DENGUE RISK FACTORS AND COMMUNITY PARTICIPATION IN BINH THUAN PROVINCE, VIETNAM, A HOUSEHOLD SURVEY

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Abstract. To look for risk factors for dengue and community participation in dengue control in Binh Thuan Province, Vietnam, three communes with a low incidence of dengue and three with a high incidence, in Binh Thuan Province, were compared. Knowledge, perception and preventive practice of dengue were measured by means of a structured questionnaire. A check list of environmental observations was used to evaluate environmental factors. Focus group discussion was conducted to evaluate perceptions of key factors for dengue vector control and community participation. One hundred ninety households in 6 communes were included in the study. Several statistically significant differences between low and high incidence communities were identified. The factors associated with a higher risk of dengue fever on the logistic regression were occupation (farmer) (RR 7.94; 95%CI 2.29-27.55), number of children less than 15 years old in the household (RR 1.54; 95%CI 1.06-2.23), no experience with dengue fever in the household (RR 2.334; 95%CI 1.12- 4.88), a garden near the house (RR 2.22; 95% CI 1.18-4.17) and water containers having mosquito larvae (RR 1.64; 95%CI 1.02-2.62). Television was the most important source of information. There were differences in risk factors for dengue among communes with low and high incidences. Communication regarding dengue prevention should be improved in high incidence communes. Community participation in dengue vector control should be promoted to make the dengue control programs more efficient with greater coordination of resources.

INTRODUCTION

Dengue fever and dengue hemorrhagic fever (DF/DHF) are among the leading causes of disease in Vietnam. Since 1963, the number of reported cases has steadily increased. During the dengue pandemic of 1998, 1.2 million cases were reported in 56 countries, southern Vietnam was severely hit with 234,866 reported cases (439 cases/100,000 population) and 342 deaths (Ha *et al,* 2000). In a recent study we showed the incidence of primary infections has been quite stable over the past decade (Thai *et al,* 2005). In 2002, 31,754 cases with 52 deaths were reported in southern Vietnam. In 2003, these numbers were 31,754 and 72, respectively (WHO, 2004, 2005). Since then, the National Dengue Fever Control Program was launched in Vietnam. This program aims to promote health education and communication, strengthen the role and responsibilities of steering committees at different levels and to improve surveillance, early diagnosis and treatment.

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Similar to when Surgeon General William Crawford Gorgas (http://history.amedd.army.mil/tsgs/Gorgas.htm) tried to change undisciplined domestic behavior in workers on the Panama canal, a top down approach to public health services to control the aedes mosquito is not always popular and nearly unfeasible in large urbanized areas. Community participation is therefore pivotal for effective dengue vector control (Parks and Lloyd, 2004). It is surprising to realize that in Vietnam, where community participation has always been such a strong component of the public health services, a national dengue control program was launched significantly later than in surrounding countries (Cheng, 2005; Phuanukoonnon *et al,* 2005) while the National Malaria Control Program, initiated in 1992, received compliments for being so successful (Hung *et al,* 2002; Nam *et al,* 2005). The main reason was the mortality rate of malaria dictated prioritization over dengue, as well as the different social and political determinants of dengue and malaria vector control. In Asia, anopheles mosquitoes live mainly in forested areas, and malaria is typically a disease that "descends out of the dark" (of the forest) on poor inhabitants of rural and forested areas. In contrast, aedes thrives on the small improvements in housing that people make following economic progress, such as replacing a thatched roof with a corrugated roof with gutters and barrels to collect water. To a certain extent, dengue transmission is a consequence of human behavior and therefore its control requires strong community participation.

In Binh Thuan Province, southern Vietnam, dengue fever is responsible for one-third of cases of acute undifferentiated fever (Phuong *et al,* 2006b). The estimated annual incidence of cases of dengue fever in this province is 11.7% (Thai *et al,* 2005). Cases of complicated dengue are routinely notified to the Provincial Center for Preventive Medicine, mostly without laboratory confirmation. The annual incidence of notified cases of complicated dengue fever varied in communities from 0.2/1,000 to 7.9/1,000 population between 1999 and 2003.

To investigate household conditions, knowledge and perceptions about dengue, which are possible determinants of community participation in dengue control, we conducted this study. The differences were observed in these incidence data between communities provided the opportunity to analyse risk factors by comparing communities with high and low incidence data.

