

Research Paper

Knowledge, attitude, and practices related to dengue among caretakers of elementary school children in Chanthaburi Province, Thailand

ABSTRACT

Aim: To assess dengue related knowledge, attitudes, and practices among caretakers of elementary school children in Thailand.

Methods: Data on socio-demographic characteristics, sources of information; knowledge; attitude and practices related to dengue were collected from a random sample of 628 caretakers in a cross sectional study. Logistic regression was performed to explore factors associated with dengue-related knowledge, attitude and practices.

Results: Mass media (76.7%) and healthcare facilities (67.4%) were the most common sources of information on dengue. Only 37.8% of caretakers had high levels of knowledge of dengue; caretakers with post-secondary education were more likely to have high knowledge than those with primary education (adjusted odds ratio (aOR) 2.0, 95% CI [61.28–3.31]). Caretakers with a family income greater than 200,000 Baht were more likely to have high knowledge compared to those with an income less than 50,000 Baht (aOR 1.94, 95% CI [1.16–3.23]). Dengue knowledge was not significantly associated with caretaker age, sex, marital status, or occupation. Attitudes towards dengue prevention were moderate but not significantly associated with any particular factor. Civil servants were less likely to use mosquito repellent compared to factory workers (aOR 0.44, 95% CI [0.20–0.10]). Most caretakers (80.7%) had discussed dengue with their children in the past 6 months.

Conclusion: Knowledge of dengue among school children's caretakers was low. This needs improvement, especially in caretakers with low income and/or education. Attitude toward dengue was moderate and most caretakers were practising dengue prevention. Dengue prevention interventions among children, that involve caretakers, may require improving knowledge and attitude towards dengue among the caretakers.

Keywords: School health, health education, dengue prevention

1. INTRODUCTION

Dengue is the fastest spreading mosquito-borne viral disease in the world [1]. It is estimated that 50 million dengue infections occur each year around the world; approximately 2.5 billion people living in dengue-endemic countries in tropical and sub-tropical regions of the world are at risk of infection [2,3]. Its clinical presentations vary from asymptomatic infection to classical dengue fever (DF) and a more severe form, dengue haemorrhagic fever (DHF). Dengue infection is a serious public health problem that has dramatically increased in tropical regions of the world [2,3]. It has also become a leading cause of child mortality in several Asian countries [4].

Thailand's first reported dengue epidemic occurred in 1958 [5]. Since then, several epidemics have swept the country; the most recent occurred in 2010, when 53,149 cases of DF and 60,770 cases of DHF, including 3,028 dengue shock syndrome and 135 dengue deaths, were reported nationwide [6]. According to the Thailand Ministry of Public Health (MoPH), the majority of dengue-infected individuals are school-age children, more than 25% of whom are 10–14 years old [6].

While dengue continues to be a major public health problem, there is as yet no specific medication or vaccine for its treatment or prevention, though various vaccines against dengue are currently in the pre-clinical and clinical stages of development [7]. A recent trial of a dengue vaccine produced mixed results; the vaccine showed protection against 3 out of the 4 dengue virus strains but was generally ineffective [8]. Avoiding bites, mainly from *Aedes aegypti* mosquito species, therefore remains the only effective method to prevent dengue infection [9].

A number of studies on knowledge, attitudes, and practices (KAP) regarding dengue among adults in Thailand have been conducted [10,11]. There is, however, a paucity of studies that have explored this topic among direct caretakers of children, who bear the brunt of the disease [12]. Since caretakers play a key role in the health of children, such studies are necessary to inform the development of effective dengue infection prevention strategies for children. The objective of this study was to assess dengue related KAP among caretakers (parents or guardians) of elementary school children and to explore the predictors of the KAP.

2. MATERIAL AND METHODS

2.1 Study design and setting

This was a cross-sectional study of caretakers of children in grades 4 to 6. The study was conducted in Chanthaburi Province of Thailand, located in the east of the country, bordering Cambodia to the east and the Gulf of Thailand to the south. The province, with a population of approximately 513,000 inhabitants, occupies an area of 6,338 km² subdivided into 10 districts. Chanthaburi is one of the provinces with a high burden of dengue. Dengue incidence data from the MoPH show a general increase in the morbidity of DF per 100,000 from 66 in 2005 to 224 in 2010. Morbidity from DHF also increased from 78 to 205 per 100,000 over the same period [13]. Thailand has universal free basic education with 9 years of mandatory school attendance. There are 196 public elementary schools in the province; 185 serve grades 4 to 6. At the time of this study, the total number of children in these grades was 13,127, most of whom were aged between 10 and 12 years.

