

**Documenting outputs, outcomes and learning
from Ecohealth Projects:
Dengue**

Final report

by

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Executive summary

Dengue has become a major public health threat in the Americas. Traditional approaches to dengue prevention and control have been inherited from the vertical control programs that targeted the vector as the core of the control strategy. Failures to efficiently reduce vector densities have forced the development of interventions with innovative approaches where community involvement has been pursued with limited impact in the control of the overall spectrum of breeding sites in the household and peridomestic surroundings.

IDRC launched an initiative to prevent and control dengue based on the principles of transdisciplinarity, community participation, equity and gender directed towards a better understanding of health determinants and improvement of population health through sustainable environmental changes. Dengue infection in urban Latin American and Caribbean countries was approached by 8 proposals funded in Cuba (2), Mexico, Guatemala, Colombia, Brazil, Argentina and Uruguay. A review of the technical proposals plus additional documents produced during the implementation of the projects was the base of the analysis presented. Sites visits to Cuba, Argentina and Uruguay allowed for a more direct contact with the research teams and interviews with local stakeholders.

The document presents a brief epidemiologic panorama of dengue and highlights the growing trend of the disease in the region. It basically discusses the successful integration of different scientific disciplines (social and biological) and their methodological approaches to the better understanding of a deteriorated environment and its influence in health (dengue in particular). It discusses how every research proposal generated a community based intervention targeting dengue determinants and the implementation of educational and behavioural strategies to modify the environment where vector's breeding sites proliferate. The different ecological, social and cultural scenarios of the areas studied illustrate the complexity of the determinants of dengue transmission and the challenges for its control. The majority of the projects were successful in mobilizing local community members and different stakeholders, generating effective communication strategies to address local health needs and dengue control. The impact on disease and entomological risks reduction requires further evaluation since even with very low breeding indexes transmission may occur as detected in Cuba. The interaction with different institutions (health, environmental, education) governmental agencies (water, waste management, urban planning, municipal authorities, etc.) and non-governmental stakeholders, are a necessary ingredient to produce long lasting effects and scale-up of the local interventions.

IDRC's initiative is weighed against traditional prevention and control approaches that include community participation as a component to the overall strategy. The knowledge produced and the impact of the interventions at a local level are described as successful experiences but gaps and problems are identified. If local experiences were successful in terms of mobilizing resources, issues on sustainability and scale-up of interventions are addressed.

Documenting Outputs, outcomes and learning from Ecohealth Projects: Dengue

*It takes a lot more than technical information
to construct pathways for the solutions of problems.*
Oliveira e Valla , 2001

Dengue as a global health problem

Dengue is not a new disease in the Americas and vector control strategies in the past were at the verge of eradicating the vector from our continent. Many of the countries now involved with IDRC were free of the vector creating the false idea that any control strategy should achieve similar changes. It is precisely the change in the environment that makes vector control a more challenging activity today than it was in the past.

The current distribution of the vector in the Americas is below that which the vector can reach, especially with the deterioration of social and economic conditions in the region. While global warming is posited? as an important influence in the establishment of the vector in other latitudes, *Aedes aegypti* has already demonstrated its ability to reach Philadelphia or Montevideo in the past, and its capacity to transmit yellow fever or dengue in the present. *Aedes aegypti* is a domestic vector, breeds inside houses and yards in artificial containers of different nature, capacity and purpose. The vector's behaviour make it a tricky target for existing vector control technologies since larvicides have *low coverage* in terms of the large pool of breeding sites present in any urban environment; insecticides are *short in reach* regarding the effective penetration into the vector's resting places and *short lived* in terms of the mortality of adult mosquitoes produced when sprayed. Aside from these technical problems, there is no public health program with enough human resources to tackle all households in urban centers where *Aedes aegypti* represents a health risk (*short response capacity*).

Population movements (migration, tourism, etc) are important vehicles for spreading the serotypes and strains, while routes of international trade provide natural paths for vector dispersion, therefore no country is immune to the risks of dengue disease transmission in a global economy. Dengue is not a disease of poverty because it affects wealthy neighbourhoods as well, it should be considered rather an expression of a threaten environment. Protection is not an individual responsibility but a collective concern since there is no vaccine nor effective treatment, and control technologies have only a limited impact. On the other hand, peoples' behavior towards the domestic environment is creating new risks linked to the fast urbanization process in the region that challenges municipal responses to satisfy basic sanitary infrastructure needs. Today cities are better communicated by more and faster means of transport creating urban networks where risks are easily spread from a local setting to an international scenario.

Traditional approaches to disease prevention and control of dengue have been inherited from the vertical oriented programs that targeted the vector as their primary, and in some instances, their only objective. Conventional vector oriented programs maintain the use of larvicides and insecticides supported by breeding sites elimination as the core of the control strategy. Failures to efficiently reduce vector densities have forced the development of interventions with innovative approaches where community involvement has been pursued with

limited impact in the control of the overall spectrum of breeding sites in the household and peridomestic surroundings.

Dengue is not a health priority to the communities affected since their social, economic and environmental realities are more compelling and urgent than those put forward by a disease that on individual basis, is usually inadvertent, mild, solved by self medication or rarely requires the use of health services. For the public health authorities, dengue control is approached as a community responsibility and is not understood as a problem that demands resources and financing from different governmental agencies and municipal actors besides the health sector.

Practical, technical and conceptual drawbacks have emerged in recent years demanding new or more integrative approaches to the control of dengue because the determinants of transmission encompass more than biological factors of the disease where most of the technical arguments for control have concentrated. Strategies on dengue control have been dominated by biomedical paradigms leaving aside the social, economic, cultural and environmental determinants of the disease. The core essence of the Ecohealth approach is to understand dengue as a sanitary problem linked to social, economic and environmental determinants that create the breeding conditions of the vector and dissemination factors of the infection, amplifying its biological lethal potential.

The objective of the present report is to give an overview of the outcomes, outputs and challenges faced by the Ecohealth approach regarding the control of dengue in the Latin American and Caribbean region.

Epidemiological context

Dengue has steadily established itself as the most important vector-borne disease in the Americas and threatens the health of millions of people living in urban, suburban and rural environments. Dengue emerges as a public health challenge due to its clinical behavior where a simple infection transmitted by the mosquito bite can rapidly advance in some cases to a severe hemorrhagic syndrome that can lead to the death of the individual infected. Its incapacitating nature and the severity of clinical features expressed in an epidemic fashion is always a medical emergency to every health care system because of the increasing number of cases demanding treatment and the need to reduce vector densities responsible for the transmission. Clinical and public health services have proved to be unable to control this disease since there are no vaccines available to prevent transmission, no effective medical treatments that avert the development of severe signs and symptoms, and no sustainable control measures against the vector that guarantee the protection of affected communities.

The Americas is living a period of intensive dengue transmission with half a million cases of dengue fever and almost 15,000 cases of severe hemorrhagic dengue occurring on average per year in the region. The geographical expansion in Latin America has only left Uruguay* and Chile free of dengue transmission although the vector is already present in territories once thought to be free of the risk. During the period 2000 to 2006 the peak of transmission occurred

* During the preparation of this report a suspected case of dengue was reported in Montevideo but was not confirmed by laboratory testing.

in 2002 with more than one million cases reported in the region, most of them reported by Brazil (Table 1). The co-circulation of the four serotypes in the region is not homogenous but constant introductions from one country to another due to population movements and trade increases the risk of severe dengue infection. Differences in the magnitude of transmission reported are modulated by several factors linked to the surveillance system and the laboratory capabilities in each country.

Table 1. Dengue cases in selected countries, 2000-2006

| Country | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|-----------|---------|---------|-----------|---------|---------|---------|---------|
| Argentina | 1,700 | 11 | 214 | 135 | 3,284 | 34 | 181 |
| Brazil | 231,471 | 413,067 | 780,644 | 341,902 | 112,928 | 203,789 | 346,550 |
| Colombia | 22,775 | 55,437 | 76,996 | 52,588 | 27,523 | 30,475 | 36,741 |
| Cuba | 138 | 11,432 | 3,011 | 0 | 0 | 75 | ? |
| Guatemala | 9,006 | 4,516 | 7,599 | 6,750 | 6,352 | 6,341 | 2,863 |
| Mexico | 21,715 | 6,210 | 9,844 | 5,010 | 8,202 | 16,862 | 27,287 |
| Uruguay | | | | | | | |
| Americas | 400,519 | 652,212 | 1,015,420 | 517,617 | 267,050 | 427,627 | 539,993 |

Source: PAHO, Feb, 2007

If Brazil concentrates a large proportion of cases, dengue incidence (per 100,000) puts Colombia in a competing situation (table 2). Cuba had an important epidemic in 2001 and local reports indicated that a large epidemic during 2006 affected most of the island. PAHO has not reported this last event and should be requested to inform the magnitude of the epidemic due its epidemiological importance.

Table 2. Dengue incidence in selected countries, 2000-2006

| Country | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|-----------|-------|-------|-------|-------|-------|-------|-------|
| Argentina | 4.6 | 0.03 | 0.6 | 0.4 | 8.7 | 0.1 | 0.5 |
| Brazil | 136.1 | 239.4 | 452.4 | 198.1 | 65.4 | 118.1 | 200.8 |
| Colombia | 53.8 | 272.7 | 210.3 | 258.7 | 135.4 | 149.9 | 180.7 |
| Cuba | 1.2 | 101.6 | 26.7 | 0 | 0 | 0.7 | ? |
| Guatemala | 79.1 | 38.6 | 65.0 | 57.8 | 54.3 | 54.3 | 24.5 |
| Mexico | 21.9 | 6.2 | 9.8 | 5.0 | 8.2 | 16.8 | 27.2 |
| Uruguay | | | | | | | |

Source: PAHO, Feb, 2007
Rates per 100,000

The dengue hemorrhagic statistics put Colombia in a leading position with around one third of the cases reported by that country (Table 3). Differences in diagnostic capabilities in the rest of the region may explain the likely sub-notification of severe cases in many countries.

Table 3. Dengue Hemorrhagic fever cases in selected countries, 2000-2006

| Country | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
|-----------|-------|--------|--------|--------|-------|--------|--------|
| Argentina | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Brazil | 59 | 679 | 145 | 713 | 77 | 433 | 628 |
| Colombia | 1,819 | 6,563 | 27 | 4,878 | 2,815 | 4,306 | 5,379 |
| Cuba | 0 | 69 | 12 | 0 | 0 | 0 | ? |
| Guatemala | 42 | 4 | 47 | 22 | 39 | 32 | 4 |
| Mexico | 50 | 191 | 1,429 | 1,419 | 1,959 | 4,255 | 4,477 |
| Uruguay | | | | | | | |
| Americas | 5,667 | 15,500 | 14,374 | 10,994 | 9,810 | 14,557 | 14,429 |

Source: PAHO, Feb, 2007

IDRC Ecohealth approach and dengue control in selected countries

The International Development Research Centre (IDRC) launched an initiative based on the principles of transdisciplinarity, community participation, equity and gender directed towards a better understanding of health determinants and improvement of population health through sustainable environmental changes. Dengue infection in urban Latin American and Caribbean countries was approached by 8 proposals funded.

- Dengue control in Fortaleza, Brasil (100999); team leader: Andrea Caprara
- Dengue control in Colombia (100999); team leader: Gabriel Carrasquilla Gutiérrez
- Ecosystem Approach to the Sustainable Prevention and Control of Dengue (Cuba) - Phase II (101545); team leader: Mariano Bonet
- An Integrated and Participatory Dengue Surveillance System (Cuba, 101091-004); team leader: Cristina Diaz
- Ecosystem Approaches to Dengue Prevention in Argentina and Uruguay (101814); team leaders: Nicolas Schweigmann and Cesar Basso
- Dengue in the border of Guatemala and Mexico (Guatemala, 101091-003); team leaders: Ricardo Lujan and Juan Arredondo

The countries involved in IDRC's proposals concentrated at least 59% of the cases of classical dengue occurring in the region from 2000 to 2006, percentage that increased to 86% of the total cases during epidemic years. These countries also notified 12% to 73% of the hemorrhagic fever cases in the region depending on the year of transmission. Although local in nature, the experiences brought by the research proposals in these countries can be useful to other countries in the region. The IDRC initiative sums the outcomes of each individual country with the additional value acquired from the interaction of two settings: the border in Mexico-Guatemala and the travelling corridor between Buenos Aires, Colonia and Montevideo.

