

Intersectoral coordination, community empowerment and dengue prevention: six years of controlled interventions in Playa Municipality, Havana, Cuba

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Summary

OBJECTIVE To document the process, outcome and effectiveness of a community-based intervention for dengue control.

METHODS The primary intervention, focused on strengthening intersectoral coordination, was initiated by researchers in January 2000 in a pilot area in Playa municipality, Havana. In August 2002 health authorities extended the intervention to neighbouring areas, one of which was selected for evaluation. In August 2003 a complementary strategy, focused on community empowerment, was initiated in half of the pilot area. In our control area, routine dengue activities continued throughout the study period. Longitudinal process assessment was carried out using document analysis, interviews and group discussions. Random population surveys in 1999, 2002 and 2005 assessed levels of participation and behavioural changes. Entomological surveillance data from 1999 to 2005 were used to determine effectiveness.

RESULTS Mean scores for participation in the pilot area were 1.6, 3.4 and 4.4 at baseline, and 2 years after initiating intersectoral coordination and intersectoral coordination plus community empowerment interventions, respectively. While in the control area little behavioural change was observed over time, changes were considerable in the pilot and extension areas, with 80% of households involved in the community empowerment intervention showed adequate behavioural patterns. The pilot and extension areas attained comparable entomological effectiveness with significantly lower Breteau indices (BIs) than the control area. The pilot (sub-) area with the community empowerment intervention reached BIs below 0.1 that continued to be significantly lower than the one in the control area until the end of the study.

CONCLUSION The study showed a trend in the levels and quality of participation, behavioural change and effectiveness of *Aedes* control from the routine activities only over an intervention with intersectoral coordination to one that combined intersectoral coordination and community empowerment approach.

keywords *Aedes aegypti*, dengue, prevention and control, participation, evaluation studies, Cuba

Introduction

Dengue fever/dengue hemorrhagic fever (DF/DHF) is the most widespread viral vector-borne disease in the world, with cases exceeding 50 million each year (Farrar *et al.* 2007). Transmission is increasingly endemic, with epidemic outbreaks in the Americas, Southeast Asia and the Pacific (Guzman & Kouri 2002; Kouri 2006). A handful of dengue vaccines is in development, although none are close to being licensed (Guzman *et al.* 2004b). Control of its main vector, *Aedes aegypti* mosquito, is the only available prevention method. In recent decades the emphasis shifted

from a top-down to an integrated approach (Spiegel *et al.* 2005). Intersectoral coordination, environmental management, health education and community participation are the key elements to success (Kay 1994; Gubler & Clark 1996). Community-based strategies have been developed in countries worldwide (Parks *et al.* 2004; Spiegel *et al.* 2005; Heintze *et al.* 2007), but there is presently need for more evidence on how these strategies can be effectively and sustainably implemented.

Effective dengue prevention has been a longstanding priority in Cuba. *Aedes* control was established as a vertical programme in 1981 (Kouri *et al.* 1998).

