Foundation for the Peoples of Asia and the Pacific and the National Institute of Health and Epidemiology

Community Programs in Dengue Surveillance and Control in Viet Nam

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Report for PCC Meeting

July 1999

Schoolchildren discover mosquito larvae during a clean-up campaign.

Meso eating a mosquito larva

A project funded by AusAID and DFID Department for International Development

Project Co-ordinating Committee Report

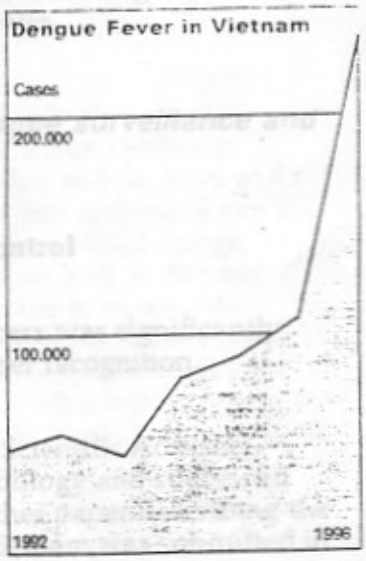
July 1999

Summary

The project's key achievements in its first full year of field operations include:

- First eradication of *Aedes aegypti* for 26 years by any method, and world first using combination of community participation and biological control (published in American Journal of Tropical Medicine and Hygiene, October 1998, subsequently highlighted as a global achievement in the British Medical Journal, February 1999).
- Community-based mosquito control activities were underway and *Mesocyclops* were introduced into large water containers by June 1998. By July 1999, the level of mosquito larvae in project communes had fallen by between 84 and 100%. All six villages of Di Su commune saw 100% reductions, thus following Phan Boi village into potential eradication status. This compares with the 18 months required to achieve significant reductions during the pilot project prior to Phase 1 and has far exceeded the expectations of the project team.
- The National Institute of Hygiene and Epidemiology has developed a nationally recognised expertise in vector surveillance and control and success in this project has led to a key role in the new National Dengue Control Program.
- The Ministry of Health has approved the use of the project methodology for application in selected sites in the National Dengue Control Program.
- The 1998 dengue epidemic was Vietnam's second worst with 235,000 cases of dengue and DHF and 368 deaths. As of July 1999 there were 53 suspected cases of dengue from three project communes of which 12 were serologically confirmed as dengue. These rates were generally much lower than in residents from neighbouring untreated communes.
- The NIHE Virology laboratory is now able to produce low-cost and reliable dengue diagnostic test kits which can be used to serologically confirm dengue presence.
- Health staff have been trained from 3 provinces and promotion of the strategy has extended to more than 24 provinces.

Wider Context



During 1998, Vietnam experienced its second worst widespread epidemic of dengue and dengue haemorrhagic fever. As shown in the adjacent chart, there were over 235,000 cases requiring hospitalisation and 368 deaths – more than double that of the previous year. Dengue fever became the country's biggest infectious disease problem claiming more deaths than malaria, HIV/AIDS and tuberculosis. WHO reported that dengue had become the leading cause of hospitalisation and death amongst children in South-East Asia, and estimated that around 95% of dengue cases occurred in children under 15[1]. This is explained partly by the fact that unlike adults, young children have not developed immunity from years of exposure and infection to dengue.

The Ministry of Public Health (MOH) responded by elevating dengue control as their highest priority and, for the first time, established a National Program for Dengue Control with over £ 600,000 in implementation funds. Up until then, the annual national budget allocated to dengue control had been less than £ 16,000. During 1996, this project's senior scientific advisers, Prof. Brian Kay and Dr John Aaskov prepared a national plan of action which provided the framework for the current National Program. Members of the project team from NIHE also played a key role in the establishment and planning of the national program. Prof. Tran Van Tien is the Co-chair of the national committee with Dr Vu Sinh Nam and Prof. Truong Uyen Ninh as the entomology and diagnostic experts on the committee.

One of the project's most significant achievements was the adoption of the project methodology as a key component of the national program at the March 1999 meeting of the national committee. This resulted in the allocation of funds to all three project provinces to help expand the method to other high risk communes. Funds were also allocated to the Institute Pasteur in Ho Chi Minh City to undertake a small trial of the methodology.

[1] 'Guidelines for Treatment of Dengue Fever/Dengue Haemorrhagic Fever in Small Hospitals' by WHO, Regional Office for South-East Asia, New Delhi, 1999

Achievement of Objectives

The overall goal of the project is to reduce the incidence of dengue fever in targeted areas in northern Vietnam. It aims to do this by meeting the following objectives.

Objective 1.1 Develop local expertise and leadership for dengue surveillance and control

Output 1: Trained personnel in dengue/DHF surveillance and control

The skills, experience and leadership of the core project team members was significantly strengthened through further training, scientific collaboration and peer recognition.

Dr Nam (Senior Project Entomologist) and Prof Brian Kay (Senior Scientific Adviser) published one paper in October 1998, describing the project methodology and successful eradication of the dengue mosquito at one of the project sites. Another paper describing the progress made in other project sites as well as in other regions of Vietnam was submitted in early 1999.

The national level staff received the following training:

- Dr Nam, Dr Diep and Mr Phong (both Community Program Officers) undertook a study tour to Bangkok, Singapore and Queensland to learn from different approaches used in the management of dengue control programmes and analysis of data.
- Dr Gerald Marten (a mosquito control and Mesocyclops expert) visited the entomology laboratories for discussions on biological control using copepods.
- Dr Maria Hoynska visited the entomology laboratories to provide specialist copepod identification training to Mrs Yen of NIHE Entomology Dept.

In turn, Dr Nam, Prof Kay, Mr Phong, Dr Diep and Mrs Yen led dengue vector surveillance and control workshops for 28 provincial, 60 district and 129 commune health workers in the six project communes. One workshop was held in Hanoi during April 1998 for provincial health workers. Six other one-day workshops were held on-site for district and commune health workers. Several half-day refresher lessons were held on-site as needed.

Dr Nam's staff have taken a prominent role in national efforts to control dengue by helping to set up similar programmes in 4 other provinces and carrying out feasibility studies in another 17. They have now trained a total of 289 health staff and collaborators in dengue vector control, including senior staff from the Pasteur Institutes in Nha Trang and Ho Chi Minh City. This additional expansion of project activities was funded by the new National Dengue Program. As mentioned in the background section, three key project members were appointed on the National Steering Committee for this program. The joint project manager, Prof Tran Van Tien was appointed as the vice-chairman of the committee, with Dr Nam and Prof Ninh as committee members. These appointments, which reflect a recognition of the training, experience and success gained from the project by these team members, will have a significant influence on the future development of dengue control throughout Viet Nam.