2.2 Selection of study population

Caretakers of public school pupils in grades 4 through 6 were eligible for inclusion in the study. Sample size was estimated according to a z value of 1.96 for a 95% confidence level, an expected proportion of caretakers with correct knowledge on dengue assumed to be 0.5, and a precision of 5%. Further adjustment was made to account for a projected non-response rate of 10% and a design effect of 1.5. Using these parameters, a sample size of 640 caretakers was calculated.

A list of all elementary schools including the number of pupils in grades 4–6 was generated. Using the probability proportionate to size (PPS) method, a random sample of schools was selected to participate in the survey. It was decided, for logistical reasons, that for each random number picked, 22 pupils would be drawn from the respective school. However, due to the PPS methodology, it was possible to select the same school more than once. Whenever this happened, the sample to be drawn from the particular school was obtained by multiplying 22 by the number of times the school had been selected. Within each school, pupils were selected according to stratified sampling with the grades constituting the strata.

2.3 Data collection

Data were collected in April 2012. Each selected pupil was given a sealed pack to take to his/her caretaker. The pack contained an information sheet, consent form, questionnaire to be completed, and an empty envelope in which the completed questionnaire was to be sealed and given back to the pupil to return to the research assistant posted at the school. Arrangements were made for a research assistant to visit the child's home and administer the questionnaire in case the caretaker was illiterate.

2.4 The questionnaire

Data comprising socio-demographic characteristics, sources of information about dengue, knowledge of dengue, attitude towards dengue, and practices related to dengue were collected through a pre-tested, self-administered questionnaire. Knowledge was assessed via 13 questions with a total of 28 items; 1 question was pictorial. The questions covered 6 main topics namely dengue transmission; symptoms; treatment; seasonality; vector breeding grounds and vector characteristics. One point was given for each correct response. Respondents who had never heard about dengue scored

0. Attitude was assessed by asking participants to rate their perceptions of 8 statements about dengue on a Likert scale (strongly agree, agree, undecided, disagree, and strongly disagree). Each statement was given a score of 1 to 5; 1 implying very poor attitude, and 5 very good. The minimum and maximum possible attitude scores were therefore 8 and 40, respectively. Dengue related practices assessed included health seeking behaviour after dengue infection, presence of mosquito breeding grounds in the compound, use of mosquito repellents and discussing about dengue with children.

Reliability of the knowledge and attitude scores, assessed through Cronbach's alpha, was 0.72 and 0.70, respectively. The questionnaire was prepared in English and translated into Thai with a back translation to English to ensure accuracy.

2.5 Statistical analysis

Data were double entered by using EpiData, then validated and exported to Stata v.11 (Stata Corporation, College Station, Texas, USA) for cleaning and analysis. Caretakers' characteristics, sources of information about dengue, and dengue-related practices were summarised by using frequencies and percentages. Scores for each knowledge and attitude item were summed, and the median value was used to create a dichotomous variable of high and low knowledge level. Dengue-related practices considered in this analysis were the use of mosquito repellent and talking to children about dengue in the past 6 months. Univariate analyses of the association between caretakers' characteristics and dengue knowledge, attitudes, and practices were performed through chi-squared tests and Mantel-Haenszel methods to obtain p values and crude odds ratios (cOR). Multivariate analyses were performed using logistic regression to obtain adjusted odds ratios (aOR). All variables with $p < 0.1$ in unadjusted analysis were included in the multivariate analyses. The significance of each variable included in the model was tested by using likelihood ratio tests. The reported p-values are two-tailed; significance was set at $p < 0.05$.

3. RESULTS

Of the 640 questionnaires distributed, 634 were returned. Six of the returned questionnaires had not been completed and were therefore excluded from analysis, resulting in a response rate of 98.1%. Characteristics of the respondents are shown in Table 1. Most respondents (67.8%) were women with a mean age of 40.1 (standard deviation [SD] $\pm$ 8.9) years; the majority of participants were married (81.1%), Buddhists (98.7%), and of Thai descent (99.5%). The most common occupations were factory (41.4%) and farm work (26.3%); 6.4% were civil servants. Half the respondents had only 1 child aged 15 or younger in the household. Slightly less than half (44.6%) of respondents had an annual family income of less than 50,000 Baht (about \$1600 US dollars).

