

## Achieving sustainability of community-based dengue control in Santiago de Cuba

Maria E. Toledo Romani<sup>b,\*\*</sup>, Veerle Vanlerberghe<sup>a,\*</sup>, Dennis Perez<sup>b</sup>,  
Pierre Lefevre<sup>a</sup>, Enrique Ceballos<sup>c</sup>, Digna Bandera<sup>c</sup>, Alberto Baly Gil<sup>b</sup>,  
Patrick Van der Stuyft<sup>a</sup>

<sup>a</sup>*Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium*

<sup>b</sup>*Department of Epidemiology, Institute of Tropical Medicine "Pedro Kouri", Cuba*

<sup>c</sup>*Provincial Center of Surveillance and Vector Control, Santiago de Cuba, Cuba*

Available online 29 November 2006

### Abstract

Achieving sustainability is one of the major current challenges in disease control programmes. In 2001–2002, a community-based dengue control intervention was developed in three health zones of Santiago de Cuba. New structures (heterogeneous community working groups and provincial/municipal coordination groups inserted in the vertical programme) were formed and constituted a key element to achieve social mobilization. In three control zones, routine programme activities were intensified. We evaluated the sustainability of the intervention strategy over a period of 2 years after the withdrawal of external support.

Data on maintenance of effects, level of institutionalization and continuity of activities through capacity building were collected via documental review, direct observation, questionnaires, key informant and group interviews and routine entomological surveys.

The intervention effects, evaluated through larval indices and behavioural change indicators, were maintained during the 2 years of follow-up. In the intervention area, 87.5% of the water storage containers remained well covered in 2004 and 90.5% of the families continued to correctly use a larvicide, against 21.5% and 63.5%, respectively in the control area. The house indices further declined from 0.35% in 2002 to 0.17% in 2004 in the intervention area, while in the control area they increased from 0.52% to 2.25%. Institutionalization of the intervention, assessed in terms of degrees of intensiveness (passage, routine, niche saturation), was reaching saturation by the end of the study. Key elements of the intervention had lost their separate identity and became part of the control programme's regular activities. The host organization adapted its structures and procedures accordingly. Continuous capacity building in the community led to participatory planning, implementation and evaluation of the *Aedes* control activities. It is concluded that, in contrast to intensified routine control activities, a community-based intervention approach promises to be sustainable.

© 2006 Elsevier Ltd. All rights reserved.

**Keywords:** Sustainability; Institutionalization; Capacity building; Vector control; Dengue; Behavioural change; Cuba

\*\*Also corresponding author.

\*Corresponding author. Tel.: +32 32476386; fax: 32 32476258.

*E-mail addresses:* [mariaeugeniatoledo@yahoo.es](mailto:mariaeugeniatoledo@yahoo.es) (M.E. Toledo Romani), [vvanlerberghe@itg.be](mailto:vvanlerberghe@itg.be) (V. Vanlerberghe), [dennis1905@yahoo.com](mailto:dennis1905@yahoo.com) (D. Perez), [plfevre@itg.be](mailto:plfevre@itg.be) (P. Lefevre), [balygil@yahoo.com](mailto:balygil@yahoo.com) (A. Baly Gil), [pvds@itg.be](mailto:pvds@itg.be) (P. Van der Stuyft).

## Introduction

Dengue is a rapidly expanding public health problem. Worldwide, epidemics have become more frequent and involved larger populations (Gubler & Meltzer, 1999; Guzman et al., 1990; Harris et al., 2000; Kouri et al., 1998). In the endemic areas in Asia and in the Americas, the incidence of the severe and fatal forms, dengue hemorrhagic fever (DHF) and dengue shock syndrome, has increased dramatically over the last decades (Anonymous, 2000; Kay & Vu, 2005). The only currently available option to prevent or reduce dengue infection is the control of *Aedes aegypti*, the main vector of the virus. Dengue's global re-emergence reflects the difficulty of maintaining effective vertically organized control programmes in a rapidly changing socio-economic environment and highlights the urgent need to develop alternative, sustainable and integrated approaches that should rely on community participation as a key element (Rosenbaum et al., 1995; Winch, Kendall, & Gubler, 1992). Despite the growing consensus regarding the need for community-based *Ae. aegypti* control strategies, community participation is often limited to collaboration in the destruction of peridomestic larval habitats and in periodic clean-up campaigns, not infrequently in response to coercive measures (Gubler, 1989). This 'passive' participation could explain the short-lived effectiveness of such strategies, which are often not maintained once external support is withdrawn (Gubler & Clark, 1996; Lloyd, Winch, Ortega-Canto, & Kendall, 1992).

Many health projects in Latin America have promoted participation to improve populations' health (Winch et al., 1992), but few large-scale participatory programmes have been studied and indicators to evaluate their long-term effectiveness and sustainability, remain unclear. Indeed, systematic research about the long-term maintenance of health programmes is at an early stage and there is, to date, no substantial body of literature. The phenomenon of programme continuation has been referred to by several terms such as programme "maintenance", "sustainability", "institutionalization", "incorporation", "integration", "routinization", local or community "ownership" and "capacity building" (Shediac-Rizkallah & Bone, 1998). The most frequently adopted—albeit controversial—definition is maintenance of activities and results after external financing and support has been withdrawn (US Agency for International

Development, 1988). Various authors have proposed models for the exploration and evaluation of sustainability (Bossert, 1990; Bracht, 1999; Olsen, 1998; Shediac-Rizkallah & Bone, 1998). According to Scheirer (2005), the most inclusive framework is offered by Shediac-Rizkallah and Bone (1998). These authors suggest that indicators to measure sustainability fall into three distinct categories: maintenance of health benefits achieved through the continuation of an initial programme, the maintenance of programme activities within a host organization (institutionalization), and the maintenance of capacity building of the recipient community (Shediac-Rizkallah & Bone, 1998).

