COMMUNITY-BASED APPROACH FOR PREVENTION AND CONTROL OF DENGUE HEMORRHAGIC FEVER IN KANCHANABURI PROVINCE, THAILAND

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Abstract. An action research design was conducted in two villages of Mueang District, Kanchanaburi Province to assess the effectiveness of a community-based approach program. Knowledge, perceived susceptibility, self-efficacy, and regular larval survey behavior were measured for program outputs. Container Index (CI), House Index (HI), and Breteau Index (BI) were used to confirm program outcomes. Key community stakeholders in the experimental village were identified and empowered through active learning in the village. Monthly meetings with the key stakeholders were used to share experiences learned, to reflect on the program outputs and outcomes as well as to plan for the next cycle of program activities. The program was quite successful. Knowledge, perception, self-efficacy, and larval survey practices in the experimental group were significantly higher than before the experiment, and higher than the comparison group. CI, HI, and BI were decreased sharply to better than the national target. Community status as community leaders was the best predictor for larval survey behavior at the first survey. Participating in the study program activities was the best predictor at the end of the program. The results from this study suggest that the dengue hemorrhagic fever (DHF) prevention and control program at the sub-district health level should be more proactive and emphasized at the village level. Monitoring the disease control program outputs and outcomes should be performed regularly during monthly meetings. Finally, local health officers need to be empowered for these matters.

INTRODUCTION

In Thailand, DHF has occurred for more than forty years. The first large outbreak of the disease occurred in 1958 (Bureau of Epidemiology, 2002). During the first few outbreaks, the disease was found mainly in Bangkok and its surrounding areas, then the disease spread to all regions of the country (Daengharn *et al*, 1996). The reported numbers of cases of DHF from 1999-2003 were quite high, ranging from 30,000-120,000 cases, with case fatality rates (CFR) of 0.12-0.21% (Bureau of Epidemiology, 1999-2003). DHF mainly affects the age-group less than 15 years old, with the highest percentage of cases occurring in the 5-9 years age-group, followed by the 10-14 years age-group. It has been noticed that the proportion of cases in the age-group of fifteen and over has increased slightly from 20% to 30% (Ungchusak, 2002). The disease needs to be studied further because DHF outbreaks occur not only in the rainy season but throughout the year. There seems to have been a shift in the age-groups affected from younger to older people (Wangrungsarb, 1997; Rojanapithayakorn, 1998).

To prevent and control DHF, emphasis should be on community participation, since this is viewed as the only approach that is cost-effective and will provide effective disease control over the long run (Gubler and Clark, 1994; WHO,

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2002). In this case, community members were required to carry out source reduction measures, such as emptying water containers, removal of solid waste material, including used tires, and their proper disposal, and preventing breeding in man-made breeding places. These activities not only require community participation, but should be continuously active by linking with the culture and lifestyle of the community (WHO, 1999). Community is the focal point in developing, implementing, and evaluating a community-based DHF control program. It should also be a center for continuing learning for community members. In Thailand, efforts to control DHF have not been effective. A main constraint is the failure to mobilize all sectors who should be involved in the DHF control activities (Rojanapithayakorn, 1998).

Kanchanaburi is one of the DHF endemic provinces in Thailand. The morbidity rate has been 86.5 per 100,000 population (Kanchanaburi Provincial Public Health Office, 2003). This is higher than the national target of less than 60 per 100,000 population (Ministry of Public Health, 2002). In 2003, among the districts of Kanchanaburi, Mueang district had the highest incidence of DHF. This action research was conducted in two villages of Mueang to assess the effectiveness of a community-based empowerment program (CBEP) regarding the change of knowledge, perceived susceptibility, self-efficacy about DHF, and larval survey practices, CI, HI, and BI of the study village.

