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**HEMISPHERIC PLAN TO EXPAND AND
INTENSIFY EFFORTS TO COMBAT**

Aedes aegypti

REPORT

**CARACAS, VENEZUELA
APRIL 1997**

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CONTENTS

EXECUTIVE SUMMARY	1
I. INTRODUCTION	3
A. EPIDEMIOLOGICAL SITUATION WITH RESPECT TO DENGUE, DENGUE HEMORRHAGIC FEVER, AND YELLOW FEVER IN THE AMERICAS	4
B. CURRENT STATUS OF PROGRAMS FOR THE CONTROL AND ERADICATION OF . Aedes Aegypti.....	6
II. OBJECTIVES	7
III. GOAL.....	7
IV. ORIENTATION FOR PROGRAM TO COMBAT <i>Ae. Aegypti</i>	7
A. PRINCIPLES AND GUIDELINES.....	7
B. STRATEGY TO COMBAT <i>Ae. Aegypti</i>	8
V. COMPONENTS OF THE PLAN.....	8
A. ELIMINATION OF <i>Ae. Aegypti</i> BREEDING SITES	8
B. EMERGENCY CONTROL	12
C. ENTOMOLOGICAL SURVEILLANCE.....	14
D. EPIDEMIOLOGICAL SURVEILLANCE	15
E. TRAINING	16
F. RESEARCH	17
G. STRUCTURE AND MANAGEMENT	17
VI. COST OF THE HEMISPHERIC PLAN.....	19
Table 1. Country Expenditures in the Americas on Programs to Combat <i>Aedes aegypti</i> , by Component, 1996 (MPHSW).....	20
Table 2. Total Cost of All Components of the Programs to Combat <i>Aedes aegypti</i> <i>versus</i> the Projected Cost of Total Coverage (MPHSW).....	21
Table 3. Cost per Component of the Hemispheric Plan	22
VII. SEQUENCE OF ACTIVITIES IN THE NATIONAL PLANS	23
VIII. MONITORING AND EVALUATION OF THE PLAN	24
IX. THE ROLE OF PAHO.....	25
BIBLIOGRAPHY	26
<i>Annex 1: List of Participants.....</i>	
<i>Annex 2: Self-evaluation of the Current Situation in the Countries.....</i>	
<i>Annex 3: Basis for Calculating the Estimated Cost of Total coverage with Direct Operations to Combat <i>Aedes. aegypti</i></i>	

EXECUTIVE SUMMARY

Dengue and dengue hemorrhagic fever have become an increasingly serious problem in the countries of the Region of the Americas, which in recent years have been hit by widespread, explosive epidemics. Even more alarming is the emergence of dengue hemorrhagic fever since the Cuban epidemic of 1981 and its gradual spread to other countries in the Region. Since that year more than 40,000 cases of dengue hemorrhagic fever have been reported by 25 countries.

While there has been no urban transmission of the yellow fever virus in the Americas for over 40 years, the high-density of *Ae. aegypti* in urban centers located in enzootic areas of this disease constitutes a potential risk for the urbanization of the virus. The events in Peru in 1995, where 492 cases and 192 deaths were notified, is evidence that the risk is real.

The campaigns to eradicate *Ae. aegypti* in the 1950s and 1960s, grounded in the resolution of the Pan American Health Organization adopted in 1947, were highly successful. By 1972 the vector had been eradicated in 21 countries of the Region. However in the 1970s, the lack of support and, in some cases, the abandonment of the eradication programs resulted in a reinfestation of the countries, erasing the efforts of the previous years.

In 1985 the Pan American Health Organization (PAHO) adopted a resolution recommending that the countries implement the strategy for *Ae. Aegypti* control, but the dengue and dengue hemorrhagic fever situation continued to worsen in the ensuing years.

In 1995, given the steady deterioration in the situation, the Directing Council of the Organization, at its 38th Session, adopted a resolution creating a task force to study the feasibility, timeliness, and appropriateness of drawing up a hemispheric plan for the eradication of *Ae. aegypti* in the countries of the Region.

Having seen the document prepared by the task force, the Directing Council of PAHO, at its 39th Session in 1996, adopted Resolution CD39.R11, urging the Member Governments to prepare national plans to expand and intensify efforts to combat *Ae. aegypti* with a view to its eventual eradication and to form a task force made up of professionals from the Member Countries to develop the hemispheric plan.

In compliance with the above-mentioned Resolution a task force of experts from several countries met in Caracas, Venezuela from 21 to 25 April to draft the hemispheric plan. The national plans drawn up by the countries in compliance with the 1996 resolution of the Directing Council served as the framework for the Hemispheric Plan to Expand and Intensify Efforts to Combat *Ae. aegypti* that is now being presented. The task force also analyzed the factors leading to success that were present in the initial eradication campaigns in the Region, as well as those that had led to the failure of these efforts, resulting in the reinfestation of countries that had achieved eradication.

The task force noted the differences between programs for control and eradication, since they require different strategies, methodologies, and goals. Control implies the efficient use of limited resources to combat the vector in areas at greatest risk for dengue or yellow fever epidemics, while eradication implies universal coverage of the activities to combat the vector to secure its total elimination, as well as subsequent surveillance to prevent reinfestation.

The purpose of the Hemispheric Plan is to step up activities to combat *Ae. aegypti* in order to achieve levels of infestation approaching zero to eradicate the vector and thereby eliminate circulation of the dengue viruses. The feasibility of a Plan with these characteristics was analyzed, bearing in mind the principles and guidelines that must be applied in each country to interrupt dengue transmission.

The task force noted the differences among the countries with respect to the status of their current programs and activities to combat *Ae. Aegypti*. In most cases, the strategies and resources allocated are inadequate in qualitative and quantitative terms for undertaking a program to combat the vector with the goal of eradication.

Each component of the Hemispheric Plan emphasizes the estimated cost in order to underscore the vital importance of resources when implementing a strategy to eradicate *Ae. aegypti* in the Region. Thus, the total cost of implementing Plan is US\$1,681,774,877 a year, 85% of which corresponds to direct operations to combat the vector, 4% to epidemiological surveillance, 10% to social participation and communication, and 1% to sanitation activities.

There was consensus among task force members that the bulk of the funds for implementing the Plan will come from the public sector. PAHO will support and advise the Member Governments and will cooperate with them in the preparation and execution of the national plans, providing the technical information that will allow for the greatest impact that is technically possible.

The differences among the countries led the task force to favor the implementation of a five-stage regional strategy, beginning with the initial activities to expand and intensify efforts to combat the vector, moving on to the eradication stage and, finally, to surveillance to prevent reinfestation.

It became clear that there was a need to work on problem solving and the negative factors present in the majority of the countries, and that political will, translated into resources to implement this strategy, should be given the highest priority in every country of the Region.

I. INTRODUCTION

According to the World Health Organization (WHO), two-fifths of the world population is at risk of dengue infection, and more than 100 countries have been stricken by dengue or dengue hemorrhagic fever epidemics. WHO estimates that more than 50 million cases of dengue and dengue hemorrhagic fever occur annually, with 500,000 hospitalized cases and 20,000 deaths. Some 95% of the cases are in children, and infection rates are as high as 64 per 1,000 population. Controlling the disease is expensive, and the epidemics are having a serious impact on the socioeconomic development of the countries.

Between 1948 and 1972, *Ae. aegypti*, the mosquito vector of dengue and yellow fever, was eradicated in 21 countries in our Hemisphere. In 1997, virtually every country in the Americas is **reinfested**, including southern areas of the United States. Moreover, numerous epidemics of dengue and dengue hemorrhagic fever have occurred in the Region, a situation that has become a growing health problem.

The ministers of health of the countries of the Hemisphere have recognized the gravity of this situation, discussing this topic and adopting Resolution CD39.R11 during the 39th Directing Council of PAHO in September 1996. This resolution mandates that the Member Governments collaborate in the definition of general guidelines for a Hemispheric Plan to Expand and Intensify Efforts to Combat *Ae. aegypti* with a view to its eventual eradication in the Americas.

In compliance with the aforementioned resolution, in December 1996, the Program on Communicable Diseases (HCT) of PAHO's Division of Disease Prevention and Control brought several experts together in a meeting at Headquarters to draft a form/guide that was sent to the countries of the Region in January of 1997. The purpose was to assist them in drawing up national plans to expand and intensify efforts to combat *Ae. aegypti*, which would be used in the preparation of the Hemispheric Plan.