Between 2001 and 2002, a pilot project was developed in Santiago de Cuba with the objective to achieve active participatory *Ae. aegypti* control. At the end of the project, the community had become actively involved and changes in human behaviour were documented alongside a decrease in entomological indices (Toledo et al., 2006). Up to 2004, we evaluated the sustainability of the strategies during a period of 2 years after withdrawal of external support to the project.

## Material and methods

### Context

The Cuban *Ae. aegypti* Control Programme has been hailed as one of the few success stories (Arias, 2002; Gubler & Clark, 1996). It receives important support from the government and is aided by public mobilization in times of epidemics (Gubler & Clark, 1996; Valdes et al., 1999). For 16 years (from 1981 to 1997) there were no reported autochthonous cases of dengue in Cuba. In 1997, the municipality of Santiago de Cuba (475 580 inhabitants), located in Western Cuba, was the first one presenting an epidemic after the *Ae. aegypti* eradication (Valdes et al., 1999). Subsequent other small outbreaks were detected in Havana City in 2000–2001 (Pelaez et al., 2004), which highlighted the need to readjust actions and prevent the disease from spreading. A pilot project (2001–2002) for participatory dengue control was therefore elaborated and implemented, as described in detail elsewhere (Toledo-Romani, Baly, Ceballos, Boelaert, & Van der Stuyft, 2006). We will limit ourselves here to provide a short description of the set-up. The community-based strategy was implemented in three health zones, purposively selected from the districts with major

*Ae. aegypti* infestation levels, and compared with intensified routine activities in three control zones.

#### *Routine vector control activities in both zones*

The routine *Ae. aegypti* control programme is vertically organized and mainly managed at national level, but—to a certain extent—the decision-making process is decentralized to the health zone level, enabling the inclusion of local environmental and social characteristics. Standard control activities are carried out by campaign workers and include source reduction through periodic inspection of homes, larviciding of water storage containers, selective adulticiding and health education.

Besides the vertical *Ae. aegypti* control programme, there are intersectoral groups, which are governmental structures responsible for environmental management. These groups are formed by persons representing different sectors. They avail of some resources (human and financial) to realize their activities such as water delivery, aqueducts, water drainage, housing and garbage collection. They meet once a week (in meetings called “Puesto de Mando”) and they collaborate closely with the vertical vector control programme.

#### *Activities in the intervention area*

The community-based pilot strategy was headed by community working groups (CWG), formed by formal and informal community leaders, primary health care workers and campaign workers from the vertical control programme. After receiving training on participatory methods, these groups stimulated and accompanied the people in the community in making their own situation analysis of the needs, problems and priorities for dengue control, and in developing, implementing and evaluating action plans in response to the above. The CWG were coordinated by and received technical support from newly created Municipal and Provincial Coordination Groups (composed of epidemiologists, entomologists, health programme managers and campaign workers). The Tropical Medicine Institute ‘Pedro Kouri’ (IPK) of Havana City provided technical advice and the “framework agreement” between Institute of Tropical Medicine, Antwerp and the Belgium Directorate-General for development cooperation funded partially the pilot project. After 2 years, in January 2003, the external support came to an end.

#### *Activities in the control area*

In 2001, following reports of an increase of entomological indices, the government decided to intensify the routine activities in the control areas. This consisted mainly in the application of chemical measures such as: focal and peri focal treatment, generalized adulticiding, and provision of water tanks (meant to replace defectives ones). Furthermore, local leaders were trained to deliver dengue-related IEC messages and to promote environmental risk reduction.

#### *Data collection and analysis*

In the 2 years following the withdrawal of the external support (January 2003–December 2004), the sustainability of the project was assessed through the collection of quantitative and qualitative data in both intervention and control areas. The conceptual framework and operational indicators proposed by Shediac-Rizkallah and Bone (1998) were used to this end. They defined three possible positive sustainability outcomes: (1) maintenance of effects, (2) institutionalization and (3) maintenance of activities through capacity building of the recipient community (Sarriot et al., 2004).

#### *Maintenance of effects*

The maintenance of effects achieved through the intervention was evaluated with indicators of behavioural change and entomological indices.

In 2004, a cross-sectional survey was conducted in 400 randomly selected houses (200 in each area). A questionnaire evaluated satisfaction, knowledge and participation in the sampled households. Behavioural changes were assessed through direct observation of practices and behaviours in households, following an observational grid, and review of the community risk maps. The data for 2000 and 2002 had been obtained in a similar way in the intervention area, but in the control area no surveys were conducted and the information was extracted from available routine data (for the area as a whole). Three key indicators were selected to analyse behavioural changes: the use of temephos (a larvicide), the protection of artificial containers and the coverage of water storage containers. We defined a family with an at risk behaviour as one with incorrect use of temephos and/or presence of unprotected artificial containers and/or presence of badly covered containers for water storage. In order to determine the predictors of these behaviours,

they were correlated through a multivariate analysis using logistic regression with the variables collected through the questionnaire. The latter comprised 18 questions to be rated on a five-point scale. Cronbach's  $\alpha$  test was calculated in order to ascertain their unidimensionality and dichotomous outputs were obtained. Knowledge about dengue and *Ae. aegypti* had an  $\alpha$  reliability of 0.81; low knowledge was defined by <70% of 9 questions correctly answered. Involvement had an  $\alpha$  reliability of 0.86; involvement was defined by participation in all steps from problem identification up to the evaluation of action plans. Satisfaction with the response to the felt needs had an  $\alpha$  reliability of 0.80; satisfaction was defined by 100% positive answers on the 5 satisfaction questions.

Entomological indicators and data on main breeding sites were collected from the routine information produced by the control programme and were available over the whole period of intervention and follow-up. The type and location of the main breeding sites of *Ae. aegypti* were identified in each area. A  $\chi^2$  test was used to compare proportions. An ANOVA model was constructed to assess the effect of the 'area' and the 'year' on the house index (number of positive houses/total number of houses inspected  $\times$  100%). The statistical analysis was carried out using SPSS 9.0.

#### *Level of Institutionalization*

The institutionalization of the newly formed structures within the vertical control programme was evaluated through a process analysis in the intervention area. The data were collected through a review of documents, observations, key informant interviews and in-depth group interviews (Patton, 2001) with the CWG members and health programme managers.