MATERIALS AND METHODS

One Vang Yen sub-district village and one Ban Kao sub-district village of Mueang district were selected as the study sites. Key community stakeholders of the Vang Yen village, the experimental area, were identified. They were village health volunteers, the village headman, community schoolteachers, sub-district health officers, and Tambon (sub-district) Administration Organization (TAO) members. They were empowered at the beginning of the study through a Community-based Empowerment Program (CBEP). The main strategies of the program were ongoing training activities that were developed on the basic concepts of a problem solving process: problem identification, clarification of the problem, identification of possible solutions, project development, implementation, and evaluation. Active participatory learning and action, small group discussions, brainstorming, and continuous dialogue were the main educational methods.

Each key community stakeholder planned DHF control activities with household representative members within his or her own zone. In order to enhance the learning experience through participatory learning, the activities' outputs and outcomes were reported at a monthly meeting. Program effectiveness was assessed mainly through the following indicators: knowledge gained regarding DHF was used to assess the program direct output; regular mosquito larval survey. Eliminating and controlling mosquito breeding places was used to assess the main output of the program. Reductions in CI, HI, and BI were used to assess the program outcome, as shown in the study conceptual framework (Fig 1).

The research instruments were an interview questionnaire and a larval survey form. The questionnaire consisted of four parts, socio-demographic variables, knowledge of DHF, perceived susceptibility and self-efficacy, and behavioral practices in controlling and eliminating mosquito breeding places, as well as regular larval surveys. The Cronbach's alpha coefficient method (Rosenthal and Rosnow, 1991) was employed to assess the reliability of the questionnaire. Quantitative data collection was done at pretest and posttest using the questionnaire. Mosquito larval surveys were conduced at the beginning, middle, and end of the program. Qualitative data were collected from the stakeholders and selected household representatives through home visits.

Univariate analysis was performed for demographic variables. The Student's *t*-test was conducted to examine differences in knowledge, perception, self-efficacy, and larval survey practices between the experimental and the comparison groups. Variables found to be highly associated (Beta value) with the larval survey practices were considered for inclusion in the multivariate model. Multiple Classification Analysis