The general approach of each research team to the application of the methodological pillars in IDRC's Ecohealth initiative can be summarized in a general framework where contexts were identified, targets selected and baseline, process and impact indicators designed to evaluate the impact and products of each intervention.

Table 4. Framework of Ecohealth Dengue Control Proposals

| Context | Targets | Baseline data | Evaluation Indicators | Impact and results |
|---------------------------------|--|--|--|--------------------------------------|
| Social and economic | Identification of health needs, social and living conditions | Housing, public health and sanitary infrastructure | Stakeholders level of involvement | Adoption of results Policy making |
| Cultural and educational | risk perceptions, health attitudes, roles of community members | Knowledge, attitudes and practices | Educational interventions | Behavioral change |
| Ecological | Environment characterization | Risk maps | Breeding sites characterization (types, density, productivity) | Risk and Disease reduction |

In general terms, most of the proposals coincide in the identification of three contexts (socioeconomic, cultural/educational and ecological) linked to the urban environment and its influence in the health of populations. For each context, a set of targets were selected for detailed characterization. In the social context, the target was to identify and describe the problems and social dynamics of each intervention area, collecting baseline data for a detailed description of the housing conditions as well as the public and sanitary infrastructure. The sequence of events lead to the recognition of the main actors (stakeholders) that could participate and create positive contributions to the project. The expected results in the social context were the adoption of the products that varied from the strengthening of local capabilities for dengue control to its impact in policy making.

In the cultural context the target was the definition and analysis of the determinants of behavior regarding risk perceptions, health attitudes, roles of community members and key actors and identification of health needs. A vast range of social methodological tools (qualitative studies) were used to explore knowledge, attitudes and practices towards health and the environment of the different actors in the community. Once understood or interpreted, a wide range of behavioral interventions were designed to improve health issues (dengue control) through interventions directed to the healthy management of the environment (impact).

The ecological context demanded a detailed characterization of the social, cultural and physical environment and was scrutinized and mapped through the use of innovative computerized technologies where the entomological potential (breeding risks) was graphically portrayed. Entomological surveys in almost every project were used to measure the levels of change in behavior of individuals or the magnitude of participation of the communities involved. The results from each intervention were measured in terms of vector's densities, disease rates (limited), environment changes, water management or overall health improvements.

The next section presents a brief description of the main contents of the work developed by each proposal and is complemented with additional information (methodological and technical) displayed in Tables 5 to 7. The presentation of data varies since the projects are in different stages of development. Projects in Brazil and Colombia are in a "diagnostic" or baseline stage; those in Argentina and Uruguay are in the final stage of summarizing results while projects in Mexico and Guatemala are finished or in a follow-up stage (Cuba).

The results presented in this evaluation were basically obtained from the review of the different proposals to IDRC and the technical reports forwarded by the research teams on a periodical basis. Direct interviews were held with research team members in Cuba, Montevideo and Buenos Aires. Field visits to the study sites were performed and allow the interview with several members of the community members and technical staff like local public health authorities, health promoters, students, vector control personnel, different stakeholders, etc. Personal interview was held with principal investigator in Mexico but no field visit was performed since interview was held in another city and state where the investigator was living. Different educational and technical materials were provided by research teams and some data on the capacity building generated by the projects was also provided. Email communications were also performed with the research teams to clarify and provide additional data.

Dengue control in Fortaleza, Brazil

A descriptive study bridging anthropology, entomology and policy research was done in 2 middle-high socioeconomic areas and 4 low socioeconomic sections of 2 urban neighborhoods in Fortaleza. The project produced baseline data based through ethnographic studies that helped understand people's living conditions in relation to the vector's environment. Entomological and epidemiological data were linked to climate variables. Social studies reflected around water management, specially related to patterns of water storage associated to climate issues like droughts in the region. Psychodrama was used as a tool for social mobilization, creating a scenario where people could build their capacity to act appropriately (change behavior) in community and health problems. This behavioral intervention is intended be tested in further stages of the research if funding is available.

Basic outcomes: detailed analysis of health perceptions and dengue related attitudes. Water management in conditions where drought is a seasonal problem creates an interesting setting for dengue risks.

Dengue control in Colombia

The project was developed in two middle size cities (Girardot and Melgar) in the Department of Tolima that are interconnected to the capital city by local weekend and seasonal tourism ("floating" population in recreational houses coexisting with migration of poor populations in search of employment opportunities). Social, entomological and health risk surveys were performed in order to create baseline data for future interventions. Detailed information regarding environmental variables and breeding sites were reported. Dengue is not recognized as a problem by the population even though dengue is present and high vector densities were found. Among the relevant issues reported is the "therapeutic itinerary" as an operative category that serves to describe trajectories of individuals seeking competent solutions (pool of options) to their health problems based on subjective assessment of disease severity, perception of risk and available resources in the environment used accordingly to the diversity of meanings attached to dengue. Water management is well thought-out and organized by needs (individual or collective) and by social status but not around vector related activities.

Basic outcomes: a detail survey on *Aedes aegypti* risk factors. A comprehensive analysis of water management, environmental determinants and breeding risks in the areas studied.

Dengue control in Cuba

An Integrated and Participatory Dengue Surveillance System, EL Cotorro, Cuba :

The project was developed in El Cotorro, a suburban area with mixed rural and urban socioeconomic characteristics, bordering the city of Havana. The work was centered in the development of an active surveillance system to monitor vector densities and set up the early detection of dengue cases supported by the active participation of the community. Community groups were formed (Grupos Vecinales) and they were in charge of monitoring the environmental risks in the community, promote the solutions within their capabilities and establish contact with other social organizations (Consejo Popular de Salud) when solutions were out of their reach. Community members developed and were responsible for the collection of health and

environmental indicators and discussed them with the team established in the district health unit. An interesting management of environmental risks was developed in which open public spaces where breeding sites represented environmental or health hazards were transformed into small parks, family orchards or recreational yards. Strong entomological surveillance and serological data allowed the design of computerized risk maps in a geographical information system. Detailed information (environmental, social, demographic, entomological and epidemiological data) was gathered and risks maps were produced to guide work on the risk areas identified. The methodological and practical approaches of this project were later adapted and introduced in an urban environment in Centro Havana.

Basic outcomes: A labor intensive clinical and entomological surveillance system with GIS support. Scale-up of the intervention to municipal level and provided important inputs to the national agenda on vector control program. Small but effective impact on environmental changes by changing public spaces with high breeding risks into recreational parks, clean public gardens and individually own orchards.

Ecosystem Approach to the Sustainable Prevention and Control of Dengue in Centro Havana, Cuba

Centro Havana is a high density populated urban area in the capital city with serious sanitary infrastructure deficiencies and restricted access to potable water. Overcrowding and irregular water service (available by night) and inadequate waste collection services are some distinctive features. This district was previously targeted for an urban renovation project years after the economic crisis in the 1990's (Período especial) so work in this area was facilitated by the solid organization of social groups in the area. Based on the experiences in El Cotorro, the project in Centro Havana adopted methodological and practical experiences on dengue surveillance and control. The core of the project was to change ways families dealt with water collection and storage and introduced a surveillance system that gathered entomological and environmental risk information supported by epidemiological and clinical data of potential dengue cases as an early risk detection system. Integration and flow of data from the 3 subsystems (entomological /environmental/ epidemiological) allowed the deployment of opportune actions in the risk areas identified. The area changed from a high to a medium risk categorization during the period of the intervention and reports by team members indicate that during the 2006 epidemic this area was among the last to enter the epidemic and among the first to be free of the transmission.

Basic outcomes: A less labor intensive clinical and entomological surveillance system with GIS support. Scale-up of the intervention to municipal level and provided important inputs to the national agenda on vector control program.

Ecosystem Approaches to Dengue Prevention in Argentina and Uruguay

The special condition of these two countries in relation to the absence of dengue and *Aedes aegypti* in Montevideo and the presence of the vector but no local transmission of dengue in Buenos Aires, created particular challenges to the research teams in both countries. The first challenge was to create individual proposals that dealt with the potential local problem in face of the regional risks. The second challenge was to create an environmental risk assessment system based on entomological data in two different scenarios, one where the vector exists and the other where it doesn't. This created an additional challenge in terms of motivating health awareness

when you target a disease that is not present or when people have no previous experience with it but represents a serious health threat to the community.

Buenos Aires

The research study took place in four different neighborhoods with different socioeconomic status (2 low /poor Barrio Charrua y Loma de Rosa and 2 middle class, Villa Pueyrredón and Olivos in Vicente López district), the basis for implementing a participatory approach was to contact local health promoters and ‘alfabetizadoras’ or literacy workers (religious group) and work with local schools in those neighborhoods to involve children and their families. Entomological data was collected in all areas connecting the study sites (transectas). Climate variables and geographical information systems allowed the creation of aerial maps and views of the entomological and environmental data. Feedback to the community was performed through local newspapers, stands in fairs and public spaces. Schools participated in a very outstanding manner with a long term commitment. From the pilot intervention in two schools, the whole district with more than 10 schools adopted the formative strategy and created a program on health and the environment focused on dengue control that was implemented in every school and their communities. The recent dengue epidemic in Paraguay created unusual interest in the activities developed by the project and some members of the research team (entomologist, municipal primary health authority, health promotion leader) were requested by the government authorities to incorporate the experiences into an action plan against the threat of dengue in the country.

Basic outcomes: An entomological surveillance system with GIS support. Educational intervention was systematized by educational authorities with important impact on students, teachers and community members. Intervention provided important inputs to the national agenda on vector control program.

Uruguay

A similar proposal was generated in Uruguay with 2 areas selected (1 working class neighborhood and 1 middle class) in Montevideo and Colonia (tourist center), where entomological surveillance of the areas was done with children in the schools involved along with larger entomological studies (transect (lines connecting study areas) and graveyards). Urban developers and architects contributed with innovative approaches in computer technologies to understand local breeding sites ecology. Climate specialists contributed with data that enabled a better understanding of vector biology in the area. Geographic information systems incorporated social, demographic, entomological and environmental variables to generate a Follow up Observatory and an Early Warning System, still in process. The schools elaborated fine educational materials with different levels of complexity or detailed information according to the target audiences. Information was produced after theoretical and practical sessions that included knowledge and attitude surveys as well as entomological investigations and laboratory work. Promotional material was designed accordingly to keep the environment free of the mosquito. The level of awareness that governmental areas have about the results of the project is very important since the research team (based on academic institutions) has direct contact with health and social institutions. The recent report of a case of dengue in the country has given credibility and responsibility to the results of the project.

Basic outcomes: An entomological surveillance system with GIS support. An Early Warning System is still to be provided. Interesting input from architects and urban planners in the

understanding of the domestic environmental conditions. Educational intervention had an important impact on students, teachers and community members. Intervention materials and products were used to design the national agenda on vector control program.

Dengue in the border of Guatemala and Mexico:

An interesting opportunity was created by combining a geographical area with intensive population movements, endemic dengue transmission, painful living conditions and a deteriorated social environment. Both proposals approached two water related problems (dengue and diarrhea) from the perspective of an environmental problem. While not directly linked in the field, the individual proposals can also be seen as complementary from a regional perspective. The areas selected in both countries have similar problems with respect to reliable water supply and poor water quality. Residual waters are not treated therefore contaminating surface and groundwater sources. Wells are not supervised by municipal authorities and are in close proximity to latrines and septic tanks.

Mexico

Two small towns in the southern border with Guatemala (Huixtla and Ciudad Hidalgo) were selected in the study. One is in the border with the natural social conditions of a poor bordering town and the other is a few kilometers away. Dengue and diarrheal diseases were approached from an environmental perspective in terms of water management and household hygiene. Several transversal surveys were performed during the study to measure impact. Health promotion groups were formed (Monitores comunitarios) that were basically women who organized workshops and meetings with community members that were mobilized to control breeding sites and elaborate educational material that would promote behavioral changes related to water management and hygiene in the household. Ten 'ideal practices' were promoted to tackle each health problem (5 by 5). For dengue the practices were to cover containers, weekly cleaning of big water storage containers, daily change of water in animal drinking pots, weekly change of water in flower pots, keep tires under roof, clean the patio and the roof of the house. For diarrheal control the easy practices were boiling, filtrating, chlorinate drinking water, washing hands, protect and cover drinking water, waste disposal and clean the bathroom. Entomological, water quality analysis and epidemiological data supported the results of the intervention. Health municipal authorities in Huixtla were deeply involved because the intervention supported a local initiative of a healthy city with strong political support.