Results should be clearly described in a concise manner. Results for different parameters should be described under subheadings or in separate paragraph. Table or figure numbers should be mentioned in parentheses for better understanding.

Table 1: Characteristics of school children's caretakers in Chanthaburi Province

Characteristic		Frequency (n = 628)	Percent (%)
Female sex		426	67.8
Mean (SD) age		40.1 (8.9)	
Occupation			
	Housewife/husband	72	11.5
	Government worker	40	6.4
	Farm labourer	165	26.3
	Factory labourer	260	41.4
	Self employed	91	14.5
Children <15 years in household			

	1	315	50.2
	2	210	33.4
	3	63	10.0
	≥4	40	6.4
	Median (Min-Max)	1 (1–11)	
Marital status			
	Single	30	4.8
	Married	509	81.1
	Divorced	45	7.2
	Widowed	44	7.0
Education			
	Incomplete primary	15	2.4
	Completed primary	301	47.9
	Completed secondary	207	33.0
	Higher	105	16.7
Annual income (Thai Baht)			
	<50,001	280	44.6
	50,001–100,000	181	28.8
	100,001–200,000	82	13.1
	>200,000	85	13.5

3.1 Source of information about dengue

Nearly all respondents (97.8%) had knowledge of dengue infection (Table 2). The most common source of information was mass media (76.9%) followed by healthcare facilities (67.4%). The most common mass media source ($n = 472$) was television (TV, 94.3%). The type of information they were commonly aware of pertained to prevention (66.9%) and symptoms (48.7%). Knowledge of geographic and seasonality was reported by the least number of respondents (19.9%).

Table 2: Caretakers' source and type of information about dengue

Component		Frequency	Percent (%)
Knowledge of dengue ($n = 628$)		614	97.8
Source of information* ($n = 614$)			
	Mass media	472	76.9
	TV ($n = 472$)	445	94.3

	<i>Radio (n = 472)</i>	172	36.4
	<i>Newspaper (n = 472)</i>	168	35.6
	<i>Internet (n = 472)</i>	60	12.7
	Healthcare facility	414	67.4
	Friend/neighbour	161	26.2
	Family member	160	26.1
	School	158	25.7
	Work	88	14.3
Type of information* (n = 614)			
	Prevention	411	66.9
	Symptoms	299	48.7
	Transmission	232	37.8
	Geographic/seasonal variation	122	19.9

*Multiple responses allowed

3.2 Factors associated with knowledge

The mean knowledge score was 21.0 (SD $\pm$ 4.4) out of 28. Of the 627 caretakers, 237 (37.8%) were classified as having high knowledge (knowledge score > 22). There was a positive trend in the association between knowledge and each of education and income (Table 3). Caretakers with post-secondary education were likely to have more knowledge compared to those who had completed only primary education (cOR 2.5, 95% CI [1.6–4.0]). Similarly, those in the highest income group were likely to have more knowledge (cOR 2.3, 95% CI [1.4–3.9]) compared to those in the lowest income group; occupation was crudely associated with knowledge score. The odds of having more knowledge were 3.4 times higher in civil servants than in factory labourers (cOR 3.35, 95% CI [1.65–6.80]). The odds of having more knowledge did not differ across the other occupations when compared to being a farm labourer. Crude analysis showed no significant association between knowledge score and caretaker's age, sex, and marital status (results not shown).

After adjusting for confounding factors, the association between education and knowledge score remained significant with the odds ratios increasing in line with education (Table 3). The aOR comparing caretakers with post-secondary education versus those who completed only primary education was 2.1 (95% CI [1.3–3.3]). The observed crude association between knowledge and income was also maintained in adjusted analysis. The aOR comparing caretakers in the highest income group with those in the lowest group was 1.9 (95% CI [1.2–3.2]). In the multivariate analysis, the odds of having more knowledge among civil servants compared to factory labourers became non-significant

3.3 Attitude scores and factors associated with attitude

The mean attitude score was 27.3 (SD $\pm$ 3.1) out of 40. Out of 625 caretakers, 304 (48.6%) had a high attitude (attitude score > 27). Univariate analysis did not reveal any significant association between attitude score and sex, age, education, income, occupation, or knowledge score (results not shown).