The content analysis was guided by the conceptual model of Goodman and Steckler (1989), revised in 1993 (Goodman, McLeroy, Steckler, & Hoyle, 1993), which evaluates the level of institutionalization of an innovative programme along two dimensions. Intensiveness, or the depth of programme integration into the host organization, forms the first dimension and has three degrees: passages, routines and niche saturation. "Passages are significant changes in organizational structures or procedures that generally occur once", as opposed to routines that occur repeatedly in the life of an organization. Finally niche saturation

refers to the maximal feasible expansion of the project within a host organization. The second dimension, extensiveness, represents the programme's integration into the different subsystems of the host organization: the production, maintenance, support, and managerial subsystems. Production concerns "throughputs", maintenance is personnel directed, support relates to relations with the environment and finally the managerial subsystem is concerned with coordination and direction of the three others.

#### *Capacity building in the community*

In both intervention and control areas, 30 key informants were interviewed to obtain their opinion about the procedures followed and the capacities reached in the community. We analysed the capacities built following eight domains proposed by Gibbon, Labonte, and Laverack (2002): representation, leadership, organization, needs assessment, resource availability, implementation, linkages and management. The analysis of the data was independently performed by two researchers in order to improve the quality of the analysis.

## **Results**

### *Maintenance of effects*

#### *Maintenance of behavioural changes*

Between 2000 and 2002, significant behavioural changes were produced in the intervention area as well as in the control area (Table 1). Two years later these changes had only been maintained in the intervention area. For instance, despite a small increase between 2002 and 2004 (up to 9.5%), the percentage of households that incorrectly used larvicide (temephos) in the intervention area remained significantly lower than the percentage found at baseline (45.6%) and in the control area (36.5%). It is also illustrative to point out that 87.5% of the houses surveyed in the intervention area correctly covered water storage containers in 2004, 2 years after project withdrawal. In the control area however, there has been a relapse in risk behaviours and containers are only correctly covered in 21.5% of the houses by the end of 2004.

The probability of at risk behaviour at household level (Table 2) was two times higher in the control area than in the intervention area (adjusted OR = 0.5, 95% CI 0.28–0.89). In the intervention area, 98% of the surveyed population had a good

Table 1  
Behavioural indicators at family level

	Intervention area			Control area		
	Before intervention <sup>a</sup> (2000)	End of intervention <sup>a</sup> (2002)	2 years after intervention <sup>a</sup> (2004)	Before intervention <sup>b</sup> (2000)	End of intervention <sup>b</sup> (2002)	2 years after intervention <sup>a</sup> (2004)
% Houses with incorrect use temephos (95%CI)	45.6 (38.5–52.4)	0.9 (0.1–3.6)	9.5 (5.8–14.0)	55.2 (47.8–62.0)	11.1 (7.0–16.2)	36.5 (29.8–43.6)
% Houses with unprotected artificial containers (95%CI)	61.9 (54.9–68.8)	6.1 (3.1–10.2)	3.4 (1.4–7.1)	60.0 (52.9–66.8)	7.3 (4.3–12.1)	18.5 (13.4–24.6)
% Houses with containers for water storage (low tanks)						
Un-covered (95%CI)	49.5 (42.4–56.6)	2.6 (0.8–5.7)	2.0 (0.5–5.0)	37.1 (30.3–44.1)	14.0 (9.5–19.6)	40.0 (33.2–47.1)
Badly covered (95%CI)	20.5 (13.1–26.8)	12.5 (8.3–17.9)	10.5 (6.6–15.6)	32.5 (26.1–39.5)	15.1 (10.4–20.7)	38.5 (31.7–45.6)
Well covered (95%CI)	30.0 (23.7–36.9)	85.0 (79.3–89.6)	87.5 (82.1–91.7)	30.4 (24.2–37.4)	70.9 (64.2–77.2)	21.5 (16.0–27.8)

Santiago de Cuba. 2000–2004.

<sup>a</sup>Survey of 200 houses (see Material and Methods).

<sup>b</sup>Routine data for the whole area (see Material and Methods).

Table 2  
Predictors of risk behaviour<sup>a</sup> at household level ( $n = 200$  in each area)

Variable (reference category) <sup>b</sup>	Crude OR (95% CI)	$p$	Adjusted <sup>c</sup> OR (95% CI)	$p$
Area (control)	0.19 (0.12–0.31)	<0.001	0.50 (0.28–0.89)	0.022
Knowledge about dengue and <i>Ae. aegypti</i> (low)	0.29 (0.11–0.77)	0.01	1.01 (0.35–2.94)	0.97
Satisfaction of felt needs (no)	0.12 (0.075–0.19)	<0.001	0.41 (0.21–0.49)	0.008
Involvement <sup>d</sup> (no)	0.0768 (0.04–0.13)	<0.001	0.19 (0.09–0.41)	<0.001

Santiago de Cuba. 2004.

<sup>a</sup>Risk behaviour = incorrect use of abate and/or unprotected artificial containers and/or badly covered containers for water storage.

<sup>b</sup>See Material and Methods for definitions.

<sup>c</sup>Adjusted by logistic regression analysis.

<sup>d</sup>Involvement = participation in the process of change, since identification of needs until evaluation of actions.

knowledge about dengue control, 81% was satisfied with the solutions implemented and 79% stated that they had been involved in the entire process. In the control areas, this held for only 92.5%, 27% and 15% (mainly formal leaders) of the population, respectively.

In the multivariate analysis, knowledge did not influence significantly ( $p > 0.05$ ) the presence of risk

behaviours in contrast with the absence of involvement ( $p < 0.05$ ) or with dissatisfaction with the solutions implemented ( $p < 0.05$ ).