MATERIALS AND METHODS

Study site and population

The study was performed in Binh Thuan Province with a population of 1.12 million persons, in 206,748 households, in an area of 7,992 km^2. The reported DF/DHF incidences for the years 1999 through 2003 are shown in Fig 1. Incidence data over these years were averaged and six communities (three with high mean incidence data and three with low mean incidence data), that were more or less equally accessible for household surveys, were selected and compared. Cooperation by local authorities was also an additional criterion for selection. A low incidence community was

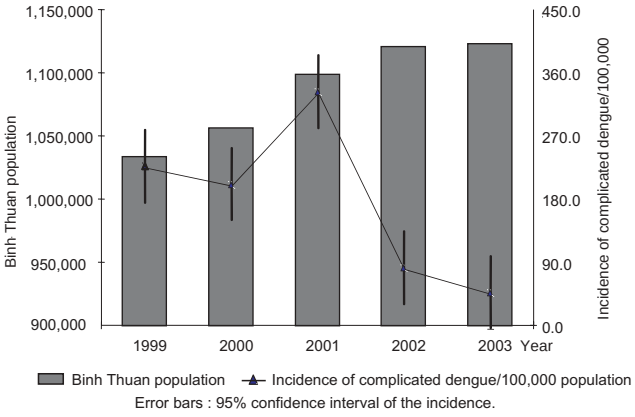

Fig 1–Incidence of complicated dengue in Binh Thuan Province from 1999 to 2003.

defined as having less than 3 new reported cases of DF/DHF per 1,000 people per year; a high incidence was defined as more than 5 new cases per 1,000 people per year.

Sample size calculation

Since there were no available data in Vietnam about knowledge of dengue infection related to using preventive measures, data from Thailand (van Benthem *et al,* 2002) was used with assumption that 60% of respondents in the low incidence communities would have taken some preventive measures. A sample size of 90 households in both groups (sample size calculation for proportions) was regarded as sufficient to detect a difference of 25% in high incidence communities, with statistical significance. Persons with knowledge of dengue reported a significantly higher use of prevention measures than persons without knowledge of dengue.

Sampling method

To recruit households within those communities for participating in the study, a notice was sent to the people's committees of the communes to inform all households about the study in order to obtain cooperation. Thirty households in each community were selected in such a way that the geographic area of the village was completely covered in a more or less random pattern.

Collection of information regarding risk factors

Information was collected in three ways. During household surveys the household environment was assessed using a printed checklist to record indoor and outdoor observations. Basic information regarding family composition and socio-economic status, knowledge, perception and preventive practices regarding dengue fever were collected by means of questionnaire. In each household, an adult (>18 years old, preferably the mother) was interviewed.

The interview was conducted by a trained staff member of the provincial Malaria and Goiter Control Center and a trained staff member of the local community primary health facility. A structured questionnaire was used consisting of five parts: (1) General verbal information (age, sex, ethnicity, religion, occupation, and number of family members in the same house, living conditions, income and debts); (2) Knowledge on dengue fever (mosquitoes, larvae, disease, and prevention); (3) Perception on dengue fever (susceptibility, severity, benefits, and barriers); (4) Preventive practice; (5) Sources of information on dengue.

Knowledge was assessed by 51 questions regarding mosquitoes and larvae (14 questions), infection (25) and prevention (12). These questions could be answered with a "yes" (scoring 1 point), "no" or "don't know" (both scoring no points), yielding a maximum score of 51. Knowledge was classified as "good" when 80% or more of the answers were correct, between 60% and 80% as "moderate" and below 60% as "needs improvement".

To assess whether perception of dengue agreed with the biomedical concept of susceptibility and severity of disease, perceived benefits and barriers, 15 questions were asked that could be answered with "agree" (3 points), "uncertain" (2 points) and "disagree" (1 point), for positive statements and "agree" (1 point), or "disagree" (3 points) for negative statements, whereby a total score of 45 could be reached. The totals were classified into three groups, using similar ranges for classification of knowledge: agreement with the biomedical paradigm of dengue, in doubt, and disagreement with the biomedical paradigm.

Preventive practices regarding dengue were evaluated by 9 questions that could be answered with "always" (2 points), "sometimes" (1 point) or "never" (0 points), for a maximum of 18 points. Using similar ranges, the results were classified as taking maximal, moderate or minimal preventive measures. Reported sources of information were tallied and handled as proportions.

The questionnaire and environmental checklist were pre-tested in 10 households in a high incidence commune and these were included in the final results so that 90 households participated in the low incidence group and 100 households in the high incidence group. They were informed of the objectives of the study and agreed to participate in the interview and to have observations made of the home surroundings.

