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Towards active community participation in dengue vector control: results from action research in Santiago de Cuba, Cuba

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Summary Community participation is advocated as essential for attaining effective dengue prevention, but knowledge of how to foster this is limited. In Santiago de Cuba, multiple small task forces were created at the neighbourhood level that included all stakeholders in the control of *Aedes aegypti*. The task forces assessed the perceived needs and elaborated action plans to promote specific behavioural change and to reduce environmental risks through social communication strategies and intersectoral local government activities. We monitored five dimensions of the participation process and assessed behavioural and environmental results and entomological outcomes. Participation was weak to good. At the household level, uncovered water storage containers decreased from 49.3% to 2.6% between 2000 and 2002, and removing larvicide from them dropped from 45.5% to 1%. There was a reduction of 75% in the absolute number of positive containers and a significant decrease from 1.23% to 0.35% in the house index. Local task forces, in which the interests of householders as well as vector control workers are directly represented, can lead to effective government—community partnerships that resolve problems of mutual concern.

1. Introduction

Dengue and its most severe manifestations, haemorrhagic dengue and dengue shock syndrome, represent a serious public health problem in the Americas (Guzman and Kouri,

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2003). Vector control programmes, mainly based on spraying with organophosphate insecticides, have been implemented since the 1970s, but the control of dengue transmission achieved often proved unsustainable (Gubler, 1989). Epidemic outbreaks in different countries of the Americas from 1980 onwards reflect this lack of sustainability of top-down-managed vector control programmes. The urgent need for alternative approaches has become obvious and community participation is frequently invoked or advocated as a key element to achieve effectiveness and sustainability (Gubler and Clark, 1996; Parks and Lloyd, 2004).

The term 'community participation' in vector control activities has been interpreted in various ways, both in theory and in practice. Typically, the community is given instructions on how to solve the health problems caused by the vector (narrow or 'top-down' participation) or is invited to implement centrally designed programmes (Rifkin, 1996). Rarely, the community is involved in the process of planning, implementing and evaluating the programme (wide or 'bottom-up' participation) (Bryan et al., 1994; Rifkin, 1996). An analysis of some community-based dengue control projects in Latin America revealed that none of these achieved wide participation at that time (Gubler and Clark, 1996).

In Cuba, the programme for *Aedes aegypti* eradication is vertically organised and the population co-operates with environmental sanitation activities. It combines entomological surveillance (of larval stages and adult mosquitoes) with vector control measures (application of the larvicide Abate® to water-filled containers and insecticide space spraying), health education and enforcement of mosquito control legislation (through fines). Dengue appeared with epidemic dimensions in 1977, 1981, 1997 and 2001 (Guzman et al., 1990; Kouri et al., 1989, 1998; Rodriguez-Roche et al., 2005). During epidemics, programme activities are intensified and a higher degree of social mobilisation is pursued. This is facilitated by the perception of the increased burden of disease, as also demonstrated elsewhere (Rosenbaum et al., 1995). Notwithstanding, studies on the 1997 epidemic in Santiago de Cuba point out that, despite the development of intensive social communication programmes, there was no impact on behaviour (Kouri et al., 1998). People continued to remove Abate® from their water containers and/or to keep their containers incorrectly or not covered (de la Cruz et al., 1999).

In 1999, we explored the perceptions related to dengue of different local stakeholders in Santiago de Cuba using qualitative research methods (Toledo-Romaní et al., 2006). The population showed adequate knowledge of dengue and its vector, but had completely transferred the responsibility for vector control to the health sector, as it did not see any room for initiative or action in this domain. Furthermore, community leaders did not manage the concept of 'bottom-up community participation' and did not master techniques to foster it. To achieve social mobilisation and wide community participation in *A. aegypti* control, we designed an intervention that built an alliance between primary healthcare staff and the communities they serve.