Table 3: Crude and adjusted odds ratios (OR) for the association between caretakers' characteristics and knowledge score

Characteristic	Dengue knowledge score n (%)		Crude OR [95% CI]	Adjusted OR† [95% CI]
	Low (< 23)	High ($\geq$ 23)		
	n = 390	n = 237		

Age					
	<30	28 (64)	16 (36)	0.81 (0.42–1.56)	0.68 (0.35–1.34)
	30–39	164 (59)	116 (41)	1.00 (ref)	1.00 (ref)
	40–49	145 (64)	83 (36)	0.81 (0.56–1.16)	0.78 (0.53–1.13)
	≥50	53 (71)	22 (29)	0.59 (0.34–1.02)	0.65 (0.37–1.15)
Education					
	Incomplete primary	13 (86.7)	2 (13)	0.34 (0.07–1.54)	0.35 (0.08–1.61)
	Completed primary	206 (68.7)	94 (31)	1.00 (ref)	1.00 (ref)
	Completed secondary	122 (58.9)	85 (41)	1.53 (1.05–2.21)*	1.45 (1.00–2.10)
	Higher	49 (46.7)	56 (53)	2.50 (1.57–3.98)**	2.06 (1.28–3.31)**
Income					
	< 50,001	194 (70)	85 (31)	1.00 (ref)	1.00 (ref)
	50,001–100,000	113 (62)	68 (38)	1.37 (0.92–2.04)	1.32 (0.88–1.96)
	100,001–200,000	41 (50)	41 (50)	2.28 (1.37–3.80)**	1.90 (1.13–3.19)*
	> 200,000	42 (49)	43 (51)	2.34 (1.41–3.87)**	1.94 (1.16–3.23)*
Occupation					
	Factory labourer	173 (67)	86 (33)	1.00 (ref)	1.00 (ref)
	Government worker	15 (38)	25 (63)	3.35 (1.65–6.80)**	2.03 (0.90–4.59)
	Farm labourer	100 (61)	65 (39)	1.31 (0.87–1.96)	1.27 (0.84–1.92)
	Housewife/husband	47 (65)	25 (35)	1.07 (0.62–1.86)	0.98 (0.56–1.71)
	Self-employed	55 (60)	36 (40)	1.32 (0.80–2.16)	1.08 (0.64–1.80)

† adjusted for all the variables in the table

*p<0.05

**p<0.01

3.4 Practice

Only 19.1% of respondents reported having been infected by dengue in the past 5 years; almost all who were previously infected sought treatment at a healthcare facility. Approximately 30% of respondents had a family member who had suffered from dengue in the past 5 years; almost all (99.4%) of those infected sought treatment at a healthcare facility. Most respondents had used mosquito repellent in the past year. Less than half of respondents (40.6%) used mosquito repellent all year round while 32.4% used repellent only during the rainy season. A quarter of the respondents used repellent irregularly. A majority of caretakers (80.7%) had discussed dengue with their children in the past 6 months. The most common topic discussed was prevention (81.8%), followed by symptoms (52%), and transmission (44.9%, Table 4).

Table 4: Practices related to dengue infection

Item	Frequency	Percent (%)
Dengue infection in the past 5 years (<i>n</i> = 627)	120	19.1
Visited healthcare facility after dengue infection (<i>n</i> = 120)	118	98.3

Family member infected with dengue in the past 5 years (<i>n</i> = 627)		174	27.8
Family member visited healthcare facility after dengue infection (<i>n</i> = 174)		173	99.4
Has fish in water container outside the house or uses larvicide to kill mosquito larvae (<i>n</i> = 523)		386	73.8
Uses mosquito repellent (<i>n</i> = 627)		390	62.2
When mosquito repellent is used (<i>n</i> = 389)			
	All year round	158	40.6
	Rainy season only	126	32.4
	Sometimes/irregularly	98	25.2
	Dry season only	7	1.8
Discussed dengue with children in the past 6 months (<i>n</i> = 627)		506	80.7
Topic discussed (<i>n</i> = 506)*			
	Prevention	414	81.8
	Symptoms	263	52.0
	Transmission	227	44.9
	Regional/seasonal variations	82	16.2