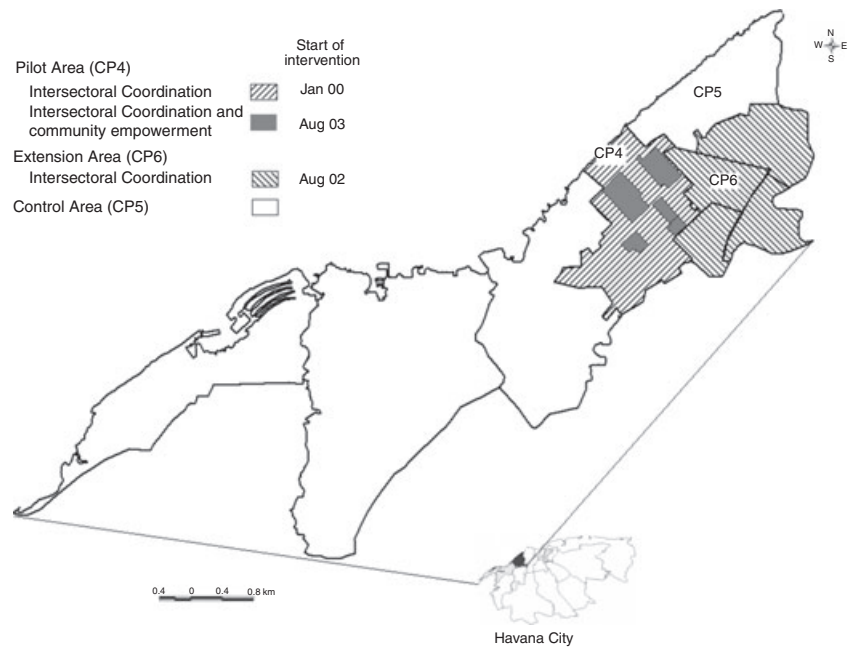


Figure 1 Study area, type and start of intervention. Playa Municipality, 1999–2005.

The programme was successful in maintaining a low level of infestation for many years, yet by 1997 an outbreak reoccurred in Santiago, with further outbreaks in Havana occurring in 2000, and then again in the following two years (Kouri *et al.* 1998; Pelaez *et al.* 2004). This prompted the health authorities to consider alternative and more integrated strategies. Pilot projects looked promising after 1 or 2 years, but their mid-term sustainability remains to be confirmed (Sanchez *et al.* 2005; Toledo *et al.* 2007).

In this study, we report 6 years' experience with an intervention study in Playa Municipality, Havana City, and the results obtained through intersectoral coordination and community empowerment.

Methods

Study site

The study was conducted in Playa Municipality, in the north-west of Havana City. Foci of *A. aegypti* have persisted in this municipality since 1992. The most productive *Aedes* breeding sites are water tanks and small containers - mainly trash, e.g. discarded bottles, jars, cans, pans - inside or close to the house (Bisset Lazcano *et al.* 2006). Among the nine 'Consejos Populares'¹ (CP) of Playa

Municipality (Figure 1), we selected CP4 for an intervention based on intersectoral coordination levels because of the area's high *A. aegypti* infestation levels. The intervention began in January 2000 (referred to as pilot area from here on). The area measures 2.5 km², has 27 030 inhabitants (9629 households) and is served by the Polyclinic '26 de Julio'. We chose as the control area CP5, an area of 2.3 km² and a population of 14 219 (6925 households), which has similar socio-ecological conditions and is served by the Polyclinic 'Ana Betancourt'. In August 2002, the municipal health authorities decided to extend the intersectoral coordination intervention to four more areas with high risk for dengue transmission (Perez *et al.* 2003). To document the process and results of the extension strategy, we selected CP6, an area of 1.4 km², 16 096 inhabitants (6893 households) and served by the Polyclinic '1ero de Enero'.

The interventions

Overview

The primary intervention was designed by a multidisciplinary research team from the Institute of Tropical Medicine "Pedro Kourí" (IPK), after a formative research process (Sanchez *et al.* 2004). It focused on strengthening intersectoral coordination at the CP level (Sanchez *et al.* 2005). A centrally organized, large scale response to the 2001/2002 dengue outbreaks in Havana temporarily disrupted implementation of the research project as

¹The Consejo Popular (CP) is a government structure between the municipal level and the 'circunscripción', the lowest level of local government. The CP is composed of representatives of the circunscripciones, community organizations, the Health Area and other sectors.

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originally designed. During this interruption, the research team critically analysed results from the intervention to make adjustments for its future orientation (Perez *et al.* 2007). After the dengue outbreak had been controlled, the health authorities decided to extend the intersectoral coordination intervention to four other CP and implemented this from August 2002 onwards. The IPK team was not involved in this extension. In August 2003, a complementary strategy that focused on community empowerment was initiated in nearly half of the pilot area (Figure 1).

Intersectoral coordination

Full details on the intersectoral coordination strategy in the study are provided in Sanchez *et al.* (2005). Briefly, in the pilot area researchers from IPK introduced in January 2000 participatory methods and facilitated dialogue in the Health Council, an intersectoral committee at CP level (which involves representatives of the government, community organizations, the Health Area, and other sectors) that manages and monitors health activities. Members were trained to conduct situation analyses and to link strategic planning with community participation. The Health Council subsequently developed an intersectoral plan for dengue prevention, with the core objective to design and implement activities for communication and social mobilization. *Aedes aegypti* control methods included the elimination of useless containers, covering water tanks and regularly cleaning public areas. After the 2002 dengue outbreak, the municipal health authorities organized short courses for family doctors and epidemiologists in the extension areas. Topics such as dengue prevention, intersectoral coordination, community participation and strategic planning were emphasized, but relatively little attention was given to developing skills for designing communication strategies and fostering participation. After the training family doctors carried out a community diagnosis and developed intersectoral plans that included sanitation activities and the delivery of locally developed materials to eliminate useless containers and ensure water tanks were covered.

