Achieving Behaviour Change For Dengue Control: Methods, Scaling-Up, And Sustainability

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Introduction

With the global resurgence of dengue and its more severe form, dengue hemorrhagic fever (DHF), the disease has re-emerged as a major threat to public health. Typical approaches to dengue control and vector control involve vertical programmes to reduce the source of transmission. Physical (e.g. destruction or other physical manipulation of water-holding containers), biological (e.g. use of fish), and chemical (e.g. use of larvicides, spraying with systemic insecticides) control methods can be successful if substantial administrative and political support is provided. However, such efforts often result in short-term control as the areas become reinfested in a fairly short period of time. Vertical vector control programmes may be ineffective because communities are not active partners in the control actions but rather are passive participants or recipients of the control efforts [13]. In light of the restructuring efforts by ministries of health to decentralize services, and of the generalized chronic underfunding of dengue control programmes, and in order to provide effective control measures, it is critical to address issues such as: (1) how to maintain quality of control in a decentralized system where decision-making takes place at regional, state, provincial or municipal levels; (2) how to ensure that funding is adequate to maintain programme infrastructure; and (3) how to ensure, where traditionally staff have been under the purview of the ministry of health (e.g. communications, entomology) rather that the regional or municipal health department, that there are trained staff in technical areas at the local level.

Dengue may present as a mild illness episode, leading many people to underestimate its seriousness and therefore the importance of controlling the mosquito vector. Some residents may be unaware of how dengue is transmitted, and some may be unaware of the source of the vector mosquito; others however may know where the

Ae. aegypti mosquito is produced and how the breeding sites can be controlled or eliminated but are not motivated to take preventive action. Even those who do follow the recommended actions may still have *Ae. aegypti* or other mosquitoes in their houses and, worse still, may suffer dengue infections if their neighbours do not participate in controlling domestic breeding sites, or they may get bitten by an infected mosquito at their place of work or study. Therefore, the issue for vector control is not whether source reduction is effective, but whether and how community participation can be a part of that source reduction effort [14,19] Regardless of whether the dengue control efforts take place through a centralized or decentralized system of care, the issues are (1) how to meaningfully engage residents in sustained control actions; (2) how to effectively communicate with residents in ever-expanding urban and semi-urban areas in light of reduced vector control staffing and chronic budget shortfalls; and (3) how to measure the impact of residents' actions on *Ae. aegypti* breeding sites. This paper is divided into two sections. The first will examine behaviour change and dengue control efforts and the second will examine delivery mechanisms for behaviour change interventions in the community.

Behaviour change and dengue control

Although experts agree that community participation and modification of human behaviour at the household level are crucial to effective control of *Ae. aegypti*, the specific form that control efforts should take continues to present a challenge to public health officials. As the context for the present paper, a review was conducted of research studies in community-based dengue control efforts published since 1995. This review was carried out through Internet search engines (PubMed, Google Scholar, etc.) and through reviews of existing paper files and library-housed journals. Given the nature of these searches, most literature identified was published in English.

All behaviour change and/or health communication-oriented papers were reviewed with respect to the following characteristics or variables:

- country/setting
- planning tool or approach used
- level at which the intervention was directed (i.e. household, school and other organizations, or entire communities or regions)
- person(s) who was(were) the source of communication or agent of change
- dependent measure or outcome variable
- research or evaluation design of the study or programme evaluation
- results, and conclusions drawn by the authors.

The studies presented here were those for which most of this information was evident in the article, especially with regard to whether any evaluation of the dengue control effort had been undertaken. A summary of these studies (or programme evaluations) is presented in table 1.

In 2005, an evaluation of 11 WHO-supported dengue communication and mobilization programmes using the communication for behavioural impact (COMBI) planning tool [26] was conducted in six South Asian and Latin America/Caribbean countries [7]. The conclusions below are derived from this evaluation, as well as from the review of recent programmes (table 1).

Progress and challenges in community-based behaviour change efforts

Multi-level behaviour and community change

As can be seen in table 1, all programmes included behaviour change efforts at the household level, and some targeted the broader community and other partners (schools were the most common partner). However, vector control cannot be effective (or at least, very effective) if carried out only on an individual basis. Thus, if mosquito breeding sites are eliminated in one household but not in a neighbour's or in public areas, the individuals in that cleaner household are likely to receive some but little added protection against dengue. At some point, however, a critical mass may be reached where a sufficient number of vectors are eliminated in an area or region, thereby reducing everyone's risk for contracting dengue. Thus, multi-level, vertically and horizontally integrated programmes offer the best solution to dengue control. For optimal effects, such programmes would include not only community-wide (e.g. mass media) and house-by-house efforts, but also those efforts of schools, worksites and other organizations within the community.