*Multiple responses allowed

3.5 Factors associated with the use of mosquito repellent

Table 5 shows the results of the association between various factors and the use of mosquito repellent. The univariate analysis showed that caretakers with higher education were less likely to use mosquito repellent compared to those who completed only primary education (cOR 0.5, 95% CI [0.3–0.8]). There was no significant difference in the odds ratios across the other education groups when compared to the primary education group. Income was crudely associated with the use of mosquito repellent, with the odds ratio of caretakers in the third highest education group compared to the lowest income group being 0.6 (*p* = 0.041). The odds ratio of the highest income group compared to the lowest income group was 0.6, but this was not significant (*p* = 0.072). Occupation was also crudely associated with the use of repellent; civil servants were less likely to use repellent compared to factory labourers (cOR 0.3, 95% CI [0.16–0.64]). The odds of repellent use did not vary across the other occupation groups. High knowledge and high attitude were not significantly associated with the use of repellent in a crude analysis (results not shown).

After adjusting for confounding factors, the association between occupation and the use of repellent remained significant, although weakened. The odds ratio for the use of repellent among civil servants compared to factory workers was 0.44 (95% CI [0.20–0.10], *p* = 0.049), but the odds of repellent use were similar across the other occupation groups.

3.6 Factors associated with discussing dengue infection with children

No significant associations were found between discussing dengue infection with children and caretakers' socio-demographic characteristics, dengue-related attitude, or knowledge (results not shown).

Table 5: Crude and adjusted odds ratios (OR) for the association between participants' characteristics and the use of mosquito repellent

Characteristic		Uses mosquito repellent		Crude OR [95% CI]	Adjusted OR † [95% CI]
		No (<i>n</i> = 237)	Yes (<i>n</i> = 390)		
Age					
	<30	16 (36)	28 (64)	0.88 (0.46–1.72)	0.90 (0.46–1.76)
	30–39	94 (34)	186 (66)	1.00 (ref)	1.00 (ref)
	40–49	94 (41)	134 (59)	0.72 (0.50–1.03)	0.76 (0.53–1.10)
	≥50	33 (44)	42 (56)	0.64 (0.38–1.08)	0.68 (0.40–1.15)
Education					
	Incomplete primary	7 (47)	8 (53)	0.61 (0.27–1.74)	0.58 (0.20–1.66)
	Completed primary	105 (35)	196 (65)	1.00 (ref)	1.00 (ref)
	Completed secondary	72 (35)	135 (65)	1.00 (0.69–1.46)	1.04 (0.72–1.52)
	Higher	53 (51)	51 (49)	0.52 (0.33–0.81)**	0.68 (0.39–1.17)
Income					
	<50,001	95 (34)	185 (66)	1.00 (ref)	1.00 (ref)
	50,001–100,000	66 (37)	114 (63)	0.89 (0.60–1.31)	0.91 (0.61–1.37)
	100,001–200,000	38 (46)	44 (54)	0.59 (0.36–1.00)*	0.67 (0.40–1.12)
	>200,000	38 (45)	47 (55)	0.64 (0.39–1.00)	0.78 (0.46–1.34)
Occupation					
	Factory labourer	85 (33)	175 (67)	1.00 (ref)	1.00 (ref)
	Government worker	24 (60)	16 (40)	0.32 (0.16–0.64)**	0.44 (0.20–0.96)*
	Farm labourer	61 (37)	104 (63)	0.82 (0.55–1.25)	0.81 (0.53–1.22)
	Housewife/husband	30 (42)	42 (58)	0.68 (0.40–1.16)	0.67 (0.39–1.15)
	Self employed	37 (41)	53 (59)	0.70 (0.42–1.14)	0.74 (0.45–1.24)

† All variables adjusted for each other

**p*<0.05

***p*<0.01

4. DISCUSSION

This study explored dengue-related KAP among caretakers of elementary school children. A majority of caretakers had knowledge of dengue; the most common sources of this information were mass media and healthcare facilities. Literature on dengue-related KAP among caretakers of elementary school children in Thailand is scarce. In a study on dengue-related KAP among migrant Myanmar women caretakers living in Thailand [14], 88.6% of the caretakers received dengue information most commonly through friends, family, or neighbours but less often through Thai television. This is probably a product of the language barrier faced by this minority population. The present findings are consistent with previous studies

172 from Malaysia and Thailand, which have reported mass media as the main source of information on dengue [15-17]. The
173 role of the mass media in creating awareness about dengue is therefore very important.

