Program for Dengue Elimination and Aedes aegypti Eradication in Cuba

**Epidemiology**

Dengue was first confirmed in Cuba in 1943, although it possibly caused an epidemic registered in 1902. In 1977, serotype 1 was introduced into eastern Cuba and rapidly spread throughout the country. During the epidemic, which lasted until 1978, 553,132 cases were notified. However, it was estimated that for every clinical case there were 10 subclinical or inapparent ones, which represents an epidemic of no less than 5 million cases. From 1978 to May 1981 only sporadic cases were reported. However, in 1981, serologically different cases began to occur and were subsequently identified as dengue serotype 2. The number of registered cases from 1977 to 1980 was:

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of cases</th>
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<tbody>
<tr>
<td>1977</td>
<td>477,440</td>
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<td>1978</td>
<td>73,692</td>
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<td>1979</td>
<td>1,497</td>
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<td>1980</td>
<td>169</td>
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Table 1 presents the cases notified weekly and daily average of cases during the epidemic which took place from 9 June to 10 October 1981. A total of 344,203 cases were recorded with 158 deaths (101 in children under 15 years). The epidemic peaked on 6 July with 11,721 cases; the last of these was reported on 10 October and the epidemic was declared over on 19 November. The 158 deaths were caused by dengue hemorrhagic fever (dengue shock syndrome), believed to have been produced by dengue 2 following shortly after the dengue 1 infections. A total of 116,143 cases (almost 34 per cent) were hospitalized. The morbidity rate for persons 15 years or older was 28.6 per 1,000 population; for those between 5 and 14 it was 25.8 per 1,000; for children between 1 and 4 it was 24.5 per 1,000; and for those under 1 it was 24.1 per 1,000. It should be noted that these fairly stable morbidity rates apply to variable population groups and, therefore, the lowest crude rate actually applies to the highest incidence of the disease (24.1 per 1,000 for infants under one year). Figure 1 shows the distribution of cases notified per day.

**Aedes aegypti Campaign**

**Preparatory phase:** A review of the control operations carried out in the 1977-1978 epidemic shows a combination of emergency measures such as ultralow volume aerial spraying of insecticide and ground thermal fog applications, plus routine larviciding and reduction of foci. Because of the reduced number of sporadic dengue cases and the need to attend to other priority health problems, the A. aegypti premises index gradually rose after 1978. A team of consultants from the Pan American Health Organization evaluated the vector control program in 1980 and made a number of recommendations for its improvement. Unfortunately, many of these were just being initiated when the 1981 epidemic broke out. The estimated average A. aegypti premises index was 35 before any emergency control measures were put into effect.
As soon as dengue activity was identified, the vector control program began to take measures similar to those used in 1977-1978. With the available equipment, staff began ultralow volume ground fogging and thermal adulticidal malathion applications, as well as larviciding (temephos), and reduction of breeding sources. Simultaneously, aerial ultralow volume applications of malathion were begun over densely populated areas reaching to four applications in 10-day cycles. Aerial applications continued beyond 6 July, when the maximum number of cases was registered. The active control program undoubtedly had a decisive role in the subsequent sharp decline of cases. However, at that time, no widespread entomological evaluations were made and aerial treatments were confined to urban areas despite the spread of the epidemic to other sections.

As a result of the experience of the 1977-1978 and 1981 epidemic, a decision was made to eliminate dengue and eradicate *Ae. aegypti* mosquito from Cuba—a noteworthy move, since there had been a slowdown in the eradication and control campaigns. The situation became more serious because the motivation for mosquito control had decreased and new obstacles were present.

Cuban authorities studied the problems of lack of discipline, dedication, motivation, and the vectors' resistance to insecticides, and the cost; they also examined the historic solutions to these problems and outlined a program which used information from other successful programs. Among others, they decided to:

1. Undertake an intensive attack program using every available resource to reduce the chance of resistance to insecticides, reduce long-term expenditures, and minimize community apathy.

2. Declare the dengue situation a national emergency and allow Civil Defense to mobilize their resources during the attack phase. This provided the necessary staff and discipline to meet goals set for this phase and gave the Government time to recruit and train personnel for a newly created *A. aegypti* eradication campaign of the Ministry of Public Health.