At the community and regional levels, responsible agencies may need to identify 'programme champions' in order for their efforts to succeed, while at other levels, groups of individuals may share responsibility for maintaining programme momentum and integrity. An assessment of different leadership modalities from the WHO evaluation revealed that roughly half of the programmes were led by strong, forceful individuals, while the others seemed to be more 'committee driven', with two to several individuals sharing responsibility and decision-making. Neither model seemed to have an advantage over the other. In one case, the group of individuals responsible for the effort seemed not to agree on its key aspect, impeding progress towards COMBI goals. In another, the programme champion was such a strong individual that one would worry about the future of the programme after leadership turnover. But in most other cases, the model that was chosen by the country or community seemed to be the best one for them, a phenomenon consistent with recent research on tailoring health communications. The advantages of a programme champion are that their investment of energy and enthusiasm will often achieve more results in the short term, while the downside relates to the unclear implications for longer term sustainability and generalizability to regions without such individuals.

In any case, enthusiasm will at some point die out, especially among non-paid volunteers, thus threatening sustainability. Setting limited periods of commitment or allowing the workers to move on at some point to other health issues or even other

communities (perhaps helping new neighbourhoods to start their own front-line worker teams) could be among the methods used to optimize commitment. Second, plans must be developed to fade an effort out once progress has been sufficient or nearly so. Booster (or spot-check) home visits, for example, should be increasingly infrequent, thus avoiding both health worker and homeowner burn-out. Should entomological, epidemiological or behavioural data indicate a need to renew a full intervention, this could then be accomplished on a shorter-term scale, reverting to spot-checks when needed.

While much has been written about social marketing and many examples of successful social marketing have been projects that took place over several years, there are few examples of incorporation of social marketing principles in dengue prevention and control programmes. According to the UK National Social Marketing Centre (2006) [22], social marketing is 'the systematic application of marketing concepts and techniques to achieve specific behavioural goals, for a social or public good'. In a comprehensive white paper on how to create a 'people-centred' public health strategy, the authors examine how to improve disease prevention and health promotion within the British National Health System, and they assess the potential of social marketing to move beyond the prevention models currently in practice. The authors state that social marketing 'can support efforts to achieve an appropriate and effective balance between the role of individuals and the role of the state and relevant bodies'. Although an assumption might be that, in resource-rich countries, such approaches would be systematically developed and supported, in reality the public health and the health care systems generally function as two separate entities with differing views on what prevention is and who the target audience should be. It is important to clarify that a national media campaign is *not* social marketing, although it might be part of a social marketing programme. Regardless of the framework, the following issues have been identified as essential to understanding prior to the development of any community-based approaches.

Operationalization of behaviours

Few programmes provide clear definitions of specific human actions that can improve control as part of the planning phase of community programmes, and those that do often leap ahead to an examination of indications of mosquito breeding in the evaluation effort (table 1). A key element in any health behaviour change or disease prevention programme comprises the initial step of 'operationalization' of target behaviours. Operational definitions of behaviours or the environments surrounding them emphasize an objective observation of the physical aspects of the behaviours. Thus, a behaviour can be observed directly and reliably by examining the frequency, duration, or strength of the behaviour (e.g. the frequency of applying larvicide, the duration of cleaning used to reduce algae in a 55 gallon drum, the intensity with which an individual appears to scrub a cement basin), or the physical by-product of that behaviour (e.g. the number of tyres left unprotected in a backyard vs. the number filled with dirt or placed under a roof). Operational definitions, therefore, go hand in hand with the nature of the assessment used to arrive at those descriptions

of behaviour. Thus, phenomena such as 'knowledge of breeding cycles' or 'fear of mosquito contamination' are not behaviours per se but inferred inner causes of these behaviours. In practice it is often difficult for health education or vector control professionals to arrive at specific operational definitions of behaviours, as they have frequently been trained to emphasize these internal mechanisms.

In *Ae. aegypti* control efforts, it may be difficult to observe the nature of the behaviour, and therefore for monitoring purposes it is often necessary to select physical by-products of the behaviour rather than an observation of the behaviour. Nonetheless, behaviours must still be operationally defined even if their direct performance cannot be observed. It is only through the operationalization of each behaviour that indicators can be developed to measure whether or not the behaviour has taken place and to what extent it has been carried out.

