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## **Knowledge, Attitude, and Practices Related to Dengue among Caretakers of Elementary School Children in Chanthaburi Province, Thailand**

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### **Authors' contributions**

*Authors RT and CW designed the study, wrote the protocol and performed the statistical analyses. Authors RT, CW, KM and TLT wrote the first draft of the manuscript. Authors RT and TLT managed the literature searches. Authors 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.*

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### **ABSTRACT**

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

**Study Design:** Cross sectional study

**Place and duration of the Study:** Chanthaburi Province, Thailand, in April 2012

**Methods:** Data on socio-demographic characteristics, sources of information; knowledge;

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attitudes and practices related to dengue were sought from a random sample of 640 caretakers. Logistic regression was performed to explore factors associated with dengue-related knowledge, attitude and practices.

**Results:** Of the 640 respondents invited to participate in the study, 628 (98.1%) returned completed questionnaires. 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 higher knowledge than those with primary education (adjusted odds ratio [aOR] 2.0, 95% confidence interval [CI] 1.28–3.31). Caretakers with a family annual income greater than 6,400 US \$ were more likely to have higher knowledge compared to those with an income less than 1,600 US \$ (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 towards 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]. The 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]. The clinical presentations of dengue vary from asymptomatic infection to classical dengue fever (DF) and to more severe forms of dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS) [5].

Thailand's first reported dengue epidemic occurred in 1958 [6]. 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 DSS and 135 dengue deaths, were reported nationwide [7]. 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 [7].

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 [8]. 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 [9]. Avoiding bites, mainly from *Aedes aegypti* mosquito species, therefore remains the only effective method to prevent dengue infection [10].

A number of studies on knowledge, attitudes, and practices (KAP) regarding dengue among adults in Thailand have been conducted [11,12]. There is, however, a paucity of studies that have explored this topic among direct caretakers of children, who bear the brunt of the disease [13]. 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. MATERIALS 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 km<sup>2</sup>; 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 [14]. 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 to 6 were eligible for inclusion in the study. A caretaker was defined as a child's biological parent who was staying with the child. For children who were not staying with a parent, a caretaker was defined as a guardian who was staying with the child and had the responsibility of day-to-day care of the child. 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. A total of 21 schools were selected through this method. 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, a consent form, a 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. A research assistant was on standby 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. Additionally, 9 of the questions required 'true', 'false', or 'don't know' answers while the rest were multiple choice questions that required identifying correct answers. 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 and a wrong or 'don't know' response obtained a score of 0. Respondents who had never heard about dengue obtained an overall score of 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 AND DISCUSSION

#### 3.1 Results

Of the 640 questionnaires distributed, 634 were returned. Six of the returned questionnaires were blank and were therefore excluded from analysis, resulting in an overall response rate of 98.1%. All respondents completed the questionnaires without the help of research assistants. 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] ± 8.9) years; 81.1% were 30-49 years old. 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 \$1,600 US dollars (50,000 Thai Bahts) or less.

**Table 1. Characteristics of school children’s caretakers in Chanthaburi Province**

Characteristic	Frequency (n = 628)	Percent (%)
<b>Female sex</b>	426	67.8
<b>Age</b>		
<30	44	7.0
30–39	280	44.7
40–49	228	36.4
≥50	75	12.0
Mean (SD)	40.1 (8.9)	
<b>Occupation</b>		
Factory labourer	260	41.4
Civil servant <sup>a</sup>	40	6.4
Farm labourer	165	26.3
Unemployed	72	11.5
Self employed	91	14.5
<b>Children &lt;15 years in household</b>		
1	315	50.2
2	210	33.4
3	63	10.0
≥4	40	6.4
Median (Min-Max)	1 (1–11)	
<b>Marital status</b>		
Single	30	4.8
Married	509	81.1
Divorced	45	7.2
Widowed	44	7.0
<b>Education</b>		
Incomplete primary	15	2.4
Completed primary	301	47.9
Completed secondary	207	33.0
Higher	105	16.7
<b>Annual income (US \$)<sup>b</sup></b>		
≤1,600	280	44.6
1,601–3,200	181	28.8
3,201–6,400	82	13.1
>6400	85	13.5

<sup>a</sup>this includes different occupation categories in the civil service all amalgamated due to small numbers

<sup>b</sup>exchange rate: 1 US \$ = 31.25 Thai Bahts

### 3.1.1 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 seasonal variations of dengue 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
Radio ( $n = 472$ )	172	36.4
Newspaper ( $n = 472$ )	168	35.6
Internet ( $n = 472$ )	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

### 3.1.2 Factors associated with knowledge

The mean knowledge score was 21.0 (SD  $\pm$  4.4) out of 28. Of the 627 caretakers (response rate 98.0%) who completed all the knowledge questions, 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). However, there were no significant differences in the odds of having high knowledge across other occupations with reference 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.

**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 <sup>a</sup> (95% CI)
	Low (< 23) n = 390	High (≥ 23) 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)**
Annual income (US \$)				
<1,600	194 (70)	85 (31)	1.00 (ref)	1.00 (ref)
1,601–3,200	113 (62)	68 (38)	1.37 (0.92–2.04)	1.32 (0.88–1.96)
3,201–6,400	41 (50)	41 (50)	2.28 (1.37–3.80)**	1.90 (1.13–3.19)*
>6400	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)
Civil servant <sup>b</sup>	15 (38)	25 (63)	3.3+5 (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)
Unemployed	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)

<sup>a</sup> adjusted for all the variables in the table

<sup>b</sup> this includes different occupation categories in the civil service all amalgamated due to small numbers

\*p<0.05

\*\*p<0.01

### **3.1.3 Attitude scores and factors associated with attitude**

The mean attitude score was 27.3 (SD ± 3.1) out of 40. A total of 625 caretakers responded to all the attitude questions (response rate 97.7%); 304 (48.6%) of them 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).