Significant reductions in entomological risks of dengue transmission were observed as a result of community-based interventions, but unfortunately no impact was observed in diarrheogenic risk factors (i.e., fecal coliforms in drinking water). Nevertheless, such 'failure' could be in part due to the fact that bottled drinking water was fecally contaminated before, and residents were not compelled to boil it because they thought that such water was clean. Also, because prevention of diarrheogenic risk factors had to be carried out on a daily basis, as opposed to dengue vector prevention activities, suggested on a weekly basis, poor resident hygienic habits could add to fecal contamination of drinking water.

Basic outcomes: Combination of the intervention to address diarrhea and dengue control. Design of feasible, relevant health practices at the household level. Use of innovative entomological indexes and evaluation of entomological results.

Guatemala

Two small size cities (Tecun Uman and Coatepeque) in the border with Mexico were selected for the study. Coatepeque has excellent municipal organization and health services actively involved in community affairs while Tecun Uman lives the opposite situation. Both health problems (dengue and diarrhea) were approached in a similar (methodological) fashion than the project in Mexico and the entomological component was even supported by the Mexican team. Since the sources of risk factors for dengue and diarrheal disease are similar, the approach was to promote the rational and proper use of water and disposal of waste at home, community and municipal levels. Two transversal surveys (baseline and final) were done in one area as intervention and the other as control. Community monitoring groups (volunteers) were trained to monitor *Aedes aegypti* breeding sites, cases of disease, household water quality and water management at home. Formats were developed with the community members. Healthy practices at the household level were promoted (5 by 5 see Mexico section) and were supported by a massive communication strategy (radio, posters, songs, press releases and fairs). Community monitors (volunteers) were trained as Environmental Health Promoters. Entomological data was collected regularly and an increase in household control activities and a decrease in vector densities were documented.

Basic outcomes: Combination of the intervention to address diarrhea and dengue control. Design of feasible, relevant health practices at the household level.

The following tables (5 to 7) summarize and give an overview of the different components of the research proposals. They describe the composition of the research teams and the interaction with different stakeholders; the basic traits of their methodological approaches in terms of the quantitative (surveys) or qualitative techniques used to approach the problem; the support from the health infrastructure (laboratory and surveillance) and control programs (entomological); and the main environmental determinants. Finally, they highlight the issues regarding water management and breeding site determinants.

Table 5. Ecohealth strategies by country

| Project | Project Leadership | Transdisciplinary Composition | Multisectorial (participatory) Stakeholders | Gender issues | Institutionalization, scale-up |
|---|-----------------------------------|--|---|---|--|
| Urbanization, community dynamics, policy response and Dengue control in Fortaleza, Brazil (Andrea Caprara) | Medical Doctor and Anthropologist | Public health specialists, nutrition, anthropology, pedagogue, nursery | Collaboration with local community centers, schools, NGOs. | Women's role in domestic settings, household hygiene and health risk | Diagnosis stage. Intervention institutionally based (Municipal Control Programme) |
| Dengue Control in Colombia (Gabriel Carrasquilla) 2004-2005 | Epidemiologist | Anthropology, public health specialists, health promotion, entomology | Community Action Boards Municipality and Vector Transmitted Disease Program Network of health promoters paid by municipal authorities, | Not reported | Municipality and Vector Transmitted Disease Program, (4 days of disposable items collection campaign) Economic sanctions for breeding sites legally allowed but not reinforced. |
| Ecosystem Approach to the sustainable prevention and control of dengue, El Cotorro, La Havana 2003-2005 (Cristina Diaz) | Social Scientist | Epidemiology, educational specialist, psychology, statistics, | Municipal primary health care unit, Popular Health Councils, Neighborhood groups, sanitary workers of the health and popular councils, Statistics Information System, Vector Control Program (Unit of surveillance and Antivectorial Fight), Environmental Sanitation | 17 vecinal groups created but composition changed with functions | Easily transferred to the health sector. Institutionally based: integrated to health sector. |
| Integrated participatory dengue surveillance system (Mariano Bonet) | Epidemiologist | Sociology, Social workers, entomology, biology | Cuban Women Federation and Defense Committee more involved Municipal primary health care unit, Popular Health Councils, (neighborhood groups, Vector Control Program (Unit of surveillance and Antivectorial Fight) | Team members, domestic properties: tires vs aquatic plants | Easily transferred to the health sector. Institutionally based: integrated to health sector. |
| Ecosystem approaches to dengue prevention in Argentina, 2005 (Nicolás Schweigmann) | Entomologist | Sociology, Veterinary, entomology, anthropology, biology, health promotion, social workers | Social clubs, pension centers, community centers, health centers, schools, educational sector, health authorities, literacy workers, Parent's committee, religious groups, Bolivian consulate, radio and newspapers, Barrio Assembly | Use of spaces School based with promoters and amplifiers of gender roles | Fast adoption by educational districts, governmental agencies due to threat of dengue epidemic Vecinal and institutional acceptance due to epidemiological situation |
| Ecosystem approaches to dengue prevention in Uruguay, 2005 (César Basso) | Entomologist | Social scientists, climate specialists, architecture, urban development, biology | Schools, municipal authorities, health sector | Age related, older groups fixed domestic functions with women | Fast adoption of procedures even before the creation of the Early Alert model and Follow up Observatory |
| Dengue in the border of Guatemala 2002-2004 (Ricardo Luján) | Epidemiologist | Health promotion, microbiologist entomologist, social workers, | city majors, community resources, municipal authorities, Ecoclubs, schools, etc., Primary Environmental Urban Health Promoters | Women roles in the household (weak) | Educational and communication material used at different levels, useful for other interventions, |
| Dengue in the border of México 2002-2004 (Juan Aredondo) | Entomologist, | Health personnel, microbiologist entomologist, social workers | Municipal level involved, community groups formed, community leaders and local resources, community volunteers (monitores comunitarios) | Women roles in the household, intervention practices according to each gender | Strong links to the municipal level |

Table 6. Intervention sites, methodological approach and technical support

| Project | Level of intervention | Baseline, process and impact indicators | Surveillance and laboratory support | Entomology Support |
|--|---|---|--|--|
| Urbanization, community dynamics, policy response and Dengue control in Fortaleza, Brazil (2005) (Andrea Caprara) | Poor sub-urban and middle high areas | Qualitative (ethnographic, in depth observations, unstructured interviews, participant observation, life stories, focus groups) Quantitative data entomological information | All household water containers in the study area were inspected, and larvae were collected and classified in the FNS (Health National Foundation) laboratory | Every activity performed by the <i>Aedes</i> Control Program in the Study Area has been registered. (Approximately 1500 control program workers perform home visits within the Dengue Fever control program in the town of Fortaleza). |
| Dengue Control in Colombia (Gabriel Carrasquilla) 2004-2005 | Two middle size cities, "tierra caliente" middle & low income neighborhoods | Qualitative (ethnographic, focus groups RAP, in depth interviews) direct social observations Quantitative data (cross sectional survey risk factors for dengue and entomological data) | None | Strong entomological methods, biological control (fishes in tanks) |
| Ecosystem Approach to the sustainable prevention and control of dengue, Cotorro, La Havana 2003-2005 (Cristina Diaz) | Rural and urban areas in Havana Low population density 1,131 hab /Km ² | Transversal survey, risk factors for infestation; KAP surveys Indicators developed with the community | Strong health care infrastructure, detection of cases, serology and clinical capacity. | Active surveillance of vector densities; Categorization of breeding sites, no productivity, Strong vector control program |
| Integrated participatory dengue surveillance system, Central Havana (Mariano Bonet) | Urban environment with high population density (43,600 hab /Km ²) | Environment, entomological, clinical, epidemiological and community indicators; KAP's (pre and post) Key informant interviews | Strong health care infrastructure, detection of cases, serology and clinical capacity. | Active surveillance of vector densities; Case control study determinants of infestation; Use of commercial insecticides (area of concern) |
| Ecosystem approaches to dengue prevention in Argentina, 2005 (Nicolás Schweigmann) | Urban areas; middle and lower class neighborhoods (poor Bolivian community) | Workshops, interviews, social practices, ethnographic methods, participant observation, semistructured surveys and field observation | Not incorporated | Important support, ovitraps, breeding sites identification; municipal vector control personnel involved |
| Ecosystem approaches to dengue prevention in Uruguay (César Basso) | 4 Urban settings in working and middle class neighborhoods in Montevideo and Colonia | Workshops, interviews, social practices, ethnographic methods, participant observation, | Not incorporated. | Ovitraps, entomologic surveys, biological control (copepods) supported by climate expertise and urban design |
| Dengue in the border of Guatemala 2002-2004 (Ricardo Luján) | Two middle size cities in the border | Transversal surveys no stratification KAP's, in depth interviews, focus groups. Baseline data | Water quality: total and fecal coliforms and chlorine residues in water, Dengue cases reported | typology of breeding sites (disposable and controllable) House Condition Index changes |
| Dengue in the border of México 2002-2004 (Juan Arredondo) | Two middle size cities in the border | 4 transversal surveys (cross over), baseline, 2 mid-lines and final line, stratified; RAP's and KAP's, in depth interviews, focal groups, house trials | Water quality: total and fecal coliforms and chlorine residues in water, Dengue cases reported | Detail surveys, typology of breeding sites (disposable and controllable) House Condition Index, Entomological and diarrheogenic risk indices |

Table 7. Ecological, water management and breeding sites determinants

| Project | Environmental Variables | Water management | Breeding sites determinants | Political milieu that influences dengue control |
|--|---|---|---|---|
| Urbanization, community dynamics, policy response and Dengue control in Fortaleza, Brazil (Andrea Caprara) | Rainy season, temperature, humidity, domestic environment, water provision and basic sanitation | Irregular piped water distribution. Inadequate system of water distribution at household level; Cultural ties and practices due to droughts | The most productive breeding sites are inadequate containers such as pots, tanks, drums, wells at household level. The presence of these containers is due to inadequate water management Seasonality (droughts) | None detected |
| Dengue Control in Colombia (Gabriel Carrasquilla) 2004-2005 | Touristic areas, weekend places, Girardot 138,000, Melgar with 28,596. Intra- domiciliary water supply, sewage, garbage, precipitation, solar brightness, evaporation, mean temps, humidity, influenced by rainfall | Cleaning low tanks weekly too much, clean deposits vs fishes or chemicals Water supply is suspended on weekends for tourism Tourism is a determinant of water management | HI >30% BI= 49; Larvae and adult forms surveys, indexes, control activities, low tanks are most important based on pupae, responsibility on vector personnel, government, recycling of disposable containers (useful) | Decentralization of health services and priority setting |
| Ecosystem Approach to the sustainable prevention and control of dengue, Cotorro, La Habana 2003-2005 (Cristina Diaz) | No climate data or vegetation, The rubber and steel industries in the proximity could influence the breeding sites and control | Deficient water infrastructure, physicochemical and microbiological study of water (nitrates, pH, fecal coliforms) | Stratification of risk, alternative biological methods (copepods, Bacillus thuringiensis, Bactivec), problems identified are outside domestic setting (solares, pets, abandoned houses, vertederos) | Vertical oriented mobilization Strong official support |
| Integrated participatory dengue surveillance system (Mariano Bonet) | Infrastructural: blocked drainage, construction debris, water leaks, vacant lots, flooded basements, tanks in poor conditions. Environmental indicators at household level | Evaluation of pesticides impact in air and water | Breeding sites are low tanks (38%), barrels (14%) cisterns (3.4%), 55% intradomiciliary not protected. Conditions of breeding sites explored, mostly useful containers | Vertical oriented mobilization Strong official support |
| Ecosystem approaches to dengue prevention in Argentina, 2005 (Nicolás Schweigmann) | Temperature, rainfall, humidity, vegetation, basic sanitation, | Water containers management | Seasonality, high densities in all areas, Ovitrams | Legitimacy of governmental agencies after economic crisis |
| Ecosystem approaches to dengue prevention in Uruguay (César Basso) | Climate variables, breeding sites ecology of domestic setting | Water containers management | Domestic utensils and use in the house. | Social oriented government Strong legitimacy of educational agencies |
| Dengue in the border of Guatemala 2002-2004 (Ricardo Luján) | Temperature, rainfall, humidity, vegetation, water pollution | Water use, management of solid waste disposal | Entomologica indexes Waste disposal, housing conditions | To be defined |
| Dengue in the border of México 2002-2004 (Juan Arredondo) | Temperature, rainfall, humidity, vegetation, basic sanitation, water pollution, | Water use, quality, management of solid waste disposal, intervention with <i>untadita</i> in water storage containers and water replacement/turning/elimination of non-water storing containers | Indicators of impact housing conditions, compliance of residents with <i>agua segura</i> initiative, evaluation of intervention on entomological and diarrheal agents | Lack of involvement of local health authorities at the beginning |

The following section gives an overall view of the main traits of the projects in terms of their social and epidemiological context to understand the variety of conditions where dengue flourishes. It also highlights the main challenge faced by all projects in terms of creating a new kind of awareness towards dengue control due to the fact that most study sites have been exposed to dengue in the past and control strategies have created the general perception that dengue control is a responsibility of governmental agencies. It also addresses the issue of sustainability as a major challenge since community participation initiatives are labor intensive, geographically concentrated, directed towards selective groups depending on the intervention strategy and long term enterprises.