The operationalization of behaviour starts with the selection of one or more specific target behaviours. These behaviours are selected on a variety of criteria, the most important of which is whether the behaviour itself seems to have an impact on the specific health problem. Nevertheless, many different behaviours may potentially have such an impact and the target behaviour must be narrowed down to a manageable single or small group of behaviours. Therefore, programme planners should also address the following in the selection of target behaviours:

- **Feasibility**: To what extent would the performance of the target behaviour result in negative consequences for the individual performing it (e.g. changing the taste of drinking water by adding temephos or fish)? Is the behaviour compatible with the person's current practice and with sociocultural norms in the community? Does the potential target behaviour require an unrealistic rate or frequency or duration in order to be sufficient? What are the costs of the target behaviour in terms of time, energy or other community-identified expenditures?

- **One step at a time**: Are there any existing 'approximations' to the target behaviour? Is the behaviour already being performed perhaps at a substandard but detectable level? Can this behaviour be 'shaped' to meet criteria? Are there monitoring systems (see below) in place that could be used to provide feedback to household residents, health staff, and others who may gradually provide evidence of improvement in behaviour [12]?

  Some confusion about how to operationalize target behaviours derives from an inability to distinguish between whether the target behaviour exists at all, or whether it does not exist in adequate strength due to 'performance deficit' or 'skill deficit'. 'Performance deficit' refers to a situation in which individuals may actually possess an existing skill but either do not receive the reinforcement necessary for performing the behaviour or receive inadequate reinforcement and hence do not engage in adequate practice. As part of the performance deficit analysis, understanding the functions served by containers (not just their type and capacity) that are potential breeding sites in the home is key to determining the actions that can be implemented

[19,9]. In contrast, a 'skill deficit' is simply that the individual does not have the knowledge and practice associated with adequate performance of a skill regardless of whether he or she is motivated to engage in that behaviour. Health communication and social mobilization efforts take very different forms depending on whether the bulk of the population evidences skill or performance deficit with respect to the control of mosquito breeding.

- **Context of the behaviour**: To further complicate the definition and selection of target behaviours, general community needs and capacity must be examined simultaneously. In most studies, both the target behaviours and the communities selected evidence a range of 'difficulty'. When using the COMBI planning tool, programme planners must focus on target behaviours that will have a measurable impact on the specific component of dengue prevention and control being addressed through the communication/social mobilization plan; the target behaviours, however, are the result of a community-based process through which the target population and the programme planners identify and test behaviours for feasibility and effectiveness. Other programmes have used other models or processes to define behaviours within a participatory community process (table 1). The target areas also evidence a range of characteristics in socioeconomic status and accessibility, ranging from communities enjoying schools, roads in good condition, utilities, general municipal services, and employment, to others with high crime and low employment, and buildings and roads in poor physical condition. Some communities may be within a few kilometres of their health centres while others are in remote locations. In other words, some communities are relatively easy to work with, while others are more difficult.

  These independent dimensions of behavioural and community 'difficulty' may lead one to conclude that generally, when planners select a difficult community (e.g. poorer, with higher crime), they may want to begin with an 'easier' target behaviour (e.g. hermetic covering of containers). Should more accessible and prosperous communities be selected, planners can be more ambitious with respect to the choice of target behaviours (e.g. frequent emptying and scrubbing of containers). It is axiomatic that poorer communities need more resources to achieve an equivalent result. Planners should focus on what is truly practical for modest or resource-poor environments (resource-poor referring to both the programmatic environment and the target community).

The monitoring–feedback loop

Related to the integration of efforts and the operationalization of specific, observable target behaviours is the need for an emphasis on information sharing and feedback loops through monitoring and evaluation. Few studies reported in the literature (table 1) indicate that systematic monitoring and evaluation have been carried out, and perhaps only a few have used ongoing monitoring to improve or reinforce efforts. Vector control and health education/communications staff seem to understand in general what evaluation is, but how to conduct routine programme monitoring, and how to use those data for programme adjustments throughout the

year, do not seem to be clearly understood. While many national programmes can show that data are collected for calculating entomological indices, few can describe how these data are used during household visits since *Aedes* breeding sites are not prioritized, leading to the ongoing promotion of general behavioural messages that have limited impact on mosquito breeding as evidenced in continued high larval indices.

