Factors Associated with Dengue Prevention and Control in Two Villages in a Central Thai Province: A Retrospective Review

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Objective: *To study the factors associated with dengue prevention and control in Moo 6 (the 6th village) and Moo 7 of Tambon Kaeng-phak-kut, Thaluang District, Lopburi Province.*
Material and Method: *The authors reviewed the raw data collected by public health officers and village health volunteers (VHVs) as their routine tasks. The authors analyzed the data, 30 dwellings per each village, to compare the demographics, knowledge, attitude, and practice of subjects from Moo 6, a dengue-outbreak community, with that from Moo 7, a control group, as well as larval indices between these 2 studied groups. The present retrospective study is approved by Siriraj Institutional Review Board, Certificate of Approval No. Si393/2012.*
Results: *Both groups of subjects had no statistically significant difference in basic dengue knowledge ($p = 0.862$), attitude towards dengue prevention and control, practical knowledge ($p = 0.457$), and actual practice to eliminate Aedes larvae and prevent it laying eggs, except for the practice of managing water container in bathroom or toilet ($p = 0.015$). On the other hand, dengue incidence and larval indices of both villages were apparently different.*
Conclusion: *Although incorrect basic dengue and practical knowledge of subjects from both villages were similar, dengue outbreak in Moo 6 of Tambon Kaeng-phak-kut was superior. It may be due to difference in actual practice on larval elimination in water container in bathroom or toilet as well as other factors other than personal factors such as public services, public places, and community surroundings.*

Keywords: *Dengue prevention and control, Factors, Community, Thailand*

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Dengue hemorrhagic fever is an important public health problem in tropical regions and nowadays is escalating to be an international concern. The 20% dengue mortality rate could be reduced to less than 1% by proper management[(1)]. Dengue patients need close follow-up. Therefore, it reduces patients' time, money, and quality of life. In addition, a number of patients ignore their early flu-like symptoms and do not seek medical care.

In the last two to three years, dengue incidence in Thaluang, Lopburi, located in central region of Thailand, has increased continuously (Fig. 1) until it exceeded the dengue control goal in the "Healthy Thailand 2010" project set by Thai Ministry of Public Health. The goal to control dengue incidence is to be not more than 50 patients per 100,000 people per year.

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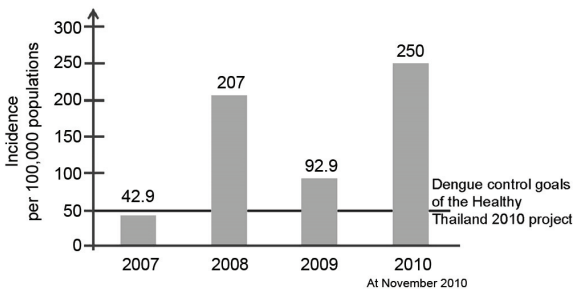

Fig. 1 Dengue incidences in Thaluang District, Lopburi Province.

According to epidemiological data from the Department of Family Clinical Practice and Community, Thaluang District Hospital, Lopburi, dengue incidence of Kaeng-phak-kut in 2009 and 2010 were 26.9% and 38.6% of that of Thaluang District, respectively, with Moo 6 (the 6th village) as major contributor (71.4% and 61.5% of all dengue patients from this Tambon). In contrast, there was no dengue patient from nearby Moo 7, so the authors conducted retrospective research comparing these two villages on factors that may influence dengue outbreak that will lead to future planning to prevent and control dengue, especially at village level[2]. The previous studies found that good dengue knowledge did not correlate with good dengue-prevention practices[3], and larval control methods complicatedly interacted with household water use in Northeast Thailand[4], but there were few previous national studies aimed to find out factors associated with dengue prevention and control in knowledge-attitude-practice, KAP model.

Material and Method

Public health officers and village health volunteers (VHVs) regularly conduct home visit in the areas under Thaluang District Hospital responsibility and collect data (demographics, knowledge, attitude, practice of respondents, and larval indices) from that communities as routine tasks. The authors retrospectively reviewed the available data collected from Moo 6 and Moo 7 of Tambon Kaeng-phak-kut, located in Thaluang District. The reason why the authors chose these two villages as studied model was described above. The present retrospective study was approved by Siriraj Institutional Review Board (SIRB), Certificate of Approval (COA) No. Si393/2012.