Community empowerment

This intervention, initiated in August 2003, eventually involved almost half (five out of 12) of the *circunscripciones* in CP4, the initial pilot area. The design was inspired by the practice of Popular Education (Freire 1972). Community working groups (CWGs), at the *circunscripción* level, composed of formal and informal leaders

from existing community organizations, were motivated to work on dengue control and take responsibility for managing vector control activities in their areas. The community empowerment intervention targeted five participatory processes: capacity building, community dengue surveillance, social communications, behavioural change and participatory evaluation. The communication and community mobilization strategies were developed at the *circunscripción* level. The principal practices promoted at individual and collective level were covering of water tanks, protection of containers collecting rainwater and elimination of useless containers. Participation was only loosely defined beforehand by the IPK research team. The full concept was discussed and agreed in the workshops held at *circunscripción* level. The family doctors involved started the participation process once they felt ready to put the acquired knowledge and skills into practice. Consequently, the incorporation of *circunscripciones* was gradual: one by August 2003 and two by March and August 2004. The IPK research team withdrew from the intervention at the end 2004, but another two *circunscripciones* conducted the whole process by themselves in 2005 (Perez *et al.* 2007).

Routine control programme

Routine dengue prevention activities consisting of vector control, surveillance and health education were conducted throughout the study period in all CPs of Playa Municipality. Standard *A. aegypti* control actions comprised entomological surveillance, source reduction through bimonthly house inspection, application of larvicides (temephos), use of adulticides with pyrethroids when *A. aegypti* foci were detected, health education and enforcing of mosquito control legislation through the use of fines. These were done by vector control technicians. Family medicine clinics, that provide free health care for approximately 120 families, assured clinical–epidemiological surveillance through passive case detection. Health educators at municipal levels delivered dengue-related information as well as education and communication messages.

During the 2001–2002 outbreak, dengue control actions were accelerated in two key phases. The first phase began in June 2001, as soon as dengue transmission was detected. Family doctors paid regular home visits to search for cases of dengue-like illnesses and to communicate messages on dengue and *A. aegypti* control. Vector control actions were augmented with outdoor spraying in a radius of 100 m² around the house of confirmed cases. The frequency of inspection cycles was changed from bimonthly to monthly. The second phase, referred to as the ‘Intensive Campaign’,

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was launched in January 2002. It involved people at all levels of society, from the Head of State to households. The campaign aimed to eliminate adult mosquitoes, to step up environmental management and to improve sanitation efforts (Pelaez *et al.* 2004). The frequency of inspection cycles was reduced to biweekly. This 'Intensive Campaign' lasted until March 2002.

Data collection

Process

A longitudinal assessment was carried out using document analysis, interviews and group discussions. All activities documented by the Health Council and by the CWG were enumerated over key calendar years, and classified into six categories: education, sanitation, intersectoral coordination, surveillance, negotiation of behaviours, and evaluation.

Assessment of community participation relied on observations by, and reaching consensus amongst, the CWGs involved. Participation was quantified using Rifkin's framework of assigning a score (1 = none, 2 = weak, 3 = fair, 4 = good and 5 = excellent) to each of the framework's dimensions: needs assessment, leadership, organization, resource mobilization and management (Rifkin *et al.* 1988).

Outcome

We developed a questionnaire based on the methodology proposed by Reyes *et al.* (1996) to evaluate the population's involvement in decision making, execution and evaluation of dengue control activities. In 1999, 2002 and 2005 trained nurses administered the questionnaire to independent samples of 125 households in the pilot and extension areas. The households were selected by systematic random sampling from the list of households covered by the polyclinic in the corresponding area.