From 22 to 24 April 1997, the task force, made up of experts from several countries, met in Caracas, Venezuela, to draft the Hemispheric Plan based on the national plans. The members of the task force are listed in Annex 1.

A. Epidemiological Situation with respect to Dengue, Dengue Hemorrhagic Fever, and Yellow Fever in the Americas

DENGUE

Dengue re-emerged in the Americas in the 1960s, with major epidemics in Venezuela and a number of Caribbean islands, including Puerto Rico and Jamaica.

In the second half of the 1970s dengue 1 was reintroduced in the Americas, causing a pandemic that swept Central America (El Salvador, Honduras, and Guatemala), Mexico, the United States (Texas), and northern South America (Colombia, Venezuela, French Guiana, Suriname, and Guyana), together with virtually all the islands of the Caribbean. This pandemic occurred in 1978-1980 and, while 700,000 cases were reported, estimates put the actual number of people stricken by dengue 1 at several million.

During the 1980s, several major epidemics were again recorded in endemic countries. The spread of dengue 1 to South America was especially significant. Outbreaks were observed in five countries (Bolivia, Brazil, Ecuador, Paraguay, and Peru) that had been dengue-free for several decades or that never had reported the disease. Estimates indicate that several million people were infected in the five countries, with several case fatalities reported.

The last two tropical countries infested by *Ae. aegypti* that had been dengue-free (Costa Rica and Panama) reported indigenous transmission of the disease in 1993. The following year dengue 3 was reintroduced in the Americas. This serotype was detected almost simultaneously in Panama and Nicaragua, and it was in this latter country that an epidemic of dengue and dengue hemorrhagic fever originated. In 1995 dengue 3 spread to other countries in Central America (except Belize) and to Mexico, causing major outbreaks. Since dengue 3 had not circulated in the Americas since 1978 (a 16-year absence) it was estimated that 200 million susceptible people currently reside in areas infested with *Ae. aegypti*, which means that there is a potential for dissemination of the serotype and, thus, major epidemics.

In 1995 dengue epidemics hit Central America, the Caribbean, and South America (particularly Brazil). A total of 284,483 cases were reported by 41 countries, constituting the highest incidence of dengue since 1981. In 1996, 250,707 cases were reported, some 80% of which occurred in Brazil.

Dengue Hemorrhagic Fever

The epidemiological and social conditions that fostered the exacerbation of the dengue hemorrhagic fever in Asia are currently present in Latin American countries. It is important to note that the situation in our Hemisphere is similar to that of Asia in the 1950s and is evolving in a similar manner.

The first and most serious epidemic of dengue hemorrhagic fever in the Americas was caused by dengue 2 in Cuba in 1981. During that epidemic, 344,203 cases of dengue and dengue hemorrhagic fever were reported, with 10,312 serious cases and 158 deaths. The second most significant epidemic occurred in Venezuela in 1989-1990, at which time 5,990 cases and 70 deaths were reported. The circulating viruses were serotypes 1, 2, and 4, although in the fatal cases only dengue 2 was detected. Some two-thirds of the cases and deaths from dengue hemorrhagic fever notified by Cuba and Venezuela were in children under the age of 14. Between 1981 and 1996, in all years except 1983, cases of dengue hemorrhagic fever were reported in the Americas. During that period, 41,669 cases of dengue hemorrhagic fever were reported by 25 countries, with 576 deaths. The marked increase in the number of cases in the present decade (28,434) over the past decade (13,235) should be noted. The 25 countries that reported suspected or confirmed cases of dengue hemorrhagic fever were the following: Venezuela (22,170), Cuba (10,312), Colombia (3,446), Nicaragua (2,641), Mexico (1,467), Brazil (597), Puerto Rico (305), El Salvador (287), Dominican Republic (174), Jamaica (108), French Guiana (53), Honduras (37), Guatemala (20), Suriname (11), Dominica (11), Guadeloupe (7), Trinidad and Tobago (7), Grenada (3), Martinique (3), Panama (3), Aruba (2), Barbados (2), Costa Rica (1), St. Lucia (1), and St. Kitts and Nevis (1).

The growing hyperendemicity of dengue with the circulation of several serotypes constitutes a serious risk factor for a deterioration in the current situation in the Region.

Yellow Fever

During the eighteenth and nineteenth centuries and the first three decades of the twentieth century, there were major epidemics of urban yellow fever in the Americas, with high mortality, especially in port cities. Although there has been no urban transmission of the yellow fever virus in the Americas for over 40 years, cases of the wild form are reported every year in at least five countries (Bolivia, Brazil, Colombia, Ecuador, and Peru). Some 80% of the cases reported in the 1980s and 1990s occurred in Peru and Bolivia. The high-density of *Ae. aegypti* in numerous urban centers located in enzootic areas for the wild form of yellow fever is a potential risk for the urbanization of the disease. This risk was particularly significant during the epidemic that ravaged Peru in 1995, when 492 cases (192 deaths) were reported, many of which were hospitalized in areas infested by *Ae. aegypti*.

B. Current Situation of the Programs for the Control and Eradication of *Ae. aegypti*

In 1947, the Pan American Health Organization adopted a resolution on the eradication of the *Ae. aegypti* in the Americas, achieving eradication of the vector in 21 countries by 1972. Unfortunately, most of these countries have been reinfested due to inadequate surveillance and the lack of eradication activities in neighboring countries.

In 1985 PAHO adopted a resolution recommending that the countries implement programs grounded in a strategy to control *Ae. aegypti*. In the 1995 Guidelines of the Pan American Health Organization for the Prevention and Control of Dengue and Dengue Hemorrhagic Fever, the control strategy is defined “as the cost-effective utilization of limited resources” to prevent epidemics of dengue and dengue hemorrhagic fever. In 1995 the Directing Council of PAHO adopted Resolution CD38.R12 recommending the immediate creation of task force to study the feasibility, timeliness, and appropriateness of drawing up a hemispheric plan for the eradication of *Ae. aegypti* as an effective means of controlling dengue and urban yellow fever in the Americas. In 1996 it adopted Resolution CD39.R11, instructing PAHO and the countries to prepare the Hemispheric Plan to Expand and Intensify Efforts to Combat *Ae. Aegypti* with a view to its eventual eradication.

Current Problems

The specific activities of the health services and control programs are being hindered, to one degree or another, by economic, political, social, and administrative factors. Moreover, there is a failure to make the official priority assigned to dengue prevention and control a reality; activities to control the vector lack sustainability, which is related to the programs' lack of institutionalization, as well as the lack of intra- and intersectoral integration and community participation.

The majority of the programs are administratively under of the ministries of health and known as the *Ae. aegypti* and yellow fever service, or they are combined with the malaria or vector control service. There is usually little communication and collaboration with other departments or divisions within the ministry (epidemiology, sanitation, education, etc.), other ministries, governmental and nongovernmental organizations and agencies or community groups. There is also little staff training in the programs and virtually no operations research.

The countries combat the vector chiefly with insecticides. Larvicides are frequently applied to containers that could be destroyed or collected, and there is excessive use of adulticides applied in “ultra-low-volumes” (ULV) in areas where there is no transmission of dengue. This method is useful for suppressing epidemics but not for routine control.

II. OBJECTIVES

The objective of the Hemispheric Plan is to heighten activities to combat ***Ae. aegypti*** in order to obtain levels of infestation approaching zero, with a view to its eventual eradication.

III. GOAL

The goal of the Hemispheric Plan to combat ***Ae. aegypti*** will be to interrupt dengue transmission in the Americas through a steady decline in the areas infested with ***Ae. aegypti***.

IV. ORIENTATIONS FOR THE PROGRAMS COMBAT TO ***AE. AEGYPTI***

A. Principles and Guidelines

To finish drafting and implement the Hemispheric Plan to combat ***Ae. aegypti*** in order to interrupt the transmission of dengue, the following conditions must be fulfilled:

- Institutional status and legal backing for the programs by the ministries of health and governments.
- Efforts to eliminate the social and environmental conditions that foster the proliferation of the vector.
- Effective community participation.
- Strengthening of the central level through restructuring and reorganization.
- Decentralization, strengthening, and adaptation to local structures.
- Integration and intra- and intersectoral action.
- Integration of governmental and nongovernmental organizations.
- Universality and synchronization in the implementation of the Hemispheric Plan.
- Reorganization of available resources at all levels.
- Integration and compliance with the technical guidelines contained in the Guidelines, manuals, etc.
- Participation of research and training centers.