Output 2: Trained trainers

Four provincial health workers, trained as dengue vector control trainers during the 1996 entomology workshop, became assistant trainers during the April 1998 workshop and will take the role of main trainers in the April 1999 workshop.

The 17-day April 1998 workshop for 28 health workers, covered not only the use of *Mesocyclops* to control the dengue vector, but also sampling and surveillance methods; identification of *Mesocyclops* and the dengue vector; the dengue situation in Viet Nam and the region; the national strategy for dengue control; and the project's strategy and work plan. During the workshop, the 4 new trainers helped to prepare lessons, set up microscope demonstrations, assisted new students in how to identify *Mesocyclops* as well as dengue mosquitoes and larvae and supervised the assembly of new funnel traps to be used in mosquito surveillance. They also helped lead the teams during the practical exercises held in project villages. Post-test results showed that trainees greatly improved their knowledge with an average score of 90% compared to the pre-training result of 63%. With support from the 4 trainees and advice from Prof Kay, the training was provided by Dr Vu Sinh Nam, his staff, and the project coordinator.

Following the workshop, the trainers then took primary responsibility for rapidly mobilising resources to implement entomological surveillance and control activities at each site before the onset of the dengue season.

Output 3: Training manual and materials

Two training manuals (in Vietnamese) were prepared in early 1998 and used in the entomology workshop. They focus on the techniques for dengue surveillance and integrated control and include reference material covering all topics presented in the training course. This coverage has ensured that the manuals continue to be used by health workers as an on-going reference. The manuals were prepared by Dr Nam with translated inputs from Prof Kay, Dr Holynska and Dr Janet Reid (Smithsonian, USA). Sixty copies were printed and bound for the project sponsored workshop. The manuals have also been used in other workshops held by NIHE to train staff from non-project sites. The manuals are available only in Vietnamese and can be mailed out on request.

Training materials developed during the past year include a large poster, a brochure for school children, two lesson plans, several short videos and workshop manuals for use in schools. Again, all materials are in Vietnamese and are available on request.

Output 8: Improved local expertise in clinical and serological surveillance methods

During the spring of 1998, blood samples were taken from teenage students a project commune and a control commune to compare the presence of dengue antibodies. In the treated project commune of Nghia Dong, blood samples were taken from 50 students and 179 adults. Of these 23% tested positive for recent dengue infection. In the untreated control commune, the rate was 37% of 300 students. More detailed comparisons and analyses will be made following the next serological surveys in the middle of the 1999 dengue season in September.

Output 9. Develop a sustainable local capacity to reliably diagnose dengue infection

The capacity for serological diagnosis of dengue was strengthened through:

- Study tour by Prof Ninh to the AFRIMS diagnostics laboratory in Bangkok during February 1999.

- Assessment of the diagnostic facilities at each project site.
- Improvement of calibration of serological tests at NIHE.
- Six provincial diagnostic staff took trained in dengue diagnosis and serology at a workshop in Hanoi.
- Six district and 8 commune health staff trained in dengue diagnosis and system for dengue testing and reporting.
- Procurement, training and use of the new 'Pan-Bio' 5-minute dengue test kits at Hung Yen and Hai Phong Provinces.

Facilities and methodologies were established at the NIHE Virology Laboratory of Prof. Ninh to produce low-cost kits to test for the presence of dengue infection in blood samples. These 'ELISA' kits were then checked and sent out to the two project provinces with the necessary equipment to process and read the results from these test kits.

With project support, Prof Ninh visited the AFRIMS laboratory early in 1999 learned about new methods of dengue antigen preparation in the production of ELISA kits.

During an evaluation visit in April, Dr Aaskov examined the quality of the ELISA test kits and found that they needed improved calibration to increase the reliability of their results. By obtaining 10-20 ml of dengue positive serum from up to ten patients, Prof Ninh was able to address this issue. The sera were calibrated against another test method using the 'PanBio' brand five-minute rapid test kit and then used as internal standards to calibrate the ELISA tests. This collection of "standard sera" should last the laboratory several years.

The reproducibility of the ELISA assays also posed a concern. A methodology involving the plotting of key indicators from the control samples is now being used to alert staff to changes in assay performance and permit remedial action to be taken.

Dr Aaskov and Prof Ninh undertook an evaluation of diagnostic capability and facilities in the project sites during April. This revealed that the newly divided province of Hung Yen had no serological or diagnostic equipment and was unlikely to receive any for at least another year. Secondly, the delay in procuring the 4 commune motorcycles caused difficulties in transporting blood samples from suspected dengue patients to the provincial laboratories.

These issues were addressed through the temporary substitution of the more expensive PanBio rapid tests for the ELISA testing. These are a complete dengue testing kit that can produce results in 5 minutes. Furthermore, the tests can be easily conducted in the district or even commune health centres. However, this solution is too costly to be sustainable and the project will continue to aim for the local production and use of ELISA tests as soon as facilities are built in Hung Yen.

Objective 2. To implement community-based programmes based on innovative and low-cost strategies for dengue/DHF surveillance, control and prevention.

Output 1: Community initiatives and projects

- 129 collaborators have made 133,091 person contacts to monitor mosquito levels and educate residents on a monthly basis;
- 11,675 households inoculated with *Mesocyclops*;
- 71 community education and awareness meetings with an average attendance of 168 villagers
- 17 training courses for teachers with teachers providing a total of 128 hours of teaching to 126 classes
- 37 clean-up campaigns involving 9,451 school children and 238 teachers resulting in the collection of 31,900 kg of discards;

- quiz nights organised for 2,625 school children;
- regular presentations of key messages on loudspeakers, radio and television as well as provision of posters and 5,000 brochures to schools and households.

Collaborators selected and trained

The project's collaborators form the backbone of the community activities. They work directly with householders and are responsible for raising awareness, discussing issues, monitoring mosquito breeding sites and inoculating household containers with *Mesocyclops*. Project staff worked with district and commune authorities to select 115 collaborators who were motivated to work in public health, had sufficient time to undertake household visits, were able to learn new techniques and methods for dengue control and were happy to work for a small monthly allowance (60,000 VND).

Commune based workshops were held to educate collaborators, health workers and school teachers about dengue fever and its transmission. Lectures, discussions and videos were used to cover the following topics: the signs and symptoms of dengue fever and dengue haemorrhagic fever; how the virus is transmitted from person to person; the type of mosquito which can transmit dengue; the relationship between this mosquito and human activities; new and old methods of controlling dengue; and the role of community participation in dengue control.

All collaborators then received practical training in how to: undertake monthly surveys of mosquito breeding sites in households; monitor households for mosquitoes, larvae and *Mesocyclops*; raise householders awareness about dengue; breed *Mesocyclops* and inoculate them into water containers; and to report and analyse data.

