4
Overall attitude (14 questions)		
Positive (≥ median)	240	**56.9**
Negative (< median)	182	43.1
Preventive Behavior Level		
1st of HEP: Personal preventive behavior (4 questions)		
Good (≥ median)	227	**53.8**
Poor (< median)	195	46.2
2nd of HEP: Vector control management (7 questions)		
Good (≥ median)	223	**52.8**
Poor (< median)	199	47.2
3rd of HEP: Social-support (5 questions)		
Good (≥ median)	222	**52.6**
Poor (< median)	200	47.4
4th of HEP: Community participation(2 questions)		
Good (≥ median)	256	**60.7**
Poor (< median)	166	39.3
Overall HEP (18 questions)		
Good (≥ median)	212	**50.2**
Poor (< median)	210	49.8

*Bloom's classification (1956), ** Dane Bertram criteria (2006), *** Anchor Order on Item Response (1978).

environment practice such as vector control management because respondents were received knowledge from mass media, TV., and village health volunteer. Then, the knowledge level of respondent was high level. Percentages of the respondents had a positive attitude on vector control management, social-support, and community participation were 64.0%, 56.4%, and 80.6%, respectively. Involving to study in Lao PDR (Sayavong *et al.,* 2015) showed that high level of positive attitude of community and regularity in monitoring were the key success factors in dengue prevention and control. In part of the preventive behavior level, good and poor preventive behavior were decided by over and under the median of the preventive scores. The results indicated that majority of the respondents had good preventive on personal preventive behavior (53.8%), vector control management (52.8%), social-support (52.6%), and community participation (60.7%) (Table 1). This result finding was similarity with the report of Phuanukoonnon *et al.* (2005) mentioned that people using at least one of preventive behavior measurements that can prevent and control dengue fever in the household level (Koenraadt *et al.,* 2006).

3.3 Effective method for prevention and control dengue fever in the Central region of Thailand

Considering the effective method for prevention and control dengue fever of respondents, most of the effective methods were sleep under mosquitoes (51.9%). According to the World Health Organization, insecticide-treated mosquito net (ITN) is a main item of current global malaria and dengue control initiatives supported. A study in Thailand (Koenraadt *et al.,* 2006) found that sleep in mosquito net is one effective method for protect mosquito bite and infect dengue. This finding contrast with the finding of preventive behavior, only 5% of respondents always sleep under mosquito net at daytime. Hence, this finding can conclude that most of respondent known the effective of dengue prevention and control method but poor on practices. The reason of this finding, promote the public awareness and promote more practical are necessary among household respondents.

3.4 Association between the independent and dependent variables

Table 3 presented the results of the chi-square analysis, logistic regression analysis, and multiple logistic regressions illustrating the association between the independent and dependent variables. The independent variables significant to the dependent variable by the chi-square test were further investigated by multiple logistic regressions to find the strength of association between HEPs as preventive behavior regarding dengue vector control measure. The results of the statistical analysis indicated that HEP on personal preventive behavior, vector control management level, social-support

Table 2. Effectives method for prevention and control dengue fever in Central region of Thailand

Methods	Number	Percentage (%)
1. Sleep under mosquito net	219	51.9
2. Use effective mosquito repellent	98	32.2
3. Use abate sand	135	32.0
4. Use effective mosquito spray or insecticide	110	26.1
5. Household environment practice outdoor and indoor on weekly basis	67	15.9
6. Empty, cover or dispose of containers where water can gather	57	13.5
7. Eliminating mosquito breeding sites around your home and neighborhoods	52	12.3
8.Waste management around your home on weekly	23	5.5
9. Use fish (Guppy) to stop larvae development.	17	4.0

Table 3. Association between factors and good preventive behavior based on HEP by multiple logistic regressions