In addition, two focus group discussions, one in the low incidence community (Ham Hiep) and one in the high incidence community (Ham Kiem), were organized with participation of key informants. The discussions concentrated on community participation in vector control. Key informants were representatives of the People's Committee, health post, women union, farmer union, youth union and village health workers (Maynard-Tucker, 2000; Webb and Kevern, 2001).

Data handling and statistics

Data collected during the household survey were handled as variables of the unit of investigation, the household. The knowledge, attitudes and perceptions of the respondents were regarded as representative of the entire household. The age and gender of the respondents were used to control for comparability of the low and high incidence groups. Frequencies were calculated to describe variables. The chi-square test was applied to compare, in a univariate way, the frequencies of categorical data between the two groups. A multivariate binary logistic regression model was used to explore the factors associated with the incidence of dengue fever. Statistical analysis was done using SPSS (version 12.02, SPSS, Illinois).

Ethical considerations

This study was approved by the Binh Thuan Provincial Health Service and the People's Committees of the participating communities. Verbal consent for household interviews and environmental observations was obtained from respondents at their homes.

RESULTS

One hundred ninety households participated, 90 in the three low incidence communities and 100 in the high incidence communities.

Household environments

The types of housing and indoor factors were not different between the two groups. Having a garden near the house (34.4% *vs* 55% in the low incidence and high incidence group, respectively), having an animal shelter near the house (21.6% *vs* 45%) and having rubbish around the house (29.4% *vs* 44.3%) were significant differences between two groups ($p < 0.05$). In the low incidence group there were fewer households with water containers than in the high incidence group (87.8% *vs* 97%, $p < 0.05$) but the mean number of water containers per household was not significantly different. Aedes larvae were found in 15.6% of the households in the low incidence group and in 25% of the households in the high incidence group, a difference that did not reach statistical significance.

On multivariate binary logistic regression analysis, having a garden near the house and water containers having larvae, were associated with a high incidence of dengue fever. (RR 2.22; 95% CI 1.18-4.17; p=0.013 and RR 1.64; 95%CI 1.02-2.62; p=0.040, respectively).

General information obtained by questioning

Univariate comparison of answers to the general questions about the household showed in high incidence communities there were more farmers (53% *vs* 14%), more Buddhists (42% *vs* 24%), more people with only primary education (36% *vs* 20.5%), more families having more than 3 young (<15 years) children (21.6% *vs* 9%) and more households with financial debt (15% *vs* 2%) while in the low incidence area there were more households

Table 1
The level of knowledge of dengue fever in communities with high and low dengue incidences.

	Communes		p- value[a]
	Low incidence *n* (%)	High incidence *n* (%)	
Knowledge overall			0.046
Good knowledge	14 (15.6)	19 (19.0)	
Moderate	69 (76.7)	62 (62.0)	
Needs improvement	7 (7.8)	19 (19.0)	
Median score (90th percentile)	38.0 (42)	36.9 (41.0)	
Min-Max	15 - 43	11 - 45	
Knowledge on mosquito and larvae			0.213
Moderate	54 (60.0)	51 (51.0)	
Needs improvement	36 (40.0)	49 (49.0)	
Knowledge on disease			0.273
Good knowledge	22 (24.4)	26 (26.0)	
Moderate	54 (60.0)	50 (50.0)	
Needs improvement	14 (15.6)	24 (24.0)	
Knowledge on prevention			0.451
Good knowledge	86 (95.6)	93 (93.0)	
Moderate and needs improvement	4 (4.4)	7 (7.0)	

[a]by chi-square test

with televisions (97.8% *vs* 90%) and persons who previously had dengue fever (45% versus 30%) (all p<0.05). Other characteristics, such as the number of household members, the presence of a toilet, radio or electricity and the source of water) were not statistically different.

Applying multivariate binary logistic regression with high and low incidence treated as dependent variables, being a farmer (RR 7.94; 95%CI 2.29-27.55, p=0.001), the number of children under 15 years old in the house (RR 1.54; 95%CI 1.06-2.23, p=0.045) and no recall of having had dengue fever (RR 2.334; 95%CI 1.12-4.88, p=0.024) were associated with a higher incidence, while the total number of household members was associated with a lower incidence (RR 0.76; 95%CI 0.62-0.95; p=0.013). Religion, education, having a television or radio, monthly income, and financial debt were not associated with the incidence of reported dengue cases.