The training also highlighted issues that would need to be addressed in implementing community activities. This included the project's high workload requirements from the collaborators, lack of televisions in two districts and a lack of loudspeakers in two communes. The workload reduced with increasing experience and is now seen as less of a problem. In order to save the team from having to take televisions from Hanoi to two of the field sites for video screenings, televisions were purchased for two of the districts from savings made from the motorbike budget.

Following their training, the collaborators were allocated approximately 100 households that they then visited each month. During each visit, the collaborators would encourage households to clean-up discarded containers; survey mosquito breeding sites inside and outside the house and note down the presence of larvae.

Mesocyclops Inoculation

During July 1998, *Mesocyclops* distribution campaigns were completed in all six project communes. The two day campaigns aimed at introducing *Mesocyclops* into water containers prior to the Dengue season were undertaken by the 2 CPOs, 2 NIHE technical officers, 38 provincial and district health workers and 115 collaborators. The distribution campaigns received strong support from the local authorities which also saw the engagement of the Women's Union, Youth Union and Peasant's Union. Following the entomological surveys, large clean water tanks (usually concrete) were identified and selected as key breeding sites for *Mesocyclops*. The collaborators and project staff introduced *Mesocyclops* into these containers to breed for one month. Then the *Mesocyclops* were inoculated into wells, tanks and large water containers by pouring in a glass-full of the water from these containers.

The first day of the inoculation was launched as a community clean up and *Mesocyclops* inoculation campaign at a community meeting. Most communes encouraged secondary school students to become involved in visiting households with teachers and collaborators and helping to clean up discards from peoples yards. Collaborator visits and loudspeaker announcements were used to remind the community and explain the aims of the campaign.

Cleanup Campaigns

In Nghia Dong, Xuan Kien, Xuan Phong, 342 school childen joined in to collect discarded containers and eliminate mosquito breeding sites on the same day as the *Mesocyclops* distribution campaign. In Di Su and Nghia Hiep, nearly 400 pupils participated in a separate clean up campaign soon after *Mesocyclops* inoculation. The cleanup and education campaign in the urban commune of Lac Vien was delayed until early December and involved 50 school children. This delay is likely to have contributed to higher than expected mosquito larvae numbers in this commune. Data collected between October and December showed that mosquito larvae numbers in discarded containers decreased significantly after the cleanup campaigns.

All communes made regular loud speaker announcements to encourage cleanup of discarded containers. The Hai Phong project site lacks a loud speaker system and a mobile loud speaker team was set up to visit each hamlet.

Community Education Campaigns

A program of community education resulted in a total of 71 community meetings, consisting of talks, videos, quiz games, slides, posters, songs and personal testimonials were held between May 1998 and January 1999. These were held in each hamlet in the evenings to maximise attendance. The meetings drew fifteen percent of the total population with numbers at each meeting ranging from 300 in Nam Dinh down to between 30 and 60 in Hai Phong, where meetings were confined to local houses due to a lack of meeting halls. Project staff felt that the turnout and the level of participation in the rural sites was particularly encouraging (given that there was stiff competition from the televised regional football championships). The personal stories from families previously affected by dengue fever, the quiz games and slide shows were particularly well received and attracted the most feedback. Project staff found it more difficult to motivate attendance from the urban households in Hai Phong and the turnouts were comparatively low. These were the first public meetings to be organised by the local health workers and lessons were learned and ideas gained on how to better prepare the next round of meetings during 1999.

Dengue issues were also integrated into other meetings of commune leaders and mass organisations, including the Women's Union, Youth Union and the Peasant's Union. In an effort to increase community support, the Hai Phong project team also organised a community dengue control workshop for 117 community leaders from 10 hamlets and 69 house groups.

School Activities

During October 1998, 250 local secondary school teachers from all project sites attended hands-on workshops on dengue fever and its control (lectures, video, posters, practical displays and discussions). The presentations also covered ways that the teachers could teach pupils about dengue control and specially prepared teaching materials (posters, lesson plans, booklets and pamphlets) were provided to schools.

Project officers also spent a day at each primary and secondary school giving presentations to a total of 6,690 pupils on dengue fever and its control.

All schools later conducted lessons on dengue fever and pupils joined clean-up campaigns to eliminate mosquito breeding sites. The school and commune health centre in Nghia Hiep also agreed to spend the last day of each month to undertake dengue clean-up and community education activities.

The school children from the Xuan Kien were particularly enthusiastic and performed a play on the dengue mosquito. Despite being performed outdoors on a cool autumn night, the play attracted more than 1,000 villagers. The project team is now considering further development of the content and the quality of the play in order to produce an educational video. Other schools in Nam Dinh also announced plans to organise school-wide competitions during 1999.

Small Community Projects

The Small Community Project fund was proposed as a means of both generating additional income to provide on-going support for collaborator allowances at the end of the project and as a way of supporting any community-based initiatives that could assist with dengue control. The best example of the latter was to boost recycling schemes which also help reduce mosquito breeding sites.

During August and September 1998, detailed discussions were held in each community about the purpose and guidelines for the Small Community Project Fund and the best way to invest it locally. By December, each Commune Project Management Committee prepared and submitted proposals from ideas suggested by committee members, collaborators and interested members of the community.

During proposal preparation, each community came across a fundamental difficulty. They found that the proposed small project participants were not willing to provide returns on investment that were greater than the current rate of bank interest. Business equity was also ruled out because of recipients' unfamiliarity with it and their desire to maintain total control of activities. This meant that returns on investment would be between 9.6 and 12% per annum. However, up to 50% of these funds would be taken up in scheme management and risk costs associated with repayments.

An additional concern was that only one of the proposals, a bid to boost the recycling capacity in My Van district in Hung Yen Province, would have a direct impact on the health of the community. Other proposals ranged from two livestock micro-credit schemes for cows and ducks to a photocopying and printing service. Additional opportunities were then provided for other more suitable submissions but no further significantly different ones were submitted.

Further discussions with each community led to an emerging consensus in 5 communes that, considering the risks involved in each proposal, the highest returns would best be obtained by investing the funds in a bank account (12% per annum but with no management costs). The fifth commune with the recycling proposal was able to demonstrate low risk and on-going returns guaranteed by the Commune People's Committee taking an equity in equipment to purchased with the project funds. Based on these discussions, the project management team favoured the funding of the recycling initiative in Di Su commune and investing the funds for the remaining five communes in secured investment accounts in Vietnam. The funds were then placed in a general interest bearing bank account pending consultations with project donors.

Arrangements for a secure bank account are now being negotiated with the Bank of Vietnam. This situation was discussed with a representative from AusAID who agreed with the new directions. Discussions will now be held with a representative from the British Embassy.

Funding for the recycling initiative was transferred to the project partner's bank account pending the a final business plan and funding agreement.