Understanding of and enthusiasm for the COMBI interventions among residents seems to be largely a function of health workers giving individual, specific feedback at the household level. In fact, health workers and volunteers seem to be more cognizant of and capable when they use specific behaviourally-based feedback rather than more general exhortations to the community. Monitoring and evaluation data must be accessible and apparent at higher levels as well. In the Nicaragua programme, maps with colour-coded pins used to track neighbourhood outbreaks of dengue and malaria provided feedback to all staff and community health volunteers regarding epidemiological markers for programme progress, and pinpointed specific blocks in the neighbourhoods where more intensive education and behaviour change work were needed. Staff and volunteers met each month to discuss the neighbourhoods and specific challenges, so that staff and volunteers received continuous feedback and reinforcement for their work, just as residents had received through the self-retaining of records.

A weakness of all programmes examined to date is the lack of behavioural indicators that have been tested and validated for routine field use within the context of national dengue programmes. Although indicators have been created and tested in some studies (e.g. in Mexico, Honduras), these indicators have not been operationalized within a dengue prevention and control programme setting. There is lack of staff with specific expertise in this area within ministries of health, leading to ongoing, inappropriate use of entomological indicators as proxies for human behaviours.

Delivery of behavioural interventions to target populations

To date, special community-based projects may use ministry of health staff, a combination of ministry of health/externally funded staff, or may be completely externally funded. The ongoing challenge is how to take promising results from a special project and deliver them on a national scale, taking into consideration differences in vector ecology and in local level capacity to manage programmes, lack of local level staff with behaviour change expertise, political changes that impact programme services from national to municipal level, staffing changes at all levels, and chronic funding and staffing shortages.

Because most behaviour interventions have been delivered through the existing structure of dengue programmes, for the most part, after a certain period, the

programme reverts to its original focus and programming, that is, to entomological surveying and source reduction conducted by vector control staff. This is not only the case for behavioural interventions, but laboratory and case management also tend to function independently, even though the need for integration of the five essential components has been highlighted over the past years [23-24,33] In order to address this issue, the Regional Program Office for Dengue Prevention and Control of the Pan American Health Organization developed a Strategy for Integrated Dengue Management (EGI-Dengue), a process by which countries functionally integrate the five key components of a dengue prevention and control programme (epidemiology, entomology/vector control, community participation, laboratory, case management) [25] The EGI-Dengue process convenes a national technical expert group with two to three experts in each of the five components to prioritize actions for each component area and then to prioritize actions across the five areas. The national group of experts monitors the implementation of the national integration strategy via the logic framework (marco logico) developed as part of the process. The EGI-Dengue process has been under way in the Americas since 2004.

Behavioural risk indicators

Good programme planning is based on understanding *who* needs *what* service(s), *when*, and *where*. Unfortunately, we do not have indicators by which we can measure dengue behavioural risk, such as blood pressure is used to indicate heart disease and blood sugar to indicate diabetes. We need to be able to stratify areas using epidemiological, entomological and behavioural risk indicators in order to develop and then deliver an intervention mix that will respond to the priority risk indicators of that area.

Key issues for consideration in behaviour change interventions

- Programme leadership and planning for sustainable community participation and involvement.
- Transfer of technical knowledge and skills in planning participatory behavioural interventions to health workers, community volunteers and other partners at the local level.
- Creation and maintenance of monitoring and feedback systems at the local and national levels, including the development of behavioural indicators.
- Judicious mix of communication channels (interpersonal, mass media, publicity, etc.) to support programme behavioural goals over time, based not just on available funding but also on effectiveness for the local context.

Priority research questions

- How can indicators that measure behaviour change, and the extent of this change, be operationalized?
- What are the indicators of behavioural risk and how can these indicators be part of a stratification process based on epidemiological, entomological and behavioural risk indicators?

- Can the current, entrenched programme delivery model, which is not, for the most part, achieving the goals and objectives of controlling dengue fever/DHF, be revamped, or do we need a new programme model?
- How can cost effectiveness be measured? Do we need to measure the added benefit of each individual component since we don't have a fully integrated model that can be used as a reference point?
- How can we go to scale from pilot models of community-based communication/mobilization efforts?