Study populations

The authors used data randomly collected from villagers who have lived in Moo 6 or Moo 7 of Tambon Kaeng-phak-kut, Thaluang District, Lopburi Province, for four years or more, and excluded villagers who have emigrated more than one-fourth of 4-year duration living in aforementioned villages. Available data collected by Public health officers and VHVs were 30 subjects per each village.

Case record form

The authors constructed a case record form divided into five parts corresponding to five groups of data collected by Public health officers and VHVs[5]. The first part was about subjects' demographics. The second one aimed to assess basic dengue knowledge[6] (Table 1) and asked subjects about their dengue knowledge resource. The six statements for assessment of attitude towards dengue prevention and control were in the third part with three possible answers (Table 2). Statement 1, 2, 3, and 5 represented positive attitudes, whereas statement 4 and 6 represented negative ones.

Table 1. Basic dengue knowledge questions

Item	Each of these statements is (true, false, or I don't know)	Correct answer	p-value	Percentage of correct respondents	
				Moo 6	Moo 7
1	Urban mosquito (*Culex* sp.) is dengue vector	False	0.598[a]	36.67	43.33
2	Dengue vector mosquitoes often bite humans at nighttime	False	0.592[a]	66.67	60.00
3	Dengue vector mosquitoes lay their eggs in clean water sources	True	0.190[a]	50.00	66.67
4	Dengue is common in rainy season	True	>0.999[b]	90.00	86.67
5	Person who gets high fever and malaise may have dengue	True	0.706[b]	90.00	83.33
6	When you catch high fever, you should use acetaminophen as antipyretic instead of aspirin	True	0.542[a]	80.00	73.33
7	Mosquito net usage in daytime does not prevent you from dengue	False	0.052[b]	83.33	100.00
8	Temephos sand granules can kill mosquito larvae but cannot kill the adult	True	0.488[a]	80.00	86.67
9	Temephos sand granules must be re-applied at least every 6 months	False	0.195[b]	16.67	3.33
10	Standing-water source eradication is useful in dengue prevention and control	True	>0.999[b]	96.67	93.33

[a] p-values calculated by Chi-square test
[b] p-values calculated by Fisher's exact test

The fourth part, a case record form, showed subjects' opinions about the obstacles to dengue prevention and control. The fifth one consisted of nine 4-choice, one-best questions (Table 3, Fig. 3) to evaluate practical knowledge of dengue prevention and control. The first question of this part asked what is the best method to control dengue. The correct answer is mosquito larval elimination[1]. The eight remaining items questioned the best choice for eliminating *Aedes* larvae from each household's standing-water source (Table 3). Public health officers and VHVs also enquired villagers about actual practices of subjects in detail, including any methods used other than given choices. The authors classified actual practices into two groups, 1) incorrect practices and 2) correct practices or not have the water containers. The former meant any practices that were not effective in preventing *Aedes* laying eggs or eliminate larvae under the authors' considerations of method, step, quantity, and frequency.

Larval indices

VHVs' tasks moreover include exploration of standing-water sources inside each subject's house and in 100-meter radius around for *Aedes* larvae and calculation larval indices[7]: House (WHO) index (HI, percentage of houses positive for larvae), Breteau index (BI, the number of containers positive for larvae per 100 houses), and Container index (CI, percentage of containers positive for larvae). The authors compared these indices between the two studied villages. In addition, standing-water sources around temples and schools located in the studied community were explored. The authors reviewed the CIs of those places.