#### *Maintenance of reduction in entomological indicators*

From 2000 to 2002, the house indices had been significantly reduced in the intervention area (from 1.23% to 0.35%) as well as in the control area (from

2.08% to 0.52%) (Fig. 1). Two years after withdrawal of external support, the median house index in the intervention area had been maintained and even decreased from 0.35% to 0.17%, while in the control area it had increased from 0.52% to 2.25%, thus reaching pre-intervention values. There was a significant effect observed of the “area” and the “year” in the post-intervention period (repeated measures analysis of variance,  $p < 0.05$ ).

At baseline (2000), the main breeding sites in the control and intervention areas were found in the domestic environment (intra and peridomiciliary), specifically in low water tanks (60.7% and 65%,

respectively) (Toledo et al., 2006). In 2004, the number of *Ae. aegypti* foci was much lower in the intervention area in comparison with the control area. Moreover, in this latter area, the main breeding sites were found in the domestic environment (86.4%), while in the intervention area they were found in the communal area (75.8%) (Table 3). This difference is statistically significant ( $p < 0.01$ ). In the control area, 66.3% of all foci were found in low water tanks, while in the pilot area, 58.1% were found in other types of containers (e.g. spiritual vases, flower vases, natural containers ...) and 16.1% were found in building basements.

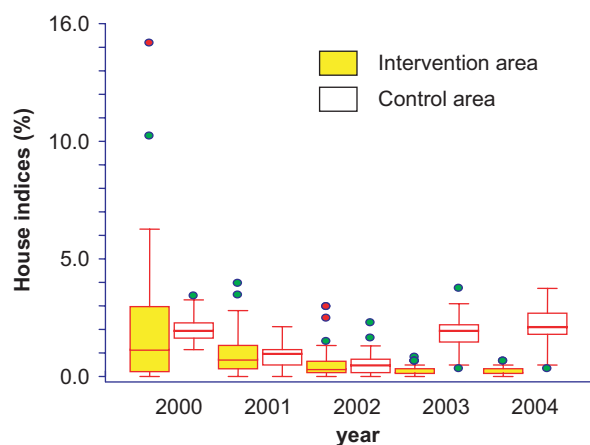


Fig. 1. Distribution box plots of the house indices of house blocks by area and by year. Santiago de Cuba. 2000–2004.

*Level of institutionalization of the community-based strategy within the vertical vector control programme (Fig. 2)*

Institutionalization can be defined as the process of mutual adjustment that occurs between an innovative programme and a receptive organization. The highest level of institutionalization is reached when the innovation loses its separate identity and becomes part of the organization’s regular activities (Shediac-Rizkallah & Bone, 1998).

Fig. 2 illustrates this institutionalization of the newly formed structures (CWG and Provincial/Municipal Coordination Groups) within the host organization, existing of the dengue vector control programme and the governmental intersectoral

Table 3  
Breeding sites by type, localization and area

Type of breeding site	Intervention area				Control area			
	Intra domiciliary No. (%)	Peri domiciliary No. (%)	Communal area No. (%)	Total No. (%)	Intra domiciliary No. (%)	Peri domiciliary No. (%)	Communal area No. (%)	Total No. (%)
Artificial containers	—	1 (33.3)	2 (66.7)	3 (4.8)	—	29 (70.7)	12 (29.3)	41 (5.5)
Low water tanks	1 (25.0)	3 (75.0)	—	4 (6.5)	289 (66.3)	147 (33.7)	—	436(58.6)
Elevated water tanks	—	6 (66.7)	3 (33.3)	9 (14.5)	—	68 (53.5)	59 (46.5)	127 (17.1)
Other containers	2 (5.6)	2 (5.6)	32 (88.8)	36 (58.1)	79 (68.7)	31 (27.0)	5 (4.3)	115(15.5)
Basement of buildings	—	—	10 (100)	10 (16.1)	—	—	25 (100)	25 (3.3)
Total	3 (4.8)	12 (19.4)	47 (75.8)	62 (100)	368 (49.5)	275(36.9)	101 (13.6)	744 (100)

Santiago de Cuba, 2004.