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Ref.	Country/setting	Planning tool	Level	Intervention/change agent	Dependent measure/ outcome	Evaluation design/time period	Results and comments
[27]	Cambodia: three rural villages	Selection of polypropylene hoop with netting after initial field test of 19 different jar covers	H	Professional staff distributed deltamethrin-treated polyester net covers for water storage jars	Density of immature stages and adult mosquitoes	Pre- and post-intervention cross-sectional tests over 12 weeks	Effective at preventing growth in larval stages; little impact on adult mosquitoes
[20]	Bucaramanga, Colombia	Stages of change in housewives	C,O,H	Mandatory community service for 11th grade students with primary focus on door-to-door campaign targeting housewives Multi-level social marketing (print, theatre, radio, social events)	Knowledge and awareness among students; Household Index of mosquitoes in various stages	Pre- and post-intervention: 8-month knowledge test among students; 5-year follow-up of households using House Index	Knowledge increase House Index dropped from 18% in 1998 to 5% in 2003 Recommend 3+ year intervention to achieve impact
[16,17, 3,10, 11,31]	Dominican Republic	Formative studies with female heads of household revealed a desire for 'clean water'	C, H	Breeding site reduction Use of biological control (i.e. fish) to reduce larval stages of the mosquito Information transmission via national & local sources Direct counselling from health educators	Not indicated	Not indicated	Simple and economical health education messages very beneficial
[2]	Fiji	National KAP survey + formative research to understand household mosquito behaviours	C,O,H	Multi media social mobilization to reduce breeding sites - focus on control of tyres and drums	Larval indices; no. of tyres in yard and whether they were controlled	Pre- and 10-month post-intervention test on primary outcomes among 100 randomly sampled houses	Increased control of tyres (from 34% to 61%) Recommendations: - Focus on behaviours rather than only on knowledge; keep behavioural targets simple - Time-series evaluation rather than pre- and post-intervention basis
[8]	El Progreso, Honduras	Examination of existing cleaning behaviours	C,O,H	Multi media campaign & community mobilization Household visits by volunteers teaching effective scrubbing of concrete basins, the primary water storage device	House Index, incidence of dengue cases, morbidity rates, exposure to and understanding of key messages; no. of households visited; media	Pre- and post-intervention tests	Surveys in 2002–2003 revealed awareness among 35% of housewives; need for reinforcement of behaviour.

Ref.	Country/setting	Planning tool	Level	Intervention/change agent	Dependent measure/ outcome	Evaluation design/time period	Results and comments
				Mass media component to support community effort	exposure surveys Entomological information, epidemiological information, household visits		
[15]	Purwokerto City, Central Java, Indonesia	KAP survey: revealed knowledge, but lack of action.	C,O,H	Social mobilization and communication via community meetings, training, inspection role-modelling, and identification/ endorsement of key stakeholders Dasawisma: Ten-house alliance where house occupants rotate inspection responsibility Dissemination of 'source reduction kit' with emphasis on '3Ms': cleaning, covering, burying	Monthly dasawisma evaluation to measure level of preventive behaviour (active, less active, not active). Quarterly larval surveys Tracking of dengue hemorrhagic fever (DHF) hospital cases	Dasawisma activity ratings every month Pre- and post-intervention larval surveys	House Index decreased from 20% pre-intervention to 2% with intervention
[28]	Johor Bahru, Johore, Malaysia	Minimal success with other strategies	C, H	COMBI approach: 1) Social mobilization (public relations campaign, volunteers, youth) 2) Communication (buntings, self-evaluation checklist, radio and newspaper advertisements, point-of-service promotion, dengue-related radio advertisements and talk shows) Main emphasis on vector inspection/prevention and early fever detection	KAP survey results from household heads or age 18+ Treatment-seeking behaviours in hospital admitted dengue patients	Pre- and post-intervention surveys using multistage stratified sample (926 of 1712 were paired) Treatment-seeking survey	99% of respondents in post-intervention survey self-reported Sunday household inspections vs. 71% in pre-intervention survey 59% of dengue-related hospital admissions occurred within 24 hours of fever onset (42% in control areas)
[6]	Colima, Mexico	Pre-intervention KAP and entomological survey	C, H	1) Educational campaign to encourage community participation in breeding ground elimination; presentation, video, socio-drama; reinforcement with prevention-related small	Prevalence of Aedes aegypti; KAP levels regarding dengue and vector	Prospective evaluation Pre- and post-intervention KAP and entomological	Reduction in Basal House Index, Basal Container Index, and Basal Breteau Index No significant changes in KAP after the