2. Materials and methods

2.1. Context

Santiago is one of the Cuban municipalities where *A. aegypti* foci are most frequently reported, despite continuous surveillance and vector control activities. In 1981 Santiago was affected by an epidemic that spread across the country, and in 1997 by an epidemic outbreak that remained limited. Santiago de Cuba is located in the western part of the island, in the province of the same name. The average temperature oscillates between 30 °C and 32 °C and rainfall is scarce. The municipality is the most densely populated of the whole country and has 475 580 inhabitants, of which 87% live in the urban zone. There are residential settlements under construction and the periurban neighbourhoods lack adequate sanitary conditions. Since there is major damage to the piped water system and water is supplied only every 15—21 days, the population stores drinking water at home in multiple containers. Garbage collection is sometimes deficient, which leads to accumulation of trash. The city (or municipality) of Santiago is covered by a dense network of approximately 400 family medicine practices staffed with family doctors and nurses. A practice covers a neighbourhood with some 500—600 inhabitants, which are regrouped in health areas of 40—45 practices and one policlinic that is staffed with specialists.

2.2. Study design

The study was conceived as quasi-experimental and the actual intervention phase was conducted over a 2-year period (2001—2002). Three health areas, 'Julián Grimau', '28 de Septiembre' and 'José Martí', were purposively selected amongst those with high *A. aegypti* infestation levels. Within these three areas, 20 family medicine practices and the neighbourhoods they covered were randomly selected as intervention sites. An equal number of control practices/neighbourhoods were selected within three other health areas, '30 de Noviembre', 'Camilo Torres' and 'Carlos J. Finlay' (aiming at comparability with regard to vector infestation, urbanisation and population characteristics). In these control sites, only the routine activities of the *A. aegypti* control programme were to be conducted. The study received clearance from the ethical committee of the Institute of Tropical Medicine 'Pedro Kourí', Havana, Cuba, and from the national health authorities. Community representatives approved the intervention and individual informed consent was obtained from persons interviewed and from the inhabitants of the houses inspected.

2.3. The intervention

The goal of our intervention was to mobilise the community for all stages of *A. aegypti* control, from problem identification over planning and implementation up to evaluation. In 2000, an external research group from the Institute of Tropical Medicine 'Pedro Kourí' in Havana, in coordination with the health authorities of Santiago, set up a local researchers team that was to guide the project. The external and local teams jointly conducted formative research by means of a knowledge, attitudes and practices (KAP) survey, focus group discussions, behavioural observation and in-depth interviews (Toledo-Romaní et al., 2006). As indicated above, this study highlighted the need to involve the community actively in dengue control and to build partnerships between the community, primary healthcare staff, vector control staff and governmental intersectoral bodies. The design of the actual intervention was based on the formative research findings and was elaborated through a participative process and discussions between the external and local researchers and the local health staff.

In early 2001, the family doctors of the 20 selected neighbourhoods in the intervention sites created a new organisational structure, 'Los grupos de Trabajo Comunitario' or 'Community Working Group (CWG)'. A CWG was composed of formal and informal leaders, public health workers from the governmental vector control programme and the doctors and nurses of the neighbourhoods' family medicine practices. The group had between 10 to 20 members who received no financial incentives. The learning needs of the CWG were assessed during a workshop and subsequent training was offered by the external research team based on interactive methods. The groups became responsible for co-ordination of intersectoral actions at the local level and were asked to rethink ways of involving the community. Leadership of the CWG was initially taken up by the family doctors, but was subsequently handed over to community health promoters. The local research team assumed responsibility for documenting the process, monitoring behavioural changes, evaluation, and implementation of continuous training according to needs identified by the actors involved in the project. It became an integral part of the municipal office for dengue vector control. The external research group visited the local research team on a bimonthly basis to provide technical support and coaching if required. Its contact with the different CWGs was limited to one short supportive visit per year.