Knowledge of dengue fever

In general, respondents in the low incidence group had a greater understanding than respondents in the high incidence group. Table 1 shows the results classified into three groups according to their need for health education. Understanding of prevention was good in both groups (95% and 93%) but there were some discrepancies in understanding the symptoms and signs of disease; in the low incidence group, 7.8% of the respondent's knowledge was classified as needing improvement versus 19% in the high incidence group. The level of knowledge of mosquitoes and larvae was insufficient in both groups.

Perception of dengue fever

Even more than knowledge, people's perceptions of dengue need illustration with the raw data given in Table 2. Table 3 shows the

Table 2
Perceptions on dengue infection in communes with low and high incidences.

	Commune					
	Low incidence (%)			High incidence (%)		
	Agree	Uncertain	Disagree	Agree	Uncertain	Disagree
Perceived susceptibility and severity of disease						
Young child is more at risk to dengue than elderly	90.0	5.6	4.4	87.0	10.0	3.0
All people are vulnerable if there is a dengue case	66.7	16.7	16.7	55.0	23.0	22.0
People are more at risk for dengue in the rainy season	97.8	1.1	1.1	93.0	6.0	1.0
Dengue usually is mild and self limited	17.8	45.6	36.7	4.0	41.0	55.0
Without proper treatment, dengue can lead to severe infection or death	96.7	2.2	1.1	93.0	6.0	1.0
Perceived benefits						
Dengue infecton is preventable	90.0	5.6	4.4	85.0	12.0	3.0
Sleep in bednets in daytime can prevent infection	96.7	3.3	-	90.0	8.0	2.0
Destroy stagnant water places to prevent mosquitoes from laying eggs	98.9	1.1	-	93.0	6.0	1.0
Putting larvavivorous fish in water containers	98.9	1.1	-	88.0	6.0	6.0
Cover water containers to prevent mosquitoes from laying eggs	98.9	1.1	-	93.0	6.0	1.0
Innoculation of children to prevent dengue infection	84.4	10.0	5.6	84.0	13.0	3.0
Perceived barriers						
There is no time to change water regularly	10.0	2.2	87.8	19.0	8.0	73.0
It is not easy to fill in all stagnant water places	11.1	4.4	84.4	19.0	9.0	72.0
It is harmful to spray insecticide in the house	30.0	12.2	57.8	26.0	25.0	49.0
It is unconvenient to sleep in bednets during the daytime	53.3	5.6	41.1	50.0	14.0	36.0

classification into levels of agreement with the biomedical model, analysed by incidence group. Although perceptions about dengue fever agree fairly well with the biomedical paradigm, which is the basis for the dengue control program, in both groups, it tended to agree more with the low incidence group. In the high incidence group there were more "uncertain" answers than in the low incidence group. People's perceptions disagreed most regarding the severity of disease: 36.7% and 55% of respondents in the low and the high incidence groups, respectively, assumed that dengue was not a mild and self limited disease. More than 80% in both groups agreed that vaccination would be a good preventive measure for children once this became available.

Dengue preventive practices

All respondents in the low incidence group answered they always kept the house and environment clean and covered all water containers; but only 24% in the high incidence group did. There was a significant difference regarding preventive practice between the 2 groups ($p = 0.003$). In the low incidence group 4.4% of the respondents needed to improve their practice versus 21% in the high incidence group (Table 4).

Sources of information about dengue fever

The most important source of information about dengue fever for both groups was television. There were no differences between the two groups in regards to television, radio,

Table 3
Agreement of perceptions regarding dengue fever with the biomedical paradigm in communities with low and high incidence of reported dengue.

Agreement of perceptions with biomedical paradigm	Communes		p- value[a]
	Low incidence *n* (%)	High incidence *n* (%)	
Overall			0.031
Maximal	82 (91.1)	80 (80)	
Moderate	8 (8.9)	20 (20)	
Median score (90th percentile)	40.7 (43)	39.8 (43)	
Min-Max	33 - 44	29 - 44	
Perceived susceptibility and severity			0.173
Maximal	74 (82.2)	74 (74)	
Moderate	16 (17.8)	26 (26)	
Perceived benefits			0.068
Maximal	89 (98.1)	93 (93)	
Moderate and minimal	1 (1.1)	7 (7.0)	
Perceived barriers			0.347
Maximal	59 (65.6)	62 (62.0)	
Moderate	19 (21.1)	17 (17.0)	
Minimal	12 (13.3)	21 (21.0)	

[a] by chi-square test

Table 4
The level of preventive measures for dengue in communities with low and high incidence data for reported dengue.