### 3.1.4 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 is mosquito repellent 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) <sup>a</sup>		
Prevention	414	81.8
Symptoms	263	52.0
Transmission	227	44.9
Regional/seasonal variations	82	16.2

<sup>a</sup>Multiple responses allowed

### 3.1.5 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.

**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 <sup>a</sup> [95% CI]
	n (%)			
	No (n = 237)	Yes (n = 390)		
<b>Age</b>				
<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)
<b>Education</b>				
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)
<b>Annual income (US \$)</b>				
<1,600	95 (34)	185 (66)	1.00 (ref)	1.00 (ref)
1,601–3,200	66 (37)	114 (63)	0.89 (0.60–1.31)	0.91 (0.61–1.37)
3,201–6,400	38 (46)	44 (54)	0.59 (0.36–1.00)*	0.67 (0.40–1.12)
>6400	38 (45)	47 (55)	0.64 (0.39–1.00)	0.78 (0.46–1.34)
<b>Occupation</b>				
Factory labourer	85 (33)	175 (67)	1.00 (ref)	1.00 (ref)
Civil servant <sup>b</sup>	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)
Unemployed	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)

<sup>a</sup>All variables adjusted for each other<sup>b</sup> this includes different occupation categories in the civil service all amalgamated due to small numbers

\* $p < 0.05$

\*\* $p < 0.01$

### **3.1.6 Factors associated with discussing dengue infection with children**

We did not find significant associations between discussing dengue infection with children and caretakers' socio-demographic characteristics, dengue-related attitude, or knowledge (results not shown).

### **3.2 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 [15], 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 from Malaysia and Thailand, which have reported mass media as the main source of information on dengue [16-18]. The role of the mass media in creating awareness about dengue is therefore very important.

A knowledge gap regarding dengue infection was shown, with only 37.8% of caretakers reporting high knowledge of the disease. Studies have found mixed results on the level of knowledge about dengue. One study conducted in a rural Malaysian community reported good knowledge on dengue [17] while others performed in Thailand have reported moderate [15] or unsatisfactory knowledge levels [13] among caretakers. It is generally difficult to compare knowledge levels across different studies because of the unstandardised nature of the tools used.

In a general population study in Kamphaeng Phet, Thailand, gender, age, and education were significantly associated with knowledge level [11]. These findings were however not replicated in a study in Malaysia [19]. The current study found that the higher the education or income, the higher the knowledge level, implying that caretakers with low education or income levels stand to benefit more from health education programs meant to improve dengue knowledge.

About half of the caretakers in this study had a positive attitude towards dengue prevention but, surprisingly, there was no significant association between attitude and any other particular factor. A general population study in Malaysia reported significant associations between attitude towards dengue fever and the level of education and employment status [19]. This study in Malaysia however, did not adjust for confounding variables.

Assessments of the association between knowledge and dengue control practices has previously shown mixed results, with some studies showing a significant association [11,12] and others showing no association [15]. A review of dengue KAP studies in Latin America and Asia found that traditional education strategies are not effective in changing population behaviour [20]. The present findings are in line with those of a study in Brazil that found no association between knowledge and practice [21]. A qualitative study in Thailand found that during outbreaks, increased awareness about dengue may not ensure sustained larval control practices but other barriers such as beliefs and insufficient control agents must be identified and surmounted for sustainable adoption of practices [22].

Use of formal healthcare services for management of dengue infection was virtually universal. This could be related to the existence of universal health care in Thailand, but even before this universal healthcare was in place, one study had already found that Thais with DHF seek treatment at healthcare facilities first [23]. The present study found civil servants to be less likely to use mosquito repellent. This may be due to their mainly office-based work environments, making them less likely to perceive being bitten by mosquitoes as

a real threat. We did not find education or income to be associated with use of mosquito repellents. These findings are surprising but reveal that use of repellents was not influenced by affordability or the education status of respondents but rather by the working environment. On the contrary, a study in Pakistan found that individuals in higher socio-economic groups had better dengue preventive practices [24].

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

However, this study has a number of limitations. Given that the questionnaire was self-administered at home, it is possible that caretakers sought help from other family members in answering some of the questions. This might have resulted in more favourable answers. The low knowledge scores however, do not seem to support this. Efforts made at the design stage of the study minimised this situation by including clear instructions in the information sheet directing respondents to answer the questions by themselves. Assessing the degree of compliance with these directions was outside the scope of this study. Although there are a number of dengue prevention practices, we only assessed two: use of larvicides or fish to control the breeding of mosquitoes in water containers lying in the compound and the application of repellents. It is possible that participants were involved in other dengue prevention practices that the study did not capture.

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

#### **4. CONCLUSION**

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

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## **CONSENT**

All authors declare that written informed consent was obtained from all participants prior to completing questionnaires.

## **ETHICAL APPROVAL**

Ethical approvals for this study were obtained from the Chulalongkorn University College of Public Health Sciences, Thailand (approval no. 046/2012), and from Chubu University, Japan (approval no.230020).

## **COMPETING INTERESTS**

Authors have declared that no competing interests exist

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