Self-evaluation of the Current Situation in the Countries. Operational and Technical Classification of the Programs

Annex 2 lists the essential components of programs to combat *Ae. Aegypti*, assigning a percentage to each. Thus, every country will determine what its situation is and what areas will need to be improved if it is to meet the anticipated targets.

B. Strategy to Combat *Ae. aegypti*

Control and eradication are strategies with different methodologies and goals.

Eradication implies universal coverage of all the breeding sites of the mosquito in every households in every infested locality in the country to completely eliminate the vector, together with subsequent and ongoing surveillance against reinfestation. The initial cost of this strategy is high, but once the mosquito is eliminated, the cost of surveillance against the reinfestation is much lower, and the transmission of dengue and urban yellow fever is completely prevented.

Control is based on preventing epidemics and deaths from dengue and urban yellow fever. The areas at greatest risk are identified, and efforts are focused on these areas to reduce--but not eradicate--the vector. The cost of the control strategy is lower than the cost of the attack stage of the eradication strategy but higher than the maintenance stage of the eradication strategy (surveillance against reinfestation). After some years, the cost of control could be greater than the cost of eradication.

An intermediate strategy between control and eradication, especially when resources are insufficient for universal coverage, would be the total elimination of the vector in a few high-risk areas, the progressive expansion of these vector-free zones, and surveillance against their reinfestation.

V. COMPONENTS OF THE PLAN

A. Elimination of *Ae. aegypti* Breeding Sites

The elimination of artificial containers, such as disposable bottles, tires, and barrels, where the *Ae. aegypti* mosquito breeds is the cornerstone of any effort to prevent dengue. The effective control of *Ae. aegypti* breeding sites includes environmental sanitation, social participation, communication, health education, and chemical and biological control. The development of an effective strategy requires a coming together of diverse disciplines such as entomology, engineering, behavioral psychology, communication/health education, and sociology/medical anthropology. The basis for any effective action is local eliminating of the principal breeding sites and the factors that permit or foster their existence. The best way to achieve control is by modifying two main factors: 1) the quality of basic services (environmental

sanitation); and 2) human behavior at the household level. The use of chemical agents should be considered a complementary component beyond the physical elimination of *Ae. aegypti* breeding sites.

1. Role of Environmental Sanitation

Environmental sanitation activities are geared mainly toward the elimination of breeding sites and deal mainly with two specific areas: water and solid waste. When the drinking water supply is nonexistent, irregular, or poor, water is commonly stored in tanks, barrels, and other containers, and these can produce large quantities of mosquitoes. When refuse collection is irregular or poor, unserviceable materials such as cans, bottles, and tires very frequently pile up in yards, with the same consequences: greater numbers of mosquitoes.

1.1. Drinking Water

- a) Barrels and other containers where people deposit drinking water, either because they have no household water supply or because the service is irregular.
- b) Community or individual storage tanks for drinking water.

1.2. Solid Waste Management: The problems here are concentrated in the development of breeding sites:

- a) Around residences, due to discarded refuse in the form of containers, bottles, tires, etc., which are usually found in gardens, outdoor laundry areas, and on flat roofs.
- b) In public areas (in abandoned containers and tires left in inappropriate places of final disposal, such as riverbanks, illegal refuse dumps, and roadsides.
- c) Near industry (due to the storage of materials for industrial use, chiefly the retread industry).

According to PAHO data, the sanitation situation in the Region with regard to drinking water is as follows:

	1995/PAHO
• Urban drinking water coverage	84%
• Rural drinking water coverage	41%
• Urban sewerage	80%
• Excreta disposal	40%
• Collection	70%
• Final refuse disposal	30%
• Housing shortage	16%
• Inadequate housing	38%
• Upgradable housing	21%

The response of the countries to the survey conducted by the task force that was drafting the Plan in early 1997 yielded the following data:

• Urban drinking water coverage	83%
• % of houses that require water storage	36%
• Municipios with refuse collection	80%
• Adequate refuse disposal (<i>Ae. aegypti</i> approach)	59%

The coverage varies in each country, and the influence of these elements on breeding site formation varies with local conditions. The data, moreover, are for municipios, which does not imply that coverage 100% coverage of residences within each municipio. The main sanitation activities that should be considered for a program to eliminate ***Ae. aegypti*** are:

1. - Improvements in the water supply system;
2. - Proper solid waste management (collection of refuse and recycling);
3. - Elimination of natural and artificial breeding sites; and
- 4.- Management of the environmental surveillance system

Other activities and infrastructure, such as sewage systems, urban drainage, and rodent control, bear a less direct relation to ***Ae. aegypti*** control. However, they should be considered fundamental to improving the quality of life of the population, and not only as control measures for endemic diseases.

2. Role of Social Participation and Communication

Social participation is understood as a component of the programs to combat ***Ae. aegypti*** that is integrated with all the other components, especially with environmental sanitation and chemical control activities. Community participation is

not a single isolated activity but an ongoing process that can be used to develop an integrated program. This means that social participation requires continuing discussions between communities and program personnel to develop activities capable of modifying the practices and human behaviors that facilitate the proliferation and maintenance of potential breeding sites of *Ae. aegypti*.

It is impossible to eliminate breeding sites through the improvement of basic services alone. The proliferation of such sites is due to specific human behaviors that foster their existence, namely:

1. - Storing water, which occurs when the water supply is irregular.
2. - Accumulating used materials such as tires, cans, and bottles because of their potential usefulness and/or value or the difficulties connected with their disposal;
3. - Keeping water in water dishes or other receptacles for dogs, cats, chickens, and other domesticated animals; and
4. - Keeping water in containers for plants such as vases and flowerpots.

In order to change these behaviors, an integrated strategy is needed that considers the advantages and disadvantages of current and alternative behaviors and the cultural and social barriers to behavioral change.

Social participation includes not only the participation of organized community groups (community council, neighborhood committee) but institutions and organizations such as civic associations, churches, schools, and nongovernmental organizations, as well as the individual participation of each member of the community. Social participation is necessary for improving basic services and promoting changes in human behavior. Communication/education for health utilizes several channels of communication, such as schools, the mass media (television, radio), and the print media to support the improvement of basic services and promote changes in human behavior.

In communities that lack basic services, where the principal breeding sites are receptacles for water storage and disposable bottles, a community development strategy is usually recommended. In this type of strategy, the community identifies its own problems and collaborates with the government and/or nongovernmental organizations (NGOs) to find solutions. Control of other types of breeding sites, such as water dishes or plant containers (flowerpots, planters, vases) is achieved through specific communications channels, such as individuals with high credibility (veterinarians, botanists) or stores where pets and/or gardening products are sold. While the first type of activity takes place at the local level, this other type is often organized at the national level with local support.

The private sector is an important factor that can participate in several ways: sponsoring public service announcements (printing pamphlets, sponsoring television

spots) and/or community activities; placing instructions or warnings on high-risk products--that is, those that often become breeding sites (cans, planters, water dishes, tires); recycling materials and using the media to promote recycling (tires, glass, cans); and marketing mosquito control products (larvicides, barrel covers, screens).

3. Role of Chemical Control

Operations to combat the *Ae. aegypti* mosquito should be carried out, whenever possible, with minimal use of insecticides and only then choosing safer, highly effective products with very low toxicity and the potential for little or no environmental pollution.

Treating foci is the basic operation of the attack stage of a program to combat *Ae. aegypti*. Focal treatment includes the elimination or modification of breeding sites with community involvement, and the application of larvicides to water deposits that cannot be destroyed. When health workers provide door-to-door focal treatment, it is important that they properly inspect the areas surrounding the dwelling, as well as its interior.

Larvicides, such as **temephos** in grains of sand in solutions of 1%, are used and applied in doses of 1 ppm to all water deposits that cannot be eliminated and/or destroyed within and around dwellings. These deposits or reservoirs can be classified as useful to man, not useful or eliminatable, and natural.