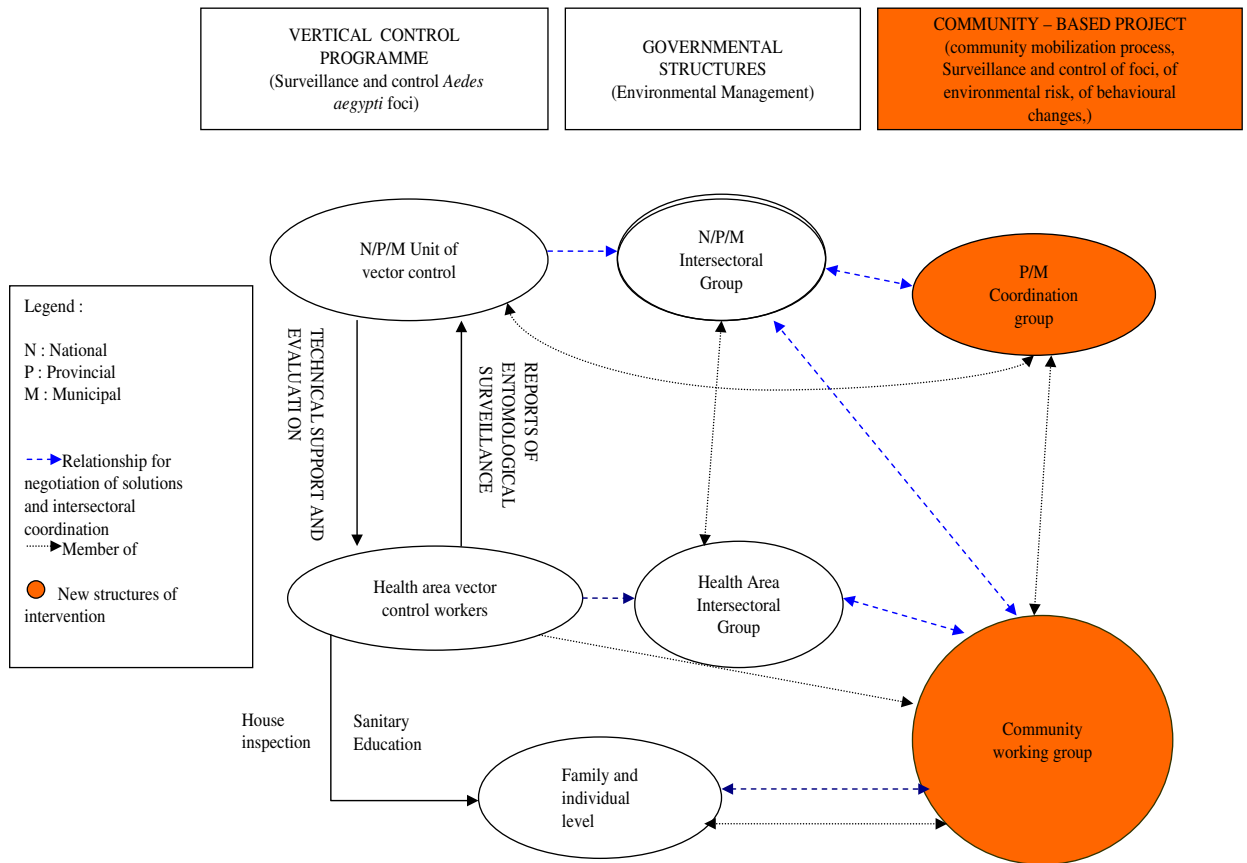


Fig. 2. Institutionalization process of the community-based strategy. Santiago de Cuba, 2000–2004.

groups, which are both present at national, provincial, municipal and health area level.

The link between the coordination groups and the host organizations at the different levels is based on the negotiation of solutions in response to the identified problems by the community.

The first degree of institutionalization intensive-ness, also called ‘*passage*’, has been achieved through the following significant changes in organizational structure or procedures. The implementation plan of the community-based strategy was approved by the provincial authorities in 1999 (*supportive subsystem*). A new provincial coordinating group was created to develop the formative investigation, to train human resources and to accompany the implementation process in the communities (*maintenance subsystem*). At community level, the CWG were formed to identify the problems of general concern to the communities, to elaborate and execute the action plans and to evaluate the results through elaborated instruments for surveillance of environmental risk and beha-

viour (*productive subsystem*). Health promoters were trained to take the leadership of these groups. The representatives of the CWG were incorporated as members of the intersectoral groups. Other institutions than the members of the intersectoral group (e.g. for health education, for mass media communication) participated in several actions (*supportive subsystem*). The activities of the CWG were included in the annual plan of the health area’s vertical control programme (*managerial subsystem*).

The second degree of institutionalization intensity, also called ‘*routine*’, was characterized by the following organizational events. The annual plan of the social mobilization strategy was elaborated and executed during the 2 years of project and the 2 years after the withdrawal of the external support (*supportive and production subsystem*). Funds for the activities of the Provincial/Municipal Coordination Group and the CWG were included in the annual budget of the control programme (*production and maintenance subsystems*). Relationships were built and maintained between the different structures

involved, and then evolved from collaborative relations to team work based on negotiations. Procedures of the operations of the “project” were integrated within the vertical programme: the training of health promoters (*maintenance subsystem*), the active participation of campaign workers in the CWG (*maintenance subsystem*), the inclusion of the risk and behaviour surveillance in the routine activities of the campaign workers and of the primary health care team (*production subsystem*).

Currently, institutionalization is heading towards the third degree of institutionalization intensity, ‘*niche saturation*’. The municipal direction of the control programme has perceived the benefits of the approach in terms of effectiveness. The mutual adaptation of values and norms between the control programme and the social mobilization project continues. The control programme is now actualizing its structures and procedures to extend this experience to the whole municipality of Santiago de Cuba and presents the social mobilization strategy as an integrated part of its activity plan.

#### *Capacity building in the recipient community*

Capacity building can be defined as ‘the increase in community groups’ abilities to define, assess, analyse and act on health (or any other) concerns of importance to their members’ (Gibbon et al., 2002).

The community capacities achieved in each of the different domains are presented in Table 4.

In the intervention area, these capacities were obtained through training of the CWG and the community. The Municipal/Provincial Coordination Groups conducted the participant training of the CWG, with as content: skills in the field of interactive problem and solution identification, risk and behaviour surveillance, elaboration and evaluation of action plans and coordination and management of intersectoral actions. The community was continuously skilled over the 4 years in participatory social communication techniques and risk surveillance, based on exchange of experience with CWG and/or campaign workers during the execution of control activities.

Capacities have been reinforced in the control areas, but the training focused on the campaign workers of the vector control programme to improve their technical skills and their work efficiency in fighting the vector. The community continued to be passively involved in the control of dengue. They received educative messages through

mass media and community meetings where it was explained “what they should do” to prevent *Ae. aegypti* foci, without any active involvement in problem identification or action plan elaboration.

#### **Discussion**

The maintenance of effects with regard to entomological indicators and behavioural changes, the integration of new procedures into the standard operating practice of the vertical programme at community, municipal and provincial levels and the capacity acquired by the new community organizations (CWG) constitute sustainability outcomes of the project in the intervention area in Santiago de Cuba.

In the following sections, we discuss the relevance of operational indicators, the study limitations and theoretical and methodological issues related to sustainability assessment.

#### *Maintenance of effects*

In terms of public health, sustaining an innovation in organizational terms without maintaining results in terms of outcomes makes no sense. Therefore, it is necessary to show that the innovation is still effective once sustained in its host organization. In a non-endemic country such as Cuba, health benefits and effect on transmission cannot be evaluated because dengue cases are only present during (sporadic) epidemics. Therefore, proxy indicators have been chosen such as entomological indices and behavioural change indicators, which have already been used in a few studies to determine the effectiveness of community-based strategies (Renganathan et al., 2003) with mixed results (Winch et al., 2002). Behavioural changes are indeed hard to achieve and sustain in dengue control (Gubler & Clark, 1994; Parks & Lloyd, 2004).