Table 2. Percentages of respondents' answers in each attitude question

Item	Statements	Percentage of respondents who answered						p-value
		Agree		Not sure		Disagree		
		Moo 6	Moo 7	Moo 6	Moo 7	Moo 6	Moo 7	
1	Dengue can be a cause of death	93.33	100.00	6.67	0.00	0.00	0.00	0.154
2	Dengue is a disease requiring prevention and control	96.67	100.00	3.33	0.00	0.00	0.00	0.317
3	*Aedes* breeding control is essential for community	96.67	100.00	3.33	0.00	0.00	0.00	0.317
4	Dengue prevention is the duty of only public sector	23.33	16.67	10.00	10.00	66.67	73.33	0.545
5	Temephos sand granule application in standing-water sources, e.g. vases, ant traps under cupboards' legs, must be re-applied every 3 months at least	86.67	90.00	13.33	10.00	0.00	0.00	0.690
6	To cover water-storage containers with their lids is unnecessary	23.33	20.00	3.33	3.33	73.33	76.67	0.701

p-values calculated by Mann-Whitney U test

Table 3. Correct practical knowledge on larval elimination

Item	Methods to eliminate mosquito larvae or prevent it laying egg in...	p-value	Percentage of correct respondents	
			Moo 6	Moo 7
1	Flower vases	0.592[a]	60.00	66.67
2	Drinking water-storage containers	0.612[b]	96.67	90.00
3	Water containers in bathroom and toilet	>0.999[b]	90.00	90.00
4	Big plant pot plates	0.706[b]	10.00	16.67
5	Lotus basins or water-storage ponds	0.488[a]	86.67	80.00
6	Used tires, probable new standing-water source after raining	0.260[a]	63.33	76.67
7	Discarded cans, plastic bags, fruit peel, potential standing-water sources	0.243[a]	80.00	66.67
8	Water-filled ant traps supporting under food cupboards' legs	0.063[a]	26.67	50.00

[a] p-values calculated by Chi-square test
[b] p-values calculated by Fisher's exact test

Results

Subject characteristics

The comparison of subjects' demographics between Moo 6 and Moo 7 by exact significance test showed no statistically significant difference in age, occupation, and education level (p = 0.807, 0.477, and 0.259, in order). Mean age was 42.55±12.27 years for Moo 6 and 43.35±12.51 years for Moo 7. Most of subjects were agricultural workers (53%), and the remainder were employees, merchants, and others. Regarding education, 36.7%, 35.0%, 11.7%, and 13.3% of subjects, respectively, were lower elementary, upper elementary, junior high, and senior high school graduates or higher. The remaining 3.4% did not received formal education.

Basic knowledge about dengue

Both groups' total scores were not statistically significantly different (p = 0.862), and they distributed as a normal curve (Fig. 2). Means ± SDs of them from Moo 6 and Moo 7 were 6.90±1.37 and 6.97±1.59, respectively.

Correct rate analysis for each question did not demonstrate any statistically significant differences between the two groups. Nonetheless, percentages of correct respondents were less than 70 in both groups for question 1, 2, 3, and 9 (Table 1).

Attitude towards dengue prevention and control

Subjects' answers to the third part of case record form (six attitude questions: both positive and negative statements, as mentioned above) did not exhibit statistically significant difference (Table 2).

More than 85% of subjects from both groups (despite Moo 7 was slightly greater) agreed, less than 15% unsure, and 0% disagreed with positive attitude statements, whereas 15 to 25% of subjects agreed (and needed to be rectified in their attitudes), 3 to 10% unsure, and less than 80% disagreed with negative attitude statements. The authors found no statistically significant difference in both positive and negative attitudes between the two groups (Table 2).

Practice of dengue control

Even though most of the subjects from both groups correctly knew "mosquito larval elimination" is the best way to prevent and control dengue (p = 0.598), 40% of all subjects still misunderstood the process (Fig. 3).

Total scores for eight practical knowledge questions normally distributed (Fig. 4) with means ± SDs as 5.13±1.07 for Moo 6 and 5.37±1.33 for Moo 7 without statistically significant difference (p = 0.457).

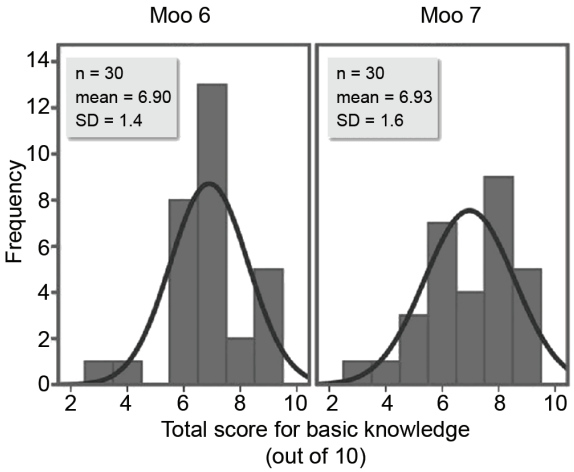

Fig. 2 Knowledge on dengue.

