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CONTINGENCY PLAN FOR EMERGENCY MANAGEMENT OF DENGUE AND DENGUE HEMORRHAGIC FEVER OUTBREAKS IN THE DOMINICAN REPUBLIC

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by

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I. BACKGROUND AND RATIONALE

Dengue fever, an acute febrile illness caused by four serologically related mosquito-borne viruses, is endemic in the Caribbean region. Evidence from institutions such as OPS and CDC and national surveillance programs indicate that dengue epidemics have occurred in the Caribbean with increasing frequency over the past 25 years and sporadic cases of dengue hemorrhagic fever/dengue shock syndrome (DHF/DSS) a severe form of the disease, have been documented in several countries in the region in the 1980s. In 1981, Cuba experienced epidemic DHF/DSS caused by dengue 2 virus with over 100,000 persons hospitalized over 5 month period.

While laboratory-confirmed cases of DHF/DSS meeting the OMS case definitions have not been reported in the Dominican Republic (RD), sporadic clinical cases of hemorrhagic disease have been described in recent years. Serologic and virologic surveillance for dengue has recently begun in the RD which indicates considerable dengue transmission. Of 152 children with febrile viral syndrome whose blood was tested during the first 6 weeks of 1988, 34 (22%) were positive for dengue IgM antibody by ELISA .pa serology. Three serotypes were isolated from these Dominican sera by the CDC laboratory in San Juan, Puerto Rico, including 5 dengue - 4 viruses, 4 dengue - 2 viruses and 1 dengue - 1 virus. The simultaneous circulation of multiple dengue serotypes, and the high levels of Aedes aegypti mosquito populations documented by SNEM and Vector Control Project throughout the RD pose a serious threat of continued dengue outbreaks and the emergence of DHF/DSS in the RD.

Although emphasis should be placed on continuous prevention rather than emergency measures of Ae. aegypti, history has shown that this is not always practical. OPS and USAID sponsored a workshop on the emergency control of Aedes-borne epidemics in May 1987. Part of the workshop was devoted to development of a contingency plan based upon three phases: The preparatory phase, the alert phase and the emergency phase. The objective of each phase of control is to produce a plan of action for the rapid reduction of Ae. aegypti female populations and maintain low densities until dengue virus transmission disappears.

II. THE NATIONAL COMMITTEE FOR CONTROL OF DENGUE EPIDEMICS

1. Committee Members will be appointed by a designated representative of the Secretary of State of Public Health and Social Assistance (e.g., Director National of Health).

2. Members will include representatives of the following:

   a. Virology Laboratory of the Laboratorio Nacional de Salud Pública "Dr. Defilló".

   b. Servicio Nacional para la Erradicación de la Malaria - SNEM.

   c. Dominican Pediatric Society

   d. Dominican Medical Association (AMD)

   e. Infectología, Robert Reid Cabral Hospital

   f. Hospital L. E. Aybar

   g. Departamento de Recursos Humanos, SESPAS (Health Education)

   h. SESPAS - Sección de Epidemiología

   i. Hospital Padre Billini

   j. USAID/GODR-PUCMM Proyecto de Control de Vectores

   k. Hospital Central de las FF. AA. y P.N.

   l. Hospitales del Seguro Social

   m. SESPAS - Servicios de Salud

   n. SESPAS - Director Nacional de Emergencias

   o. USAID

   p. OPS

   q. Secretaria del Comité

   r. Asociación de Hospitales y Clínicas Privadas

   s. Professional Nurses Association

The Committee Chairman shall be the National Director of Health unless otherwise designated by the Secretary of Health of SESPAS. The committee chairman shall designate a committee secretary. Members and resource individuals will form sub-committees on contingency planning, epidemiological surveillance, entomological surveillance and vector control, clinical diagnosis and treatment, and health education.

3. Center of Operations

   A. Location: The Infectious Disease Office of Hospital Dr. Robert Reid Cabral has tentatively been identified for this purpose. A large conference room is nearby for committee meetings.