The CWG launched a situation assessment exercise with the community to identify local needs and priorities for dengue control. Special attention was paid to opportunities for reconciling the interests of the community with *A. aegypti* control needs defined by the public health workers. Thereafter, action plans were elaborated and implemented. Behavioural change was promoted with respect to common behaviours that favoured mosquito proliferation: incorrectly or not covering water storage containers; not protecting artificial containers (potential breeding sites such as bottles, cans, etc. not protected from filling with rainwater); and removing Abate® from water storage containers. The CWG also negotiated solutions with the community and with governmental intersectoral groups for eliminating particular environmental risks: transforming empty lots where trash was dumped into vegetable gardens; repairing broken water pipelines; and sealing the foundations of some buildings that were identified as a main breeding site. For the repair of water storage containers and the construction of covers, they secured cement, wood and nylon, which was provided free of charge to the community by the local government. All these activities were accompanied by a social communication strategy, which aimed at mobilising the population and promoting healthy behaviours. The strategy used community resources to elaborate local educational messages, which were delivered through interpersonal communication in face-to-face encounters and in community meetings as well as through local mass media. Additionally, risk surveillance was set up and consequently conducted by the community through the introduction of tools for mapping intradomiciliary and extradomiciliary environmental risks.

2.4. Activities in the control areas

The routine *A. aegypti* control programme is vertically organised, but to a certain extent decentralised decision-making is possible at the health area level in accordance with local characteristics and the entomological situation. Standard control activities carried out by the programme's vector control workers comprise entomological surveillance, source reduction through periodic inspection of homes, larviciding of water-holding containers including those used for domestic water storage, selective adulticiding, health education and enforcement of mosquito control legislation through the use of fines when breeding sites are found on a property lot.

In view of reports on Breteau indices (BI) higher than 1 in Santiago and on dengue outbreaks in Havana (Pelaez et al., 2004), the government decided in the first quarter of 2001 to intensify routine control activities drastically in all highly infested health areas of the municipality. The action plans elaborated by the health authorities included chemical measures (weekly focal and perifocal treatment and selective adulticiding) and, in a few selected areas, the provision of plastic water containers at a price of 250 Cuban pesos to replace defective ones (i.e. with holes, broken or rusty). Furthermore, local leaders were trained to deliver dengue-related information, education and communication (IEC) messages and to promote environmental risk reduction.

These intensified routine control measures were implemented in all three control health areas in view of their high BI, but not in the three intervention areas that were no longer, given the intervention, considered a priority.

2.5. Data collection and analysis

In the intervention areas, processes (community mobilisation indicators), results (behavioural changes) and outcomes (entomological indicators) were monitored. In the control areas, only information on entomological indicators was collected.

Community participation was assessed on the basis of participative observation (Patton, 2001) by the members of the CWG and the local research team, by review of relevant documents (action plans, meeting reports, memoranda and monthly reports of activities) and by in-depth interviews with six key informants in each health area. Key informants were selected by the community amongst the formal and informal community leaders. The information collected was used to evaluate the quality and intensity of community participation before and after the intervention. The analysis was guided by the five criteria for appraising community participation proposed by Rifkin: needs identification, leadership, organisation, resource mobilisation and management (Rifkin et al., 1988). A quantitative content analysis

(Stemler, 2001) of each interview was carried out, assigning a participation score of 1 to 5 to each criterion (1 = none, 2 = weak, 3 = fair, 4 = good and 5 = excellent). These scores were first averaged per criterion and subsequently averaged over criteria to yield a measure of the degree of participation achieved in each intervention health area.

To assess indoor environmental changes, 200 houses were randomly selected in the intervention sites. Information was collected before and during the intervention, using structured questionnaires and by direct observation. Behavioural indicators were the percentage of houses where Abate® was removed from the water storage containers, the percentage of houses with unprotected artificial containers and the percentage of uncovered or incorrectly covered water storage containers. McNemar's test for paired samples was used to determine statistical significance, and 95% CI for the difference in proportions were calculated. The results of the questionnaire and the observations were triangulated (Patton, 2001). Modifications in the extradomiciliary environment were assessed through graphic images and from reports of the activities by community groups.