When treating a water deposit, its total volume is assessed and the insecticide is applied accordingly. Some of the insecticide will remain at the bottom of the deposit, where it will be released as new water is added (see technical information on temephos).

Health workers who do the focal treatment should also educate residents about the procedure, indicating what is expected of them and how they should collaborate by keeping the larvicide where it was placed to prevent the development of breeding sites for the mosquito.

B. Emergency Control

Adulticides should basically be used during epidemic outbreaks of some of the diseases transmitted by the vector. Adult mosquitoes are controlled with chemical compounds, almost always as an emergency measure. The use of adulticides to combat the vector should be confined to epidemics and should not be considered routine.

As a precaution, it is a good idea for the program to procure and maintain a certain number of heavy and portable equipment units, as well as insecticides for space spraying.

The adult *Ae. aegypti* is combated in the following manner:

Space spraying with heavy equipment

In emergencies created by epidemic outbreaks of dengue or dengue hemorrhagic fever or by some other disease transmitted by *Ae. aegypti*, spatial applications of aerosols of cold insecticides (ULV) or hot insecticides (thermal fogging) are appropriate means of rapidly reducing *Aedes* densities, killing infected females. These treatments are applied from the street using heavy equipment mounted on vehicles.

Short cycles (3 to 5 days) should be used and repeated successively until a consistent reduction in the number of patients is achieved. The most appropriate hours for spraying are from dawn to early morning and dusk, when temperatures drop.

Space spraying at ultra-low volume (ULV) is appropriate for urban areas in medium and large cities with flat, paved streets. Equipment maintenance and cleaning are essential to ensure the proper functioning and longevity of the machinery.

Household Space Spraying with Portable Equipment

This type of adulticide treatment is conducted during daylight hours as support for the spraying with heavy equipment in areas inaccessible to the vehicle carrying the equipment. The treatments are applied room by room, with a 3-second aerosol jet spray directed toward the ceiling of each room and on the property surrounding the dwelling.

Perifocal Treatment

This is an emergency adulticide treatment involving the application of an insecticide suspension with a residual effect to the outside and inside of containers that cannot be destroyed, as back-up for the treatment with larvicides. This is usually done in the areas with the highest *Aedes* density.

C. Entomological Surveillance

Goals:

- 1) To establish infestation or reinfestation indexes in each locality.
- 2) To determine the relative importance of various types of containers in mosquito production.
- 3) To investigate the presence of other vectors (*Ae. albopictus*) as risk factors for dengue transmission.
- 4) To monitor the *Aedes* mosquito's susceptibility to insecticides.

Stages:

- 1) To determine the distribution and indexes of *Ae. aegypti* in order to assess the risk of dengue transmission
- 2) To establish entomological surveillance methods in order to determine the levels of infestation and detect new infestations

Activities

The principal methods of infestation surveillance used so far are house inspections and the utilization of egg traps (ovitrap and larvitrap). House inspections consist of examining all containers inside and outside of dwellings and microscopic identification of the larvae found. The results are expressed as the House Index (the percentage of houses with the larval stages of *Ae. aegypti*) and the Breteau Index (the number of containers infested per 100 houses inspected).

Ovitrap are water-filled receptacles placed in houses by inspectors to attract mosquitoes so that they will deposit their eggs. The two most common types are pieces of tire and plastic or glass containers. They are especially useful for the detection of new infestations or reinfestations, and they are more economical in terms of the inspector's time. The results are expressed as the percentage of positive traps.

It is not necessary to inspect all houses in a locality to determine the level of infestation. Depending on the size of the area surveyed and the desired index level, a sample can be used (usually 10% to 33% of the houses), in accordance with the PAHO dengue guidelines (1995). The houses to be inspected should be distributed uniformly throughout the locality.

In order to detect new infestations, periodic visits can be made to the "strategic points" in each locality--that is, the places most likely to be infested and

generate foci that will infest the rest of the locality--for example, cemeteries, tire shops, automobile graveyards.

D. Epidemiological Surveillance

1. Basic Concepts

The object of the dengue epidemiological surveillance system is early detection of cases to permit the speedy application of measures for control, interruption of transmission, and the prevention of epidemics. In order to achieve this, it is important to identify suspected cases through active case-finding and epidemiological studies.

Dengue and Dengue Hemorrhagic Fever in the Americas: Guidelines for Prevention and Control details the specific concepts and activities for conducting surveillance in a manner suited to the particular epidemiological situations currently found in the countries of the Hemisphere.

Guidelines for epidemiological surveillance have been established for the integrated control of dengue and the struggle against *Ae. aegypti*. Thus, it should be emphasized that in order to achieve the objectives of the Hemispheric Plan, it is necessary to:

- Prioritize and systematize active surveillance as the main instrument for early detection of cases or epidemic outbreaks.
- Strengthen active surveillance by all state, private, and local health institutions and hospitals with duly trained personnel.
- Establish sentinel sites or centers to monitor the disease and determine the serotypes in circulation. In this regard it is important to consider early detection of serotype 3 of the dengue virus in areas where it has not yet been detected.
- Broaden information dissemination and improve knowledge about the differential diagnosis, clinical classification, and treatment of dengue to physicians in health facilities at all levels of care.
- Perform a comprehensive analysis of the behavior of febrile syndromes and the local entomological situation to intensify active case-finding.
- Stratify the different geographical areas on the basis of risk factors, taking a number of factors into consideration, such as population density, points of entry to the country, entomological situation, environmental sanitation, water supply, and the history of dengue in the area.

- Apply the technical standards of the Guidelines to consolidate serological and virological monitoring of suspected cases.
- Provide laboratory feedback to the local level.
- Increase coverage by the laboratory network and decentralize serological diagnosis, taking into account the epidemiological situation, communications, modes of access, and socioeconomic characteristics of every country and maintain quality control of the network.

2. Implementation of Epidemiological Surveillance

The basic instruments for epidemiological surveillance of dengue are:

- 1.- The collection of samples during active case-finding of febrile illness at the community level; or, confirmation of the clinical diagnosis, accompanied by information on the date the fever began and the place of residence.
- 2.- Laboratory processing of the samples, which will yield information on the serotype of the infecting virus for immediate notification of the health centers.
- 3.- Identification of an *Ae. aegypti* or *Ae. albopictus* presence, or entomological surveillance.
- 4.- Epidemiological research
- 5.- The information system
- 6.- Training
- 7.- Evaluation

Epidemiological surveillance of dengue is usually part of the countries' epidemiological surveillance systems, and strengthening of the epidemiology services is recommended in the short term at the different levels of the health systems.

E. Training

Reorientation of the current national programs for the control of dengue and *Ae. aegypti* will require the training of human resources. Thus, workshops and seminars should be held for to exchange information and promote new strategies, as well as ongoing discussions on the standardization of activities.

Training is recommended in the following areas:

1. Clinical diagnosis, laboratory techniques, and case management;

2. Entomological surveillance;
3. Environmental sanitation;
4. Handling of emergencies;
5. Management and processing of operational and epidemiological information; and
6. Techniques to promote community participation

F. Research

Methods and combinations of methods for controlling the vector that are low-cost and applicable require operations research on the identification, classification, and seasonal frequency of mosquito sources or breeding sites; identification of geographical areas and populations at high risk for dengue outbreaks; adequate doses of larvicides; and alternatives for biological control of the vector's larvae.

Moreover, research is needed to identify the social factors that determine behaviors in a community with regard to the sources or breeding sites for mosquitoes and a situation of epidemiological alert.

G. Structure and Management

Management Structure

In order to develop an effective strategy to control breeding sites, technical capabilities must be strengthened and integrated at the national and local (management) level. At the national level it is necessary to establish or strengthen a multidisciplinary technical group consisting of experienced professionals in the fields of education, sanitation, chemical control, entomology, and epidemiological surveillance to carry out the following functions:

1. - Integration with other ministries: education, environment, etc.
2. - Support for legislation to guarantee compliance with and the implementation of the program. For example, sanitary codes and laws that promote the sale of recyclable containers.
3. - Selection of differentiated and appropriate strategies for each main breeding site; for example, chemical or biological control, recycling, and environmental sanitation.
4. - Development, implementation, and evaluation of plans (strategies) for communication at the national level, including the preparation and assessment of radio and television spots

5. - Operations research to understand the behaviors that promote the existence of breeding sites.
6. - Technical support for local program development.
7. - Collaboration with private enterprise at the national level.
8. - Collaboration with NGOs at the national level.
9. - Development of training programs for the various program components.
10. - Securing of national and international resources for sanitation, social participation, and chemical control.