5 Problems and solutions

Case definitions. Several communes continued to use a restrictive set of clinical symptoms to diagnose dengue fever rather than the broader definition proposed by the project. This may have led to some dengue cases being missed. Discussions with relevant parties during December led to a new agreement on a general case definition to be used during 1999. Notices outlining the agreed criteria were sent to all relevant clinics and hospitals.

Patient records. While most commune health centres had comprehensive patient records, those in others were difficult to follow or were incomplete. The present record system does not provide an opportunity to record whether or not a patient has provided blood for diagnostic purposes or the results of any such testing. Efforts are to be made to overcome these issues in our study areas, and, at the least, patients will be informed of the results of serological testing as soon as possible. To improve the flow of data, a serology request form has been developed and is being distributed to all commune health centres.

Blood sampling. Because initial dengue infection in young children may be a very mild or inapparent, it may pass un-noticed. The diagnostic team is therefore undertaking a serological survey in apparently healthy school children in a control commune to which *Mesocyclops* has not been introduced. It is very difficult to collect intra-venous blood samples from healthy people. The first baseline serological survey undertaken in 1998 showed that there can be strong cultural barriers against providing blood samples. The anxiety about the procedure together with the sight of their own blood are believed to have caused two children to faint whilst giving blood. Unfortunately, this only helped reinforce the initial anxieties.

The problems were mostly addressed during the second and third serological surveys by more careful preparation which involved the direct participation of the NIHE Project Manager and Provincial Authorities. Meetings were held with parents to explain the procedure clearly and the importance of giving small blood samples. This helped reassure parents but the children still remained very anxious.

Some commune health centres are staffed by doctors while others are staffed by paramedical technicians. In principle, both can take blood samples but have no way to store them safely until they can be sent to the province. Therefore, in practice, commune health staff prefer to have provincial doctors visit to collect blood samples and return to the laboratory for testing. Savings from the diagnostics budget were used to purchase very small refrigerators in which serum samples could be stored until transport to the provincial laboratory is available.

High level of discarded containers in Lac Vien. Entomological surveys and monitoring of the urban project site at Lac Vien showed that project activities were not as effective in reducing mosquito larvae populations and levels of discarded containers as other project sites. The situation was highlighted when a dengue fever was confirmed in one teenager within the commune during October. Discussions and investigations revealed several key difficulties. Firstly, the lifestyle and working habits of the urban population made it more difficult to implement an epidemiological vector control program. This included problems ranging from

not being able to access households where the key family members worked during the day to the fact that people had less time and were less interested in hearing preventive health messages. It was also clear that the project's requirement for each collaborator to visit 100 households every month was unrealistic in this commune. Secondly, there were weaknesses in the leadership of the local project team reflected in weak monitoring of collaborators and delays in organising a community cleanup campaign and engaging the local schools. Thirdly, there were weaknesses in the levels of commitment and the skills of the local collaborators. Project management committed additional time and resources to assist the local authorities in addressing these issues during November and December. Valuable suggestions were made by the collaborators themselves – including one to focus efforts on those houses where mosquito larvae were continuing to be found. A renewed commitment from the heads of the provincial and city health services resulted in a community cleanup day which engaged the local high school, the replacement of several ineffective collaborators, refresher training for collaborators, workshops for community leaders, and a plan to increase the number of collaborators by around 25% during 1999. An entomological survey during December revealed significant reductions in larvae numbers and in the amount of discarded containers. The project team will continue to monitor the situation here closely and adapt activities as required.

Suitability of small project initiatives

As described in the previous section under Small Community Projects, difficulties were identified in generating sufficient returns from five of the six potential projects. This has been addressed by a decision to invest these funds in a secure bank investment account.

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Attachment A. Key Statistics for Project Sites

Province	District	Commune	Status	Households	Population	Collaborators
Hai Phong	Ngo Quyen	Lac Vien	Existing	2,878	11,664	25
Hai Phong	Ngo Quyen	Gia Vien	Control			0
Hung Yen	My Van	Di Su	Existing	1,750	9,534	20
Hung Yen	My Van	Nghia Hiep	New	1,062	4,203	11
Nam Dinh	Nghia Hung	Nghia Dong	Existing	1,625	6,463	18
Nam Dinh	Xuan Truong	Xuan Kien	New	2,010	8,201	19
Nam Dinh	Xuan Truong	Xuan Phong	New	2,350	9,582	22
Nam Dinh	Xuan Truong	Xuan Tien	Control			0
			Totals	11,675	49,647	

Mesocyclops chomps its way towards eradicating dengue

by Philippe Perdriau
AFP Journalist June 1999

Nghia Hiep, Vietnam, June 22 (AFP) – Children armed with scoops peer into water cisterns in this northern village, verifying the presence of *Mesocyclops*, a miniature one-eyed crustacean, the new hope in the fight against dengue fever.

In one year, the introduction of the *Mesocyclops* in six test communes in northern Vietnam by volunteers working with school children has virtually eliminated the larvae of mosquitoes bearing dengue fever which claims hundreds of lives in Vietnam and thousands worldwide.

In Vietnam last year 235,000 people were infected with dengue, of whom 383 died. The disease is endemic to tropical regions; its symptoms strong fever, and in the most extreme cases, internal bleeding which leads to rapid death.

But now, doctors in Hanoi say they have found a way to combat the disease.

"In 1989 we identified the *Mesocyclops* in a lake in central Hanoi and discovered they had a ferocious appetite for the larvae of *Aedes aegypti*, the tiny daytime mosquitoes which transmit dengue," Vu Sinh Nam, a doctor from the National Institute of Epidemiology told AFP.

Under a microscope in Dr Nam's entomology laboratory, the voracious appetite of the tiny *Mesocyclops* is obvious: in a matter of seconds they can devour dozens of larvae.

"Each *Mesocyclops* can eat about 40 larvae a day, and continue to kill more even after its appetite is appeased," explains Dr Nam.

"The introduction of the *Mesocyclops* into the water reservoirs in the test communes has yielded results beyond our expectations: 100 percent of these mosquitoes were eliminated in one commune, and 94 percent in five others," he says.

These hungry crustaceans can be found in abundance in most lakes and ponds in northern Vietnam, when employed within the framework of a program financed by Australia, Great Britain and Netherlands, they hold the key to the future fight against dengue, he says.

What's more, the larvae are easy to transport, says Dr Nam.

"We can easily raise large quantities of *Mesocyclops* in the laboratory and we have discovered that they can survive for up to one month in moss sponges, enabling us to send them to all villages who request them," he explains.

Ahmet Bektas, the Vietnam Director from the Australian Foundation for the Peoples of Asia and the Pacific (AFAP) which participates in the programme said the *Mesocyclops* is an appealing alternative to spraying insecticides.

Chemicals are inefficient, as they kill other useful insects and spraying is generally too costly for undeveloped countries affected by the disease, he said.

"The use of the *Mesocyclops* which could exits in all the regions affected by dengue is effective, cheap, ecological and well accepted among village communities," Bektas said.