In addition, behaviour changes were assessed over time in a panel survey conducted in 125 different households (selected as described above). Information on behaviour related to *A. aegypti* breeding sites was collected using structured questionnaires (scrubbing of tanks, eliminating useless containers, elimination of breeding sites) and direct observation (tanks in good status, well-covered tanks, gardens and yards without useless containers). Students completing their master degree in Epidemiology at IPK carried out these panel surveys. Information on participation of the householders in sanitation and other community activities was extracted from routine activity reports of the CWG. Attendance at more than 50% of activities was classified as 'regular'.

Entomological impact

We used routine entomological surveillance data collected by the National Vector Control Program in each aforementioned area from January 1999 to December 2005. In the pilot area we differentiated the zones where only the intersectoral coordination intervention was carried out from those where the community empowerment intervention was implemented. Vector control technicians inspected all houses for aquatic stages of *A. aegypti* in every inspection cycle. We extracted information on the number of houses inspected and the number of positive containers (with *Ae. aegypti* pupae or larvae) at the house block level.

Data analysis

Spider diagrams were used to represent the changes in the number of dengue prevention activities conducted and in the scores for the different dimensions of community participation.

Differences in the proportion of households participating in the execution, design and evaluation of dengue control activities in the three areas during the different stages of the project were tested using the Chi-square test, taking into account the clustered nature of the data. The percentage of households demonstrating correct dengue-related practices (and 95% confidence intervals) were calculated for the different phases in the pilot and control areas.

We calculated the means of the Breteau indices (BIs, number of positive containers per 100 houses) over time periods per area and type of intervention. A two-way ANOVA model considering the latter two main effects and the interaction term was fitted using SAS procedure GLIMMIX. Possible autocorrelation among the residuals was taken into account by including a first order autoregressive process for the residuals. The likelihood ratio test was used to test the autoregressive against the independence model. The mean BI level in the pilot, extension and control area were compared at each period. For the last two time periods we also tested the differences between BIs in the control area and in the section of pilot area where the community empowerment intervention was implemented (CP4b). The false discovery rate (FDR) method was applied in order to adjust for multiplicity using SAS procedure MULTTEST.

Ethical clearance

The interventions in the pilot area received ethical clearance from the Ethics Committee of IPK and the municipal

health authorities. The extension of the experiences in other CPs of Playa Municipality was the sovereign decision of the Ministry of Health.

Results

Process

Figure 2 depicts the changes in the number of activities, by type, in the different phases of the project. At baseline only a small number of sanitation and education activities were executed. Through intersectoral coordination the number of sanitation and intersectoral activities increased, with the same order of magnitude in both the pilot and the extension areas. Although the quantity of educational activities did not change significantly from baseline, their scope was different, and more emphasis was put on practicalities of dengue prevention at household level. During the community empowerment intervention all types of activities increased in the pilot area. More attention was given to community surveillance, changes in behaviour and participatory evaluation. The educational activities allowed for the development of teamwork skills and enabled people to reflect on individual and community practices. Activities related to the negotiation of behaviours were only implemented during this community empowerment intervention: members of the CWGs visited the houses in their

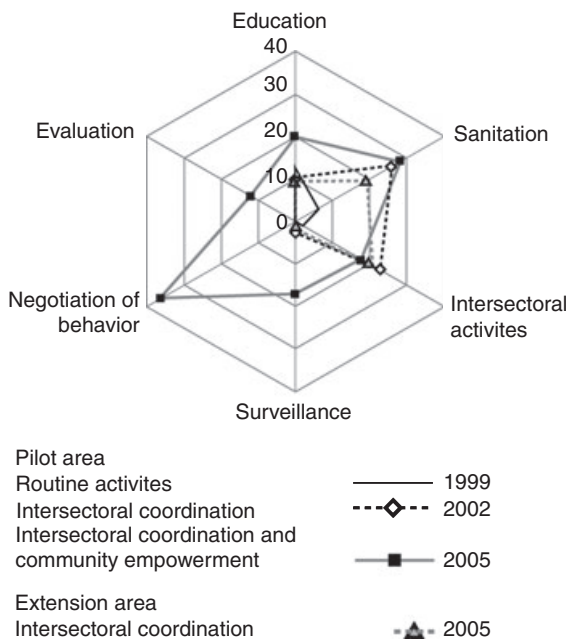


Figure 2 Type and total number of activities executed per year, by area. Playa Municipality, 1999–2005.

communities, surveying - together with the head of household - backyards and water storage containers, offering options to protect or eliminate the containers, and conducting follow-up visits to reinforce the message and appraise the implemented solutions.