Entomological information was obtained from the provincial epidemiological surveillance and vector control units, who conducted, on average, bimonthly inspections of all dwellings in the intervention and control sites. Annual house indices (total of houses positive for at least one container with *A. aegypti* larvae/total of inspected houses) and container indices (total of positive containers/total of inspected containers) were computed for each block of houses, as well as the total annual absolute frequency of positive containers. The house and container indices before and during the intervention were paired per block and the Wilcoxon test for paired samples was used to test for statistically significant differences. Containers were grouped according to type. Containers used for storage of water, such as low tanks (predominantly plastic or metal), elevated tanks (generally concrete) and underground cisterns, were classified as 'used for water storage'. Items that did not serve to store water, such as bottles and cans, tyres and larvitraps, were classified as 'trash/not in use'. Percent differences in the number of positive containers were calculated comparing the years 2001 and 2002 with the year 2000 (pre-intervention). A log-linear model was constructed to assess the influence of the variables 'year' and 'area' on the change in the number of positive containers between 2000 and 2002. SPSS 9.0 (SPSS Inc., Chicago, IL, USA) was used for analysis.

3. Results

3.1. Degree of community participation

Figure 1 depicts the changes in the process of community participation by means of Rifkin's tool (Rifkin et al., 1988), explained in Section 2.5. In the pre-intervention period, the mean scores were 2, 1.6 and 1.2 for the areas José Martí, 28 de Septiembre and Julián Grimau, respectively. In other words, participation was weak or virtually absent in the three areas. The most important deficiencies were found on the criteria needs identification, management and resource mobilisation. After the intervention, the mean values for José Martí and 28 de Septiembre were both 4.4, corresponding to good participation, whilst that of Julián Grimau was 2.2, reflecting weak participation. The lowest scores in this area were for the management and resource mobilisation criteria.

3.2. Behavioural changes in the intradomiciliary and extradomiciliary environment

The behavioural indicators monitored in the intervention sites changed significantly (Table 1). Before the intervention (2000), behavioural risk factors were detected in two-thirds of the 200 randomly selected houses. At that time, a total of 2021 large water storage containers were present, a number that remained stable during the intervention. At the end of the study (2002), the number of uncovered water storage containers had decreased by 46.7% ($P < 0.01$) and the number of houses with unprotected artificial containers had decreased by 55.5% ($P < 0.01$). The number of houses where the larvicide Abate®, which is claimed by the population to have a bad taste, was removed from water storage containers decreased from 45.5% to 1% ($P < 0.01$).

The main risks identified in the extradomiciliary environment were the presence of empty lots where trash was dumped, breakdowns in the water supply network and in the sewage system, and unsealed building foundations. After the needs assessment, the communities planned the execution of a set of activities that they identified as locally important. In José Martí and 28 de Septiembre, empty lots were transformed into vegetable gardens. In Julián Grimau the community focused on cleaning areas with trash around private premises. After negotiations and co-ordination with

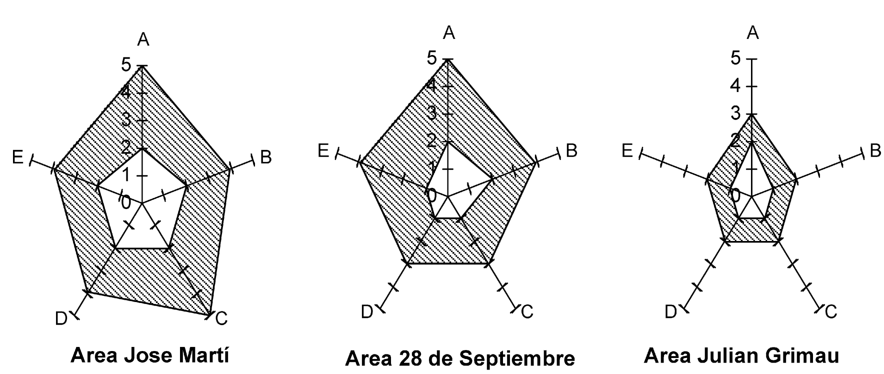

Figure 1 Changes in the process of community participation in the different intervention health areas, Santiago de Cuba, 2000—2002.