Indeed, rural villages play a key role in the success of the project: each month volunteers use the *Mesocyclops* to purge old vessels of stagnant rain water in which mosquitoes breed.

In Nghia Hiep, in the province of Hung Yen 25 kilometres (16 miles) south of Hanoi, school students organized by the People's Committee go door to door explaining to peasants the importance of turning up jars and to leave no stagnant water anywhere, not even in a bottle top.

"The children and volunteers have been coming here every month since the program began in July 1998, and have taught us much about mosquitoes and the *Mesocyclops* which we have put into our water reserves," said villager Tran Thi Nguna.

Building on the success in Vietnam, Dr Nam says there is every reason to believe it can be duplicated elsewhere.

"This method could rapidly spread to all affected countries: Thanks to the *Mesocyclops* and an education program which alerts village communities to the battle against mosquitoes, dengue could be conquered," says Dr Nam

Students performing their dengue play for the community

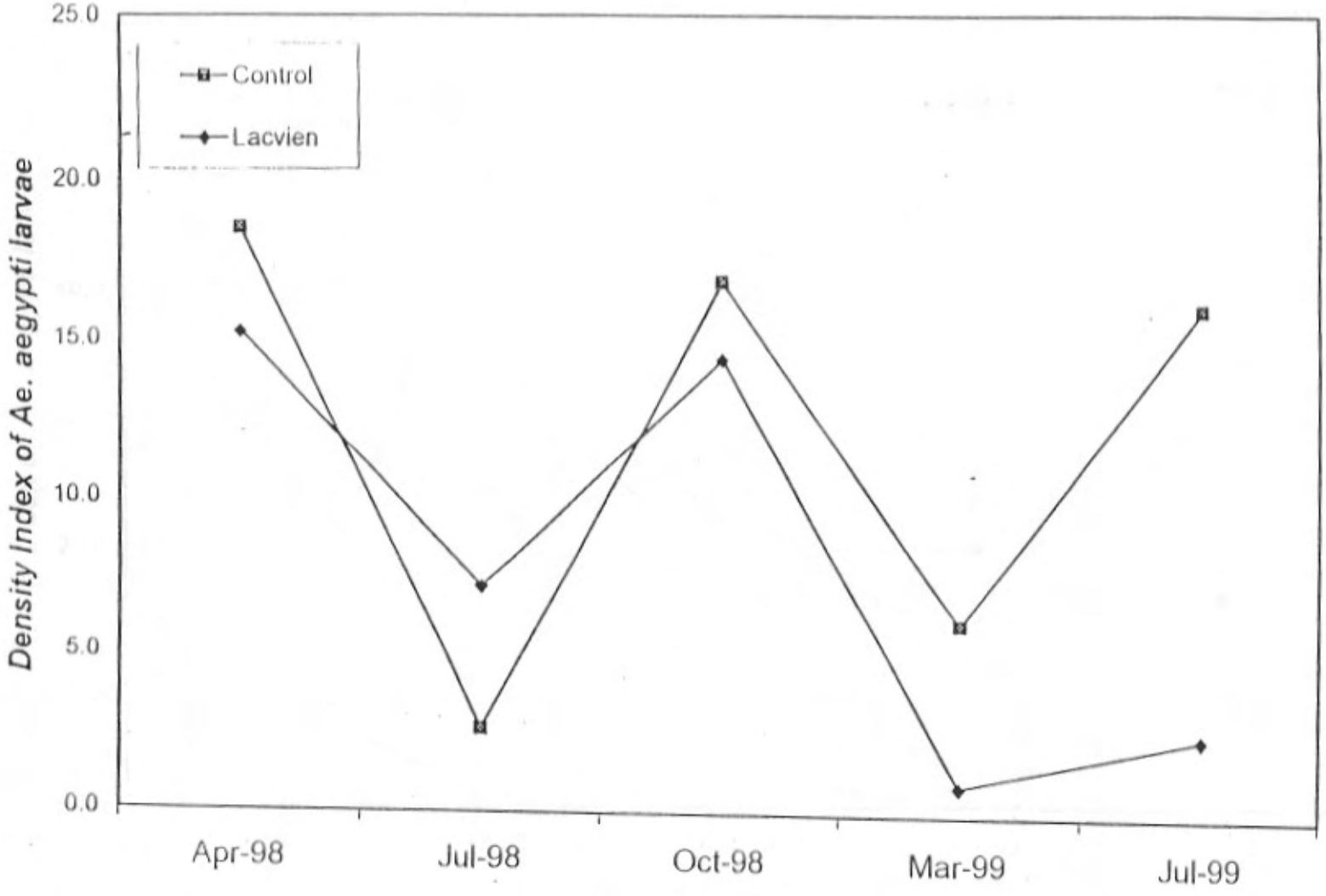
Students and collaborators putting 'Mesos' into water containers