3. Stock insecticides in sufficient quantities and equipment to develop the attack and consolidation phases.

4. Adopt a flexible program that could easily be changed as needed.

5. Cover the entire country simultaneously and utilize public support.

**Intensive Attack Phase:** The plan was to end the attack phase against *A. aegypti* in less than two months. On 26 July the announcement of the attack phase was made, the actual campaign began on 3 August, and finished on 30 September within the established time goal. The following measures were taken:

1. 100 per cent house coverage with temephos (1 per cent sand granules) at doses of 1 ppm (local application) and fenthion 40 per cent wettable powder (perifocal application).

2. 100 per cent coverage of the interior of the premises using motorized backpack mist blowers with 95 per cent deodorized malathion at 7-day cycles.

3. Street spraying with ultralow volume malathion or thermal fog in all cities at a 7-10 day cycle.

4. Activating Law 27 on sanitation which authorizes vector and *A. aegypti* campaign staff to issue legal summons to those not having eliminated breeding sites.

5. Initiating a health education campaign and special clean-up days.

6. Establishing special teams of evaluators (acting independently from the *A. aegypti* inspectors), who made their rounds a few days after the inspectors in order to note missed treatments.

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During this phase, between 13,000 and 15,000 members of the Civil Defense, vector control, and A. aegypti campaign, as well as a number of temporary staff transferred from other industrial and governmental agencies, served the campaign in some capacity. In addition, students and other individuals served as volunteers in clean-up and other activities. This phase was coordinated by municipal and provincial Civil Defense staff working closely with staff from the department of vector control, the A. aegypti campaign, hospitals, and polyclinics.

The equipment for the intensive attack phase was available for the consolidation phase and included 215 ground vehicle-mounted ultralow volume foggers, 3,961 portable mist blowers, 4,407 hand compression spray pumps, and 307 vehicles. The average amount of malathion used per premise by a portable mist blower treatment was 35 ml; the average for the ground-operated ultralow volume fogging equipment was 500 ml/ha (125 ml/minute operation).

Figure 1 shows that on 3 August, the day the intensive attack began, 3,319 cases of dengue were reported, while after 15 September, an average of only three to six cases were reported per day. By the end of August, the provincial averages for the A. aegypti premises index ranged between 0.6 and 0.0 for a national average of 0.2. By the end of this phase the national average was 0.09.

Consolidation Phase: Begun on 1 October 1981 when all activities of eradication were transferred to the A. aegypti campaign, the staff comprised 13 persons at the national level (including an entomologist) and 6,676 persons at the provincial and municipal levels.

This phase is expected to last one year. It consists in the application of focal and perifocal treatments until the mosquito has been eliminated.

There is evidence, however, that the current 8-week cycles will be sufficiently effective to eradicate A. aegypti from most of the country. If this happens, the 4-week cycles will be used only in risk and infested areas. Throughout most of the country, activities will be limited to surveillance tasks. However, both inspectors and evaluators will carry temephos in case positive sources of A. aegypti are found. Special surveillance and treatments are planned for the rainy season.

To reduce the possibility of resistance to the organophosphate insecticides—malathion, fenthion, and temephos—the following measures will be taken: inspectors will be equipped with a sharp pick to puncture metal containers; chiefs of brigades and higher-ranking staff will enforce Law 27 more strictly; breeding source reduction campaigns, a major factor in a national rodent control program, will indirectly reduce potential breeding sources; and biological control by fish may be used in some water containers.

In January 1982, all campaign personnel will be given ovitraps similar to those used for surveillance in Panama. About 6,000 of them will be placed at or near staff members' homes and will be checked every seven days for evidence of mosquito breeding.

When a breeding source is discovered by staff inspecting houses or ovitraps, an intensive attack against A. aegypti will start in a 300 to 500 meter radius of the source. This new attack will include focal and perifocal treatments, intradomiciliary aerosol mist and extradomiciliary ultralow volume insecticide applications. There will also be breeding source reduction and health education campaigns with weekly evaluations until the area is negative. At that time the monthly visits will begin.

On 15 November, the national A. aegypti premises index was 0.03. Summaries of all campaign activities are made and circulated weekly to all provincial and municipal campaign staff.

Commentary on the Campaign

The following aspects of the campaign are noteworthy:

Use of communication media and health education. The Cuban experience illustrates the importance of these factors in any vector control program.