Table 1 Behavioural changes in the intradomiciliary environment in the intervention area before and at the end of the intervention, Santiago de Cuba, Cuba, 2000—2002

	2000		2002		Difference	
	N	%	*N*	%	%	95% CI
Houses ($n = 200$)						
Where abate is removed from containers	91	45.5	2	1.0	44.5[a]	37.4—51.53
With unprotected artificial containers	123	61.5	12	6.0	55.5[a]	47.9—63.0
Status of large containers for water storage						
Uncovered	996	49.3	53	2.6	46.7	44.3—48.9
Incorrectly covered	418	20.7	250	12.4	8.3	6.0—10.6
Well covered	607	30.0	1715	85.0	55.0	52.2—57.3
Total	2021	100	2018	100	0.0	—

[a] Paired difference.

Table 2 Median of the container indices (%) per house block, before and at the end of the intervention, by area, Santiago de Cuba, Cuba, 2000 and 2002

Container type	Intervention area (48 house blocks)			Control area (49 house blocks)		
	Median		Median paired difference (95% CI)	Median		Median paired difference (95% CI)
	2000	2002		2000	2002	
Used for water storage	0.18	0.06	−0.12 (−0.14 to −0.11)	0.27	0.06	−0.21 (−0.22 to −0.20)
Trash/not in use	0.00	0.00	−0.00 (-0.12×10^{-3} to -0.08×10^{-3})	0.01	0.00	−0.01 (-13×10^{-3} to -8×10^{-3})

governmental intersectoral bodies, building foundations were sealed and the water supply network was repaired in José Martí. In 28 de Septiembre, the frequency of garbage collection was increased from two to four times a month, and seven points of damage to the water supply network were repaired, which resulted in shortening the water supply cycle from every 15 days to 7 days.

3.3. Impact on entomological indicators

In the intervention and control sites the overall median of the container index per house block was below 1 per thousand before the intervention, but it was appreciably higher for containers 'used for water storage' than for 'trash/not in use' items (Table 2). There was a significant reduction in the median container indices between 2000 and 2002. Figure 2 also reveals a significant reduction ($P < 0.01$) in the median house indices per block of houses, from 1.23% to 0.35% (72% reduction) in the intervention sites and from 2.08% to 0.52% (75% reduction) in the control sites. Furthermore, we observed a decrease in the variability of the house indices in the intervention sites. It is of note that the highest house indices in 2002 pertain to the Julián Grimau health area. In the intervention as well as in the control sites, progressive and significant reductions (log-linear analysis; $P < 0.01$) were achieved in the number of positive containers (Table 3).

4. Discussion

Active mobilisation of the community, starting with local identification of problems and needs and supported by CWGs where the interests both of providers and users of health services were represented, led in this study to effective *A. aegypti* control. Behaviours at the household level changed significantly and environmental risks for the presence of the vector decreased. This was accompanied by a significant reduction in entomological indices.

In the original design, intervention and control sites were planned. Apart from the statistical drawbacks inherent to a cluster design, the government intensified the routine vector control activities (in the control sites only), which somewhat complicates the interpretation of our results. These kinds of problems with the evaluation of community intervention trials and the issue of contamination have

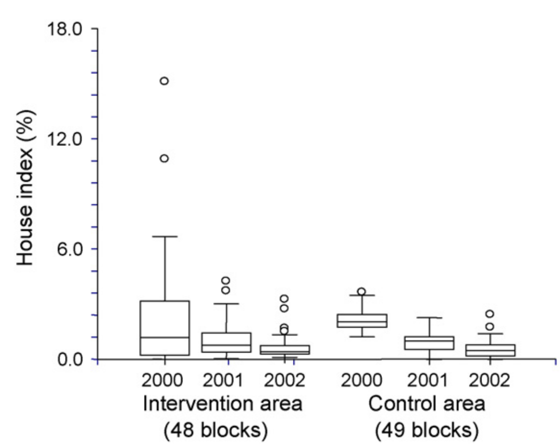

Figure 2 Box diagram of the house index per house block, by area and year, Santiago de Cuba, 2000—2002.