General context

Among the significant issues that should be highlighted in this initiative are the ecological diversity of the sites represented, the varied social and economic contexts of the areas studied and the epidemiologic momentum of the places selected. In terms of their social, political and economic circumstances, the countries and cities selected also provide an interesting spectrum of environments that model dengue transmission and modulate the impact of the preventive responses implemented. While on individual basis each reality provides motivating results on its own, the incorporation of the results on a group basis allows for further interpretation and understanding of the global phenomena in the region.

The sites represent urban as well as suburban environments where *Aedes aegypti* flourishes without ecological restrains (Montevideo is the exception) and provide different challenges to vector control strategies since populations profile, density, housing conditions and public infrastructure differs from one area to another. In Cuba we have an extremely high-density populated area as Centro Havana and a suburban neighbourhood outside la Havana, less densely populated and with rural traits, as El Cotorro. In Fortaleza we deal with a heavily populated suburban neighbourhood within an important urban centre while in Colombia we deal with two medium size cities that have intensive communication with a capital city. In the case of Mexico and Guatemala as well as Montevideo and Buenos Aires, the proposals incorporate the bordering relationships between two countries and the influence one area has over the other. In the case of Mexico and Guatemala, the study sites were small urban towns not densely populated. Particular issues arise since the cultural and ethnical ties between Guatemala and Mexican populations are very similar (Maya origin). In Buenos Aires the areas were basically urban. One of the urban settings selected (Barrio Charrúa) is highly populated area and with people coming from Bolivia and Paraguay. In the case of Montevideo, the areas are urban moderately populated even in the case of the poor urban areas.

With regards to dissemination factors such as population movements and economic forces like tourism the proposals offered interesting data. In Cuba, stability of people living in the study communities is greater than those living in Fortaleza where intensive migration from the rural areas is a predominant trait. In Mexico and Guatemala, intensive migration between the areas is the common denominator because of their cultural ties but important differences exist in terms of receptor and expulsion dynamics. Temporal and seasonal migration links the study areas in Colombia, while in Uruguay and Argentina population movements involve a major regional pattern that engages high risk areas like Paraguay.

Population movements are also visible in terms of tourism and every country faces this economic force with different intensity. Cuba has recently opened its economy to the tourist industry and this particular situation has provoked a change in the environment since commodities for tourists are now easily available with an as yet unmeasured impact in the number of increasing non-recyclable containers and potential breeding sites. The southern border of Mexico with Guatemala has population movements local in nature but with international implications since this is the port of entry for many South and almost all Central American people moving towards the United States. Tourism between Buenos Aires and Montevideo is the major risk factor for the dissemination of the vector and the infection among these two countries that also faced the introduction of the virus from other neighbouring countries like Paraguay and Brazil. Tourism is also a fundamental activity in the areas selected in Colombia but the risk that arises is more local than regional. The political implications of these issues are managed in various ways by each country.

The ways in which every country organizes its social response to health problems is also an important trait to understand the potential impact of the Ecohealth approach initiative proposed by IDRC. The political organization in each of the countries is extremely important to measure or understand the scaling up capability of each project and how evidence based decisions are taken in different social environments.

Without pretending to describe the social and political organization in each country, it is important to gaze at least at some examples to understand the impact the projects may have in different political and social environments. For example, Cuba has been a historical model of effective public health education and how traditional vector control programs have been working in the region. The sophisticated and labour intensive discipline of the program has kept dengue transmission under control although important outbreaks and epidemics have occurred in recent years. Reasons for outbreaks in Santiago (1997), Havana (2000, 2001, 2002 and 2006) can be tracked down to the influence of tourism and the environmental and social deterioration due to the economic crisis in the 1990's. Previous epidemics have become sanitary disasters in the island and therefore the government has responded with an outstanding surveillance infrastructure to monitor vector densities and early detection of dengue cases. Along with this sanitary infrastructure and technical resources, Cuban society relies on the effective mobilization of local social units like the Revolutionary Defence Committees (CDR), Popular Health Committees (CPS) and Revolutionary Women Federation (FMR) to deal with the basic needs of the population. Even in such organized social structures, enhanced community participation, generated by the project, proved to be invaluable to the overall dengue control program in Havana city.

On the other hand, Buenos Aires has been living with *Aedes aegypti* since 1986. The serious economic crisis in 2001 brought down many social programs and community resources. A recent dengue epidemic in Paraguay has imported cases of dengue in several sectors of the city with positive vector densities. The risk of an epidemic is real so government officials, interacting with the group in charge of the project, have requested that the experience gained by the public health services involved in the project be adopted by local authorities. In the case of Montevideo, Uruguay, where no *Aedes aegypti* has been found, the government is deeply concern on the future development of the metropolitan area of the capital city. Since urban planners recognize the risk of dengue as a logical consequence of the city's growth, the threat of an introduction of dengue

derived from Argentina or the recent epidemic in Paraguay, has created an unprecedented interest in the results of the project. In Colombia, different responses are expected since the process of decentralization of health services and political initiatives provides certain autonomy to the municipal governments putting individual agendas in dispute of resources. This situation is expressed through different kinds of support or receptivity towards the range of health initiatives present in the Colombian scene. The scaling up potential of these experiences in a setting like Mexico is similar to Colombia. Local authorities can develop individual agendas based on existing available resources and political commitments. An example is that of Huixtla which implemented a healthy city initiative that was not extended to the neighbouring city.

In terms of their epidemiological backgrounds each area provides a priceless setting to test the principles of Ecohealth approach to dengue prevention and control since transmission patterns are historically different. Cuba has been able to sustain a vigorous control over *Aedes aegypti* and dengue transmission until last year when an important epidemic affected most of the island (personal communication with senior dengue researchers in the country). Neither PAHO nor Cuba have made a statement regarding this situation which certainly arises serious concerns to all countries in the region since Cuba has the most proactive and meticulous vector control program in the Americas. Mexico and Guatemala have had dengue since the early 80's and suffered epidemics as a region basically linked to intensive migration within the area. In the case of Brazil, endemic dengue distinguishes the city of Fortaleza and the areas selected in the study, while in Colombia dengue transmission is also a trait in the two cities selected. In the case of Buenos Aires and Montevideo, this region represents the most actual epidemiologic moment since Buenos Aires is infested with *Aedes aegypti* but has no local transmission although migration from Paraguay has introduced several imported cases to the metropolitan basin. Montevideo, on the other hand, has no *Aedes aegypti* in the metropolitan area but is surrounded by foci in different areas in the country. Uruguay reported one native case in March but was not confirmed. In epidemiological terms, the areas studied included countries with occasional but explosive epidemics, mixed with highly endemic cities that have intensive transmission and dengue hemorrhagic cases all the way down to a city with no *Aedes aegypti* but a high risk of introduction and transmission.

Awakening of consciousness (creating awareness)

An interesting phenomenon arises from the integration of data and the results gathered through qualitative research methodologies in every site. The projects all faced different challenges in order to make the community understand the relevance of management of the environment and its links to dengue control as a product of a healthy environment. The situation is not so difficult when the communities already have experienced dengue and family members or neighbors have been affected by the disease. Their relationship with the disease and the risk it represents is completely different from those communities in Buenos Aires and Montevideo that haven't been exposed to the disease and their only knowledge is through mass media information. No matter how common or unknown the disease may be in the area selected, one of the principal targets of all proposals was to create a new type of awareness around this particular public health problem. Dengue is not a new disease in the region but it certainly represents a new risk for many countries. The research teams in countries where dengue has been endemic for a couple of decades (Mexico, Guatemala, Colombia, Brazil) in those who suffered occasional but epidemic transmission (Cuba) or those who have imported dengue cases or nothing at all (Argentina and

Uruguay) designed their preventive strategy based on their previous experience either successful like in Cuba, or not, like Mexico or Guatemala.

In this case, we can assume that a new paradigm in dengue control is being established by IDRC's Ecohealth approach by conceptualizing dengue as a problem linked to the environment and not as an individual vector-borne disease that needs to be tackled with specific technical resources. In the IDRC's initiative, the emphasis is put on the environment and the factors that are identified as a threat to healthy environments. The innovative forms in which every project addressed the challenge created new insights to the solution of the problem. By linking dengue to the environment, they understood that the magnitude of the efforts required for control are bigger and permanent. When dengue is seen in the traditional framework, efforts and strategies are smaller, shorter in time and occasional in periodicity.

The proposals funded by IDRC worked on the basis of building up the community awareness of risk to the health of the community when the environment deteriorates. Mosquitoes are identified as a nuisance, their breeding sites as a risk and disease as a consequence. Dengue and breeding sites control were built into the umbrella of health and a cleaner urban environment, a topic that also requires a fresh approach to the set of cultural, popular and social beliefs around the disease and its determinants.

The approach to dengue control had to be adapted to new circumstances even in cases like Cuba, where the control program can be considered highly successful in terms of the low level of vector densities reached all year round and all over the country. Adoption of new strategies in Cuba and elsewhere were required because the standard response of the community to epidemics is based on an emergency scenario where the institutions and social organizations mobilized every human resource available in the area to tackle the breeding sites. The proposals funded by IDRC faced the indelible fact, imbedded in the community, that the vector control personnel is responsible for checking the domestic and peri-domestic containers; applying larvicides in tanks and cisterns as well as insecticides inside and outside the houses on a regular basis. In the past, and under the principle of reaching effective control of dengue transmission, this strategy partially worked in Cuba and not so successfully in other countries in the region. In order to modify the social relationship with this disease, the model proposed by IDRC's projects worked on the basis of health risks and the environment where dengue and *Aedes aegypti* appeared as a risk, not as the prominent and independent problem. As one member of the team in Havana city stated: *We need to work on risks not on problems... if we need to spray insecticides then prevention failed...* This situation is particularly true to community members involved in the projects in Buenos Aires and Montevideo since they have not experienced dengue in their community and therefore mobilization can only be generated if awareness of risk is in place.

Sustainability

Community participation health projects face an indelible reality that threatens their fundamental nature since participation germinates as a voluntary action based on the recognition of a problem that requires continuity of actions for overcoming the problem encountered. Finding the ingredients necessary to generate a continuous action is especially critical when changes in behavior are expected to modify the environment where the problem arises. Sustainability provides an additional difficulty to community participation projects because it searches not only

for continuity of actions but seeks an evolving scheme of actions nourished by the results of previous experience.

It has been an attribute of the projects financed by IDRC to foster the sustainability of prevention and control actions and the variable ways it has been accomplished. While most of the proposals emphasized the impact on behavioral changes of individuals, families and groups, there was also a more subtle mention of changes in the behavior of institutions (health, education, municipal authorities, etc.). A fundamental partner in all of the projects was the role of institutional agencies linked to health and environmental issues but changes were also required in these stakeholders in order improve the continuity of the project.

In the context of Latin American countries, the perceived legitimacy of the government institutions by civil society is fundamental in order to understand and guarantee the sustainability of programs. While most of the projects worked along with different state institutions, none of them was really based on them primarily because the communities have their own appreciation and assessment of those institutions at the local level. In Cuba there was a strong link with health institutions and municipal authorities and their participation is unquestionable when taking decisions regarding the welfare of the communities. In Buenos Aires the recent economic and social crisis has left the credibility of institutions on a very low level that needs to be recovered. The project nevertheless was very well supported since it was guided by academic institutions linked to governmental agencies. In Uruguay one of the reasons the scaling up of the project may be so successful was the respect people have of the different governmental institutions which were involved on a bottom-up as well as a top-down relationship with the project. The projects in Colombia, Brazil, Guatemala and southern Mexico all have several degrees of collaboration with governmental institutions and everyone mentioned the high level of commitment necessary in order to bring the projects to a useful end.