Mosquito larvae density in project communes

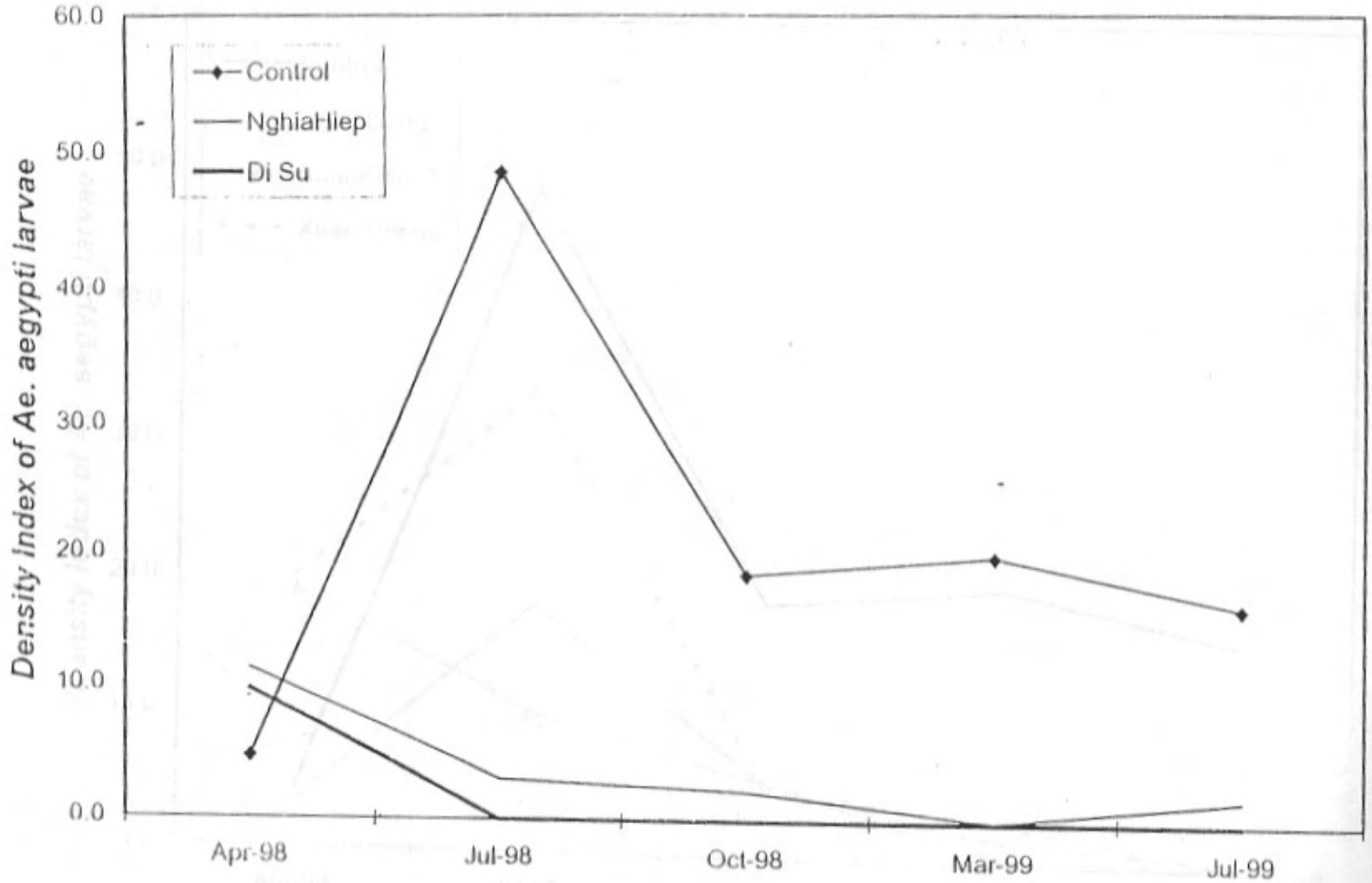
Province	Commune	Apr-98	Jul-98	Oct-98	Mar-99	Jul-99	% reduction
Control communes							
Hai Phong	Gia Vien	18.5	2.6	16.8	6.0	16.0	13.6
Nam Dinh	Xuan Tien	4.6	48.5	16.5	20.0	16.2	-252.4
Treated communes							
Hai Phong	Lac Vien	15.3	7.2	14.4	0.9	2.5	83.6
Hung Yen	Di Su	9.6	0.0	0.0	0.0	0.0	100.0
Hung Yen	Nghia Hiep	11.2	3.0	2.2	0.1	1.8	84.0
Nam Dinh	Nghia Dong	3.5	18.2	5.5	1.6	0.5	86.6
Nam Dinh	Xuan Kien	19.0	10.2	5.4	0.4	0.3	98.5
Nam Dinh	Xuan Phong	20.0	34.0	5.3	3.1	0.1	99.5
	Rural areas	12.7	13.0	3.7	1.0	0.5	95.8
	Urban area	15.3	7.2	14.4	0.9	2.5	83.6

RESULT OF DF/DHF VECTOR SURVEILLANCE IN PROJECT COMMUNES

Province	Commune	Indies	Apr-98	Jul-98	Oct-98	Mar-99	Jul-99
Hai Phong	Lac Vien	DI	0.22	0.17	0.26	0.06	0.17
		HI	16.50	16.00	19.00	4.00	14.00
		BI	27	32	48	7	31
		HI Lar.	21.00	27.00	35.00	7.00	21.00
		DI Lar.	15.25	7.20	14.40	0.93	2.50
		CI	10.09	8.77	13.33	3.68	12.65
	Gia Vien	DI	0.53	0.50	0.90	0.31	0.63
		HI	30.00	26.00	39.00	20.00	30.00
		BI	53	46	76	36	68
		HI Lar.	37.00	33.00	48.00	29.00	43.00
		DI Lar.	16.48	2.63	16.82	6.03	15.97
		CI	21.37	17.36	30.50	20.69	35.42
Hung Yen	Di Su	DI	0.06	0.00	0.00	0.00	0.00
		HI	6.00	0.00	0.00	0.00	0.00
		BI	9	0	1	0	0
		HI Lar.	6.00	0.00	1.00	0.00	0.00
		DI Lar.	9.64	0.00	0.02	0.00	0.00
		CI	3.15	0.00	0.40	0.00	0.00
	Nghia Hiep	DI	0.34	0.02	0.06	0.02	0.03
		HI	18.00	2.00	4.00	2.00	1.00
		BI	25	10	11	1	7
		HI Lar.	20.00	9.00	10.00	1.00	7.00
		DI Lar.	11.24	2.95	2.17	0.10	1.80
		CI	7.51	3.48	3.72	0.46	3.17
Nam Dinh	Nghia Dong	DI	0.23	0.20	0.19	0.08	0.07
		HI	13.00	12.00	11.00	5.00	7.00
		BI	10	14	14	7	7
		HI Lar.	10.00	10.00	11.00	7.00	7.00
		DI Lar.	3.50	18.15	5.46	1.61	0.47
		CI	2.40	5.89	5.57	2.95	3.78
	Xuan Kien	DI	0.16	0.19	0.16	0.10	0.04
		HI	10.00	13.00	13.00	7.00	4.00
		BI	15	18	13	2	4
		HI Lar.	14.00	17.00	11.00	2.00	4.00
		DI Lar.	19.00	10.17	5.44	0.35	0.29
		CI	4.40	7.40	5.65	0.95	2.17
	Xuan Phong	DI	0.38	0.35	0.12	0.09	0.04
		HI	20.00	18.00	10.00	8.00	3.00
		BI	23	39	8	9	2
		HI Lar.	19.00	30.00	8.00	9.00	2.00
		DI Lar.	20.00	33.97	5.34	3.06	0.10
		CI	4.95	12.70	3.12	3.19	0.92
	Xuan Tien	DI	0.50	0.72	0.39	0.25	0.36
		HI	28.00	34.00	25.00	16.00	20.00
		BI	17	42	34	25	42
		HI Lar.	16.00	34.00	23.00	20.00	31.00
		DI Lar.	4.60	48.51	18.50	19.99	16.21
		CI	7.80	15.60	13.00	9.26	17.72
	Rural areas	DI	0.23	0.15	0.11	0.06	0.04
		HI	13.40	9.00	7.60	4.40	3.00
		BI	16	16	9	4	4
		HI Lar.	13.80	13.20	8.20	3.80	4.00
		DI Lar.	12.68	13.05	3.69	1.02	0.53
		CI	4.48	5.89	3.69	1.51	2.01