	Communes		p- value[a]
	Low incidence *n* (%)	High incidence *n* (%)	
Preventive practice			0.003
Maximal	32 (35.6)	32 (32.0)	
Moderate	54 (60.0)	47 (47.0)	
Minimal	4 (4.4)	21 (21.0)	
Median score (90th percentile)	13.9 (16)	12.8 (16)	
Min-Max	10 -17	5 -18	

[a] by chi-square test

local speakers, village health workers or books as to the source of information. The only difference in the source of information was in the personnel of the community health post (76% in the high incidence group, 92.2% in the low incidence group) and posters (76% and 87.8% in high and low incidence groups, respectively) (both $p < 0.05$).

Focus group discussions on community participation in vector control

All participants agreed that dengue was a serious problem because of its tendency to spread. They were well informed regarding dengue fever in their commune and they considered that dengue fever was on the decline locally.

In Ham Hiep, a commune with a low incidence, key informants said their commune had few cases of dengue because people had a good perception of the control of dengue fever and kept the environment clean, thus limiting the places suitable for dengue vector breeding and laying eggs. Actions taken included filling stagnant water places, covering water containers, and putting salt in ant traps under food cases.

In Ham Kiem, a commune with a high incidence of dengue, a system of supplying tap water to households was recently introduced and the number of water storage tanks has decreased. This resulted in a reduction in the number of places suitable for egg laying of dengue mosquitoes. It was considered that community participation was the main factor for reduction of dengue fever cases. The key informants for both communes agreed cooperation of organizations and local unions as led to control of dengue in recent years.

In both communes it was recognized that children of poor families in crowded houses were victims of dengue fever because of lack of bed nets, poor sanitation and insufficient care by parents. Both communes suggested that health education could help to alleviate this problem and for the Ham Kiem commune support for poor families and supplying tap water were suggested.

In both communes it was considered that the community had to play an important role in prevention of dengue fever because the people in the community were the victims of dengue fever, however, there were some discrepancies in beliefs regarding responsibilities and actual behavior. In Ham Hiep it was felt the people in the community had the primarily responsibility, with support from the health center and the people's committee. On the other hand, the Ham Kiem (high) commune considered that the major responsibility was with the leaders of the dengue control program and the health personnel, though all people shared this responsibility.

At the time of this discussion, in Ham Kiem community activities of cleaning the environment, covering water containers and others were organized 4 times per year with monitoring by health volunteers or members of the dengue control program. In Ham Hiep, activities were performed 2 times per year with cooperation of the dengue control program and the youth union. The two communes agreed that these activities, although effective, were not 100% successful, and were not enough to completely control dengue fever.

Dengue control in Ham Kiem was considered difficult because people live scattered over a large area and because of the relatively large number of poor families. From the discussions the following recommendations transpired: health education with activities attractive for children should be organized in schools, impregnated bed nets should be distributed to poor families and targeted insecticide spraying should be organized, participation of local health authorities should be improved in Ham Kiem, and receive a greater budget and in Ham Hiem the local cable speaker system should be improved. All realized that outbreaks of dengue fever may occur if activities of control and prevention of dengue fever were ignored.

DISCUSSION

This study shows an association between high notification rates of dengue in a community and a higher proportion of farmers, low income, lower levels of education, having more children below 15 years of age, no recall of having had dengue fever before, more water containers and more containers positive for aedes larvae. Many of these factors are related to "poverty", a risk factor for dengue that has also been reported from other regions, sush as Puerto Rico (Winch ***et al,*** 2002).

The differences in incidences of notified cases of dengue between the communities in this study may reflect other mechanisms than virus transmission and vector density. In Vietnam notification of dengue depends on clinical recognition of the disease. There are guidelines for this but it is well documented that signs and symptoms of dengue are fairly non-specific, and recognition of hemorrhagic dengue using the tourniquet test is neither specific nor sensitive (Phuong *et al*, 2002, 2006b). Differences in health seeking behavior of patients, and diagnostic and notification behavior of doctors may also influence notification rates. For example, private clinics do not notify cases of dengue hemorrhagic fever.

Information collected during household surveys may be subject to recall bias as well as differences in the way questions were asked. However, the interrogators had extensive experience with this type of surveillance and the population is familiar with this technique. The results of the questionnaires were supported by household observations and by what was observed during focus group discussions.