Along with the co-responsibility with governmental institutions, it is necessary to stress that practices, especially those dealing with dengue control, can only be changed and sustained when they are supported by efficient municipal infrastructure. All projects worked on developing a methodology that could bring the necessary managerial capabilities to the members of the communities so as to empower them with skills for the identification of problems and solutions. Some solutions were within their reach while others required an active participation of public agencies responsible of certain key areas (water provision, waste management, education, etc.)

1. What is the level of integration of IDRC's Ecohealth approach and its methodological pillars in the individual projects supported?

Transdisciplinarity

The organization of the teams within each country also provided interesting inputs. The composition of each team was created according to the needs and epidemiological context of each project. Nevertheless, the research teams mixed social and biomedical strengths that proved incredibly useful to the Ecohealth approach. Leadership of the projects had a balance in terms of the academic background of the principal investigators and team leaders. It also shows a balance in gender, not in the leadership of the projects but in the composition of the teams. Most of the balance may be shaped by the inclusion of social and medical sciences where women have a

more important participation. In the end, it is the input from every scientific discipline and the perspective of men and women in the projects that nourished the proposals, strategies and approaches of Ecohealth projects. An important effect was how the contributions by each discipline were impregnated with the principles and theoretical inputs of the others. It was common to see “biological” and “social” oriented members of the team supporting each other’s work in the field.

The Ecohealth proposals embraced new technologies and specialists into the groups. Computer generated maps and geographic information systems (GIS) were practically incorporated by every proposal. Risk maps, where population, vector densities, social and environmental variables are interrelated, appear as innovative tools that could be very useful in the operative level. Urban developers and architects in Montevideo provided new insights and computer technologies to better understand the ecology of local breeding sites. Climate specialists in Argentina and Uruguay also incorporated important analytical variables in the study of entomological settings, obtaining a more integrated vision and understanding of vector biology. Medical epidemiologists participated in areas where dengue has been a serious health problem in the community.

Entomology had a distinctive participation in all projects providing baseline data, identifying risk areas and measuring potential impact of interventions. The use of traditional entomological indexes and incorporation of new ones (productivity and House Condition indexes) represented a challenge to the projects as a whole. Although most of the projects explored from a social perspective the usefulness of certain containers in the domestic setting, there seems to be a need to unify the criteria, typology and the way breeding sites are measured or categorized, especially when this data is expected to reflect changes in the behaviour promoted by the interventions. An important issue that arises from the Ecohealth approach is that containers should be seen not only from the water management perspective but also from the solid waste or environmental deterioration perspective.

Social sciences were represented by diverse disciplines (sociology, anthropology, pedagogy, social work, health promotion, gender specialists, etc). Their invaluable input to the understanding of health problems and community relationships is unquestionable. In depth interviews, focus groups techniques, key informant interviews, KAP surveys, observational studies etc., have all provided important information to understand needs, knowledge, behaviours and attitudes towards the environment and health problems. It has been through the interaction with social scientists and their proposals that communication channels have been established and all activities surrounding the community participation been organized. Much of the success of the projects in terms of community involvement and sustainability has been produced by the analytical inputs that social scientists have brought to the field of health prevention.

All the projects were very successful in the integration of the research teams although understanding of roles, responsibilities and functions within the teams were not easily achieved given that differences in methodological approaches and understanding of scientific principles between disciplines required in depth discussions. More time than “what could be expected” was spent in those discussions but it was necessary. It was even argued that specific time for this type of interaction should be scheduled in every project before it is launched in the field.

An important attribute of the research teams' composition was that the majority of team members had previous and intensive exposure to fieldwork in community projects albeit not necessarily health or dengue related.

Community participation

Vertical approaches to disease prevention and control have failed to understand and value the role community organizations (formal and informal) can have in the implementation of effective and sustainable interventions. Public health programs still depend on a unilateral and hierarchical relationship with community members and few programs now embrace and incorporate the community in the design and implementation of their strategies (eg. HIV-AIDS).

In the case of dengue, the role of the community is fundamental to the success of any strategy that deals with breeding sites control. It must first be stated that community involvement was incorporated into the dengue vector control discourse when the impact of technical solutions (insecticides and larvicides) was evidenced as poor if not short lasting. This situation came along with the break down of many vertical control programs in the region, the deterioration of the urban environments and the lack of funding for public health programs that demanded heavy budgets but provided light results. This situation was also propelled by the political and economic ideology that established that tackling the social needs of the population was no longer responsibility of the government alone but of the individual. On the other hand, it must be emphasized that technologies and financial resources available do not allow the implementation of a prevention and control program directed towards the *Aedes aegypti* without the commitment and direct participation of the communities affected, since most of the breeding sites are "produced" inside the domestic setting. Without placing the whole responsibility on the community or lessening the responsibility of municipal authorities in charge of the provision and maintenance of the sanitary infrastructure (potable water, solid waste collection and sewage) dengue has become a challenge for public health because solutions lie outside the medical arena.

Community involvement may have different expressions in intensity, magnitude or coverage of the target population. While in some projects the participation may be more massive but short lived in terms of the people involved, in others, the intensity of their involvement although limited to some sectors of the community, can prove to be very effective in the long term. For example, in a rigidly organized society as the Cuban, community participation is not an easy task even when people respond to several official mobilizations with outstanding efficiency. It is precisely this strict form of organization one of the reasons that gives the community a chance to organize itself around local interests and problems and not only to respond to vertical and national priorities. In this particular case, the community initiatives that arose from the Neighbourhood Groups (Grupos Vecinales) used the organizations in place, as the Popular Health Council, in order to meet their objectives. In the case of Mexico, the organization of community groups (Monitores Comunitarios) and their working agenda in the community relies on the continuity and involvement of the municipal health authority whose involvement was extremely important. In Buenos Aires, the commitment of a district supervisor led to the incorporation of the experiences of the two schools initially involved in the project into the curricula of all the schools in his district. Not only did all the schools become involved, but a systematisation of the educational and formative process of teachers and students was established with a well organized program that included objectives, resources, budget, activities to be performed, products expected from each activity, and an evaluation scheme with follow up of the

results. The teachers in this district also became multiplier agents of such experience in all Buenos Aires educational districts. A similar experience was generated in Montevideo but at a lower scale (fewer schools involved). In Colombia, the networks of health promoters have motivated the interest of municipal authorities and of the Vector Transmitted Disease Program which in a way guarantees their sustainability. In Guatemala the Environmental Health Promoters and in Mexico the Community monitors are an example where selected groups can guarantee important levels of commitment and action.

The success of each project in developing a sustainable participation of the community has some basic traits. When health promotion groups are formed in the community an essential ingredient is that their members are part of the community and reside in the same areas where the project is developed. In Colombia it was a *policy not to be broken*. In some cases it is even useful, if possible, that members of the research team also belong or lived in the community where the intervention is being developed. This was the case of Vicente López in Buenos Aires and Fortaleza, Brazil. This issue turns out to be important to the community but also to the health promoter or those involved in the intervention. A finding in Barrio Charrúa in Buenos Aires illustrates the issue when lack of involvement of the school teachers and the health center personnel in the neighbourhood was identified. The qualitative studies identified an issue of hidden “discrimination” towards the population that was composed mostly by migrants from Bolivia; therefore, teachers and health center personnel thought they should not get involved with problems that were not theirs. The results also showed that teachers and doctors look at the area (the people) with disdain since they were sent there as a “punishment” or in a “stand by” position. Absenteeism and constant replacement of personnel were the rule. Commitment under these circumstances is not feasible.

In sum, all the proposals fulfilled the principle of “belonging to the community” and are now identified as Grupos Vecinales (Cuba), Monitores comunitarios (México), Red de Promotores de Salud (Colombia), Alfabetizadoras (Argentina), Grupo de Señoras (Argentina), teachers groups (Argentina and Uruguay), the Environmental Health Promoters (Guatemala) and therefore it is natural to expect better results. The case of Haydeé in El Cotorro, la Havana, is highly representative since her professional background is health promotion and she now represents the 17 Community Groups (Grupos Vecinales) created to tackle the dengue problematique in the area and also sits along with the President of the Popular Health Council of that district during the regular meetings held to deal with local problems, not only dengue.

Another issue that goes along with the sense of belonging or identity profile, is the continuous presence of members of the research team in the area. The way the projects achieved this aspect is extremely variable and it starts from direct social observational studies on site (Fortaleza). In Buenos Aires an information stand was put in the weekly fair in Barrio Charrúa and in a popular crossroads in Villa Pueyrredón. These are labour intensive activities that slowly opened community relationships to the members of the project. Vector control personnel also worked as good envoys of the project since they are routinely walking through the area. Not all personnel had good communication skills so they need to be trained to perform such an important task. It is important to keep the same personnel in charge of the same areas so the community recognizes them as the link to the project. In Cuba they say *know your area first (conoce tu área primero)*.

Communities should be understood in their social context since most have experienced social crises that often broke social ties and trust within their members. Binding with the community is difficult because of insecurity, violence, trust of migrant populations, rejection to governmental proposals, etc. Security issues in any Latin-American city are a matter of concern and it certainly awakens mistrust when project personnel sometimes request the inspection of the domestic setting. Once the community identifies the members of the project this issue tends to vanish. Nevertheless, many projects mentioned that constant replacement of personnel presents a barrier to advance in the project's objectives. Lack of bonds between the agents and the population caused by turnover of vector control personnel was an important finding in Fortaleza. On the other hand, permanence is valued. For example, after the epidemic in Paraguay hit the media in Argentina, people in the medium class neighbourhood in Buenos Aires who were indifferent to the research team at the beginning, open their houses and asked more questions to the girls in charge of monitoring the ovitramps. The same issue arises when different stakeholders (municipal health authorities) are removed by political agendas creating the need to re-socialize the project with the new authorities. This was important in Guatemala and Mexico. This raises the challenge to institutionalize the projects into the agenda of key stakeholders.

An attribute should be that community health projects use previous experiences in the areas selected and build on those results and interventions. Examples in several projects prove to be very beneficial. For example, in Centro Havana the team worked years before in a housing renovation project in the area and was later involved in the dengue control proposal. In Mexico, community groups participated in a more active manner because the cities selected had been the target of other research initiatives related to dengue control. In Guatemala a previous large scale communication intervention proved to be very effective in involving the population in the monitoring of vector control activities. In Colombia, the Vector Control Program in the municipality had already created a network of health promoters and campaigns directed to the collection of disposable items along with aerial fumigation activities and biological control initiatives (4 times per year). In Buenos Aires, the Primary Health Unit in the Vicente López municipality had developed several projects related to cholera control, drug abuse and reproductive health. It is desirable that experiences outside the health arena nourished experiences like these. In Mexico, for example, women participating in a social program directed to poverty reduction (Oportunidades) were the most participative (200 out of 360 in the intervention area were from this program). Benefits from one area can support initiatives directed towards health and the environment. On the other hand, it is important to interpret the role of political organizations since communities recognized that they promise more than what they offer and that their support is short lived. Participation in health projects can not be granted expecting material goods.

Gender oriented aspects:

The socialization of roles in terms of health care, domestic activities, community responsibilities is determined by cultural, educational and social issues. In the case of health it has been a matter of concern that women are perceived as the ones responsible of taking care of the family needs. The domestic setting is seen as a women's space and men are seen as the providers. The introduction of health as a reality related to environmental factors creates the need to modify the gender roles since the domestic and community environment is a new space where collective responsibilities need to be define and understood. As the projects faced the need to change community's perception that dengue control is a responsibility of government agencies alone, it

was also necessary to explore and identify how community members perceived and acted upon the issues of health risks in public spaces.