In this study, the only behavioural change in the intervention area that was somewhat less sustained was the correct use of the larvicide temephos. The population indicates that temephos gives a bad taste to drinking water (stored in the tanks for up to 21 days) and this is probably the reason why some people reverted to their old behaviour, throwing temephos away shortly after administration. The changes observed in the distribution of the localization of main breeding sites in the intervention area, could also represent an indication of sustained



Table 4  
Community capacities attained in different domains

Domains	Participation	Organizational structures	Leadership	Needs assessment	Resource mobilization	Implementation	Linkage	Management : monitoring and evaluation
Intervention area	The community is an actor in the different steps of the programme represented by his formal and informal leaders and the health promoters	New organizational structures were created and are functional: coordinator groups at municipal and provincial level And CWG at community level	Coordinator groups lead human resource development  CWG leads process of social mobilization	The problems, and solutions to problems are mainly identified by the community	Resource mobilization by community and intersectoral groups through negotiation at different levels	Action plans are elaborated, implemented and evaluated by the CWG with participation of the community. Support of community and governmental structures is negotiated.	Links between community, control programme and governmental structures are functional and mainly based on negotiation	Monitoring of: Project implementation and results: by coordinators groups. <i>A. aegypti</i> foci: by campaign workers. Behavioral change and environmental risks : by the community
Control area	The community has only a passive role in the control programme	No new organizational structures were created.  No empowerment of existing structures	The local public health authorities leads all strategy of vector control	The problems are identified by the local public health authorities, without involvement of the community	Resource mobilization by intersectoral groups	All actions of vector control are executed by local public health authorities, which gives orientation to the community The governmental structures contribute to solve environmental problems.	Links between control programme and governmental structures are formalized and mainly based on collaboration	Community not involved in evaluation and monitoring

Santiago de Cuba, 2000–2004.

behavioural change, since 75.8% of all sources are found outside the houses (communal area) against only 39.3% in 2000, indicating that the families are taking care of the domestic environment (intra and peridomiciliary). As the mosquitoes do not find viable sites inside the houses, they breed outdoors. A similar observation and interpretation has been made in Vietnam (Kay & Vu, 2005).

### *Institutionalization*

Institutionalization is a key process leading to sustainability (Goodman & Steckler, 1989). Specifically with regard to dengue vector control, Gubler (1989) advocated integration of both vertical (top down) and horizontal (bottom up) approaches. The integration of the new structures (coordination groups and CWG) into the vertical programme in the intervention area in Santiago de Cuba, illustrates that moves in this direction are feasible and that they seem to lead to positive effects in terms of both vector control and sustainability of behavioural change. Similarly, other experiences in social mobilization and communication for dengue prevention and control in the English-speaking Caribbean and in Honduras indicate that an institutional change in approaches (from top-down towards relying on community dialogue, negotiation and partnership) was one of the key outcomes (Parks et al., 2005). However, we identified important barriers at three levels in the process towards full institutionalization and long-term sustainability:

As in other countries, at community level, *Ae. aegypti* control is not a high priority for many people faced with a range of other more immediate problems (Suarez, Olarte, Ana, & Gonzalez, 2005). What will be the long-term fate of the CWG in terms of functionality and financial and institutional viability? The data collected and the time span used do not permit to answer these questions. However, CWG (backed-up by the Control Programme) are the structures delivering the services (action plans, campaigns) that are leading to changes in vector-related behaviour. The sustainability and capacities of these structures are therefore crucial in order to sustain these changes in the long run.

Within the vertical programme, even though conditions have changed, there could be resistance to change among vector control personnel given the remarkable successes achieved by the programme in the past. Within this vertical programme, no

permanent structures existed to organize training in the field of driving organizational processes; therefore, the new coordination groups took this task on themselves and are slowly integrating in this host structure.

Finally, an important external factor influencing the sustainability of the community-based approach to vector control seems to be the provision of adequate services to the communities at municipality level (garbage collection, waste water disposal, clean water supply). These services are provided in the entire municipality and there is a political will to further invest in them, but for the moment, due to budgetary constraints, they suffer disruptions in the control as well as in the intervention area.

In addition in top-down programmes, building and sustaining capacity requires an organizational capacity as well as the expertise of individuals (Grisso, Christakis, & Berlin, 1995; Rist, 1995). Efforts focused only on changing the institutional headquarters, and not the intermediate and local levels, will have limited impact (Babu & Mthindi, 1995). In this pilot project, the creation of coordinating groups at municipal and provincial level permitted the continuous training of human resources and it contributed to strengthen the participatory processes in the communities, but the project did not have to intervene—and did not intervene—at higher institutional levels.

### *Capacity building*

It is unrealistic to think that community participation can be organized and maintained spontaneously. Capacity building is a dynamic process and must form part of a strategy which favours the sustainability of the intervention from the beginning onwards.

The approach to capacity building used in the pilot project is ‘the community organizing’ one, which is ambitious because it aims at the transformation of individuals from passive recipients of services to active participants in a process of community change. However, forming new organizations is rarely a straight-forward process, and it is idealistic to expect community members to form workable organizations without providing the opportunities for them to acquire skills in leadership, decision-making, conflict resolution, developing norms and procedures, and articulating shared visions (Murray & Dunn, 1995; Poole, 1997). In our

study, the training of health promoters with expertise in planning and programme development and leadership skills was an important step in the process of integration and development of social mobilization. This approach was also used by the successful Heart Health Programme of Minnesota to achieve sustainability with formation of local community boards to advice in the development and implementation of programmes (Bracht et al., 1994).

Another important element to take into account to guarantee the sustainability of community-based strategies is intersectoral coordination and the creation of linkages between structures to create a platform to negotiate solutions that outreach the competence and responsibility of the community, as demonstrated by Sanchez et al. (2005).

Finally, we consider that using community participation to gather support for project activities without capacity building and true active community involvement, can be just as unsustainable as any other approach.