Figure 3 illustrates the changes in the scores for community participation in the pilot area along the dimensions proposed by Rifkin *et al.* (1988). We observed improvement in all dimensions while moving from the routine dengue control program to the intersectoral coordination intervention and then to the community empowerment intervention. Leadership was remarkably developed during the latter phase, but resource mobilization dragged behind. The mean scores over all dimensions were 1.6 at baseline, 3.4 at intersectoral coordination and 4.4 at the community empowerment phases.

Output

A clear trend was observed in residents' participation during the execution, decision making and evaluation of activities (Table 1). The principal changes in the pilot area during the intersectoral coordination were related to informing the population about decisions in dengue prevention and community participation in the execution of *Aedes* control activities. Similar results were observed for the intersectoral coordination approach in the extension areas. In the community empowerment phase the reported level of the population's influence increased considerably. Most notably 86% of respondents stated that the community's point of view was taken into account during decision making. The percentage of respondents reporting participation in the evaluation of activities also increased significantly, but still reached only 41%.

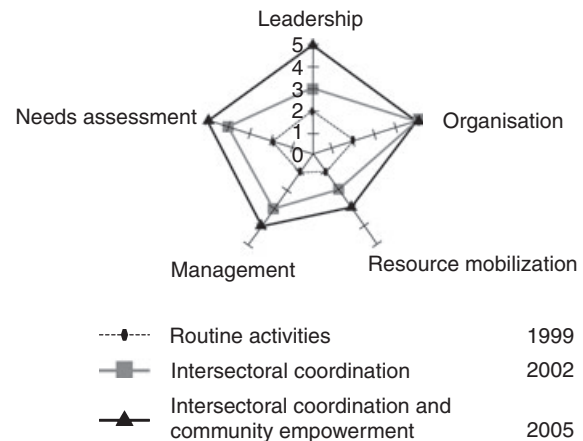


Figure 3 Changes over time in community participation in the pilot area, by intervention. Playa Municipality, 1999–2005.

Table 1 Percentage participation of the population[†] in execution, decision making and evaluation of activities related to dengue prevention by intervention and area. Playa Municipality, 1999–2005

		Routine activities		Intersectoral coordination		Intersectoral coordination and community empowerment		P value	
		Pilot area		Extension area		Pilot area			
		1999(a)	2005(b)	2002(c)	2005(d)	c vs d*	Trend (a - d)		
Execution	The population participates in community activities for <i>Aedes</i> control	48.9	85.7	83.3	94.8	n.s.	< 0.001		
Decision making	The population is regularly informed about decisions	21.7	77.8	86.7	93.3	n.s.	< 0.001		
	The population is consulted before decisions are taken	60.0	71.4	78.6	93.5	< 0.05	< 0.001		
	The decision took into account the point of view of the population	43.8	43.5	55.6	85.7	< 0.01	< 0.001		
Evaluation	The population participates in the evaluation of <i>Aedes</i> control activities	18.9	26.0	28.6	40.7	n.s.	< 0.001		

[†]Random samples of 125 households in pilot and extension area.

*P-values for the comparison between Intersectoral coordination only and Intersectoral coordination and community empowerment in the pilot area.

At baseline no significant differences were observed between the pilot and control areas on behavioural indicators and participation in dengue control activities (Figure 4). While in the control area few changes were noted over time (except for covering tanks), changes were considerable in the pilot area, in particular during the community empowerment phase. Furthermore, virtually all indicators show a clear trend from the baseline over the intersectoral coordination to the community empowerment phases. With the exception of scrubbing water storage tanks – not directly addressed by our intervention that put emphasis on covering tanks – more than 80% of households showed a behavioural pattern conducive to dengue prevention. The most notable changes were observed in the elimination of useless containers and participation in community sanitation activities.