A practical concern of all the projects was that most of the people interviewed were women. There is a strong perception that domestic hygiene is an activity under the responsibility of women even in physical activities like cleaning low tanks, like in Colombia. Some interesting results were obtained from the qualitative studies. In Buenos Aires the teachers (basically women) were identified as sources of potential bias in terms of gender definition since they could reinforce and reproduce gender stereotypes if they are not conscious of their role as women and educators. They teach who is in charge of places and roles in the domestic setting and therefore it is important to create awareness of this particular situation so as to produce a change with the children and their families. In Uruguay, the educational level and equalitarian attention women and men received in education, sets a situation where gender issues are more age related since domestic roles are fixed in women of older age groups. The economic crisis in Argentina in 2001 brought also a crisis in masculinity since women were more easily employed than men and women had double working schedule creating a new situation regarding the differentiation of roles in the domestic arena. In terms of the distribution of tasks within the household, the composition of the Grupos Vecinales in Cuba changed with time and functions since the detection of problems was basically defined by women and changed when solutions were identified and more men were involved. In Buenos Aires the project gave women in a Religious association (Caritas) the opportunity to participate and experience and interesting transformation. Adult women learning how to read and write were involved in the design and production of educational materials. This situation produced a dramatic change since they were put in a public space where they previously had no place (illiterate, foreigners), and now they taught others their experience and messages. In Mexico, most of the women participating in the project were involved in a poverty reduction social program (Oportunidades) that gives women control over the resources (money) provided by the program. This situation is empowering women in the definition of priorities and how resources are managed from a new gender perspective.

Results from the other projects identified that certain breeding sites, cleaning activities and domestic spaces were gender related and explored behavioral changes directed to this particular finding. There is a trend to link women to tidiness and cleanliness in the house and with prevention and health, which raises a quandary for researchers: if messages relate lack of hygiene with the transmission of dengue, and imply that the environment of the houses is not healthy, this may put into question the ability of the women to keep their home healthy and clean.

These examples illustrate findings of the projects that can be related to gender as an important component of the proposals. It should be stressed that change in gender roles were not systematically explored nor targeted in the interventions implemented.

Equity

This methodological pillar was not addressed directly by the proposals.

2. What is the quality of outputs generated by individual projects (in terms of knowledge generation, social capital strengthening, and knock-on or domino effects, capacity building for the team, publications, etc.) and their relevance to researchers and practitioners from the health and environment sectors?

Knowledge generation

The nature of transdisciplinarity in all projects generated an innovative approach to the understanding of health determinants through the incorporation of risk as the aim and the environment as the target. The knowledge produced by the experiences in dengue control can be adapted to tackle other health problems with similar benefits.

The projects developed a vast amount of educational materials (posters, videos, triptychs, games, songs, handbooks, slide shows, etc), that were targeted to different audiences, focused in diverse control strategies with different knowledge purposes and to encourage different levels of commitment. Compilation of a complete set of this material would be extremely useful for other researchers and communities if contents are adapted to local contexts. A good amount of publications, technical and scientific, has been produced and knowledge generated is already being presented in different forums (Annex).

Social capital strengthening and knock-on or domino effects

An outstanding result is how most of the projects were able or successful in generating awareness and interest from different government agencies. The most benefited were municipal health authorities in several sites, indistinctly of the epidemiological context in which the project was developed. In Cuba as well as Uruguay (opposite dengue realities) the project outputs were incorporated into local contingency plans and even scaled up to strengthen national dengue control agendas.

The educational sector was an active stakeholder in Argentina and Uruguay that will benefit from the experience by the systematization of the formative and educational process in teachers and students. Teachers mentioned that *projects like this one bring purpose to our educational role*.

The communities involved developed strengths and capabilities to face local problems that will eventually improve their living conditions. In the case of Buenos Aires, for example, the health promoters in Vicente Lòpez were in the process of creating a non governmental organization that would enable them to get hold of financial support for different projects and interventions in their communities. The Neighbourhood Groups in el Cotorro are working hand in hand with the Popular Health Committee. The network of health promoters in Colombia is collaborating with the local vector control program.

The work developed by all these groups is likely to create a domino effect in their communities and further follow up may show how the Ecohealth approach can enlarge its branches to other areas of concern of the communities involved.

Capacity building for the team

Interaction among different disciplines, academic centers, institutions and social key stakeholders has created a nourished milieu where benefits multiply in terms of the local capacity built in

research centers and academic institutions. The technical infrastructure (laboratory, software hardware, physical areas, equipments, etc) provided through IDRC's funding is still in operation. Teams are now recognized not only as an array of individuals specialized in a field but as an experienced research team in the area. In most of the projects, the interventions were useful for postgraduate thesis and training of local research teams. The overall experience demonstrates that innovative research initiatives generate strengths that are not created by individual efforts. One example that merits recognition is that of the health promoters in the poor urban area of Buenos Aires, where they are organizing a non-governmental organization to search for funds useful for other health issues in their neighborhood. The experience and capabilities developed in the dengue control strategy was useful to understand and tackle other health needs in the community. Follow-up of such enterprise will be necessary in order to measure the global impact of IDRC's initiative. In Guatemala, additional funds were obtained from a private foundation and the Lions Club to pursue an intervention on diarrhea control supported by the research team.

3. What are the intended outcomes of projects related to human health, environment and development? Have they been tracked? Are they being achieved and to what degree? How did projects contribute to their achievement?

The IDRC initiative is directed towards a better understanding of health determinants and improvement of population health through sustainable environmental changes. The immediate impacts of projects, given the short time frame of the proposals implementation, are more clearly seen in areas different than health, although on a long-term basis they should also become manifest in the health area.

Human health outcomes:

The projects were directly or indirectly involved in the measurement of health risks or disease prevention. Those that measured direct health impacts were Cuba (dengue), Mexico and Guatemala (dengue and diarrhea). The projects in Cuba were involved in the development of a surveillance system designed for early detection of cases and environmental risks for breeding sites. Low infestation rates in Cuba can hardly be replicated in other countries in the region, and once the projects ended, Cuba actually suffered a dengue epidemic. This issue is a major scientific and health concern because it shows that even with low entomological indexes transmission of dengue may still occur. The laboratory-based surveillance system supported by community members created risk maps, and actions were taken according to the findings. While epidemiological data was collected and mapped, the impact of the early detection system was mentioned as good since the areas in both projects (El Cotorro and Centro Havana) were the last to detect transmission and the first to control it. While no data was presented since analysis is still in progress, the low infestation rates in the areas may "guarantee" low transmission rates. The impact of the intervention can also be registered since Centro Havana was previously classified as a high risk area, and after the intervention it was classified as medium risk according to the entomological, epidemiological and environmental indicators. An overall assessment of the opportunity of the surveillance system requires a detail report by the Cuban team.

The results in Mexico and Guatemala offered some evidence of change in health risks for dengue but not so for diarrhea, although no serological evidence was produced in the case of dengue transmission. The 5 by 5 healthy practices directed towards breeding sites control and water management were evaluated and measured. The healthy practices for breeding sites and

water containers control were easier to perform (once a week) than those related to diarrheal control (daily). The frequency of the activities promoted may have an impact on the adoption of behavior changes.

The projects in Melgar and Girardot (Colombia) and Fortaleza (Brazil) are in their baseline and diagnostic stages where health risks were established but no interventions were introduced as to evaluate their impact. On the other hand, the projects in Buenos Aires (Argentina), and Colonia and Montevideo (Uruguay) represent a unique scenario to measure the impact of the interventions since no local transmission has been detected even though imported cases have occurred in Buenos Aires. The recent detection of one dengue case in Uruguay creates an ideal scenario that needs intensive follow up. Since the monitoring of health risks (entomological) is being performed and amplified by the epidemiological risk situation in Paraguay, the chance to evaluate their impact in health outcomes is optimal.

Environment outcomes

All projects developed a particular approach to measure environmental risks for mosquito breeding sites and with the exception of Colombia and Brazil, all intervention sites reported different levels of change in the management of environmental risks. In Cuba some high risk public spaces (*vertideros*) were transformed into parks, gardens, orchards or recreational spaces. Though small in scale, they proved to be feasible through community involvement. In Montevideo the cemeteries now use sand in flowerpots to prevent mosquito breeding sites, reducing the risk in neighboring areas. The breeding sites cleaning campaign 4 days a year established in Girardot, Colombia has improved the breeding environment in the area. Better water container management was registered in all sites producing lower infestation rates in several containers. Nevertheless, the recent experience in Cuba demonstrates that the reduction of infestation to minimal levels still represents an important risk for disease transmission.

Development outcomes

A long term result not evaluated.

4. What are the general gaps and challenges observed?

The experiences in the projects all bring promising results to the field of health prevention and control. Far from being conclusive they also raise some important challenges and point out gaps that need to be tackled.

The “community” is not a social homogenous unit or necessarily receptive to collective action. If we are to promote collective participation when social dynamics are torn down (unplanned urbanization, migration, insecurity, gender issues, violence, drug abuse, etc.) the rescue of “collectiveness” and the establishment of care networks could be important strategies. Further interventions need to recognize those particularities in order to produce collective changes.

If programs at the municipal level (potable water provision, garbage collection, waste management, health promotion, etc) work independently, the scale up of the interventions is definitely compromised. The experiences demonstrated that when the interventions were considered of public interest by different social actors or stakeholders, the chances of

sustainability increased substantially. It is through this channel that community and government agencies can promote alternative water supply systems and engage in the revitalization of public spaces. When appropriate municipal infrastructure is not in place it hinders changes in practices and attitudes. Municipal services need to be reoriented to allow community participation initiatives. Sustainability of interventions requires permanence and continuity of partners.

Tourism is an important economic force in most of the project sites, in some cases it is a matter of national economic security. Water management (distribution) in these areas is key to the reproduction of environmental and health risks. Stakeholders in this sector should be incorporated to protect the environment, diminish health risks and secure this economic activity (virtuous circle).

Environmental risks are not produced but reproduced and amplified by the community. The environmental deterioration registered by the projects in terms of waste management, breeding sites multiplication, water storage practices and health risks has become a natural consequence of the proliferation of non recyclable containers produced by the industry. We can not expect that house dwellers improve their domestic environment without community or local resources that keep breeding sites away. Community members have no tools to destroy or dispose of massive numbers of containers that are produced outside, introduced massively but not collected, without the direct participation of municipal authorities. On a long term basis, industries should be involved and regulated to guarantee a cleaner environment.

A serious concern for all those involved in dengue control should be the definition of transmission risks based on entomological indexes. All the projects used infestation indexes as parameters to measure environmental risks and evaluate impact of interventions when performed. The Cuban experience demonstrates that epidemics can occur when house or container indexes are below 1%. An imperative component of any proposal on dengue control should incorporate detection of cases in order to understand the level of efficacy required in terms of the low density of containers or larval density. On the other hand, traditional indexes do not reflect changes in behavior in a detailed fashion. While entomological surveys identify if containers were positive or negative they do not always describe if they are covered, turned upside down or protected. Impact of the interventions should also be established in terms of the effectiveness of such control activities (frequency of activities, duration of control status, permanence of breeding sites, productivity of breeding sites, etc).

5. How are Ecohealth approaches utilized in the individual projects different from other approaches to communicable diseases prevention and control? How are they the same? What is the added value? What is left out? What are the trade offs?

IDRC's initiative demonstrated that disease prevention and control projects do not need to be under the leadership of a medical professional to generate effective strategies and products. It was also demonstrated that technical human resources (vector control personnel) under the administration of health programs required training in their entomological as well as their communication skills.

Health is not seen from the perspective of the disease but as a risk developed from the environment. Vertical and disease oriented approaches focus on technical issues and define, and set up actions directed to particular issues and according to establish priorities. In the case of dengue the targets are the breeding sites and mosquitoes, not how or why breeding sites are produced and reproduced. The promotion of behavioral changes is based on imperative instructions (do this, this way and for this long). At the end the impact is limited, transitory and demands constant reinforcement. From the population point of view dengue is not a problem, therefore Ecohealth approaches work along the needs of the community, identifying priorities and developing capabilities appropriate for dealing with other health issues, not specific targets. Feedback, instead of reinforcement, creates awareness of their impact and promotes co-responsibility.

Community members in the IDRC`s projects were involved in the identification and understanding of their problems. These are not set according to global health policies that may or may not be justified. The health promoters are trained in the evaluation methods, sharing responsibilities and giving purpose to their actions. Indicators are designed to be accessible and simple to monitor the process and the impact of their activities. An important difference with the traditional control strategies is that communities take responsibility in monitoring environmental risks, identify solutions according to their capabilities and develop strengths to contact key stakeholders to solve problems out of their reach. While community participation projects *empower* the members of a community, traditional programs managed by health authorities “*keep power*” (technologies, educational tools, resources management) to themselves and under their authority.