DENSITY INDEX FOR LARVAE, HAI PHONG



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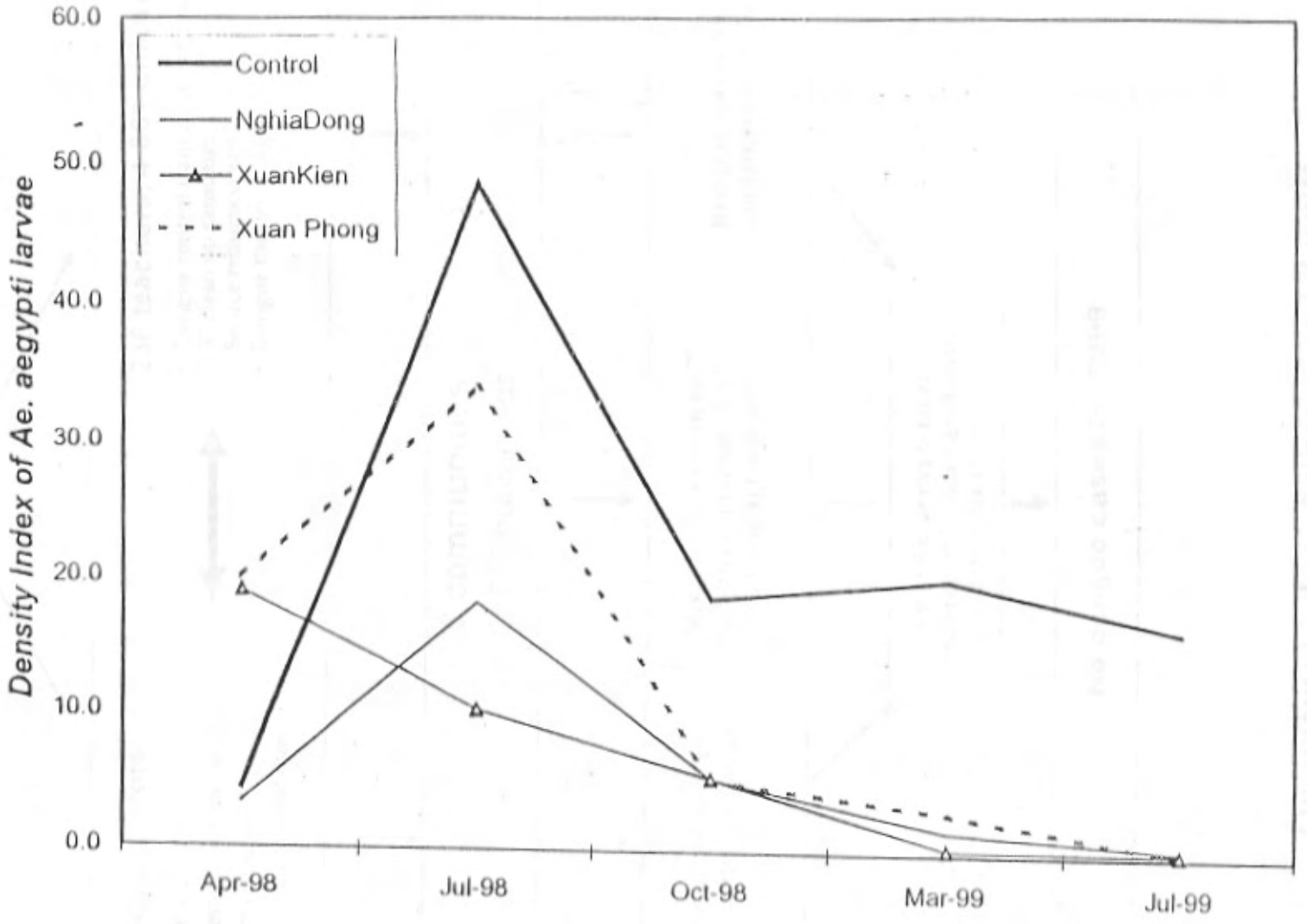

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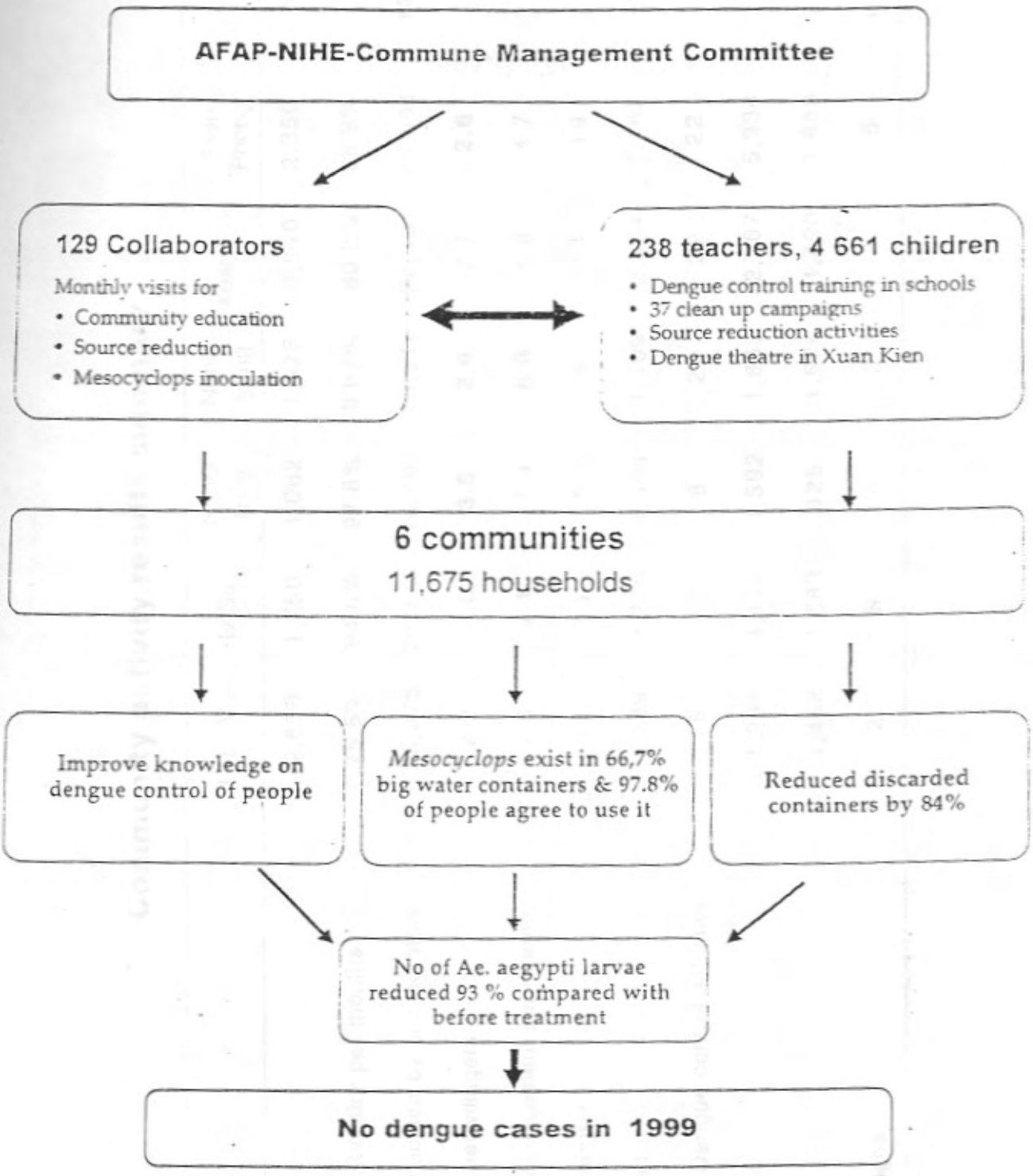