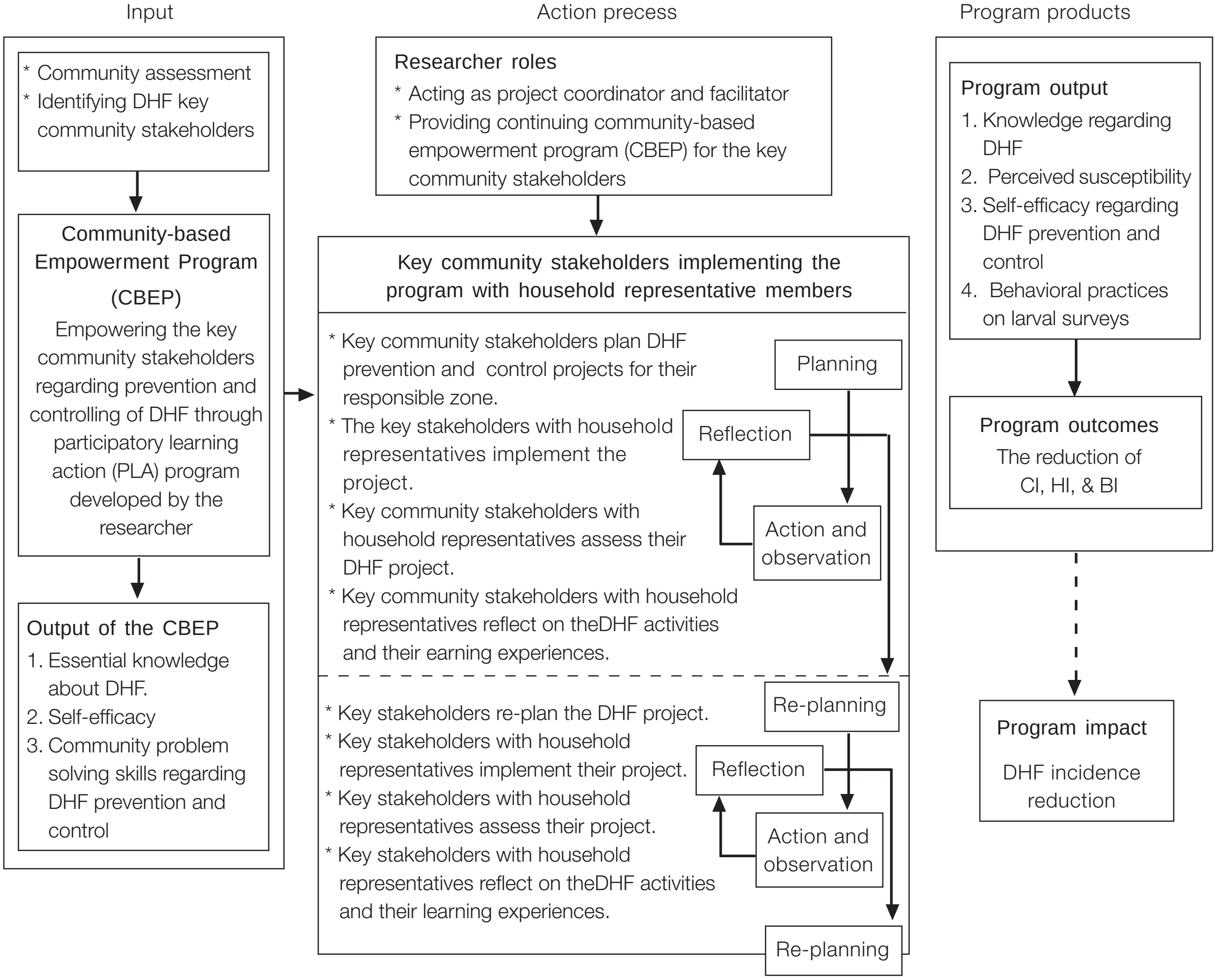

Fig 1–Conceptual framework of the community-based approach for the prevention and control of DHF.

(MCA) (Andrews, 1981) was used to determine important factors, adjusting for all variables in the model in predicting larval survey behavior.

RESULTS

The study samples were comprised of 53 (18.5%) key community leaders and 234 (81.5%) representatives of household members. A majority were female (55.4 %), age 30-49 years (53.7%). About 69.0% were married, having an educational level of Prathom Suksa (Grade 6) or lower (52.3%). They were farmers (28.9%) and unskilled labors (32.1%) with monthly incomes of ≤3,000 baht (about US$75) (41.8%). When the experimental and control groups were compared on these demographic variables using the chi-square (χ^2) test, they were not significantly different except for age and occupation (Table 1). The test was essential for the next bivariate analysis, namely the *t*-test of knowledge regarding DHF, perceived susceptibility to DHF, self-efficacy in the control and elimination of mosquito breeding places, and larva survey practices between the two study groups to examine the effectiveness of the study program, since the demographic variables in the study could affect the output variables.

Table 1
Number and percentage of the study samples by demographic variables.

Demographic variables	Experimental group (n=132)		Comparison group (n=155)	
	n	%	n	%
Gender				
Male	61	46.2	67	43.2
Female	71	53.8	88	56.8
χ^2=0.257 p-value=0.612				
Age (Year)				
≤29	8	6.1	20	12.9
30-49	71	53.8	83	53.5
50-59	37	28.0	25	16.1
>60	16	12.1	27	17.4
Mean		*47.2*		*45.2*
SD		*12.3*		*13.7*
χ^2=9.432 p-value=0.024				
Marital status				
Single	13	9.8	20	12.9
Married	95	72.0	103	66.5
Divorced	24	18.2	32	20.6
χ^2=1.015 p-value=0.314				
Education level				
Prathom (Grade 6)	64	48.5	86	55.5
Mathayom (Grade 12)	45	34.1	53	34.2
Higher than mathayom (>Grade 12)	23	17.4	16	10.3
χ^2=3.314 p-value=0.191				
Occupation				
Farmer	57	43.2	26	16.8
Employee	33	25.0	59	38.1
Other jobs	17	12.9	22	14.2
Unemployed	25	18.9	48	31.0
χ^2=5.132 p-value< 0.01				
Monthly income (bath/month)				
≤3,000	64	48.5	56	36.1
3,001-5,000	37	28.0	60	38.7
>5,000	31	23.5	39	25.2
Mean		*5079.5*		*5112.3*
SD		*5110.2*		*4854.9*
χ^2=5.091 p-value=0.078				
Community status				
Community leaders	32	24.2	21	13.5
Community members	100	75.8	134	86.5