Table 3 Total number of positive containers found per year, by area, Santiago de Cuba, Cuba, 2000—2002

	Intervention area					Control area				
	2000	2001	2002	% difference		2000	2001	2002	% difference	
				2000—2001[a]	2000—2002[b]				2000—2001[a]	2000—2002[b]
Used for water storage										
Low tanks	364	158	114	56.6	68.7	404	181	101	55.2	75.0
Elevated tanks	100	43	14	57.0	86.0	82	32	30	61.0	63.4
Cisterns	3	0	0	100.0	100.0	2	2	1	0.0	50.0
Subtotal	467	201	128	57.0	72.6	488	215	132	55.9	73.0
Trash/not in use										
Artificial	111	57	20	48.6	82.0	85	25	12	70.6	85.9
Larvitraps	8	0	0	100.0	100.0	21	16	4	23.8	81.0
Tyres	0	0	2	0.0	—	3	0	0	100.0	100.0
Subtotal	119	57	22	52.1	81.5	109	41	16	62.4	85.3
Natural	13	4	1	69.2	92.3	23	12	3	47.8	87.0
Total	599	262	151	56.3	74.8	620	268	151	56.8	75.6

[a] Percent differences in the numbers of positive containers between years 2000 and 2001.
[b] Percent differences in the numbers of positive containers between years 2000 and 2002.

been discussed at length in the literature (Sorensen et al., 1998). McKinlay (1995) has even argued that a randomised controlled trial may not be appropriate for community intervention research that targets upstream interventions. Notwithstanding, by documenting the process of implementation and by measuring behavioural change at different levels, we were able to evaluate our intervention and to clarify the outcomes. The changes in human behaviour in the intervention sites should be attributed to the intervention itself. The comparable reductions in entomological indices in the intervention and control sites constitute evidence of similar effectiveness of the community participation strategy compared with intensified routine vector control. The decrease in the indices might, in theory, also have been caused by other factors, such as climatic changes or increased effectiveness of the basal vertical vector control programme. However, no major climatic variations were reported between 2000 and 2002 and in the intervention sites the routine vector control programme maintained essentially unchanged activities during the study period.

Since the 1990s, community participation has been promoted as a pillar of effective and sustainable *A. aegypti* control programmes (Gubler and Clark, 1994) and, in search for evidence, it subsequently became a research priority of the WHO Special Programme for Research and Training in Tropical Diseases (TDR) (WHO, 2000). However, the effectiveness of community-based approaches cannot be easily demonstrated and they remain controversial at the policy-making level. We demonstrated in the present intervention that an intensified, vertical, mainly chemical-based strategy and a community-based source reduction approach can have similar effectiveness, but the latter may have advantages in terms of sustainability and costs.

The re-emergence of *A. aegypti* despite the initial success of the mass fumigation campaigns for yellow fever control in the 1960s testifies to the unsustainability of vertically structured programmes that require huge investments in human and financial resources and continuous involvement of the government to ensure implementation (Gubler, 1989). Community-based *A. aegypti* control programmes, in contrast, are often claimed to be sustainable, but these claims rely on programme evaluations after less than 1 year of functioning (Sanchez et al., 2005). However, a central question in participatory approaches is whether community efforts can be sustained long enough to result in lasting effects (Roussos and Fawcett, 2000). The behavioural changes in our intervention sites, observed after 2 years, are promising, but more prolonged follow-up is necessary to reach firm conclusions with regard to sustainability.

Cost studies of *A. aegypti* control programmes are scanty and are mainly related to the containment of dengue outbreaks and epidemics. They generally do not report details on the different cost items of preventive vector control activities. Valdes et al. (2002) evaluated the costs from a provider perspective of controlling the 1997 dengue epidemic in Santiago de Cuba and differentiated costs for case management (US$1.9 million) from costs for augmented vector control (US$7.8 million). More than 80% of the latter costs were for personnel, transport and logistics. We assume that the cost distribution of the intensified routine programme of our control sites is comparable. The community-based source reduction approach of our intervention sites should have a lower cost when taking a provider perspective, but in terms of costs to society the picture could be different. We failed to identify any published cost estimates of community-based dengue vector control approaches and can only urge for research on this subject.