Ref.	Country/setting	Planning tool	Level	Intervention/change agent	Dependent measure/ outcome	Evaluation design/time period	Results and comments
				gifts and printed materials 2) Intervention with malathion spraying alone 3) Combination education & chemical spraying treatment		surveys (post-intervention survey = after 6 months)	intervention treatment
[9]	Mérida, Yucatán, Mexico	Examination of failed prior attempts In-depth interviews, focus groups, observation of household waste and water management, KAP and entomological survey	H, O	Communication/education campaign (interpersonal/mass media): - slogans - strategically scheduled radio and television broadcasts - use of a 'spokes-puppet': Lela - new behaviour introduced every 4–6 weeks (from May–Oct 1995), depending on complexity Interpersonal, through activities in the home and school environment (primarily focused on 4th graders).	KAP and entomological surveys Composite behaviour score	Containers positive for Ae. aegypti (requirement for study participation) marked for follow-up and sampled over a ten-month period from June 1995 to March 1996	Decline in House, Container, and Breteau indices Positive increase in behaviour scores after intervention Significant increase in self-reported tyre behaviour associated with no tyre-based mosquito breeding.
[1,30]	Managua, Nicaragua	Pilot efforts and focus groups Beyond-KAP questionnaires Entomological surveys Dengue virus infections in children 3–9 years old	C	Stratified cluster sample: 30 sentinel sites Intervention: seven barrios in year 1, three more added in year 2 Control: 20 barrios Socializing Evidence for Participatory Action (SEPA) communication strategy Use of volunteers and brigadistas to encourage further action	Entomological indices to measure control of vector Aedes aegypti Serological surveys among young children Beyond-KAP survey	External evaluation conducted at 25 months Utilization of evidence cycles	By year 2, monitoring and elimination of vector larvae significantly more likely in intervention barrios compared to control barrios Intervention barrios: - Decreased use of insecticides, increased knowledge sharing and community leadership - Decrease in entomological and serological indices Reported sense of personal development in intervention community

Ref.	Country/setting	Planning tool	Level	Intervention/change agent	Dependent measure/ outcome	Evaluation design/time period	Results and comments
[32]	Puerto Rico	Increases in DHF incidence prompted need to determine impact of pilot community-based programmes	C,O,H	Community based prevention programmes: Head Start: - Children: mosquito-related activity book - Parents: video on dengue fever prevention at the Head Start centre and visit from Head Start personnel Public school programme: 4th grade science component Posters and televised public service announcements (PSAs): 'Dengue-Free Zone' Children's museum interactive exhibit on Ae. aegypti with guided tour	Qualitative data: interviews and focus groups Impact of programmes on overall infestation levels and on four specific behaviours: - Elimination of refuse - Protecting used tyres from the rain - Maintaining larvae-free water storage containers - Use of commercial indoor aerosol insecticides Behavioural outcome variables: House Index, Breteau Index, and container-specific index	Comprehensive cross-sectional evaluation	Higher levels of correct overall knowledge on dengue and decreased incorrect knowledge among parents regarding the mosquito life cycle Greater impact on children's dengue knowledge than on behaviour change and prevention
[29]	Vanuatu	Community-based formative research & audience pre-tests	C, H	Manples Community Project (est. 1998): Establish community committees; workshop and community meetings held to increase dengue fever knowledge: - Wan Smol Bag theater company model dengue-related preventive behaviours during performances at community & school events. Household donations to purchase plastic bags for small water container disposal Tyres: collection, disposal, and education (how to fill with soil), mobilization of young people to drill water	Larval surveys measuring House and Breteau indices; no formal evaluation of behaviour change	Frequent indices recording throughout programme (1998–2001)	Small outbreak of dengue in 1998 – first test of the intervention: results = 100 cases recorded with 0 mortality Consultations with the community were helpful in tailoring intervention, especially with respect to tyres

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				drainage holes in immobile tyres Volunteers apply temephos to larger water storage containers – not well received Local manufacturer commissioned to create mosquito-proof water-storage containers			
[21]	Viet Nam	Vector surveys, KAP surveys (100 households in each programme commune)	C, H	Vector control activities: - Use of Mesocyclops in water storage containers to prey on Aedes aegypti larvae. - Institution of community clean-up campaigns to collect and remove empty water containers - Prevention education campaigns and interpersonal reinforcement and motivation: church and community meetings, media broadcasts, loudspeaker announcements, drama performances, dengue football competition, and print campaign - Monitoring household mosquito prevention practices & prevalence of mosquitoes	Presence of mosquitoes, Mesocyclops, and key breeding containers Measurement of level of prevention practices adoption through standardized ratings KAP survey results	Annual evaluations to monitor and adjust activities Quarterly vector surveys Analysis of dengue prevention behaviours in cross-sectional sample of households	First project (2001) accomplished full Ae. aegypti control in five out of six communes Second project (2003) reduced larval populations by 99.6%–100%

C = community or regional; O = school, worksite or other organization; H = home; KAP = knowledge, attitudes and practices