The test of significance between the mean scores of the output variables in the experimental and comparison groups both before and after the experiment are summarized in Table 2. The minimum and maximum possible knowledge scores regarding DHF are 0 and 12, respectively. Before the experiment, the comparison group had a little higher knowledge mean score (7.09) than the experimental group (6.87) but this was not significantly different (p-value=0.383). After the study, the experimental group gained a significantly higher knowledge mean score (from 6.87 to 9.58) than the comparison group (from 7.09 to 7.46) with a p-value less than 0.01. This significant difference in the mean scores is the same as the mean scores of perceived susceptibility, self-efficacy, and weekly larval surveys. It should be pointed out that the mean scores of the perception and the self-efficacy of the two study groups before the experiment were quite high (the maximum possible scores for the perception and the self-efficacy are 12 and 33).

The CI, HI, and BI of the two study groups for the first, second, and third surveys are summarized in Table 3. During the first survey, before the experiment, both study groups had a CI, HI, and BI higher than the national maximum target for CI and HI=10, and BI=50. The CI, HI, and BI of the experimental group were slightly higher than the comparison group. When the CI, HI, and BI of the first, second, and third surveys were compared, it was found that only the CI, HI, and BI of the experimental group were decreasing. The larval indexes of the experimental group during the third survey and after the experiment were lower than these of the national target (CI=3.2, HI=6.8, BI=49.2) while the comparison group's were higher (CI=19.5, HI=60.0, BI=276.8).

Table 4 shows the Container Index for the main *Aedes aegypti* breeding places in the study areas during the first, second, and third surveys. During the first survey, the top five *Aedes aegypti* breeding places in the experimental area were small discarded items that were identified as garbage (such as used bottles, used cans, plastic bags, coconut shells and broken jars), toilet water storage, outside small household jars, inside small household jars, and a cement water storage casing. The top five breeding places in the comparison area were nearly the same as the experimental area. They were small discarded items, outside household small jars, toilet water storage, inside small household jar, and flower pot plates. The CI of these *Aedes aegypti* breeding places in the comparison area did not decrease noticeably. Some of them increased

Table 2
Comparison of knowledge, perception about DHF, and self-efficacy in controlling of DHF. Mean scores between the experimental and comparison groups before and after the experiment.

	Experimental group (N=132)		Comparison group (N=155)		*t*-value	df	p-value
	$\bar{x}$	S.D.	$\bar{x}$	S.D.			
Knowledge							
Before experiment	6.87	2.17	7.09	2.06	0.88	285	0.383
After experiment	9.58	1.79	7.46	1.87	9.77	285	<0.001
Perception							
Before experiment	9.45	1.82	9.35	1.89	0.48	285	0.63
After experiment	11.27	1.31	9.67	1.51	9.63	285	<0.001
Self-efficacy							
Before experiment	29.10	4.31	28.50	4.94	1.109	285	0.282
After experiment	31.71	2.21	29.21	3.88	6.56	285	<0.001
Larva survey practices							
Before experiment	0.30	0.46	0.34	0.46	0.702	285	0.484
After experiment	0.90	0.31	0.39	0.49	10.37	285	<0.001

Table 3
Container Index (CI), House Index (HI), and Breteau Index (BI) of the experimental and comparison groups at the first, second, and third surveys.

Study groups	CI			HI			BI		
	First survey	Second survey	Third survey	First survey	Second survey	Third survey	First survey	Second survey	Third survey
Experimental group (n=132)	21.3	4.1	3.2	77.3	19.7	6.8	367.4	100.7	49.2
Comparison group (n=155)	20.3	20.1	19.6	67.7	61.3	60	261.6	259.3	276.8

First survey: June 2004; Second survey: February 2005; Third survey: June 2005

during the second and third surveys.