Most accounts of community participation programmes in the literature evaluate results and/or outcome but do not measure the process (Rifkin et al., 1988). We used the tool proposed by Rifkin to assess the extent and quality of involvement of the community. Before the intervention, participation was weak. Educational programmes had been continuously developed by the health authorities, but without needs identification by the community. As shown by

Chiaravalloti et al. (1998), such top-down communication on dengue and its vector does not result in behavioural change. By the end of the intervention period, participation was evaluated as good in two of the intervention health areas and weak in the third. The less than optimal participation in Julián Grimau was mainly caused by fluctuations in the health sector labour force. It is also reflected in the higher median of the area's house indices per block in 2002 and in their greater variability, despite a significant average reduction.

Creation of the heterogeneous CWGs was crucial in securing genuine participation. Initially, however, a problem of leadership was observed. The CWGs were headed by the family doctors who, owing to their high clinical workload and involvement in other preventive programmes, could not invest sufficient time. At the start of the second year of the intervention, 'health promoters' were chosen among the informal community leaders and were trained to co-ordinate the CWGs. They proved capable of communicating, organising and, above all, mobilising support and resources to solve the identified problems, which is essential to achieve bottom-up community participation (Roussos and Fawcett, 2000). They were also creative in the search for alternative solutions when confronted with constraints.

Evaluation of community-based vector control interventions is confronted with conceptual problems in measuring the behaviour of the individual, family or community (Leontsini et al., 1993; Winch et al., 2002). This explains the use of changes in knowledge and in larval indices as proxies for behavioural changes (Lardeux et al., 2002; Lloyd et al., 1992; Rosenbaum et al., 1995). In Honduras, an intervention with emphasis on community participation (Leontsini et al., 1993) resulted in a significant increase in dengue-related knowledge and a relative reduction of the house indices by 20% in the second month of the intervention. No direct measurement of behavioural change was reported. Some other interventions that relied, as we did, on formal and informal leaders to organise community-based vector control measured only the traditional entomological indices. In Panama, a reduction of the house index from 8% to 4% was obtained without any use of insecticides (Gubler and Clark, 1994); in Santa Lucia, the house index decreased in two communities from 35% and 50% to 3.7% and 4.4%, respectively (Bos et al., 1988); in Thailand, an 84% relative reduction of the BI was observed (Kittayapong and Strickman, 1992). An alternative approach in Cuba, which relied more on intersectoral collaboration than on community participation (Sanchez et al., 2005), reported that the house index in the intervention area was 3.72% at baseline and decreased to 0.61% after 1 year. In the control area it remained stable throughout the study period (1.31% and 1.65%, respectively). The relative reductions in the house indices attained in Santiago de Cuba in this study fall at the higher end of the spectrum reported in the studies above.

Winch et al. (2002) developed several specific indicators to measure behavioural change in a community-based intervention in Puerto Rico: protection of used tyres; storage of aerosol insecticide in the premises; and elimination of refuse. When comparing results in their intervention and control areas, only the larval container indices were significantly different (2.6% in the intervention area vs. 8.0% in the control area). In contrast, in the present study we find consistently important and significant reductions in all the indicators of behavioural change that we developed for assessing our intervention. Chan et al. (1998) proposed an entomological index for *A. aegypti* control interventions that is composed of the different immature stages of *A. aegypti* (larvae and/or pupae) in water-holding containers. It is meant to measure changes in the cleaning of water storage containers. This latter activity was not included in the action plans elaborated by the CWG, since it was of less relevance in our local context. However, it is still not clear how reliable quantification of pupae could be achieved through routine entomological surveillance.

It is important to assess community-based vector control programmes in terms of quality of the participation process and of the specific behavioural changes engendered, and not to rely on entomological outcomes only. Securing behavioural changes is indeed a *conditio sine qua non* for attaining impact and sustainability. The present intervention created local task forces in which the interests of all direct stakeholders, including vector control workers, were represented and built a local government—community partnership that demonstrated capacity to resolve problems of mutual concern. In terms of dengue prevention, this led to decreased household risk behaviour, reduction of environmental risks and effects on entomological indicators. However, the mid-term sustainability of this approach remains to be demonstrated.

Conflicts of interest statement

The authors have no conflicts of interest concerning the work reported in this paper.

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