#### *Study limitations and conceptual framework*

A limitation of the study is that it was carried out only 2 years after the technical support was withdrawn. However, this was deemed important in order to assess the level of institutionalization and the capacity building at local level (Shediac-Rizkallah, & Bone, 1998). There is no doubt that a longer assessment period will be required in order to monitor the long-term sustainability of the intervention. Nevertheless, the first results achieved so far have been satisfactory. Another limitation is that the financial aspects of sustaining the approach were not examined and, in terms of cost, development and integration of community-based approaches within the vertical control programme raises questions. Other uncertainties are whether the changes in the strategy represent an increase in both overall efficacy and efficiency, taking into account new working procedures and the transfer of social and economic costs to community level. It is not known if these costs are sustainable at community level. Detailed research is needed on the issue of cost-effectiveness.

The framework elaborated by Shediac-Rizkallah and Bone (1998) on the basis of previous work conducted by other authors proved useful in measuring sustainability of both the intervention and of its effects. However, this framework, because

of its focus on measuring sustainability and institutionalization, does not permit to capture all the dimensions of the phenomenon and the processes, determinants and conditions leading to sustainability. Indeed, recent research from Pluye, Potvin, and Denis (2004), Pluye, Potvin, Denis, Pelletier, and Mannoni (2005) advances that sustainability and institutionalization is not the final stage of implementation and that the process of implementation and the processes leading to sustainability are linked, although different intrinsically. In particular, what produces sustainable effects in this project: the integration by itself, or the community mobilization, participation and organization, or the capacity building at this level, increased awareness, feeling of ownership towards the programme, or organizational processes (collaboration, changes in decision-making, implementation of action plans), or more responsiveness to the community's felt needs by the vertical programme, or a combination of all these?

To understand the "pathways" leading to sustainability, other frameworks and indicators are needed. Our hypothesis in this intervention is the importance of perceived ownership as an intermediate variable between community participation and programme effectiveness and maintenance, which is in line with the literature (Bracht & Kingsbury, 1990; Flynn, 1995; Rifkin, 1986).

Finally major questions remain unanswered regarding the process of "getting research into policy and practice": How to scale-up the intervention and eventually institutionalize it at provincial or even national levels? Can a pilot approach in which the community was continuously skilled in participatory techniques and risk surveillance, and that is based on exchange of experience with CWG and campaign workers really be taken to scale and sustained at scale? What are the necessary conditions and adaptations required at the higher level of the host institution in terms of organization, capacity, staffing, finance, etc.? These and other questions related to the scaling up and its cost are being addressed in ongoing studies in Cuba.

#### **Acknowledgements**

We gratefully acknowledge the role played by the health sector staff involved in the dengue prevention and control activities. We also thank the people of Santiago de Cuba who participated in the study. The study was partially funded through the

framework agreement between the Institute of Tropical Medicine and the Belgium Directorate-General for Development Cooperation.