During the initial stage of its work, the group will design a preliminary plan for the control of each main breeding site. This plan has two components: i) differentiated and appropriate technical strategies, such as chemical or biological control, recycling, sanitation, and legislation; and ii) strategies to change specific human behaviors. In addition, the group will examine the existing human and organizational resources available for conducting the activities to control breeding sites (communication, improvement of basic services, etc.). An agenda and discussion materials for the plan will be prepared, in collaboration with various institutions. This will be followed by a national campaign to raise awareness among institutions and representatives of society--for example, service clubs, the Bishops' Conference, national NGOs, and national companies--calling on them to participate in the program. After this meeting, the preliminary plan will be modified, and a timetable will be set for its implementation.

Local Level

Work in each geographical area should begin with the integration of all social actors, with a view to drafting cooperation agreements that recognize and define responsibilities in terms of achieving the established goals. A multidisciplinary group is also needed at the local level to coordinate and conduct program activities. The national level should promote and support the organization of such operational groups. The task force will consider the type of social organization in the community, the resources available, and the principal breeding sites when drawing up a preliminary plan for physical and chemical control. Thus, a local coordinating group or team should conduct the following activities:

- 1.- Promote meetings with the sanitation, education, and health institutions of the area.
2. - Raise awareness among the human resources involved in the different program areas so that they fulfill their role as educators in health;
3. - Conduct activities (meetings, contests, distribution of educational materials, etc.) that involve the population to develop an ongoing educational process, whose main focus is to change behaviors and practices that foster the proliferation of ***Ae. aegypti***.
4. - Develop training and awareness programs about the environmental and health hazards implied by the excessive use of insecticides; the target population for these programs should include the employees of the service.

5. - Launch health education and school campaigns on environmental sanitation to promote dengue control.
6. - Conduct periodic public awareness campaigns to clean up areas along rivers and roads, with support from the sanitation service and social participation.
7. - Lobby with the respective local authorities to extend refuse collection and drinking water coverage to areas where it does not exist.
8. - Negotiate the provision of uninterrupted service with the local water companies.
9. - Encourage those responsible for final refuse disposal services to ensure that landfills at least meet the criteria for preventing the establishment of breeding sites for *Ae. aegypti*.
10. - Participate in projects with an integrated approach to health, such as the Healthy Municipios Project.

VI. COST OF THE HEMISPHERIC PLAN

Expenditures for programs to combat *Aedes aegypti* in 1996 are presented by country (MPHSW) and by component in Table 1. Expenditures for social participation were not included for lack of reliable data. The total for the 23 countries reporting expenditures was \$329,328,105. Brazil and Cuba, the two countries with current eradication programs, accounted for 84% of the total expenditures for the Hemisphere.

Direct Operations to Combat the Vector account for 97% of total expenditures. Without Brazil and Cuba, Direct Operations represent 85% of the total, Communications 14%, and Training and Research less than 1% each. In these same countries, average expenditures for Sanitation were six times higher than for programs to combat *Ae. aegypti*.

Table 2 shows the total annual expenditures for all the components for each country. Without Brazil and Cuba, the average cost of the programs has risen slightly, from \$2,493,536 in 1996 to the \$2,598,289 programmed for 1999.

TABLE 1

Country Expenditures in the Americas on Programs to Combat *Aedes aegypti*, by Component, 1996 (MPHSW).

Country	Direct Control Operations	Communications	Training	Research	Total
North America and Central America					
Costa Rica	2,694,126	591,500	50,090	5,000	3,340,716
El Salvador	5,265,863	*	*	2,300	5,268,163
Guatemala	1,385,465	1,389	*	*	1,386,854
Honduras	3,285,390	30,743	*	*	3,316,134
Mexico	6,468,324	4,920,000	138,800	140,000	11,667,124
Nicaragua	2,670,111	*	*	*	2,670,111
Caribbean					
Anguilla	33,700	600	*	*	34,300
Antigua and Barb.	477,377	*	*	*	477,377
Barbados	*	10,000	*	*	10,000
Cuba	22,252,948	865,300	10,800	*	23,129,048
Dominica	151,080	*	*	*	151,080
Grenada	82,297	3,350	*	*	85,647
Montserrat	56,285	5,200	*	*	61,485
St. Lucia	591,504	30,000	*	*	621,504
St. Vincent and the G.	125,888	1,100	*	*	126,988
Trinidad and Tob.	321,402	*	*	*	321,402
South America					
Argentina	8,130,004	1,400,000	*	*	9,530,004
Bolivia	489,055	4,000	*	*	493,055
Brazil	254,380,800	*	35,000	*	254,415,800
Colombia	4,535,772	400,000	*	*	4,935,772
Ecuador	4,979,134	100,000	1,000	*	5,080,134
Paraguay	2,250,842	*	1,000	*	2,251,842
Venezuela	516,763	14,842	1,000	2,000	534,605
<hr/>					
Total	321,144,087	8,378,024	237,690	149,300	329,909,101
Average	14,597,459	523,626	33,956	37,325	14,343,874
Percentage	97.3	2.5	0.1	<0.1	100.0
Without Brazil and Cuba					
Total	44,510,339	7,512,724	191,890	149,300	52,364,253
Average	2,225,517	500,848	38,378	37,325	2,493,536
Percentage	84.3	14.8	0.5	0.4	100.0

* Insufficient data

TABLE 2

Total Cost of all Components of the Programs to Combat *Aedes aegypti* versus Programmed Expenditures for Total coverage (US\$).

Country	1996	1997	1998	1999	For Total coverage
North America and Central America					
Costa Rica	3,340,716	2,547,720	2,587,100	2,616,020	3,241,247
El Salvador	5,268,163	1,088,894	780,850	799,350	16,336,253
Guatemala	1,386,854	3,609,242	*	*	6,669,714
Honduras	3,316,134	4,117,880	4,044,776	4,037,385	5,028,863
Mexico	11,667,124	12,031,715	15,405,130	17,932,097	240,462,450
Nicaragua	2,670,111	2,578,111	2,575,111	2,575,111	6,089,538
Caribbean					
Anguilla	34,300	24,700	36,460	37,010	35,007
Antigua and Barbu.	477,337	507,052	495,052	515,052	396,396
Barbados	10,000	12,000	14,000	20,000	18,973
Cuba	23,129,048	23,375,930	23,362,495	23,354,115	1,765,062
Dominica	151,080	162,210	163,510	164,010	256,945
Grenada	85,647	103,565	179,052	174,714	16,307
Montserrat	61,485	85,985	67,255	65,705	34,188
St Lucia	621,504	591,504	*	*	1,202,201
St Vincent and Gre.	126,988	251,952	306,052	307,052	348,311
Trinidad and Tobago	321,402	318,384	*	*	79,027
South America					
Argentina	9,530,004	*	*	*	67,590,701
Bolivia	493,055	505,840	160,000		2,397,223
Brazil	254,415,800	606,831,158	157,058	156,100	877,323,459
Colombia	4,935,772	4,635,580	*	*	*
Ecuador	5,080,134	12,907,234	5,507,800	5,584,800	5,715,869
Paraguay	2,251,842	2,473,161	2,742,969	3,071,106	32,138,659
Venezuela	534,605	621,247	9234,774	1,074,928	24,690,620
Total	329,909,101	679,381,063	67,819,442	62,484,554	1,291,837,017
Average	14,343,874	30,880,957	3,767,747	3,675,562	58,719,864
Without Brazil and Cuba					
Total	52,364,253	49,173,974	44,299,890	38,974,339	412,748,495
Average	2,493,536	2,458,699	2,768,743	2,598,289	20,637,425

* Insufficient data

The last column in Table 2 shows the annual estimated cost of total coverage for each country. This estimate is based on four basic components:

- a) The cost according to a model of activities for Direct Operations to treat all houses in infested areas twice a month (85% of the total).
- b) Epidemiological surveillance costs (4% of the total).
- c) The cost of social participation and communication (10% of the total); and
- d) The cost of promoting sanitation (1% of the total).

Annex 3 describes the basis for calculating the estimated cost of the Hemispheric Plan and provides a breakdown by component.