174 A knowledge gap regarding dengue infection was shown, with only 37.8% of caretakers reporting high knowledge of the
175 disease. Studies have found mixed results on the level of knowledge about dengue. One study conducted in a rural
176 Malaysian community reported good knowledge on dengue [16] while others performed in Thailand have reported
177 moderate [14] or unsatisfactory knowledge levels [12] among caretakers. It is generally difficult to compare knowledge
178 levels across different studies because of the unstandardised nature of the tools used.

179 In a general population study in Kamphaeng Phet, Thailand, gender, age, and education were significantly associated
180 with knowledge level [10]. The current study found that the higher the education or income, the higher the knowledge
181 level, implying that caretakers with low education or income levels stand to benefit more from health education programs
182 meant to improve dengue knowledge.

183 About half of the caretakers in this study had a positive attitude towards dengue prevention but, surprisingly, there was no
184 significant association between attitude and any other particular factor.

185 Assessments of the association between knowledge and dengue control practices has previously shown mixed results,
186 with some studies showing a significant association [10,11] and others showing no association [14]. A review of dengue
187 KAP studies in Latin America and Asia found that traditional education strategies are not effective in changing population
188 behaviour [18]. The present findings are in line with those of a study in Brazil that found no association between
189 knowledge and practice [19]. A qualitative study in Thailand found that during outbreaks, increased awareness about
190 dengue may not ensure sustained larval control practices but other barriers such as beliefs and insufficient control agents
191 must be identified and surmounted for sustainable adoption of practices [20].

192 Use of formal healthcare services for management of dengue infection was virtually universal. This could be related to the
193 existence of universal health care in Thailand, but even before this universal healthcare was in place, one study had
194 already found that Thais with DHF seek treatment at healthcare facilities first [21]. The present study found civil servants
195 to be less likely to use mosquito repellent. This may be due to their mainly office-based work environments, making them
196 less likely to perceive being bitten by mosquitoes as a real threat.

197 This is one of few studies that directly assessed the KAP related to dengue infection among caretakers of children in
198 Thailand in the age bracket bearing the heaviest burden of dengue. Given the very high response rate and the fact that
199 data were collected from caretakers from randomly sampled schools, selection bias was minimised and the results can
200 easily be generalised.

201 However, this study has a number of limitations. Given that the questionnaire was self-administered at home, it is possible
202 that caretakers sought help from other family members in answering some of the questions. This might have resulted in
203 more favourable answers. The low knowledge scores however, do not seem to support this. Efforts made at the design
204 stage of the study minimised this situation by including clear instructions in the information sheet directing respondents to
205 answer the questions by themselves. Assessing the degree of compliance with these directions was outside the scope of
206 this study.

207 Lastly, this study could have been affected by recall bias, especially with regard to matters such as infection history and
208 the discussion of dengue with children.

209 5. CONCLUSION

210 Generally, caretakers in the current study had low levels of knowledge about dengue despite having learned of it through
211 mass media channels. There is a need to improve the existing mass media campaigns to go beyond raising awareness of
212 dengue to improving basic knowledge of the disease; special attention should be paid to caretakers with low income
213 and/or education levels. These groups should be targeted with appropriate dengue prevention health education
214 programmes. The attitude towards dengue in this population was moderate and most caretakers were engaged in
215 practices to protect themselves and/or their children from dengue infection. Given the important role that caretakers can
216 play in dengue prevention among school children, dengue prevention interventions in this population will require improving
217 the knowledge and attitude towards dengue among the caretakers. Finally, there is also a need to standardise tools for
218 conducting further dengue-related KAP studies to allow for comparison of findings across studies and over time.
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COMPETING INTERESTS

Authors declare that no competing interests exist.

AUTHORS' CONTRIBUTIONS

RTs and CW designed the study, wrote the protocol and performed the statistical analyses. RT, CW, KM and TT wrote the first draft of the manuscript. RT and TT managed the literature searches. NS and SS reviewed different versions of manuscript and made significant comments. All authors made significant revisions to the manuscript and read and approved the final manuscript.