Educational materials are not *produced massively* and directed to an abstract audience; in the Ecohealth approach, messages are *designed according* to cultural and educational backgrounds and materials are adequate to age groups or audiences and produced with local resources (slides, triptychs, posters, puzzles, videos, etc.). Systematization of the formative processes and learned experiences can be extrapolated to other health issues. In traditional programs, community personnel are trained in specialized areas or programs. Ecohealth approach searches for *self-reliance* in the actions of the community while traditional programs need to oversee (*supervise*) their progress.

Both approaches acknowledge that changes in attitudes and practices take time to become established but traditional programs are not concerned with *sustainability* of interventions since they are based on the *continuity* of actions and dependent on the flow of public funds. A substantial difference is the nature of the traditional programs that are based on *repetition* of actions not in *reinforcement* and *feedback*.

Traditional approaches to health prevention and control now place the responsibility (blame) on individuals (diet, lack of exercise, smoking, reproductive risks, etc.) while the Ecohealth approach searches for *co-responsibility* of all actors involved. Even in dengue control, blame in traditional programs is “*dumped*” in the household and participation is seen as a *substitute* for the lack of government investment and break down of vertical programs.

An important difference also arises from the perspective the problem is seen. While traditional control programs view the problem from the vector perspective, the Ecohealth

approach understands that breeding sites are result of a complex interaction of factors that create a deteriorated environment suitable for breeding risks. At the end, traditional programs are organized as emergency responses delivered against the mosquito without any consideration of the environment. They do not even critically assess the ecological impact of the insecticides used. Ecohealth approach intends to modify the environment to diminish the health risk and looks for a long term impact. None of the projects are in a position or time schedule to assess this issue.

6. What lessons, insights, knowledge follow from the various sets of projects with respect to social and ecological determinants of disease transmission, prevention and control strategies, and coping capacity of communities concerning the diseases?

Lessons

It has been clearly established that community members have a well structured idea (knowledge) about dengue as a disease but not regarding the mosquito as a vector of infection. The existence of knowledge does not guarantee behavioral change. Even when the notion of risk is in place, people still view government agencies as responsible for the control. An Ecosystem approach has been useful to overcome knowledge barriers and establish bridges to better understand the risks by linking the health problem to an environmental concern and a collective responsibility.

The problem of understanding and assimilating information may originate on the irregular nature of communication campaigns, the way information is elaborated and transmitted to the population, and the lack of a clear educational tasks. The projects' efficacy in dengue education and communication campaigns relied on previous identification of the community's knowledge and the messages adaptation according to the local reality. Not every action or campaign about a health problem results in long-lasting, sustainable changes or impacts at a socio-cultural level. In some cases campaigns must continue even when the threat is not present. This was certainly true for the case of Montevideo and Buenos Aires since their reality in terms of dengue experience is opposite to the one living by the other study sites. The challenge is to create risk communication strategies to improve impact of projects.

Knowledge

The major challenge ahead is to build a framework for action directed towards improved water management since negative repercussions of increasing access to water are a result of the survival needs of the community not understood as vector related activities. If water gives people the possibility to have a better standard of living, storage, accumulation or accessibility by whatever means cannot be perceived as a disease niche or a health risk. This can also be true when related to the cleaner environment since accumulation of things (usable or not) gives a certain kind of status versus not having them. Traditional control programs avoid a wide spectrum of issues why communities need to store water and where. Interventions (larvicides, insecticides and containers collection campaigns) act against community's beliefs and needs; therefore resistance is the natural response.

Ecohealth approaches search for solutions by understanding cultural and educational backgrounds involved in the management of the domestic environment. What needs to be highlighted is the relation between responsibility in the control and the production of risks. Massive introduction of a wide spectrum of non-recyclable recipients is not created by the community members. Their choices of control are limited if those containers are not collected by

public solid waste agencies as they lead to a deteriorating environment. Traditional control programs blame the community and make them responsible of controlling what is out of their control. IDRC's projects created a new set of conceptual, technical and practical tools that have the potential to enhance the control strategies in the region. By promoting co-responsibility, strengthening the interaction with different stakeholders, promoting responses according to capabilities, educating individuals, families, communities as well as institutions, the Ecohealth approach introduces conceptual innovations to community participation control schemes. By identifying actions not only related to vector control but focusing on the modification of the environment, Ecohealth projects look for a durable impact and not a transitory one.

7. Local relevance and utilization of research results: Who has and how have research results been utilized?

The IDRC Ecohealth approach is in itself a relevant result that was used to understand and design better prevention and control strategies directed to improve the environment and dengue situation in the project areas selected. Most of the projects will produce scientific publications relevant to the vector control community, governmental control programs and educational fields.

Cuba:

In this particular case, the project that took place in the suburban area of El Cotorro had immediate relevance to public health researchers and the knowledge produced was adopted by the team in Centro Havana project also financed by IDRC. While most of the methodology aimed to establish a surveillance system, additional components were incorporated to the Centro Havana project. The vector surveillance information system is labor intensive as well as the elaboration of the risk maps (GIS). Maps were very detailed because of the amount of information collected. In the end, the model was adapted to Centro Havana conditions, resources and personnel available. Members of both projects (El Cotorro and Centro Havana) were involved in the design of an emergency plan to guarantee the sustainability of dengue control in the island where all governmental actors along with community organizations participate in a coordinated manner. Much of the results from the projects were incorporated into such a plan.

Buenos Aires:

The project followed a desirable but rarely traditional route. Actually it proved to be one of the biggest bets in IDRC funding policy. Like any other project, Argentina faced the threat of dengue transmission because *Aedes aegypti* was already present in the metropolitan area. This was in essence a real prevention project and is now being put to the test. Its relevance came from the imminent risk of dengue transmission, and when the research was almost finished an epidemic in Paraguay created an ideal scenario to put all what the project was working on into practice. First, the entomological team is being recruited to perform a wider monitoring of vector densities in the metropolitan area. Second, the Primary Health Care Unit in the municipality of Vicente López (intervention area) was also invited to provide their experience in the project to organize the health promotion and community participation components of the governmental program. Third, activities in the two pilot schools of the project were later scaled up by the district supervisor to all other schools in the district. Systematization of the experience was extremely important since all the material, the program, the objectives, activities and evaluation materials were integrated and organized in a very professional manner. This was how part of the research results were used in the educational field. Another and most important way was that those teachers involved in the

development of the educational strategy became multiplier agents of the experience in the rest of the school districts in Buenos Aires. In the end, it is expected that all the schools will benefit from the information, knowledge and skills developed by the students and teachers in the two pilot schools.

Montevideo:

Understood as a common project with Argentina, the project in Montevideo was exposed to the same intensity of media information and awareness of the society as a whole. Nevertheless, the project in Montevideo is still developing its most important products: the Early Warning System and the Follow up Observatory. Governmental agencies are already asking the team leaders to provide them with data and their experience but products are not ready yet. The material developed by the schools will also be used to train other teachers and organize other schools in the recognition of the problem within their communities. During the writing of this report, one autochthonous case of dengue was reported in northern Uruguay. Predictions by the research group were fulfilled, a sanitary emergency was established and the inputs from the project are being used as part of the national contingency plan.

Mexico:

The final technical report of the research develop in Mexico is still in process and final results have not been presented to different stakeholders in the area and at national level. Local authorities have adopted the experience though it could be difficult to sustain if the municipal health authority that participated is removed since she was a key person in the development of the whole strategy of community organization. Socialization of the project is required when removal of key actors is a regular situation.

Guatemala

The technical reports show a wide participation of different stakeholders in the institutional and social level. The project served as an important input for academic training for social, biological and even sanitary engineering postgraduates.

Colombia and Brazil

These projects are still in a developing stage although promising results may be expected from both experiences. In Colombia at the end of the project a series of meetings were held with municipal authorities in both areas where results were presented and adoption of several practical control measures were discussed. Future evaluation of such interventions are targeted in a second phase of the study if funds become available.

8. What are examples of outstanding contributions of projects (eg. Knowledge, strategies, policies, health outcomes) that can be documented to showcase the achievements and potential of ecohealth approaches?

The Ecohealth approach has brought appealing and innovative issues to the prevention and control of public health problems and not only dengue as an isolated topic in the health agenda. First of all, we are transcending the approach of a health problem and specific strategies by engaging in the definition of healthy ecosystem where social, economic, cultural, biological determinants of health are analyzed and reflected upon as a unity. To interweave different elements that influence health and behavior, that are usually taken independently, gives a clearer

unity and meaning to the understanding of dengue reality. In this particular case, new technologies (GIS) were incorporated and proved to be very useful in the understanding of environmental risks, population dynamics and health hazards.

The diversity of ecological and social environments where the projects were developed illustrate the complexity of dengue transmission determinants. The rural and densely populated urban environments are settings where dengue flourishes and there is no single strategy that addresses all the determinants of the mosquito breeding risks. Water provision and waste management are important determinants of a clean environment and every proposal had particularities that required consideration in order to design appropriate interventions.

Risk awareness define by a deteriorated environment was a key contribution to involve the community in much favorable ways towards the control of vector breeding sites. Since dengue is not perceived as a priority by the community, the goal of managing the environment gave more sense to the activities proposed in the interventions.

An outstanding contribution from all the proposals was the identification of the axis of water management-water storage-risk perception-and social conditions as a complex relationship that needs to be translated into concrete actions that find coherent solutions to the social groups' realities. In every case, the problems faced were related to water management (scarcity or irregular provision, absence, abuse, misuse, etc.) and solid waste disposal that obliges members of the community to undertake certain practices that will eventually lead to health risks and environmental deterioration. This situation is analyzed not only from the individual perspective but as a social problem where every member of the community has a role and a responsibility. Far from just reducing the approach to the presence of breeding sites and practical ways to deal with them, the projects analyzed their determinants (social, cultural, economic, etc.) in order to tackle them more effectively.

Community participation is not seen as a substitute for governmental inefficacies but as a necessary component for all effective interventions. The take home message is not to blame authorities for what they stop doing but to try to solve what is on your hands. If the community solves problems, identifies obligations, accomplishes what is requested then it is able to demand action from other sectors of government. Co-responsibility with government agencies was an important outcome from all projects since "a well organized community can demand solutions" not just ask for them.

Most of the work concentrated in the identification of health problems, needs and also the proposal of solutions to those problems identified. An interesting result was the changing relationship with private and public spaces since both scenarios are now viewed as risk and where responsibility is a collective not only an individual task. Creating this type of awareness towards the environment as a group responsibility, generated the substrate for more interesting risk communication strategy with different educational materials (posters, booklets, pamphlets, songs, etc.), pertinent to different audiences, feasible for target populations, easily monitored by community members and useful to public health agencies. The analytical and technical products were also more appropriate to the needs of decision makers.

Annex 1.
Composition of research teams and activities developed
(Workshops, Congress, Publications, Thesis, etc.)

Research Teams

(* people interviewed)

Argentina

Universidad de Buenos Aires

Nicolás Schweigmann (Fac. de Ciencias Exactas y Naturales)*

Andrea Rizzotti (Fac. Latinoamericana de Ciencias Sociales)*

Gabriela Castiglia (Municipalidad de Vicente López)*

Fabio Gribaudo (Municipalidad de Vicente López)*

Edgardo Marcos (Gobierno de la Ciudad de Buenos Aires)*

Pablo Dinghi (Docente investigador)

Sandra Gómez (Docente investigador)

Santiago Maldonado (Fac. de Ciencias Exactas y Naturales)

Pablo Maccione (Fac. de Ciencias Exactas y Naturales)

Natalia Calvo (Técnica de laboratorio y campo)

Paula Prunella (Técnica de laboratorio y campo)

Mónica Monti (Técnica de campo)

Claudia Serrano (Técnica de laboratorio y campo)

Nora Burroni (Becaria)*

Gabriela Freire (Becaria)*

Vanesa D´Onofrio (Becaria)*

Sara Oberlander (Becaria)

Héctor Schillaci (Becario)*

Uruguay

Universidad de la República

Fac. de Agronomía

César Basso, team leader*

Jorge Pereira*

Fac. de Humanidades y C. de la Educación

Sonnía Romero*

Fac. de Ciencias

María Martínez*

Mónica Gómez*

Walter Norbis

Mario Caffera *

Mario Bidegain

Karina Sans

Nancy Andreoni

Danilo Calliari
Maite Ponds
Nicolás Vidal

Fac. de Arquitectura

Ingrid Roche*
Sumila Detomasi*
Mariana Alberti,
Trilce Clérico,
Ma. Gabriela Detomasi,
Rodrigo Fernández,
Néstor López.