   B. Requirements: Desk for secretary and typist, two locking file cabinets, map cabinet, bookcase for reference library, typewriter, small calculator, telephone, small conference table and chairs, fan or air conditioner, slide projector and space requirements of 4 by 6 meters. A larger conference room should be available.

   C. Finances: The Committee secretary should have a vehicle and budget for gasoline and maintenance. Funding is necessary for typist salary (could be part-time), incidental office supplies, and to cover routine expenses of the secretariat.

4. Objectives of National Committee

   The objectives of the National Committee are:

   A. Develop, maintain and improve a dengue/DHS surveillance system.

   B. Develop, maintain and improve dengue/DHS awareness in medical and lay community.

   C. Assess resources and develop, maintain and improve a system to mobilize resources to treat patients in the event of an epidemic of dengue/DHF.

   D. Assess resources for vector control and develop, maintain and improve a rapid response emergency vector control system for dengue outbreaks.

   E. Coordinate and evaluate emergency activities.

5. Duties of National Committee

   The duties of the National Committee are:

A. Write a plan and implement a country-wide dengue surveillance system based on sentinel medical centers, serological confirmation of diagnosis and epidemiological observation. Assign activities, provide necessary training and evaluate the system;

B. Designate lines of communication, formulate a plan, and disseminate surveillance data to the health care and lay communities;

C. Maintain epidemiological data, entomological information, and detailed maps to identify potential risk areas;

D. Write a plan for emergency vector control measures for localized and general dengue activity, including a rapid response vector control unit and general surveillance activities; implement the plan in the case of an emergency;

E. Write a plan for triage and hospitalization of patients in a dengue epidemic; implement in case of emergency;

F. Write a plan and develop materials for training of medical professionals in the diagnosis and treatment of dengue/DHF. Implement the training program;

G. Write a plan and develop materials for community health promoters, community-based volunteer organizations, and other community groups to promote awareness of the lay community on dengue, the role of Ae. aegypti and community-personal protection measures. Implement the training program.

H. Compile an inventory of personnel, equipment, supplies and facilities needed for emergency vector control and treatment of patients, listing existing and needed supplies and a plan for obtaining needed supplies. Obtain, distribute and control needed supplies. Inventory requires continuous updating.

I. Develop criteria for declaration of a dengue emergency, and procedures to follow in declaring the emergency. Implement procedures in the event of an emergency.

J. Recommend that the Secretary of SESPAS declare a public health emergency in the event of a dengue epidemic.

K. Designate specific responsibilities and authority of persons and institutions during a dengue epidemic.

L. Procure necessary resources during an epidemic.

M. Prioritize and direct distribution of resources, including periodical reassessment of this activity.

N. Periodically assess the level of preparation and make new suggestions for improvement.

6. Liaison

The committee will liaison as appropriate with other agencies involved in dengue surveillance such as C.D.C. San Juan Laboratory, OPS; with the media, and medical schools, private volunteer organizations and health training programs within the country.

A. During the first 6 months the committee will meet monthly to develop and implement the plans described in part 5.

7. Meetings

A. After the first 6 months the committee will meet bimonthly as long as dengue transmission is low. More frequent meetings will be held during periods of high dengue transmission.

B. During a dengue-DHF epidemic a task force of key disciplines, e.g., epidemiology, laboratory and vector control, will meet to monitor the situation and progress towards, fulfilling objectives and duties.

C. The secretary will inform members of meetings, prepare an agenda and minutes of each meeting, distribute agenda and minutes to members, and issue informative memoranda to resource persons and institutions.

D. Each subcommittee will hold meetings as required and report its status to the National Committee.

8. Duties of the Secretary

A. Organize meetings and inform the Committee's members.

B. Prepare the meetings' minutes and distribute the manuals.

C. Coordinate each subcommittee's activities.

D. Keep the list of human resources and other resources necessary for control of the vector and the disease.

E. Keep files with epidemiological data, literature on dengue, training material, news (from newspapers), maps, etc.

F. Coordination and preparation of the Emergency Plan, keep the plan up to date.

G. Inform the National Director of Health and others about the Dengue situation.

H. Prepare the budget of the Secretary and the members of the committee and present that budget to the National Director of Health.