REFERENCES

1. WHO. Neglected tropical diseases. 2010. Accessed 13 December 2012. Available: http://www.who.int/neglected_diseases/integrated_media/integrated_media_2010_Dengue_vs_malaria/en/index.html.
2. WHO. Report of the Scientific Working Group meeting on Dengue. Geneva: WHO; 2006.
3. Gubler DJ. Epidemic dengue/dengue hemorrhagic fever as a public health, social and economic problem in the 21st century. *Trends Microbiol* 2002;10(2):100-3.
4. Guha-Sapir D, Schimmer B. Dengue fever: New paradigms for a changing epidemiology. *Emerg Themes Epidemiol*. 2005;2(1)
5. Gratz NG. Lessons of *Aedes aegypti* control in Thailand. *Med Vet Entomol* 1993;7(1):1-10.
6. Thailand MoPH. Dengue fever. 2010. Accessed 3 February 2011. Available: <http://www.boe.moph.go.th/boedb/surdata/disease.php?ds=66>.
7. Thomas SJ, Endy TP. Vaccines for the prevention of dengue: Development update. *Hum Vaccin*. 2011;7(6).
8. Sabchareon A, Wallace D, Sirivichayakul C, Limkittikul K, Chanthavanich P, Suvannadabba S, et al. Protective efficacy of the recombinant, live-attenuated, CYD tetravalent dengue vaccine in Thai schoolchildren: a randomised, controlled phase 2b trial. *The Lancet*. 2012;380(9853):1559-67.
9. CDC. Dengue. 2011. Accessed 8 May 2011. Available: <http://www.cdc.gov/dengue/>.
10. Koenraadt CJ, Tuiten W, Sithiprasasna R, Kijchalao U, Jones JW, Scott TW. Dengue knowledge and practices and their impact on *Aedes aegypti* populations in Kamphaeng Phet, Thailand. *Am J Trop Med Hyg*. 2006;74(4):692-700.
11. Van Benthem BH, Khantikul N, Panart K, Kessels PJ, Somboon P, Oskam L. Knowledge and use of prevention measures related to dengue in northern Thailand. *Trop Med Int Health*. 2002;7(11):993-1000.
12. Kittigul L, Suankeow K, Sujirarat D, Yoksan S. Dengue hemorrhagic fever: Knowledge, attitude and practice in Ang Thong Province, Thailand. *Southeast Asian J Trop Med Public Health*. 2003;34(2).
13. Thailand MoPH. Intelligence/disease situation. 2010. Accessed 15 May 2011. Available: <http://www.boe.moph.go.th/report.php?cat=24&year=2010>.
14. Kyu H H, Thu M, Van der Putten M. Myanmar migrant caretakers on prevention of dengue fever: a study on knowledge, attitude and practices in Tak Province, Thailand. *AU Journal of Technology*. 2005;9(2):99-105.
15. Swaddiwudhipong W, Lerdlukanavong P, Khumklam P, Koonchote S, Nguntra P, Chaovakiratipong C. A survey of knowledge, attitude and practice of the prevention of dengue hemorrhagic fever in an urban community of Thailand. *Southeast Asian J Trop Med Public Health*. 1992;23(2):207-11.

- 264 16. Hairi F, Ong CH, Suhaimi A, Tsung T W, bin Anis Ahmad M A, Sundaraj C, et al. A knowledge, attitude and practices
265 (KAP) study on dengue among selected rural communities in the Kuala Kangsar district. *Asia Pac J Public Health*.
266 2003;15(1):37-43.
- 267 17. Luangdilok W. The performance of caretakers for prevention of dengue fever during care of patients at home.
268 Bangkok: Chulalongkorn University; 2006.
- 269 18. Claro LB, Tomassini HC, Rosa ML. Dengue prevention and control: a review of studies on knowledge, beliefs, and
270 practices. *Cad Saude Publica*. 2004;20(6):1447-57.
- 271 19. Donalisio MR, Alves MJ, Visockas A. A survey of knowledge and attitudes in a population about dengue
272 transmission—region of Campinas São Paulo, Brazil—1998. *Rev Soc Bras Med Trop*. 2001;34(2):197-201.
- 273 20. Phuanukoonnon S, Brough M, Bryan JH. Folk knowledge about dengue mosquitoes and contributions of health belief
274 model in dengue control promotion in Northeast Thailand. *Acta Trop*. 2006;99(1):6-14.
- 275 21. Okanurak K, Sornmani S, Mas-ngammueg R, Sitaputra P, Krachangsang S, Limsomboon J. Treatment seeking
276 behavior of DHF patients in Thailand. *Southeast Asian J Trop Med Public Health*. 1997;28(2):351-8.).