## References

- Anonymous. (2000). Dengue in Central America: The epidemics of 2000. *Epidemiological Bulletin*, 21(4), 4–8.
- Arias, J. (2002). Dengue in Cuba. *Reviews of Panamericana Salud Publica*, 11(4), 221–222.
- Babu, S. C., & Mthindi, G. B. (1995). Developing decentralized capacity for disaster prevention: Lessons from food security and nutrition monitoring in Malawi. *Disasters*, 19(2), 127–139.
- Bossert, T. J. (1990). Can they get along without us? Sustainability of donor-supported health projects in Central America and Africa. *Social Science & Medicine*, 30(9), 1015–1023.
- Bracht, N. (1999). *Health promotion at the community level 2. New advances*. London: Sage Publications Inc.
- Bracht, N., Finnegan, J. R., Rissel, C., Weisbrod, R., Gleason, J., Corbett, J., et al. (1994). Community ownership and program continuation following a health demonstration project. *Health Education Research*, 9, 243–255.
- Bracht, N., & Kingsbury, L. (1990). Community organization principles in health promotion: A five-stage model. In N. Bracht (Ed.), *Health promotion at the community level*. Newbury Park, CA: Sage.
- Flynn, B. S. (1995). Measuring community leaders' perceived ownership of health education programs: Initial tests of reliability and validity. *Health Education Research*, 10(1), 27–36.
- Gibbon, M., Labonte, R., & Laverack, G. (2002). Evaluating community capacity. *Health and Social Care in the Community*, 10(6), 485–491.
- Goodman, R. M., McLeroy, K. R., Steckler, A. B., & Hoyle, R. H. (1993). Development of level of institutionalization scales for health promotion programs. *Health Education Quarterly*, 20(2), 161–178.
- Goodman, R. M., & Steckler, A. B. (1989). A framework for assessing program institutionalization. *Knowledge in Society*, 2(1), 57–71.
- Grisso, J. A., Christakis, E., & Berlin, M. (1995). Development of a clinical research program in women's health. *Journal of Women's Health*, 4, 169–178.
- Gubler, D. J. (1989). *Aedes aegypti* and *Aedes aegypti*-borne disease control in the 1990s: Top down or bottom up. Charles Franklin Craig Lecture. *American Journal of Tropical Medicine and Hygiene*, 40(6), 571–578.
- Gubler, D. J., & Clark, G. G. (1994). Community-based integrated control of *Aedes aegypti*: A brief overview of current programs. *American Journal of Tropical Medicine and Hygiene*, 50(6 Suppl.), 50–60.
- Gubler, D. J., & Clark, G. G. (1996). Community involvement in the control of *Aedes aegypti*. *Acta Tropica*, 61(2), 169–179.
- Gubler, D. J., & Meltzer, M. (1999). Impact of dengue/dengue hemorrhagic fever on the developing world. *Advances in Virus Research*, 5335–5370.
- Guzman, M. G., Kouri, G. P., Bravo, J., Soler, M., Vazquez, S., & Morier, L. (1990). Dengue hemorrhagic fever in Cuba, 1981: A retrospective seroepidemiologic study. *American Journal of Tropical Medicine and Hygiene*, 42(2), 179–184.
- Harris, E., Videa, E., Perez, L., Sandoval, E., Tellez, Y., Perez, M. L., et al. (2000). Clinical, epidemiologic, and virologic features of dengue in the 1998 epidemic in Nicaragua. *American Journal of Tropical Medicine and Hygiene*, 63(1–2), 5–11.
- Kay, B., & Vu, S. N. (2005). New strategy against *Aedes aegypti* in Vietnam. *Lancet*, 365(9459), 613–617.
- Kouri, G., Guzman, M. G., Valdes, L., Carbonel, I., del Rosario, D., Vazquez, S., et al. (1998). Reemergence of dengue in Cuba: A 1997 epidemic in Santiago de Cuba. *Emerging Infectious Diseases*, 4(1), 89–92.
- Lloyd, L. S., Winch, P., Ortega-Canto, J., & Kendall, C. (1992). Results of a community-based *Aedes aegypti* control program in Merida, Yucatan, Mexico. *American Journal of Tropical Medicine and Hygiene*, 46(6), 635–642.
- Murray, M., & Dunn, L. (1995). Capacity building for rural development in the United States. *Journal of Rural Studies*, 11, 89–97.
- Olsen, I. T. (1998). Sustainability of health care: A framework for analysis. *Health Policy Planning*, 13(3), 287–295.
- Parks, W., & Lloyd, L. (2004). *Planning social mobilization and communication for dengue fever prevention and control: a step-by-step guide*.
- Parks, W., Lloyd, L., Nathan, M. B., Hosein, E., Odugleh, A., Clark, G. G., et al. (2005). International experiences in social mobilization and communication for dengue prevention and control. *Dengue Bulletin*, 28(Special Suppl.), 1–7.
- Patton, M. Q. (2001). *Qualitative research and evaluation methods*. London: Sage Publications Inc.
- Pelaez, O., Guzman, M. G., Kouri, G., Perez, R., San Martin, J. L., Vazquez, S., et al. (2004). Dengue 3 epidemic, Havana, 2001. *Emerging Infectious Diseases*, 10(4), 719–722.
- Pluye, P., Potvin, L., & Denis, J. L. (2004). Making public health programs last: Conceptualizing sustainability. *Evaluation and Program Planning*, 27, 121–133.
- Pluye, P., Potvin, L., Denis, J. L., Pelletier, J., & Mannoni, C. (2005). Program sustainability begins with the first events. *Evaluation and Program Planning*, 28, 123–137.
- Poole, D. L. (1997). Building community capacity to promote social and public health: Challenges for universities. *Health and Social Work*, 22(3), 163–170.
- Renganathan, E., Parks, W., Lloyd, L., Nathan, M. B., Hosein, E., Odugleh, A., et al. (2003). Towards sustaining behavioural impact in dengue prevention and control. *Dengue Bulletin*, 27, 6–12.
- Rifkin, S. B. (1986). Lessons from community participation in health programmes. *Health Policy and Planning*, 1, 240–249.
- Rist, R. C. (1995). Postscript: Development questions and evaluation answers. *New Directions for Evaluations*, 67, 167–174.
- Rosenbaum, J., Nathan, M. B., Ragoonansingh, R., Rawlins, S., Gayle, C., Chadee, D. D., et al. (1995). Community participation in dengue prevention and control: A survey of knowledge, attitudes, and practice in Trinidad and Tobago. *American Journal of Tropical Medicine and Hygiene*, 53(2), 111–117.
- Sanchez, L., Perez, D., Perez, T., Sosa, T., Cruz, G., Kouri, G., et al. (2005). Intersectoral coordination in *Aedes aegypti* control. A pilot project in Havana City, Cuba. *Tropical Medicine and International Health*, 10(1), 82–91.

- Sarriot, E. G., Winch, P. J., Ryan, L. J., Edison, J., Bowie, J., Swedberg, E., et al. (2004). Qualitative research to make practical sense of sustainability in primary health care projects implemented by non-governmental organizations. *International Journal of Health Planning and Management*, 19(1), 3–22.
- Scheirer, M. (2005). Is sustainability possible? A review and commentary on empirical studies of program sustainability. *American Journal of Evaluation*, 26(3), 320–347.
- Shediac-Rizkallah, M. C., & Bone, L. R. (1998). Planning for the sustainability of community-based health programs: Conceptual frameworks and future directions for research, practice and policy. *Health Education Research*, 13(1), 87–108.
- Suarez, M. R., Olarte, S. M., Ana, M. F., & Gonzalez, U. C. (2005). Is what I have just a cold or is it dengue? Addressing the gap between the politics of dengue control and daily life in Villavicencio-Colombia. *Social Science & Medicine*, 61(2), 495–502.
- Toledo-Romani, M. E., Baly, A., Ceballos, E., Boelaert, M., & Van der Stuyft, P. (2006). Participación comunitaria en la prevención del dengue: Un abordaje desde la perspectiva de los diferentes actores sociales. *Salud Pública de México*, 48(1), 39–44.
- Toledo, M. E., Vanlerberghe, V., Baly, A., Ceballos, E., Valdes, L., Searret, M., et al. (2006). Towards active community participation in dengue vector control: Results from action research in Santiago de Cuba. *Transaction of the Royal Society of Tropical Medicine and Hygiene*, in press.
- US Agency for International Development. (1988). *Sustainability of development programs: A compendium of donor experience*. Washington, DC: USAID.
- Valdes, L., Guzman, M. G., Kouri, G., Delgado, J., Carbonell, I., Cabrera, M. V., et al. (1999). Epidemiology of dengue and hemorrhagic dengue in Santiago, Cuba 1997. *Reviews of Panamericana Salud Publica*, 6(1), 16–25.
- Winch, P., Kendall, C., & Gubler, D. J. (1992). Effectiveness of community participation in vector-borne disease control. *Health Policy and Planning*, 7(4), 342–351.
- Winch, P. J., Leontsini, E., Rigau-Perez, J. G., Ruiz-Perez, M., Clark, G. G., & Gubler, D. J. (2002). Community-based dengue prevention programs in Puerto Rico: Impact on knowledge, behavior, and residential mosquito infestation. *American Journal of Tropical Medicine and Hygiene*, 67(4), 363–370.