III. THE EMERGENCY PLAN

A. Preparatory Phase

1. Surveillance

While the National Virus Laboratory has in 1988 begun testing blood samples for dengue from 3 Santo Domingo hospitals, little prior baseline data on dengue incidence in the RD is available. Ongoing surveillance for dengue fever and DHF/DSS is necessary to permit early detection of new circulating virus serotypes and outbreaks. Surveillance data can thus trigger an emergency vector control response and provide a basis for targeting vector control efforts.

a. Reporting of dengue fever and DHF/DSS

Dengue fever is not currently reportable in the RD. The Secretariat of Health should make dengue a reportable disease. At a minimum, outbreaks of classic dengue fever and single cases of DHF/DSS should be reportable on a national basis. SESPAS epidemiologists should monitor this reporting as they do for other diseases such as SIDA and tuberculosis.

Dengue case reports by age, sex, and address should be forwarded to responsible persons regionally at least weekly and to SESPAS epidemiologists in Santo Domingo at least every 2 weeks. Single cases of suspect DHF/DSS and outbreaks of reported dengue - like illness should be telephoned to SESPAS epidemiologists.

SESPAS epidemiologists should also monitor with the assistance of OPS, CDC, the Puerto Rico Health Department, and the Haitian Ministry of Health the surveillance data for dengue in Puerto Rico and Haiti. Outbreaks of dengue in these adjacent geographic areas would be likely to spread to the RD; and, in this event, surveillance should be enhanced in areas where human movement between Puerto Rico and Haiti and the RD is common.

b. Current hospital- and laboratory-based surveillance for dengue in the RD

Currently, 50-150 blood samples are being collected and tested for dengue IgM antibody each month form febrile patients at 3 large teaching hospitals serving indigent populations in Santo Domingo, Hospital Los Minas, Robert Reid Cabral, and Pedro Aybar. Plans exist to add 2 additional hospitals in Santo Domingo as sentinel surveillance sites in the near future. This system should be expanded to include other large cities serving areas where dengue is likely to be introduced from Haiti or

Puerto Rico. The assignment of Pasantes to carry out the venipuncture and other basic surveillance activities would seem a reasonable and practical way of accomplishing these objectives. The National Virus Laboratory can comfortably handle such expanded surveillance as the capacity of the serology section is 400 blood samples per week.

Forms with clinical, epidemiologic and demographic information should accompany the blood samples collected for serologic and virologic surveillance. Any case of DHF/DSS or case in whom a new ~~virus~~ serotype is isolated should have a thorough follow-up epidemiologic investigation.

c. Hospital-based surveillance for severe degree and DHF/DSS

Infections disease clinicians and hospital epidemiologists should be contacted at sentinel and other hospitals and asked to report any hospitalized suspect dengue cases. Contact should be made with these individuals regularly, at least 3 times a year, by SESPAS epidemiologists and/or the emergency committee secretary to reemphasize the public health importance of early notification of such cases.

d. Laboratory confirmation of suspected degree outbreaks

Whenever an increase in cases of dengue - like illness occurs, a team of Pasantes or epidemiologist should investigate at the site and collect blood specimens from suspect cases to confirm serologically the presence of an outbreak. This activity is especially important in areas which the sentinel surveillance system does not cover.

e. Seroepidemiologic studies

Periodic serosurvey using blood collected by venipuncture or by fingerstick on filterpaper in different areas of RD would provide useful information in the age-specific prevalence of dengue antibody and the incidence of dengue in the Dominican population. Such epidemiologic data permit an assessment of high and low risk areas within the country for dengue transmission. Information from seroepidemiologic investigations should be provided to SNEM and the medical community. SNEM can employ this information in vector control activities; and physicians and health care providers can thereby become more familiar with the distribution of dengue in the RD and attuned to thinking of dengue as a diagnostic possibility.

2. Training of Medical Personnel

The current level of awareness of dengue among physicians in the RD is quite limited as recently documented in a survey by Dr. Jesus Feris, chief of infectious diseases at Hospital Robert Reid Cabral. This lack of awareness of dengue and DFH/DSS stems in part from a lack of emphasis on dengue at all levels of medical education in the RD.

a. Physicians

The medical subcommittee of the national dengue committee should be responsible for implementing and coordinating training of Dominican physicians, nurses and paramedical personnel in the recognition and management of dengue fever and DHF/DSS.