Mexico

Center for Research in Malaria, Tapachula , Chiapas (CIP-INSP)

Juan Ignacio Arredondo-Jiménez, Principal Investigador*

José Genaro Ordóñez-González
Norma Edith Rivero
Kenia Mayela Valdez-Delgado
Teresa López Ordóñez
Margarita Pérez-Ramírez (†)
Joaquín Covarrubias
José Luis Espinoza
Raúl Monzón
Eleazar Pérez
Amílca Zúñiga

Municipal authority in Huixtla
Arhemy Durante

Brazil

Universidade Estadual do Ceará (UECE)

Andrea Caprara, MD, PhD, Principal Investigator, Professor*
Alice Correia Pequeno Marinho, MSc,
José Wellington de Oliveira Lima, MD, PhD, Professor
Eddie William de Pinho Santana, PhD, Professor

Ethnographic researchers

Lucyla Oliveira Paes Landim Santana, MPH
Paola Gondim Calvasina, MPH
Fátima Maria de Sousa Sales, Nurse, Master of Public Health Student,
Fábio Angelo Lima Verde Araújo, Nutritionist, Master of Public Health Student
Ellen Rodrigues Lima, Pedagogue, Psychodramatist,
Luisilda Maria Dernier Martins Santana, Nutritionist, Master of Public Health Student

Trainees

Mardênia Gomes Ferreira Vasconcelos, Nurse student

Amanda Nobre, Medical Student
Carolina Arcanjo Lino, Medical Student
Carlos Maximiliano Medical Student

Entomologic researchers

National Health Foundation
Carlos Alberto dos Santos Barbosa, Technician
Clodoaldo Olinda Fernandes, Technician
Fábio Gomes da Silva, Technician
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Francisco Deusimar Girão de Carvalho, Technician
Raimundo Ferreira da Silva, Technician

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Lic. Zulema Menéndez*
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Lic. Ana Margarita de la Cruz*
Dra. María Guadalupe Guzmán
Dr. Osvaldo Castro
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Lic. Ibian Castillo*
Lic. Beatriz Ramírez*
Téc. Rafael Valdés*
Téc. Aida Valero
Lic. Nereyda Noa
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M.Sc. Olga Rebeca Torres
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Dra. Zully Anabella Hernández-Ramírez
Ing. René Morales-Flores
Ing. Francis Gilroy Lewis
Ing. Ronald David Matías
Licda. Patricia Mercedes de León Toledo
Lic. Rudy Benedicto de León Calderón
Licda. Jaroslava Lemus
Lic. Jorge Arturo Matute Flores
Lic. Humberto Méndez
Lic. Héctor Sabel Gamero Figueroa
Licda. Claudia María Mérida Alemán
Licda. Evelyn Piedrasanta
Dr. Juan Fernando Hernández-Escobar

Workshops and Courses

Several activities were developed during the design and implementation of the proposals that help generate more precise documents. Workshops were also held to discuss advances and to analyze results which were very useful for the research teams. The list of events and products where researchers participated is taken from the technical reports sent to IDRC. Additional information was requested to complete each of these sections.

Taller Regional sobre Ecosalud, Dengue y Chagas en Centroamérica y el Caribe

Technical Review Panel & the Steering Committee for Ecosystemic approaches to Human Health in Central America and the Caribbean

2nd International Congress on Dengue and Yellow Fever (May 31st-June 3rd)

Socialización de Resultados con Actores Locales y Tomadores de Decisiones; Centro Internacional de Investigaciones para el Desarrollo (IDRC) No. 102477-002

EcoSalud y Transdisciplinaridad y Participación Ciudadana con Enfoque de Género; Centro Internacional de Investigaciones para el Desarrollo (IDRC) No. 102477-002

Conjunto de Discusión Académica INCAP/OPS, Guatemala – CIP/INSP, México; Centro Internacional de Investigaciones para el Desarrollo (IDRC) No. 102477-002

“Enfoque de ecosistemas para la Prevención y Control del Dengue en América Latina y el Caribe: Desafíos para la investigación. Ciudad Habana, Cuba. 4-5 de Junio/2004.

Curso Internacional de Dengue. Ciudad Habana, Cuba. Agosto/2003. Introducción al enfoque ecosistémico en Salud Humana para la prevención de enfermedades transmitidas por vectores.

Scientific forums and Congress

Dissemination of the results of the research are important assets for the research teams since feedback from other research groups is necessary. The list of events and products where researchers participated is taken from the technical reports send to IDRC. Additional information was requested to complete each of these sections.

II Congreso Internacional de Dengue y Fiebre Amarilla, La Habana, Cuba. 31 Mayo- 3Junio/2004.

Round table

An ecosystem approach to human health for the prevention of Dengue. Havana City. Cuba
Cristina Díaz, Angel M. Alvarez, Maricel García, Belkis Galindo, Ida Valdés, Yisel Torres

Basso C. & Schweigmann N. 2004. Ecosystem approach to the prevention and control of *Aedes aegypti* in Uruguay and Argentina.

Posters:

Experiences from the use of indicators for Dengue control and prevention
María de los Ángeles Mariné, Maricel García, Angel M. Alvarez (Cuba)

Determination of the chemical-physical main characteristics of the aquatic habitat of the *Aedes aegypti* in the municipality of Cotorro, Olivia Sardiñas, Maricel García (Cuba)

Aquatic habitat and dengue vector ecosystem by Teresa Torres, Maricel García (Cuba)

Applying geographical information systems in health: integrated surveillance system for dengue prevention in Cotorro, Lilliam Cuéllar, Beatriz Ramírez (Cuba)

Vigilancia Centinela en la atención primaria de salud para le prevención del dengue; Belkys Galindo, Lázara Alfonso, Angel Manuel Alvarez (Cuba)

XI Congreso de Investigación en Salud Pública. Cuernavaca, Morelos /2004.

VIII Global Forum for Health. México DF, México. 15-20 de Noviembre/2004

Presentation

Ecosystem Approaches to Dengue Prevention in Havana City. Cristina Díaz et al. (Cuba)

Participatory Dengue Prevention; Cristina Díaz et al. (Cuba)

Curso Internacional de Dengue. Ciudad Habana, Cuba. Agosto/2005.

Medicine and Health in the Tropics. Marsella, Francia. 11-15 Septiembre/2005.

Poster

An ecosystem approach to human health for dengue prevention at local level. Ángel M. Álvarez et al. (Cuba)

II Congreso Interamericano de Salud Ambiental. Ciudad Habana, Cuba. 19-23 Septiembre/2005.

Round Table

Experiencias con el enfoque ecosistémico para la prevención de dengue; Cristina Díaz, Maricel García, María de los Ángeles Mariné, Miriam Concepción (Cuba)

IV Simposio Nacional y III Encuentro Internacional “Vigilancia en Salud 2005”. Ciudad Habana, Cuba. 4 – 7 de Octubre del 2005.

Dimensión Ambiental en la Salud Humana y Calidad de Vida.; Liliam Cuellar, Beatriz Ramírez (Cuba)

Jornada Provincial de Vigilancia y Lucha Antivectorial. Cuba.

Round Table

Participación Comunitaria; Cristina Díaz, Yisel Torres, Ana Margarita de la Cruz (Cuba)

Publications

The list of events and products where researchers participated is taken from the technical reports send to IDRC. Additional information was requested to complete each of these sections.

Chapters in books

Basso C., Romero S., Martínez M., Roche I., Gómez M., Detomasi S., Pereira J. 2005. Prevención y control del vector del dengue, *Aedes aegypti* (L.), en Uruguay acudiendo a un enfoque ecosistemático. In: Augusto LGS, Carneiro RM, Martins PH (eds). *Abordagem ecossistêmica em saúde. Ensaio para o controle de dengue*. Recife: Universitária da UFPE; 2005. p. 175-85.

Scientific Articles

Calliari D., Sanz K., Martínez M., Cervetto G., Gómez M., Basso C. 2003. Comparison of the predation rate of freshwater cyclopoid copepod species on larvae of the mosquito *Culex pipiens*. *Medical and Veterinary Entomology* 17, 339-342.

Gómez Erache M., Sans K., Basso C. 2004. Recent data on freshwater Cyclopoids Copepoda from Uruguay. *Nauplius* 11, 145-148.

Caprara A., de Oliverira Lima, JW., Correia PM., Godim Cp., Paez LL., Sommerfeld J., Living with scarce water and dengue

Menéndez Z., et al A new record of *Mesocyclops pehpeiensis* Hu, 1943 (Copepoda: Cyclopoida) for Cuba. *Journal of Vector Ecology* 30 (5), (2005)

Mariano Bonet , Jerry M. Spiegel, Ana Maria Ibarra, Gustavo Kouri, Alfredo Pintre Lic, Annalee Yassi, An integrated ecosystem approach for sustainable prevention and control of dengue in Central Havana, in press.

Jerry Spiegel, Mariano Bonet, Ana-Maria Ibarra, Nino Pagliccia, Veronic Ouellette, Annalee Yassi Social and environmental determinants of *Aedes aegypti* infestation in Central Havana: Results of a case-control study nested in an integrated dengue surveillance program in Cuba; *Tropical Medicine and International Health*, in press

Abstracts in Congress

Gómez-Erache M., Sans, K. Lacerot G. & Basso C. 2001. Relevamiento de especies de copépodos (Crustacea) potencialmente predadores de larvas de *Aedes aegypti* (Diptera, Cullcidae) en la región sur del Uruguay. In: Actas de la VI Jornadas de Zoología del Uruguay. Facultad de Ciencias. 17-21 de septiembre de 2001. pp. 44.

Martínez M., Romero S., Roche I., Detomasi S., Gómez M., Pereira J. & Basso C. 2005. Implementación de un Proyecto Universitario de Investigación de *Aedes aegypti* en Uruguay. In: IV Jornadas Regionales sobre mosquitos. Tucumán, Argentina. 14 y 15 de septiembre de 2005. p. 5.

Publicación en Expert Rev. Vaccines 3 (5), (2004): Dengue, one of the great emerging health challenges of the 21st Century. Meeting Report of the 2nd International Congress on Dengue and Yellow Fever, Havana, Cuba. Guzmán M.G., Kourí G., Díaz C. et al

Posgraduate Thesis

Master in Environmental Health

Análisis de indicadores ambientales, entomológicos, y epidemiológicos en el municipio Centro Habana. Autor: Iván Giró López (Cuba)

Comportamiento de indicadores de salud del ecosistema asociados al *Aedes aegypti* y al dengue en el municipio Plaza de la Revolución. Autora: Isabel Machado Martínez

Análisis de los indicadores de un sistema de vigilancia integrado durante la etapa de aseguramiento de la campaña contra el mosquito *Aedes aegypti* en el municipio Cerro. Autor: Carlos Vázquez González.

Análisis de los indicadores ambientales, entomológicos y epidemiológicos en el municipio Guanabacoa. Autor: Misael Novoa Hernández

Comportamiento de indicadores del sistema de vigilancia para la prevención y control del dengue y el mosquito *Aedes aegypti*. Municipio Cotorro. Autor Ramón Rodríguez Jiménez (Cuba)

Un enfoque ecosistémico de salud para la prevención del dengue en La Habana Vieja. Autora: María de los A. Mariné (Cuba)

Sanitary Engineering (Guatemala)

Inga. Bárbara Rosario Cruz Cano, Calidad físico química del agua de las fuentes de agua y para consumo humano.

Ing. Gilroy Francis Lewis, Desechos municipales sólidos – producción y caracterización domiciliar, reciclaje.

Ing. Ronald David Matías Palacios, Desechos municipales sólidos – producción y caracterización de la Central de Mayoreo y mercados.

Ing. René Morales Flores, Planta de tratamiento de agua potable “La Nopalera” y redes de distribución.

Ing. José Ismael Véliz Padilla, Caracterización microbiológica de aguas subterráneas y pozos.

Inga. Isabel del Rosario Monzón Sevilla, Administración y manejo de sistemas de agua.

Ing. Mario Ruiz González, Cuenca hidrográfica del Río El Naranjo, Gestión Integrada de Recursos Hídricos.