The annual cost of total coverage of the 22 countries that furnished complete information is estimated at US\$1.3 billion. These 22 countries, with a population of 422 million, account for approximately 59% of the total population of the Americas. It has been estimated that the areas susceptible to infestation, corresponding to the 11 Latin American countries that did not report, added to the one-third of U.S. territory that is equally susceptible, would increase the cost of the Plan by US\$400 million, for a grand total of US\$1.7 billion.

The estimated cost of the different components of the Hemispheric Plan are shown in Table 3.

TABLE 3
Cost Breakdown of the Hemispheric Plan, by Component

Component	Cost (US\$)	Percentage
Direct Operations	1,423,602,485	85%
Epidemiological Surveillance	72,494,904	4%
Social Participation and Communication	168,177,488	10%
Sanitation	17,500,00	1%
TOTAL	1,681,774.877	100%

Determining the annual cost of implementing the Hemispheric Plan led the participants to discuss the potential sources of funding. While they recognized the financial difficulties that the countries were facing, the international situation suggested that the possibility of securing external financing to implement the Plan

was remote. Accordingly, implementation of this Plan will be subject to the countries' ability to provide the funds.

VII. SEQUENCE OF ACTIVITIES IN THE NATIONAL PLANS

The decision of the countries to expand and intensify their programs to combat *Ae. aegypti* had already been made when the ministers of health adopted Resolution CD39R11 in September 1996. By now, most of the countries have already analyzed their epidemiological and entomological situation and have drafted their new national plans. The next steps will be geared toward establishing national multidisciplinary commissions to coordinate program activities, identify national and international resources to implement the plans, purchase the necessary materials, equipment, and insecticides, and hire and train the personnel.

Each country has areas with different epidemiological situations, where different stages of their program can be carried to enable it to become an eradication program. These stages, described below, can be implemented simultaneously or sequentially, as the local situation permits.

STAGES

1. Preventing epidemics of dengue, dengue hemorrhagic fever, and urban yellow fever through epidemiological surveillance and efforts to combat *Ae. aegypti* in high-risk areas.
2. Preventing dengue outbreaks by reducing *Ae. aegypti* infestation to < 1.0% of dwellings.
3. Interrupting dengue transmission.
4. Eradicating *Ae. aegypti*.
5. Monitoring for reinfestation of vector-free areas.

Regardless of the stage under implementation, adequate entomological surveillance is necessary to permit early detection of the vector in areas considered uninfested.

A eradication program is divided into four stages: Preparatory, Attack, Consolidation and Maintenance.

Preparatory stage: This includes all special preparations for the campaign, procurement of materials, training of personnel, etc.

Attack stage: In addition to the activities mentioned for the intensification and expansion of efforts to combat the vector, eradication will require that all infested

areas be covered with bimonthly or quarterly cycles. When entomological surveys indicate that an area has been free of infestation for a year, it is time to proceed to the Consolidation Stage.

Consolidation stage: Bimonthly inspections of a sample of dwellings continues, but they are not treated unless they appear to be infested. If this occurs, all the houses within a 300 m radius of the focus are inspected and treated. If other houses are infested, the area returns to the Attack Stage. After a second year without infestation, the area proceeds to the Maintenance Stage.

Maintenance stage: Surveillance against reinfestation is conducted only by means of ovitraps and the inspection of strategic points.

When every locality in a country is in the Maintenance Stage, a group of experts comes to review the data, and, if appropriate, declares *Ae. aegypti* “eradicated” in the country.

Since the country programs to combat *Ae. aegypti* are in different stages because of the resources allocated, it is likely that movement from one stage to the next in the intensification, expansion, and, ultimately, eradication of the vector will not proceed uniformly for all the countries. In the initial eradication campaigns, a single country was declared free of the vector one year after the official launching of the hemispheric program in 1947. The last country was not declared “eradicated” until 24 years after the campaign had begun.

Concerning the stages of the Hemispheric Plan, the group of experts has determined that, given the experience of the past 50 years, in which the eradication and/or control strategies have prevailed only temporarily, the success of this Plan will depend on **all the countries of the Region** and not only some of them, making a commitment to its execution and deciding to support the activities with the necessary public funds.

VIII. MONITORING AND EVALUATION OF THE PLAN

Based on the epidemiological and entomological situation, together with the level of dengue program activities in each country, a monitoring system will be established from the very start of the implementation of the national plan. This system will make it possible to track progress, stagnation, and setbacks in terms of results and impact. This way, the necessary modifications and improvements can be proposed to ensure that each national plan yields the greatest impact feasible from a technical standpoint.

Thus, a series of indicators will be established that will be monitored. The main indicators will be: the incidence of classical dengue, the incidence of dengue hemorrhagic fever, and the number of houses infested by *Ae. aegypti*. However, the evaluation in terms of impact will consider the current stage of the plan (of the five proposed for achieving the goal) in the respective country.

Information for the monitoring and evaluation will come from the epidemiological and entomological surveillance systems that the countries will establish or strengthen under their national plan.

IX. THE ROLE OF PAHO

As resources permit, PAHO will support and advise the Member Governments and cooperate with them in the preparation and execution of the respective national plans. It will also monitor the implementation of the Hemispheric Plan, evaluating its progress and making technical information available to the countries that will enable them to allocate resources to achieve the greatest impact feasible from a technical standpoint.

In order to promote technical cooperation among countries and the exchange of information, periodic subregional meetings will be held, if circumstances dictate, to establish a forum in which national experiences are shared and important lessons about successes and obstacles to progress in achieving the goal can be learned.

Although there was consensus among the members of the task force that the bulk of the funds for implementing the Plan will be public in nature, PAHO will participate actively with the countries in mobilizing the external resources required for implementing the Plan. Cost estimates indicate that, except for Brazil and Cuba, which are already setting up an intensive program to combat ***Ae. Aegypti***, most of the other countries would need to increase by several times the amount of resources currently allocated to the struggle against ***Ae. Aegypti***, if they are to protect the entire population living in areas at risk for dengue.

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PRELIMINARY VERSION
PAHO/HCP/HCT/90/97
ORIGINAL: SPANISH
Annex I
List of participants

HEMISPHERIC PLAN
TO EXPAND AND INTENSIFY EFFORTS TO
COMBAT *Aedes Aegypti*

REPORT OF A TASK FORCE

CARACAS, VENEZUELA
APRIL 1997

ARATA, Andrew

Senior Tropical Disease Advisor (USAID) and
Tropical Medicine Program, Tulane University
Environmental Health Project
Address: 1302 Knox Pl.
Alexandria VA 22304
Telephone: (703) 247-7043 461-9298 (Room)
Fax: (703) 243-9004 461-9298 (Room)
Arlington, VA, USA

BRICEÑO-LEON, Roberto

Director de Laboratorios de Ciencias Sociales - LACSO
Address:
Telephone: (58-2) 661.1094
Fax: (58-2) 693.1765
Caracas, Venezuela

CAMPOS, Cornelio

Jefe de la División de Control de Vectores
Ministerio de Salud
Address: 115 Zona 1
Telephone: 262.6486
Fax: 262.4536
Panamá, Panamá.

DELGADO, BUSTILLO, Jorge

Jefe del Programa Control Sanitario Internacional y Enfermedades Tropicales
Ministerio de Salud - Dirección Nacional de Epidemiología
Address: Calle 23 y N, Vedado,
Telephone: (5-37) 32.5913 / 32.1061
Fax: (5-37) 333.973
La Habana, Cuba

GUEDES SELLERA, Paulo Eduardo

Gerente Nacional del Programa de Fiebre Amarilla y Dengue
Fundación Nacional de Salud
Address: Rua José Bonifacio No. 147, Apto. 304 C
Sao Vicente - SP
Telephone: (061) 226.4488
Fax: (061) 226.4488
Brasilia, DF, Brasil

MOQUILLAZA, José

Jubilado de OPS/OMS, STC

Address: Calle Nueve 285/301, Lima 27

Telephone: (51-14) 75.5815

Fax: (51-14) 265.3637 346.0002

Lima, Perú

TEXEIRA, María de Gloria

Comisión Independiente de Evaluación y

de Erradicación del *Aedes aegypti*

Ministerio de Salud

Address: R. Padre Feijó No. 29, Salvador, Bahía

Telephone: (071) 245.0544

Fax: (071) 237.5856

Salvador, BA, Brasil

TROMP, Lanionel

Miembro de Gerente /HEFE Suplente del Servicio de

Higiene de Salubridad de Curaçao

Servicio de Salubridad Público de Curaçao

Address: 49 Piscaderaweg Mundo Nobo

Telephone: (5999) 690964 / 62.6141

Fax: (5999) 62.6964

Curaçao, N.A.