Staff training. A television course was offered for all levels of training and seminars on the campaign and its evaluation were given to senior-level municipal and provincial staff and epidemiologists. Seminars for supervisors and biologists were also offered at the National Institute of Hygiene. These seminars provided program information to train brigade chiefs, inspectors, and evaluators for field operations. At the same time, an apprentice system was developed to train newly recruited staff and individuals transferred to the campaign for the emergency. Manuals were prepared and directive memoranda issued when activities changed. International staff supplied by PAHO gave technical courses to campaign chiefs from the provinces and to graduate biologists.

Supervision. One of the most important aspects of the program is the determination of areas of competence which permit effective functioning. The national and supervisory staff at all levels serve as field eradication workers and are highly mobile, personally responding to reports of new breeding sources.

Eradiation. Eradication is not complete, but certain factors must be emphasized. The intensive approach to eradication and coverage of the entire country from the outset reduces the chance of transferring positive containers from one area to another and, in the long run, reduces the overall cost of the program. The continuous use of mosquito population controls, although initially costly, will probably prove to be the cheapest method. Furthermore this approach reduces the possibility of insecticide resis-
tance and provides an alternative plan should resistance occur.

The consolidation phase includes a nation-wide system of ovitraps and house inspections for resting adults. As a result, larvicidal operations are actually increasing during this phase and monthly evaluation cycles cover 100 per cent of the houses.

This plan has benefitted from expert advice gained from other successful programs within the Americas.

Even if eradication is achieved, A. aegypti will undoubtedly be re-introduced as it has in many other countries. To reduce this possibility, the experience in Panama is being used to prepare a nation-wide maintenance phase and strong surveillance of seaports and airports.

Evaluation of the Campaign

This program represents one of the most intensive attacks ever waged against a vector. The strength of the approach was a result of the Government's move to make the program both a national and an individual priority and encourage the attitude that eradication is not only possible but attainable. The motivation of the staff is maintained because the program is short, gives results, and keeps everyone up to date with weekly progress reports. Each reduction of the A. aegypti premises index generates a sense of pride at the municipal and provincial level and encourages a spirit of competition to be the first to report and maintain a negative index.

(Source: Aedes aegypti Eradication Program, Parasitic Diseases and Vector Control Unit, Division of Disease Prevention and Control, PAHO, with assistance from staff from the Aedes aegypti Campaign, Ministry of Public Health, Cuba.)

Primary Health Care and Development of Services in Urban Areas

It is estimated that in the next 20 years the population of Latin America and the Caribbean will reach 610 million people, 76 per cent of whom will be living in urban areas. The massive urbanization of the population has and will continue to generate enormous needs in structural terms of environment, housing, jobs, and recreation, as well as basic sanitation services, drinking water, energy supplies, education, and personal health services.

In order to meet these needs, a more balanced distribution of resources and opportunities will be required, based on an urban development strategy that pays particular attention to underprivileged population groups, the vast majority of whom are migrants from rural areas. A fundamental component of that strategy is the appropriate development of health services and their participation in the formulation and implementation of the corresponding policies.

A Regional Technical Consultation Meeting on Primary Health Care and Development of Services in Urban Areas was held at PAHO Headquarters in Washington, D.C., on 16-20 November 1981. It was attended by technical experts from eight countries of the Region, representatives from various international organizations, and staff from the PAHO Headquarters and from different country programs.

The purpose of the meeting was to: (a) examine the health problems resulting from the urbanization process in Latin America, and review approaches to a solution, relating it particularly to primary health care strategy; (b) identify lines of action geared to the context of the goals and Plan of Action adopted to carry out the regional strategies of health for all by the year 2000; and (c) pinpoint areas needing technical cooperation, including the identification of aspects requiring epidemiological and operations research.

Because of the great complexity of the urbanization process and its manifold repercussions on the health of the population, this initial review of specific situations in metropolitan areas represents merely a first look at the general picture. It should in fact be the beginning of an active process for the analysis and design of ways of using, in urban situations, strategies adopted by the countries for achieving the goal of health for all by the year 2000 and, particularly, of using all the various aspects of primary health care: universal coverage, intersectoral relations, community participation, etc.

The meeting considered studies conducted in 1981 by national groups with PAHO support in Bogotá, Buenos Aires, Caracas, Lima, Mexico City, Rio de Janeiro, and São Paulo. These activities are part of the action designed