Household observations showed that having a garden, an animal shelter or rubbish near the house were all associated with a high incidence of dengue, similar to another study in the same area (Thai *et al*, 2005).

Important factors in the epidemiology of dengue are knowledge of the population, appreciation (perception) of the problem, preparedness to do something about it, and availability of ways and means of prevention and control. In general, knowledge of dengue fever in both communities (both low and high incidence) was moderate to good, comparable to what was found in northern Vietnam, although there, knowledge of preventive measures, assessed with comparable techniques, was less: 20% versus 70% in our study (Vu *et al*, 1998). Both studies revealed that knowledge of mosquitoes and larvae, biting and resting behavior, breeding sites and seasonal risk were insufficient. In contrast, in Thailand people were much more aware of the day biting behavior of aedes mosquitoes (van Benthem *et al*, 2002). The fact that dengue is usually a mild, self-limited disease was recognized by only 17.8% in the low incidence group and 4% in the high incidence group, while 40% of both groups were uncertain about this. The widespread occurrence of dengue as an undifferentiated febrile disease and differences in knowledge and education may have influenced this perception (Strecher and Rosenstock, 1997). How most people preceive dengue is as a complicated disease with substantial childhood mortality if not treated properly.

Another study in this province showed that self-treatment with antibiotics and antipyretics for fever was very common, and that more than 50% of the respondents did not know that aspirin should not be used in cases of suspected dengue fever (Phuong *et al*, 2006a). From these observations we may conclude that the health education program can be strengthened and adapted to the aspect of self medication.

Putting knowledge into practice remains difficult, especially when it involves customs and habits (Strecher and Rosenstock, 1997). Taking a short nap at noon is a Vietnamese habit and up to 50% of respondents consider it inconvenient to use a bednet for a nap during daytime, although they know this is a good preventive measure. About 20% in both groups always used a bed net during daytime, while 27.8% and 42% in the low and high incidence groups, respectively, never used a net during daytime. In another study, it was seen that good knowledge does not necessarily lead to good practice (Hairi *et al*, 2003).

Mass media like television, radio and newspapers are important means of conveying health messages to rural populations and have been used for dengue health education

in southern Vietnam for several years now (Bartley *et al*, 2002). In that program it was shown that the information came effectively via professional health workers (staff at the national, provincial, district, or commune level). In our study there was a difference between the low and high incidence groups in regards to information from health personnel and posters. In the high incidence group people had received less information from health personnel and had come across posters less often than in the low incidence group. The frequency, type and intensity of contact with the health sector were not examined in this descriptive study. In depth interviews could help in evaluating the effectiveness of different information sources. Exposure to posters may be useful. In Puerto Rico it was helpful in improving the protection of water storage containers from entering mosquitoes and increasing the indoor use of aerosol insecticides (Winch *et al*, 2002).

From the Focus Group discussion in the village with a high incidence of dengue (Ham Kiem) it transpired that supplying tap water and reducing the number of water storage containers were considered the most important measures to reduce and subsequently eliminate places where dengue mosquitoes could breed and lay eggs. At the time of the study, water supply in the communes was no longer different, as a tap water system had recently been installed. Changing water supplies from collection of rainwater to tap water may have a dramatic impact on the epidemiology of dengue, as was illustrated in Bangkok when housing was modernized and tap water became widely available (Chareonsook *et al*, 1999). Discussions with key informants showed that there was a good sense of the dengue situation in the communities and good knowledge of prevention and control measures. Community based vector control is an emerging new strategy for the prevention of dengue fever and other mosquito-borne diseases in Vietnam (Vu *et al*, 2005) and cooperation between the national program and local unions of women, farmers, and youth involving the whole community was considered key to successful dengue prevention efforts.

In conclusion, occupation (farmer), number of children less than 15 years old in the household, no previous experience of dengue fever in the household, a garden, and water containers having larvae were associated with the incidence of dengue in Binh Thuan Province, South Vietnam. Understanding, perceptions and preventive practices were rather good, although some aspects could be improved. Television was the major source of information. Cooperation between the national program and local unions and health staff already seems quite successful in health education and vector control but could be strengthened in some aspects. The role of village health workers in communities as a health propagandist as well as pioneers in community activities for dengue control may also be promoted. The studied communities appeared to be receptive to the concepts of dengue control and to adopt responsibility. There seems to be no significant resistance towards community participation in the dengue control program.

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