Overview of School Activities and Results

Community activity results summary

	Lac Vien	Di Su	Nghia HiÖp	Nghia §ång	Xuan Kien	Xuan Phong	Total
No of households	2,878	1,750	1,062	1,625	2,010	2,350	**11,675**
% of hh visited by collaborator per months	75.5%	94.0%	97.8%	93.7%	80.2%	68.9%	**82.3%**
Total no of villagers educated by collaborators	25,975	28,438	14,762	16,518	22,307	25,091	**133,091**
No of education times per villagers	2.2	3.0	3.5	2.6	2.7	2.6	**2.7**
No of loud speaker announcement per months	2.6	7.1	17.4	6.0	5.8	4.7	**7.3**
No of community meetings	17	11	5	8	11	19	**71**
No of villagers attended	1,186	2,216	1,304	1,109	2,464	2,162	**10,441**
No of video show on Dengue control activities	18	17	8	22	22	22	**109**
No of audiences	1,254	4,116	1,592	1,863	2,767	5,334	**16,926**
No posters at hh	1,458	1,583	825	1,576	1,490	1,850	**8,782**
No of clean up campaigns	2	5	9	3	3	5	**27**

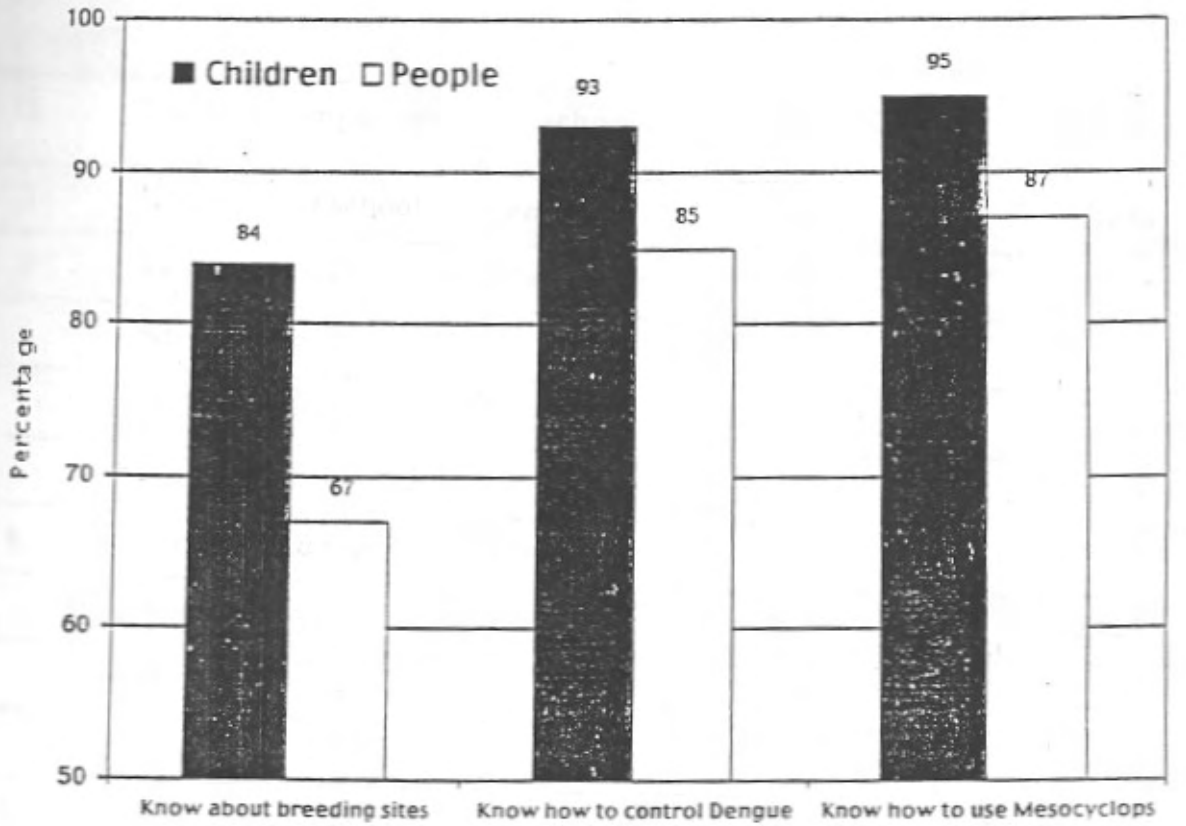
hh: household

Kap survey results summary 1998 - 1999

No	Questions	KAP 98	KAP 99
		%*	%*
1	Have heard about dengue	75	96
2	Know signs and symtoms of dengue	55	72
3	Know that dengue is transmitted by mosquitoes	55	91
4	Know that the dengue mosquito is a striped black & white	25	80
5	Know that black & white mosquitoes bite during daytime	12	53
6	Know that mosquito larvae live in		
	- Discards and ornamental containers	11	54
	- Drinking water containers	11	67
7	Know that the most inportant way to prevent dengue is to control mosquitoes and larvae	44	85
8	People whoundertake control of mosquito and larvae by:		
	- Using fish and cleaning water containers .	20	49
	- Reducing discards	6	51
	- Using Mesocyclops	3	70
9	People who understand how to use Mesocyclops	11	82
10	Willing to continue to take part in Dengue control activities	99	99

* Percentage of total interviewed persons

Knowledge on dengue control of school children and adults



Results of school activities

in 6 project communes

1	Talks on dengue control in schools	11
2	Training for school teachers	238
3	Training course for school children	
	No of classes	128
	No of lessons	128
	No of school children taught	2,191
4	Contest on dengue vector control	
	No of children	2,625
	No of prizes	88
	No of prizes for groups	12
5	Clean up campaigns	37
	No of children	9,451
	Discards collected (tons)	31.9

Other activities

- Distributed 5,000 leaflets for secondary schools
- Prepare and perform play on dengue in Xuan Kien commune
- Several national television appearances
- Make rubbish holes in the garden