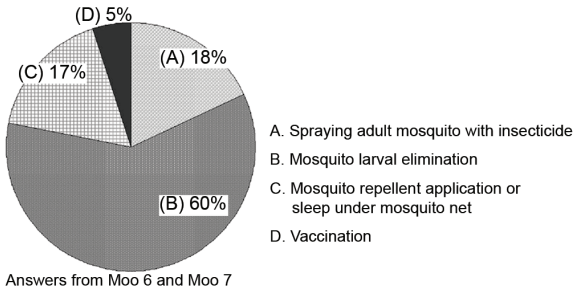

Fig. 3 The answers of the question: "In your opinion, which is the best method for dengue control?".

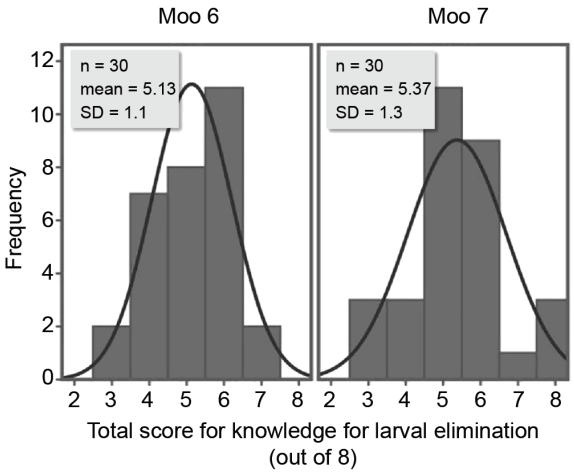

Fig. 4 Total scores for practical knowledge on larval elimination.

The authors found no statistically significant difference in answers for each question between the two groups (Table 3). Incorrect actual practice rates in both groups did not statistically significantly differ except in the caring of water containers in bathroom or toilet (80.00% in Moo 6 and 53.33% in Moo 7, p = 0.015). Although the number of subjects who knew the best practice for vases, pot plates, and ant traps was less than 70% (Table 3), more than 50% of subjects from both villages did not have those containers (Table 4).

Household standing-water source exploration

The distributions of CIs of both villages were right-skewed with statistically significant difference by Mann-Whitney U test (p = 0.030, median CIs 22.5% and 0.00% for Moo 6 and Moo 7 in order). HIs were 76.67% for Moo 6 and 46.67% for Moo 7. BIs of Moo 6 and Moo 7 were 163.3 and 90.0, respectively.

High values of both HI and CI in Moo 6 indicated dengue epidemic risk is overall high. Unlike Moo 6, high HI and low CI in Moo 7 indicated aforementioned risk spread throughout the village (according to Thai Ministry of Public Health's indicators in 2009, HI must be less than 10% and CI must be zero)[8].

Public place standing-water source survey

Noen-thong temple and Ban-noen-thong school located in Moo 6 of Kaeng-phak-kut had CIs equal to 23.07% and 0.00%, consecutively.

There were no public places such as temple or school in Moo 7.

Discussion

Our retrospective study revealed that basic dengue knowledge, attitude towards dengue prevention and control, practical knowledge, and actual practice of eliminating *Aedes* larvae and preventing the adults from laying eggs in water containers (except the ones in bathroom or toilet) of both groups of subjects were not statistically significantly different, but dengue incidences and larval indices obviously differed between the villages. The authors hence inferred Moo 6's dengue outbreak would be due to other factors other than villager such as public services, public places, and community surroundings.

In both villages, despite the fact that people practice refuse disposal in the same incorrect way, lidless dustbin usage and outdoor placement, public refuse collection services are practiced differently, weekly for Moo 7 and monthly for Moo 6. In addition, many junk shops, located in Moo 6, take care of refuse unsanitary. There are no junk shops in Moo 7. Lack of carers of the wide area around Noen-thong temple in Moo 6 results in many larval positive standing-water sources (CI = 23.07%).