WINCH, Peter John

Assistant Professor, Department of International Health

Johns Hopkins University - School of Hygiene and Public Health

Address: 615 North Wolfe St., Baltimore, MD, USA

Telephone: (410) 955-9854

Fax: (410) 955-7159

Email: pwinch@phnet.sph.jhu.edu

Baltimore, MD, USA

WORONIECKI, Olga

Asesora Técnica del Servicio Nacional de Erradicación

del Paludismo (SENEPA)

Ministerio de Salud Pública y Bienestar Social

Address: San Salvador 228,

Asunción

Telephone: (595-21) 611538 / 293329

Fax: (595-21) 293329 / 611538

Asunción, Paraguay

ZAPATA, Hortensia

Coordinadora de Redacción Diario "El Impulso"
Address: Calle Los Comuneros Urb. El Parque
Telephone: (051) 502124-25
Fax: (051) 502129 - 502130
Barquisimeto, Venezuela

SECRETARIAT

BAÑUELOS, Armando

Consultor del Programa de Enfermedades Transmisibles HCT.
OPS VENEZUELA
Address: Altamira 6ta. Av. entre 5ta. y 6ta. Transversal, No. 43
Telephone: (58-2) 267.1622 (Master) 261.1973
Fax: (58-2) 261.6069
Email: dr.armando-banuelos-at-ops/ven@cclink.paho.org
Caracas, Venezuela

NELSON, Michael

Entomólogo
OPS/OMS Brasil
Address: SEN Lote 19
Telephone: (55-61) 312.6508
Fax: (55-61) 321.1922
Brasilia, DF, Brasil

PINHEIRO, Francisco

Regional Advisor in Viral Diseases
HCP/HCT - PAHO/WHO Washington
Address: 525 23rd. St. N.W.
Telephone: (202) 974-3271
Fax: (202) 974-3688
Email: pinheirf@paho.org.
Washington, D.C., USA

PINTO, Matilde

Economist
HSP/HSO PAHO/WHO Washington
Address: 525 23rd. St., N.W
Telephone: (202) 974-3823
Fax: (202) 974-3641
Email: pintomat@paho.org
Washington, D.C., USA

RODRIGUEZ, Rodolfo

Program on Communicable Diseases

PAHO/WHO Washington

Address: 525 23rd St., N.W. #1104

Telephone: (202) 974-3494

Fax: (202) 974-3688

Washington, D.C., USA

ZEPEDA, Francisco

Coordinator, Program on Basic Sanitation

Division of Health and Environment

PAHO/WHO Washington

Address: 525 23rd St., N.W.

Telephone: (202) 974-3318

Fax: (202) 974-3610

Washington, D.C., USA

PRELIMINARY VERSION

OPS/HCP/HCT/90/97

ORIGINAL: SPANISH

Annex 2

*Self-evaluation of the Current Situation
in the Countries*

**REGIONAL PLAN
TO EXPAND AND INTENSIFY EFFORTS TO
COMBATE *Aedes Aegypti***

REPORT OF A TASK FORCE

**CARACAS, VENEZUELA
APRIL 1997**

Self-evaluation of the Current Situation in the Countries

Components	% Value	Response	
		YES	NO
1.- Legal support	5		
2.- Regulations issued at the central level	5		
3.- Regulations applied at the local level	5		
4.- Decentralization at the local level	5		
5.- Multidisciplinary Commission	5		
6.- Proactive and sentinel seroepidemiological surveillance	10		
7.- Total coverage in infested area	10		
8.- Sufficient direct operating resources	10		
9.- Urban population coverage for household drinking water supply > 80%.	10		
10.- Urban population coverage for regular refuse collection > 80%	10		
11.- Effective community participation in vector control.	10		
12.- Use of validated mass media.	5		
13.- Systematic training	5		
14.- Epidemiological research	2.5		
15.- Periodic evaluation	2.5		
Total	100		

Depending on the percentages obtained, each country can be classified under group A, B, or C and, based on this grouping the country can devise appropriate strategies and goals and move forward until it achieves eradication as described in the corresponding chapter.

Groups: A = 90 -100%
 B = 75 - 89%
 C = <75%

**PRELIMINARY VERSION
PAHO/HCP/HCT/90/97
ORIGINAL: SPANISH**

*Annex 3
Basis for Calculating the Estimated Cost of Total
Coverage with Direct Operations
to Combat *Aedes aegypti**

**HEMISPHERIC PLAN
TO EXPAND AND INTENSIFY EFFORTS TO
COMBAT *Aedes Aegypti***

REPORT OF A TASK FORCE

**CARACAS, VENEZUELA
APRIL 1997**

A. Basis for Calculating the Estimated Cost (US\$) of Total Coverage with Direct Operations to Combat *Ae. aegypti*

ESTIMATE FOR:

STRATEGIC POINTS = 1% of existing properties

OVITRAPS = 1 trap every 9 blocks. Every block with 25 properties

FIELD WORKERS

FOR INSPECTION AND TREATMENT OF DWELLINGS

1 worker per 600 properties

FOR STRATEGIC POINTS = 1 worker per 150 points

FOR OVITRAPS = 1 worker per 150 traps

SUPERVISORS = 1 per 10 field workers

SENIOR SUPERVISORS = 1 per 5 supervisors

TEMEPHOS = 100 grams/ property treated/ cycle, 6 cycles a year.

WETTABLE POWDER = 40 grams/property treated/cycle

PICK-UP TRUCKS = 1 per supervisor

MOTORCYCLE = 1 per agent for strategic points

BICYCLES = 1 per worker responsible for ovitraps

COST OF VEHICLES PER YEAR: Assuming 5 years of useful life, at a discount rate of 10%: Cost of the vehicles per year = cost of procurement divided by \$3,791--that is, 5 years' amortization.

B. Epidemiological Surveillance Costs

This chapter includes the cost (in US\$) of sampling, human resources, research, information management systems, training, and evaluation of surveillance **for all communicable diseases**, which comes to an annual total of \$483,299,360. Estimates put the cost of the specific surveillance activities for dengue at 15% of the total cost of surveillance for communicable diseases. Below, this percentage is applied to estimate the cost of each component of epidemiological surveillance for all communicable diseases.

1. Sampling.

The material and equipment needed for **collecting samples in active case-finding of febrile disease** per health post or sentinel post conducting this activity are:

- ◇ monoject tubes or vacuum tubes
- ◇ 10 ml syringes
- ◇ cotton
- ◇ adhesive tape
- ◇ pencils
- ◇ stationery—file cards
- ◇ thermal containers
- ◇ nitrogen thermos
- ◇ plastic bags
- ◇ gloves
- ◇ portable and stationary centrifuges
- ◇ transport (own vehicle)
- ◇ fuel
- ◇ per diem
- ◇ salaries for human resource: nurses and nursing auxiliaries

The cost estimates are based on data from the sampling centers in the infested areas and the respective population in each country; thus, the cost of a year's activities in all infested areas of Latin America is presented.

Sampling:

\$38,025,475 (15% of \$253,503,168).

Vehicles:

\$14,800,000 (15% of \$ 98,666,000).