The results of multivariate analysis using Multiple Classification Analysis (MCA) are summarized in Tables 5-8. Since MCA is an additive model, variables that were either significant or had a higher Beta value on the first analysis were included in the final analysis model. For the first data survey (pretest), about 27% of the variation in the larval survey practices of the study samples could be explained by all the predictors in the model (Multiple R^2 = 0.270). The grand mean of the larval survey practices was 0.303 and the standard deviation was 0.460. The community status of the samples was the best predictor in this analysis (Beta=0.469). The samples that were key community stakeholders performed higher larval survey practices than the representative household members (unadjusted predicted mean for the key stakeholders = 0.7547, adjusted for factors = 0.7564, while the unadjusted predicted mean for the representative household members = 0.2009, adjusted for factors = 0.2005). Without taking into account the effects of other predictors, about 21.9% of the larval survey practices could be explained by the community status variable (Eta=0.468). The second best predictor in the model was the educational level (Beta=0.179). Samples that had a higher educational level performed a better larval survey practices. The third best predictor in the model was the sex of the samples (Beta=0.089). Male samples seem to performed

Table 4
Container Index (CI) of the experimental and comparison group by mosquito breeding places.

Type of water-container	Experimental group (n=132)			Comparison group (n=155)		
	First survey	Second survey	Third survey	First survey	Second survey	Third survey
1. Small inside household jars						
Number inspected	692	692	692	458	458	458
Number positive	175	40	15	115	94	74
Container Index (CI)	25.3	5.9	2.2	25.1	20.9	16.6
2. Small outside household jars						
Number inspected	325	325	319	318	318	317
Number positive	95	22	13	83	112	88
Container Index (CI)	29.2	6.8	4.1	26.1	35.2	27.8
3. Large outside household jars						
Number inspected	386	386	383	199	199	199
Number positive	11	8	12	2	14	8
Container Index (CI)	2.8	2.1	3.1	1.0	7.0	4.0
4. Cement water storage casings						
Number inspected	160	160	160	93	93	93
Number positive	34	20	7	16	24	32
Container Index (CI)	21.3	12.5	4.4	17.2	25.8	34.4
5. Toilet water storage						
Number inspected	239	239	239	246	246	249
Number positive	108	17	11	64	63	66
Container Index (CI)	45.2	7.1	4.6	26	25.6	26.5
6. Ant trap for food cup board						
Number inspected	128	128	128	236	236	236
Number positive	16	4	0	36	27	30
Container Index (CI)	12.5	3.1	0	15.3	11.4	12.7
7. Flower vase						
Number inspected	122	124	131	123	124	128
Number positive	3	0	2	9	12	6
Container Index (CI)	2.5	0	1.5	7.3	9.8	4.7
8. Flower pot plate						
Number inspected	12	12	13	45	43	45
Number positive	2	0	0	11	15	8
Container Index (CI)	16.7	0	0	24.4	34.8	17.7
9. Used tire						
Number inspected	126	117	116	135	130	122
Number positive	13	7	8	12	16	18
Container Index (CI)	10.3	6.0	6.9	8.9	12.3	14.7
10. Other discarded water-containers						
Number inspected	84	60	53	141	105	305
Number positive	40	15	3	57	25	91
Container Index (CI)	48.6	25	5.7	40.4	23.8	29.8
Over all CI	21.3	5.9	3.2	20.3	20.6	19.9

First survey: June 2004; Second survey: February 2005; Third survey: June 2005;

Table 5
Analysis of variance for larval survey practices for 8 predictors before the experiment.

		Hierarchical method				
		Sum of squares	df	Mean square	F	Sig (p-value)
Main effects	(Combined)	16.396	17	0.964	6.085	<0.001
	Study villages	0.000	1	0.000	0.000	0.997
	Community status	13.513	1	13.513	85.259	<0.001
	Gender	0.336	1	0.336	2.120	0.148
	Age	0.066	3	0.022	0.139	0.937
	Education level	1.727	2	0.863	5.448	0.005
	Knowledge	0.249	3	0.083	0.524	0.667
	Perceived susceptibility	0.274	3	0.091	0.577	0.631
	Self-efficacy	0.231	3	0.077	0.487	0.692
	Model	37.488	140	0.268	1.690	0.001
	Residual	23.139	146	0.158		
	Total	60.627	286	0.212		

larval survey practices better than females. The predicted means for both the unadjusted and adjusted factors for males were higher than the grand mean, while the females were lower.