Entomological impact

Figure 5 shows the evolution in mean BIs over time in the pilot, extension and control areas. The Akaike's information criterion (AIC) for assessing model fit for the autoregressive model (–162.63) was lower than the AIC of the independence model (–3.93), indicating that the BIs were auto-correlated. Before the intervention the pilot area had the highest BI values ($P < 0.001$). This was reversed during the period corresponding to the intersectoral coordination activities in the pilot area only

($P < 0.001$). During the intensive vector control campaign in the epidemic period all areas similar BIs. After the campaign both the pilot and extension areas maintained with intersectoral coordination had significantly lower indices than the control area ($P < 0.05$). The differences between the areas with intersectoral coordination only and the control area decreased over time but remain significant ($P < 0.03$). The area with the intersectoral coordination approach together with community empowerment maintained BI values below 0.1. These values continued to be significantly lower than the control area throughout the final evaluation period ($P = 0.004$).

Discussion

The interventions in Playa Municipality increased local capacity to generate participative processes for dengue prevention. Changes were introduced in the conception and forms of work of intersectoral bodies and health teams. The communities developed at local level social mobilisation and communication strategies in a participatory way. The process indicators, community outcomes and entomological data consistently reflect a trend in effectiveness from the implementation of the intersectoral coordination intervention to the community empowerment together with intersectoral coordination phase. The results in the extension area demonstrate the replicability of the

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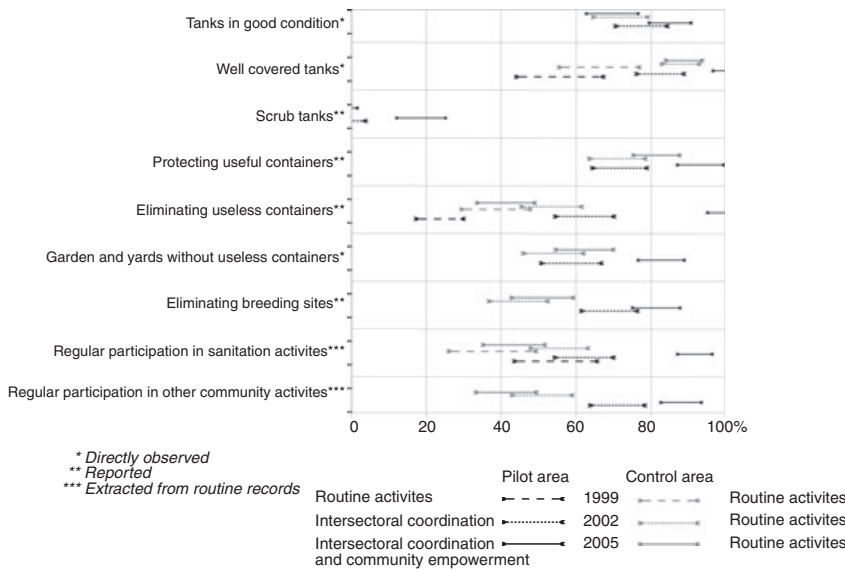


Figure 4 Dengue related practices (Percentage of households and 95% confidence interval) over time in 125 households in the pilot and in the control areas, Playa Municipality, Havana, 1999–2005.

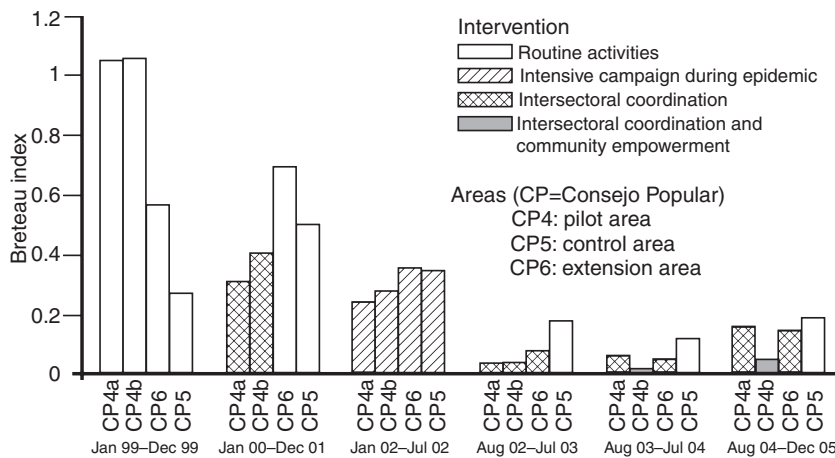


Figure 5 Mean Breteau Indices over time by area and intervention. Playa Municipality, Havana, 1999–2005.

intersectoral coordination approach. The combination of community empowerment with intersectoral coordination allowed for the maintenance of results after the withdrawal of external support.