2. Human Resources

The human resources and health system levels that would be needed per country would be as follows:

RESOURCES	CENTRAL	REGIONAL	DISTRICT	HOSPITAL
Epidemiologist	1	1	1	1
Nurse with training in epidemiology		1	1	1
Nursing aux.		1	1	
Statistician skilled in computers	1	1	1	
Vehicle	1	1	1	1
Driver	1	1	1	1
Secretary	1	1	1	1

These estimates should be multiplied by the number of countries to obtain the cost in terms of wages, which would be as follows:

**Staffing costs for specific dengue tasks:
\$15,115,426 (15% of \$100,769,509)**

3. Research

The annual cost of the operations research conducted in all countries with infested areas, with epidemiological stratification by risk factors, physiopathology of dengue hemorrhagic fever, and morbidity and mortality, would be:

\$75,000 (15% of \$500,000)

4. Information Management System.

The information management system requires the following materials and equipment in the epidemiology services:

Calculator	1	1	1	1
Photocopier	1	1	1	1
Fax	1	1	1	1
Computer	2	2	1	1
Megaphone	1			1
Broadcasting equipment	1			1
Transparency projector	1	1	1	1
Slide projector	1	1	1	1
Television	1	1	1	1
VCR	1	1	1	1
Videocamera			1	1
Freezer -70°C			1	
Nitrogen thermos				1
Centrifuges	1	1		1
Vehicle	1		1	1
Boats	1			1
Laptop	1		1	1

The total cost of inputs in all the countries would be:

\$186,503 (15% of 1,243,350)

5. Training

Training in epidemiological surveillance includes training courses for local, regional, and central government personnel in: filling out forms, identifying notifiable cases, and taking and shipping samples, as well as specific aspects of dengue prevention and control; training in information management, systems analysis of data collection and the management of existing information for its use in the programs. It will also include other topics, such as the theory and practice of electronic information management, with specific courses on databases, EPI-Info, Word, etc., and participation in congresses, seminars, and other scientific activities.

Material and equipment for training: VCR and monitor; transparency and slide projectors; transparencies and slides, including facilities for their preparation; office supplies, broadcasting equipment; megaphone; and washable and indelible markers. This equipment should be provided at all epidemiological surveillance levels.

The annual cost of this equipment for all the countries would be as follows:

TOTAL: \$281.250
a) materials and equipment: \$182,250 (15% of \$675,000)
b) courses and seminars: \$ 99,000 (15% of 660,000)

6. Evaluation of Epidemiological Surveillance

The evaluation of epidemiological surveillance should ongoing and cover the basic aspects necessary to conduct the surveillance, assessing the accuracy and timeliness of the expected results. The criteria for evaluating epidemiological surveillance include its goals, its degree of intensity and depth, as dictated by the epidemiological situation, and the basic supplies and installed physical capacity in each infested and uninfested area.

The annual cost of the periodic evaluation of epidemiological surveillance in all the countries would be:

\$101,250 (15% of \$675,000)

7. Laboratory Costs (Dengue)

(150 thousand samples per year; 65 laboratories)

	1st. Year	2nd. Year
1. Sampling and transportation	600,000	600,000
2. Laboratory tests		
• Reagents	550,000	550,000
• Equipment (computers, optical readers, freezers, etc.)	845,000	
• Supplies	650,000	650,000
• Miscellaneous (fax/telephone, electricity, etc.)	130,000	130,000
• Salaries	1,040,000	1,040,000
3. Training	65,000	65,000
4. Technical meetings	30,000	30,000
Total	3,910,000	3,065,000

GRAND TOTAL FOR EPIDEMIOLOGICAL SURVEILLANCE:
FIRST YEAR: \$72.494.904

C. Entomological Surveillance Costs

The entomological surveillance costs are included in the direct operations costs. In the attack stage, the dwellings are inspected by the same technician who eliminates and treats breeding sites. In uninfested areas, it includes only the cost of monitoring the ovitraps. Each technician covers 150 ovitraps in 5 working days, and there is an ovitrap every 9 blocks. At 25 dwellings per block, with every technician covering an area with 33,750 dwellings, compared to 600 for those doing inspection and treatment, the expenditure for surveillance is less than 2% of the total.

D. Social Participation and Communication Costs

This chapter includes the cost of operations at the national and site level. The total for the two is \$41,244,000.

In 1996, total expenditures for television, radio, newspapers, posters, and flip charts in the 15 countries that reported on their communications spending was \$6 million. The average expenditure per country for the planning and evaluation of media campaigns was \$256,000.

The cost estimate should include the following levels:

National level:

- Salaries of the members of the multidisciplinary task force (1-2 entomologists; 2-4 specialists with experience in the use of mass media, promotion of behavioral change, educational/qualitative research, and community development; 2-4 specialists in environmental sanitation).
- Training for members of the technical group, if necessary.
- Costs for developing, validating, and disseminating educational materials, as well as radio and television spots.
- National, regional, and local evaluation and support meetings.
- Technical assistance at the regional and local level and preparation of teaching tools.

Local cost for neighborhoods without basic services or with deficient services:

- One promoter for every 3 neighborhoods to work with community groups (community board, church, school) to improve basic sanitation; promote changes in behavior, convene and attend 9 meetings a month, and coordinate other institutional activities.
- Transportation and per diem for weekend work.
- Educational and other materials for use by community groups.

Local cost for neighborhoods with good quality basic services:

- 2 house calls a year per dwelling, made by vector control personnel trained in interpersonal education or by educators.
- Portable educational materials for house calls.

1. Cost of the National/State Management Structure

For a population of 20,000,000 inhabitants.

1.1.	Wages for specialists in: Communications and community development			
	4 x 18,000	=		\$ 72,000
1.2	Studies for planning and evaluating media campaigns			
	2 x 100,000	=		\$200,000
1.3	Dissemination/preparation of materials, printed matter, rad/TV spots			
	Television			\$200,000
	Radio			\$100,000
	Newspaper *			\$100,000
	Posters/Flip Chart *			\$100,000
1.4	Training of specialists			\$ 25,000
1.5	Meetings at the national level			\$ 25,000
1.6	Transportation to provide advisory services at the local level			
	2 vehicles:	Cost per year =	$\frac{2 \times 12000}{4}$	= \$ 6,000
	Per Diem			\$ 10,000
	Fuel and other			\$ 6,000
				<hr/>
				\$ 844,000

2. Cost of Local Operations

(For a population of 100,000 inhabitants.)

30% of the population (30,000 people) requires an intensive community development strategy, owing to a lack of drinking water and/or refuse collection services.

2% (5,000 people) covered by an NGO project; 25% (25,000 people) not covered by NGOs.

70% of the population requires collaboration with the entomology team to improve the educational content of house calls.

2.1	Wages for 5 promoters who perform intensive community development work (1 promoter for every 5,000 people) 5 x \$10,000 =	\$ 50,000
2.2	Subsidy for NGOs to carry out dengue activities =	\$ 5,000
2.3.	Wages for 10 field educators to collaborate with the entomology team 10 x \$10,000 =	\$100,000
2.4.	Transportation, per diem (2 vehicles)	\$ 22,000
2.5.	Printed matter \$ 1/house x 25,000 houses =	<u>\$ 25,000</u>
	Total population of 100,000 =	\$ 202,000
	Total population of 20 million =	\$ 40,400,000
	Total cost of communication/social participation for 20,000,000 people per year:	\$ 41,244,000
	a) cost of management structures	\$ 844,000
	b) cost of local operations	\$ 40,400,000

3. Cost for the Americas

The estimated annual cost of communication and social participation in the Americas is roughly 10% of the total cost of all the components. The percentage for each element is as follows:

ELEMENT	COST	PERCENT
MASS MEDIA	\$50,453,246	30.0
TRAINING	\$33,635,498	20.0
EDUCATIONAL MATERIALS	\$33,635,498	20.0
ADVISORY SERVICES	\$8,408,874	5.0
SUPERVISION	\$8,408,874	5.0
SUPPLIES	\$8,408,874	5.0
VEHICLES	\$12,613,312	7.5
EQUIPMENT	\$8,408,874	5.0
MISCELLANEOUS	\$4,204,437	2.5
TOTAL	\$168,177,488	100.0

E. Cost of Improving Sanitation Services

An analysis of the preceding data on the population living in the infested areas of the Americas leads to the conclusion that in order to provide drinking water and sanitation services to populations without service and improve the operations of networks that suffer from interruptions, some \$7,000 to \$10,000 million dollars are needed. The magnitude of these figures means that these resources will have to be obtained through channels outside the dengue control programs, through the investments normally made by municipalities or the state enterprises that perform these services. Furthermore, the estimated operating costs of the services, normally paid by users through taxes or fees, is \$700 to \$1,000 million a year.

Given the importance of improving sanitation for dengue control, it is proposed that municipal or state sanitation services (drinking water, sanitation, and refuse collection) devote 2% of their income from the annual operations of the service to public awareness campaigns, community participation, health education, and periodic clean-up campaigns. This figure would be the equivalent of \$17,500,000.