The post-test survey data were also analyzed using MCA. About 30% of the variation in the larval survey practices in the study samples could be explained by all predictors in the model (Multiple R^2=0.298). The grand mean for the larval survey practices was 0.631 and the standard deviation was 0.484. It was found that samples who participated in the study program activities performed more frequent larval survey practices than the samples who did not (Beta=0.455, Eta=0.518). The second best predictor on the post-test analysis was knowledge regarding DHF (Beta=0.096, Eta=0.331). The age of the sample was the third best predictor (Beta=0.019, Eta=0.033). The samples in the experimental area had a quite higher predicted mean for both the unadjusted and adjusted factors than the grand mean. Male, key community stakeholders, the samples with older age, having a higher level of knowledge, perception, and self-efficacy had higher predicted means than other group categories and the grand mean.

DISCUSSION

DHF has been a major public health problem for the past 30 years (Ministry of Public Health, 2002). Efforts to control *Aedes* mosquitoes have been redirected from local health services at the provincial level to community-based control using village health volunteers. Efforts have not been effective and DHF is still a major health problem in all areas of the country. The one cost-effective measure that provides effective disease control over the long run is involving the persons who are responsible for creating or tolerating *Aedes aegypti* larval habitats in the local community environment in control or elimination of those habitats. They will learn that it is in their best interest to participate with other members of their community to create community ownership of their program (Gubler and Clark, 1996).

The two villages of Mueang district in Kanchanaburi that had the highest incidence of DHF were selected to assess the effectiveness of a community-based approach for the prevention and control of DHF through action research. The data regarding the output variables, namely, knowledge regardingt DHF, perception of susceptibility to DHF, self-efficacy in control or elimination of mosquito breeding places, and regular larval survey practices strongly supported the effectiveness of the program. After the program, the mean scores of all the outcome variables of the experimental group were significantly higher than before the experiment and in the comparison group. Larval survey practices of the

Table 6
Multiple Classification Analysis (MCA) of larval survey practices by 8 predictors before the experiment.

Predictors	n	Predicted mean		Deviation from grand mean	
		Unadjusted	Adjusted for factors	Unadjusted	Adjusted for factors
Study villages	Eta≤0.001, Beta=0.080				
Experimental village	132	0.303	0.263	-0.001	-0.040
Comparison village	155	0.303	0.337	0.001	0.034
Community status	Eta=0.468, Beta=0.469				
Household members	234	0.201	0.201	-0.102	-0.103
Community leaders	53	0.755	0.757	0.452	0.453
Gender	Eta=0.110, Beta=0.089				
Male	128	0.359	0.349	0.056	0.045
Female	159	0.258	0.267	-0.045	-0.037
Age (Year)	Eta=0.100, Beta=0.080				
≤29	28	0.250	0.351	-0.053	0.048
30-49	154	0.331	0.325	0.028	0.022
50-59	62	0.322	0.274	0.019	-0.029
60^{+}	43	0.209	0.236	-0.094	-0.067
Education level	Eta=0.190, Beta=0.179				
Prathom (Grade 6)	150	0.293	0.327	-0.010	0.024
Mathayom (Grade 12)	98	0.235	0.205	-0.068	-0.098
Higher than Mathayom (>Grade 12)	39	0.513	0.456	0.210	0.153
Knowledge regarding DHF	Eta=0.116, Beta=0.074				
Low	72	0.356	0.360	0.002	0.057
Moderate	100	0.260	0.288	-0.043	-0.015
High	78	0.295	0.273	-0.008	-0.031
Very high	37	0.432	0.297	0.129	-0.006
Perceived susceptibility	Eta=0.138, Beta= 0.062				
Low	50	0.260	0.298	-0.043	-0.005
Moderate	95	0.232	0.266	-0.072	-0.037
High	86	0.361	0.327	0.057	0.023
Very high	56	0.375	0.335	0.072	0.032
Self-efficacy	Eta=0.166, Beta=0.065				
Low	64	0.234	0.326	-0.069	0.225
Moderate	94	0.277	0.330	-0.027	0.027
High	63	0.270	0.256	-0.033	-0.047
Very high	66	0.439	0.288	0.136	-0.015