Since the interventions conducted at CP level were linked to higher level structures, contamination between areas cannot be excluded. While this would be desirable, it could underestimate the interventions’ effectiveness. Also, entomological data collected through the routine dengue control programme had some limitations: different vector control technicians inspected the areas and the procedures used may not have been completely standardized; the intensity of the routine control inspection activities varied with the occurrence of dengue outbreaks. Additionally, as also illustrated here, entomological success does not

necessarily lead to complete suppression of disease transmission. Another possible bias is inherent in Rifkin’s measurement framework: the results only reflect the views of those most involved in the intervention. Notwithstanding, the findings from the random survey to measure the level of community participation in dengue control complement and corroborate the findings from the use of Rifkin’s framework. Finally, and most importantly, our study covers a period of 6 years, a timeframe that allows us to assess the effects of the two interventions over time and to observe trends.

Various authors have suggested that factors such as political will, governmental and social networks support, improvement of public health infrastructure, reinforcement of health policy and legislation, skilled manpower,

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a transdisciplinary and socio-ecological approach, imaginative leadership, intersectoral coordination, community empowerment and capacity to learn from experience are essential elements to achieve effective and sustainable dengue control (Guzman & Kouri 2002; Guzman *et al.* 2004a; Parks *et al.* 2004; Spiegel *et al.* 2005; Heintze *et al.* 2007; Toledo *et al.* 2008). However, examples of comprehensive approaches which take into account these elements are difficult to find. Their importance has been inferred from theories, failed experiences or promising short-term interventions rather than successful sustainable strategies. A systematic review of community-based dengue control strategies by Heintze *et al.* (2007) identified only 11 papers that compared intervention and non-intervention settings. All but the experiences in Vietnam (Nam *et al.* 2005), Taiwan (Wang *et al.* 2000) and French Polynesia (Lardeux *et al.* 2002) had observation periods shorter than 1 year. Only the intervention in Vietnam demonstrated a sustainable transdisciplinary, socio-ecological approach to dengue control, with the resulting elimination of *Aedes* infestation from 32 communes. Apart from political environment and health system set-up, these three experiences differ from our study in combining a community-based approach with other specific biological or chemical larval control tools. More recently, studies in the eastern province of Cuba have provided evidence of how transformation and integration of a routine vertical program, coupled with community capacity building and organization, can lead to sustainable and cost-effective dengue control (Toledo *et al.* 2007; Baly *et al.* 2007, 2009; Toledo Romani *et al.* 2007; Vanlerberghe *et al.* 2009).

The approach used in Playa differs from the above interventions in three aspects: less change to the vertical dengue control programme, more intersectoral linkages with existing organizations, and the use of a different praxis (principles of popular education) on community empowerment at the lowest level of the governmental structure, the *circunscripción*. We also integrated dengue prevention with sanitation and other health issues considered important by the community and local government. The need to integrate dengue into broader sanitation issues as a mean to sustain the effect of community-based interventions was signalled before (Leontsini *et al.* 1993). Research on other health problems also indicates that using democratic and consensus driven decision-making methods can increase community members' satisfaction, broaden participation and improve the maintenance of effects (Roussos & Fawcett 2000). In this study, intersectoral coordination boosted the implementation of sanitation activities and improved community organization and participation for dengue prevention. The empowerment approach allowed the communities to

share responsibilities through an existing community level political structure and to initiate innovation of *A. aegypti* control activities. Our results also suggest the importance of an improved capacity to learn from experience, self-reflection, and to move from vertical pedagogy schemes to more participatory ones. These aspects have been highlighted in Brazil and Argentina (de Oliveira 1998; Liborio *et al.* 2004), but one should not forget that an empowerment process should also generate changes at macro-social levels to contribute to social development. Using the results of this study as a foundation, a larger intervention is under way in another municipality of Havana City. The adaptability of the intersectoral coordination and community empowerment intervention to other contexts, its scalability and its cost effectiveness will be tested. Questions addressed are: How can experience generated at a micro and meso level contribute to general policy formulation? What changes are needed at institutional and community levels to translate this research into practice? Which aspects can be institutionalized? How to elaborate standards for national level implementation that allow and promote initiative, creativity and autonomy at the local level?

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