Unlike Moo 7, more deficient running-water supply in Moo 6 makes villagers less likely to frequently change water in bathroom containers. The

Table 4. Incorrect practices between Moo 6 and Moo 7

Item	Methods to eliminate mosquito larvae or prevent it laying egg in...	p-value	Percentage of subjects who practiced incorrectly		Percentage of subjects who practiced correctly		Percentage of subjects who did not have that water container	
			Moo 6	Moo 7	Moo 6	Moo 7	Moo 6	Moo 7
1	Flower vases	>0.999[b]	3.33	3.33	13.33	30.00	83.33	66.67
2	Drinking water-storage containers		0.00	0.00	100.00	100.00	0.00	0.00
3	Water containers in bathroom and toilet	0.015[a]	80.00	53.33	20.00	46.67	0.00	0.00
4	Big plant pot plates	0.195[b]	3.33	16.67	3.33	13.33	93.33	70.00
5	Lotus basins or water-storage ponds	0.237[b]	0.00	10.00	60.00	53.33	40.00	36.67
6	Used tires, probable new standing-water source after raining	0.317[a]	23.33	13.33	53.33	63.33	23.33	23.33
7	Discarded cans, plastic bags, fruit peel, potential standing-water sources	0.301[b]	3.33	10.00	96.67	90.00	0.00	0.00
8	Water-filled ant traps supporting under food cupboards' legs	>0.999[b]	10.00	10.00	20.00	33.33	70.00	56.67

[a] p-values calculated by Chi-square test

[b] p-values calculated by Fisher's exact test

Table 5. Budget for dengue prevention and control campaign per village each time

Materials	Cost per unit (Baht, ฿)	Number of units	Cost (Baht, ฿)
Larvicidal sand granules (temephos)	4,500	2	9,000
Sprayed mosquito insecticide	1,500	3	4,500
Diesel	31	20	620
Gasoline	42	40	1,680
Wages	300	2	1,200
Cost of food and drink for labors	3,000		3,000
Net cost			20,000

larvicidal (temephos) sand granule application into water containers may be an ineffective method because most of people do not know that it must be re-applied every three months. Furthermore, temephos supply per house from the government is inadequate. Flat-rate public health budgets distributed to each village (10,000 Baht per year) may cause differentiation in dengue-prevention-and-control campaign outcomes due to different community size, 204 households in Moo 6 and only 78 households in Moo 7. In addition, such campaign with temephos distribution and insecticide spraying requires the budget of 20,000 Baht per time (Table 5). Therefore, the budget to spray needs to come from other sources.

The success in dengue outbreak solving requires the contributions from both public and private sectors[9]. Government should provide adequate budget for each community, conduct dengue-prevention-and-control campaign at the proper frequency such as providing temephos supply every three months, and generate policies on community's environment conservation and sanitation: providing lidded dustbins and taking care of such public places as the temple[10].

With regard to people, the authors proposed five strategies, which are 1) government dependency reduction, e.g. use of traditional methods such as unripe fruit of bergamot instead of temephos to eliminate larvae, 2) a campaign encouraging people to take care of public places, e.g. community volunteers, 3) accentuation that *Aedes* larval elimination is the best dengue prevention and control method, 4) social responsibility-minded cultivation, and 5) building up the norm of healthy lifestyle.

Any dengue campaigns should stress these misunderstood points, yellow fever mosquito (*Aedes* sp.), the dengue vector, bites humans in daytime, and lays its eggs in clean water sources. Keeping water clean cannot prevent *Aedes* sp. breeding. Moreover, campaigns should emphasize that larval elimination is the best method to prevent and control the disease. In addition to the fact that larvicidal sand granules must be re-applied every three months, people should be counseled by government-independent methods to eliminate larvae such as breeding larva-eating fish in lotus basins, use of unripe fruit of bergamot instead of temephos, adding salt into ant traps located under cupboards' legs. Because both groups of villagers similarly misunderstood about dengue, the educating campaigns should be conducted in both villages and may be extended to other villages.