Grand mean=0.303; Standard deviation=0.460; R-squared (Unadjusted) 0.520; Multiple R-squared (Adjusted) 0.270

samples in the experimental village increased three times. These figures were not found among the samples in the comparison village. These changes of the experimental group were caused by the community-based empowerment program that allowed the key community stakeholders to actively participate in continuing education activities starting from conducting a community survey, identifying the problem, planning, action and observation, reflection, and re-planning with the sub-district health officers and researcher. Representatives of each household developed the control or elimination of mosquito breeding places and weekly larval survey activities with the assistance of the key stakeholders of that village zone. The activities at the household level were more specific to each household context, specifically the mosquito breeding places. The activities were also developed around the basic concept of the problem solv-

Table 7
Analysis of variance for larval survey practices for 8 predictors after the experiment.

		Hierarchical method				
		Sum of squares	df	Mean square	F	Sig (p-value)
Main effects	(Combined)	19.900	16	1.244	7.579	<0.001
	Study villages	17.930	1	17.930	109.263	<0.001
	Community status	0.072	1	0.072	0.441	0.508
	Gender	0.015	1	0.015	0.093	0.761
	Age	0.560	3	0.187	1.136	0.336
	Education level	0.188	2	0.094	0.572	0.566
	Knowledge	0.723	3	0.241	1.469	0.225
	Perceived susceptibility	0.309	3	0.103	0.627	0.598
	Self-efficacy	0.103	2	0.051	0.312	0.732
	Model	40.430	125	0.323	1.971	<0.001
	Residual	26.421	161	0.164		
	Total	66.850	286	0.234		

ing process. In this case, the activities were started from mapping of possible breeding places of mosquitoes in and around the house, identification of the breeding places, identification of possible solutions, implementation the selected solutions, monitoring and evaluation of the implementation outcomes through regular larval surveys. Besides these activities, the learning experiences of each key community stakeholder were shared and discussed in a monthly meeting in the village. The experiences were used as the inputs for project activities monitoring and re-planning.

The outcome variables, namely CI, HI, and BI, strongly confirmed the effectiveness of the study program. These three larval indices in the experimental village decreased from the first survey (before the experiment) to the third survey (after the experiment), to be lower than the maximum national target. This was due to the regular weekly larval survey practices among the household representative members, as well as the periodic sampling of mosquito larvae conducted by the stakeholders and the researcher. It should be mentioned that the CI for each type of mosquito breeding places in the experimental village during the third larval survey was lower than 10. There were no mosquito larvae found in any traps in the food cupboards or flower pot plates.

From the MCA analysis, before the experiment the community status of the study samples was the best predictor of larval survey behavior practices. More practices were found among village health volunteers and other community leaders, since they had been working closely with the sub-district health officers of their village. One of their responsibilities was the control of communicable diseases in their village, DHF has been perceived as one of their community health problems. After experimentation, type of study area was the best predictor. Households in the study village performed more regular larval surveys, about two times that of the comparison village. It can be inferred that the significantly higher number of larval surveys was directly affected by empowering key community stakeholders, specifically village health volunteers and community leaders, through on-going active learning and problem solving, which was designed for the experimental village.

Knowledge, perception, and self-efficacy did not significantly predict the larval survey for this analysis model. Self-efficacy was more reliable in explaining larval survey practices, since the practices were in concordance with the self-efficacy level. Over 70% of the samples having high levels of self-efficacy did regular larval surveys. According to Bandura's social cognitive theory (1986), individuals possess a self-belief

Table 8
Multiple Classification Analysis (MCA) of larval survey practices by 8 predictors after the experiment.