Factors	Adjusted Odds ratio	95% CI		p-value
		Lower	Upper	
Religion				
Buddhism	1.60	0.64	4.01	0.311
Islam, Christian, others	1			
Occupation				
Contractor/ Agriculture	0.88	0.37	2.10	0.767
Business /Civil staff office/Jobless	1			
Family income(per month)				
< 15,000 bath	1.08	0.14	8.39	0.940
≥ 15,000 bath	1			
Village Health volunteers				
Be VHV	1.80	0.66	4.90	0.249
Non-VHV	1			
Dengue knowledge by training program at last 12 months				
Ever been	2.20	0.68	7.16	0.190
Never been	1			
Knowledge level				
High	1.54	0.55	4.34	0.412
Low	1			
Attitude level				
Positive	1.54	0.63	3.75	0.346
Negative	1			
1st of HEP: Personal preventive behavior				
Good	6.29	2.41	16.44	<0.001**
Poor	1			
2nd of HEP: Vector control and management				
Good	104.52	30.85	354.08	<0.001**
Poor	1			

* indicates the significant difference from the baseline ($p < 0.05$), ** indicates the significant difference from the baseline ($p < 0.001$)

Table 3. (cont) Association between factors and good preventive behaviors based on HEP by multiple logistic regressions.

Factors	Adjusted Odds ratio	95% CI		p-value
		Lower	Upper	
3rd of HEP: Social-support				
Good	69.11	20.17	236.83	<0.001**
Poor	1			
4th of HEP: Community participation				
Good	6.83	2.62	17.76	<0.001**
Poor	1			
Living place				
Rural(Ratchaburi)	2.06	0.75	5.67	0.160
Semi-urban(Phetchaburi)/ Urban(Bangkok)	1			
Household sanitation				
Good (clean, no breeding sites)	1.80	0.76	4.29	0.183
Poor(had breeding sites)	1			
House distribution				
Single house	0.77	0.30	1.98	0.584
Group houses	1			
Use screens on windows and doors (observed)				
Used	0.37	0.12	1.15	0.084
Not used	1			

* indicates the significant difference from the baseline ($p < 0.05$), ** indicates the significant difference from the baseline ($p < 0.001$)

Note: reference group "0" was poor preventive behavior on household environment practices based on One Health principle regarding to dengue prevention and control measure.

level, and community participation level were significantly associated with preventive behavior based on HEPs. The best predictor on HEP in the multiple logistic regressions was vector control and management level. More than half of the respondents were good at HEP on personal preventive behavior level, which significantly associated with good HEP 6.29 times more compared with the respondents with poor HEP on personal preventive behavior. There was a significant association between personal skill and preventive behavior. According to the World Health Organization report, the personal preventive behaviors such as use of effective insect repellent, sleep under a mosquito net at day time, cover skin with long-sleeved or light color clothing, and use of screens on windows and doors were the critical element to avoid exposure to mosquitoes and prevent dengue infection (World Health Organization, 2008; World Health Organization, 2011; World Health Organization, 2012). A study of Phuanukoonnon *et al*. (2005) indicated that personal skill and preventive practice effect on dengue prevention and control. Most of the respondent (81.2%) had good at household environment practice on vector control management level, which significantly associated with good HEP 104 times more compared with the respondents with poor HEP on vector control management level. The previous study indicated that the vector control management level was the best predictor on household environment practice (Galván *et al.,* 2004). Eighty-three point eight percent of the respondents (186 of 222 respondents) had good preventive at HEP on social support level , which significantly associated with good HEP 69.1 times more compared with the respondents with poor HEP on social support level. This result was similar to the previous study in Thailand that social- support approach from a doctor, health staff affects to reduce dengue fever and significant associated with preventive behavior (Sakai *et al.,* 2007). Furthermore, 66% of the respondents (169 of 256 respondents) had good preventive behavior at HEP on community participation level, which significantly associated with good HEP 6.83 times more compared with the respondents with poor HEP on community participation level. It was reported in Arunachalam *et al.* that in India, community participation affects to dengue prevention and control (Arunachalam *et al.,* 2012). Community-based approach together with other stakeholders promoting preventive interventions of vector breeding led to a sustainable reduction in dengue vector density.

4. Conclusion

According to results in this study, it was indicated that preventive behavior based on the household environment practices.The HEP on personal preventive behavior, vector control management level, social-support level, and community participation level were significantly associated with preventive behavior based on HEPs. The multiple logistic regression analysis revealed that the best predictor on HEP was vector control and management level. From the finding of this study recommends that the community at endemic areas should conduct the One Health training program by providing knowledge and practices on One Health with collaboration all stakeholders, and promoting multi-disciplinary approach led to sustainable development.

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