Many effective ways are available to educate people on health[11] according to answers of a question "what is your source of dengue knowledge?". For instance, community radio, public address system, print media (e.g. campaign board or sticker), and public relations accessing respected persons of community such as abbot and village headman can be used[3,11]. Health providers can educate any people coming to hospital on dengue and larval elimination. Public health officers and VHVs should always educate people when they conduct a home visit or have an opportunity to do so.

To sustainably succeed in dengue eradication, we need not only the co-operation between government and people in the community but also a regularity of dengue-prevention-and-control practices.

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Potential conflicts of interest

None.

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ปัจจัยที่สัมพันธ์กับการควบคุมและป้องกันโรคไข้เลือดออกใน 2 หมู่บ้านของจังหวัดในภาคกลางของประเทศไทย: การศึกษาย้อนหลัง

สมาทร ถกลวิบูลย์, ณัทธร เบญจาทิกุล, กัญชลิกา เสถียรวิจิตร, กวินทรา ประพัฒน์รังษี, ฐานิยา เธียรมนตรี, วิโรจน์ รัตนอมรสกุล, ประเสริฐ อัสสันตชัย, มยุรี หอมสนิท

วัตถุประสงค์: *เพื่อศึกษาปัจจัยที่เกี่ยวข้องกับการควบคุมและป้องกันโรคไข้เลือดออกในพื้นที่หมู่ 6 และหมู่ 7 ตำบลแก่งผักกูด อำเภอท่าหลวง จังหวัดลพบุรี*

วัสดุและวิธีการ: *ผู้นิพนธ์ทบทวนข้อมูลดิบที่เก็บจากงานประจำของนักวิชาการสาธารณสุขและอาสาสมัครสาธารณสุขประจำหมู่บ้าน (อสม.) ผู้นิพนธ์วิเคราะห์ข้อมูลจาก 30 ครัวเรือนต่อหมู่บ้าน เปรียบเทียบลักษณะทางประชากรศาสตร์ ความรู้ ทัศนคติ และการปฏิบัติของประชากรจากหมู่ 6 ซึ่งเป็นพื้นที่ระบาด กับประชากรจากหมู่ 7 ซึ่งไม่พบการระบาด รวมถึงเปรียบเทียบดัชนีลูกน้ำยุงลายระหว่าง 2 หมู่นี้ด้วย การศึกษานี้ผ่านการรับรองจากคณะกรรมการจริยธรรมการวิจัยในคน คณะแพทยศาสตร์ศิริราชพยาบาล เอกสารรับรองโครงการวิจัย หมายเลข Si393/2012*

ผลการศึกษา: *ประชากรทั้ง 2 กลุ่ม มีความรู้พื้นฐานเกี่ยวกับโรค ($p = 0.862$) ทัศนคติต่อการป้องกันและควบคุมโรค และความรู้ในการปฏิบัติ ($p = 0.457$) ตลอดจนการปฏิบัติตนในการกำจัดลูกน้ำและป้องกันการวางไข่ยุงลาย ยกเว้นการดูแลภาชนะใส่น้ำในห้องน้ำหรือห้องส้วม ($p = 0.015$) ไม่มีความแตกต่างกันอย่างมีนัยสำคัญทางสถิติ ในขณะที่อุบัติการณ์ของโรคและดัชนีลูกน้ำยุงลายของทั้งหมู่ 6 และหมู่ 7 แตกต่างกันชัดเจน*

สรุป: *ประชากรจากทั้งหมู่ 6 และหมู่ 7 มีความรู้ความเข้าใจเกี่ยวกับไข้เลือดออกที่ยังไม่ถูกต้องไม่แตกต่างกันนัก ทั้งความรู้พื้นฐานและการปฏิบัติ แต่กลับพบไข้เลือดออกระบาดในหมู่ 6 ตำบลแก่งผักกูด มากกว่าชัดเจน อาจเนื่องจากการปฏิบัติจริงในการกำจัดลูกน้ำและป้องกันการวางไข่ยุงลายในภาชนะใส่น้ำในห้องน้ำหรือห้องส้วมที่แตกต่างกัน รวมถึงปัจจัยอื่นนอกจากตัวบุคคล เช่น นโยบายภาครัฐ ภูมิศาสตร์ และสิ่งแวดล้อมในชุมชน*