Predictors	n	Predicted mean		Deviation from grand mean	
		Unadjusted	Adjusted for factors	Unadjusted	Adjusted for factors
Study villages	Eta=0.518, Beta=0.455				
Experimental village	132	0.902	0.868	0.271	0.238
Comparison village	155	0.400	0.428	-0.231	-0.203
Community status	Eta=0.104, Beta=0.045				
Household members	234	0.607	0.620	-0.024	-0.010
Community leaders	53	0.736	0.676	0.105	0.454
Gender	Eta=0.033, Beta=0.019				
Male	128	0.648	0.641	0.018	0.010
Female	159	0.616	0.622	-0.014	-0.008
Age (Year)	Eta=0.122, Beta=0.087				
≤29	28	0.464	0.575	-0.166	-0.056
30-49	154	0.630	0.636	-0.001	0.006
50-59	62	0.677	0.585	0.047	-0.046
60+	43	0.674	0.713	0.044	0.082
Education level	Eta=0.046, Beta=0.068				
Prathom (Grade 6)	150	0.640	0.661	0.010	0.031
Mathayom (Grade 12)	98	0.602	0.603	-0.029	-0.028
Higher than Mathayom (>Grade 12)	39	0.667	0.583	0.036	-0.047
Knowledge regarding DHF	Eta=0.331, Beta=0.096				
Low	58	0.396	0.559	-0.234	-0.071
Moderate	96	0.552	0.609	-0.077	-0.021
High	73	0.753	0.683	-0.123	0.052
Very high	60	0.833	0.670	0.203	0.039
Perceived	Eta=0.331, Beta= 0.066				
Low	73	0.438	0.592	-0.192	-0.038
Moderate	70	0.514	0.627	-0.116	-0.003
High	34	0.706	0.703	0.075	0.072
Very high	110	0.809	0.636	0.178	0.005
Self-efficacy	Eta=0.226, Beta=0.043				
Low	101	0.485	0.609	-0.146	-0.022
Moderate	65	0.677	0.619	0.046	-0.011
High	121	0.727	0.654	0.097	0.024

Grand mean = 0.631; Standard deviation=0.484; R-squared (Unadjusted) 0.546; Multiple R-squared (Adjusted) 0.298

that enables them to exercise a measure of control over their thoughts, feelings and actions, that "what people think, believe, and feel affects how they behave. Peoples' behavior can often be better predicted by the beliefs they hold about their capabilities than by what they are actually capable of accomplishing, for these self-efficacy perceptions help determine what individuals do with the knowledge and skills they have." Bandura (2001) suggested that individuals form their self-efficacy beliefs by interpreting information primarily from various sources. The most influential source is the interpreted result of one's previous performance, or ***mastery experience***. Individuals engage in tasks and activities, interpret the results of their actions, use the interpretations to develop beliefs about their capability to engage in subsequent tasks or activities, and act in concert with the beliefs created. Hence, active participation in empowering activities of the study plus outcomes interpreted during the monthly meeting helped the key community stakeholders and household representative members successfully raise their self-efficacy. The interaction among the key stakeholders and between the stakeholders and the researcher also enhanced the reflection and dialogue of the stakeholders (Kolb and Kolb, 2001).

In conclusion, the effectiveness of the study program was clearly proved by univariate, bivariate, and multivariate data. Empowering key community stakeholders through active participation in on going activities played a great role in program success. Working for DHF prevention and control in the village as a partnership among primary, secondary, and tertiary stakeholders was also crucial. The increasing number of regular mosquito larval surveys led to a sharp reduction in CI, HI, and BI, which in turn decreased the risk of DHF transmission. Therefore, DHF prevention and control programs at the district and sub-district health level should be more proactive. Direct learning experiences of community stakeholders should be focused on the village level. Monitoring of DHF or other diseases control programs should be done regularly either in the village or at the health care center during monthly meetings using dialogue and discussion. Local health officers need to be empowered as well.

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