A training module on the diagnosis and treatment, which also includes aspects of dengue epidemiology, surveillance, and vector control should be developed by the medical subcommittee. A set of transparencies prepared by CDC are available from A.I.D. for this purpose and further assistance in developing training materials may be sought from OPS, CDC and/or A.I.D. The training module would be designed for 1 hour to 1/2 day presentations or workshops depending on the specific educational situation. Materials for the speakers or workshop coordinators could include, as mentioned, a set of slides or transparencies and an accompanying text. Additional training materials could be provided to physicians attending the sessions. These materials could include summaries of DFH/DSS diagnostic and treatment protocols modeled on those in OMS technical guide, and translations of key clinical articles on DFH/DSS. Pre- and post-lecture test and evaluations forms should also be prepared.

These training modules should initially be given by medical subcommittee members themselves to major medical organizations and hospital staff in Santo Domingo and other large cities. Regional or area medical subcommittees should be trained to teach the dengue modules to physicians in their area. A video could also be prepared by a prominent pediatrician for use in sites with videotape machine. Each local committee should agree on a plan for triage of patients with different levels of severity of illness to appropriate facilities in the area.

An ongoing system of training on the diagnosis and treatment of dengue and DFH/DSS should be incorporated into all levels of the medical education process. Practicing physicians should be involved through professional associations such as AMD (Asociacion Médica Dominicana) and the SDP (Sociedad Dominicana de Pediatria) and Child Survival Program. The dengue module should be given to practicing physicians for continuing medical education credit. Brief articles on dengue by members of the clinical subcommittees can be submitted to professional monthly

newsletters and publications. Pasantes should receive information on dengue in their orientations. Residents, interns and medical students should all be taught about dengue fever and DHF/DSS in their regular curriculum. Examinations at various training levels should include questions on dengue.

The OMS Technical Guide on the Diagnosis, Treatment and Control of Dengue Hemorrhagic Fever has been distributed to 38 sites throughout the country. This guide should also be made available to all local dengue clinical committees and other appropriate persons and institutions. In addition, a DHF/DSS diagnosis and treatment protocol or flow sheet should be distributed to all emergency rooms and health centers with physicians who see significant numbers of febrile patients.

The central clinical dengue subcommittee should monitor and evaluate the success of efforts to train the Dominican medical community on the diagnosis and treatment of dengue and DHF/DSS. Reporting of dengue by physicians, numbers of regional training sessions, surveys of physicians, post-module test results and results of medical students examinations and licensing examinations could be used as part of this evaluation. Based on these data, feedback from physicians receiving the training, and personal observations the committee should modify and improve upon the dengue training strategy.

b. A similar training strategy to familiarize nurses and paramedical personnel with dengue and DHF/DSS should be developed.

Modules should be geared to the level of knowledge and tasks of those receiving training. The symptoms of dengue and DFH/DSS and the potential for mortality without early and appropriate treatment should be emphasized in teaching. Nurses and paramedicals should understand the screening tests for DHF/DSS such as the tourniquet test and hematocrit. They should become familiar with the patient triage guidelines. The importance of careful monitoring of fluid intake and output of DHF/DSS patients should also be emphasized.

3. Vector Control

SESPAS/SNEM prepared a contingency plan for Ae. aegypti control in 1986. This plan continues to be valid, but it has never been activated. With the formation of the National Committee on Emergency Control of Dengue, this plan should be discussed and updated. Information in this section is designed to assist the committee in this task.

No plan of action can be developed without continuous training and research to insure proper selection and implementation of actions. Since emergency vector control is

costly and frequently of limited effectiveness, consideration should be given to community-based preventive measures, long-term improvement of potable water supply and solid waste collection, and legislation that could reduce mosquito breeding. Emergency control will depend upon the ability to respond rapidly to an Aedes-borne viral emergency which will depend upon a baseline of epidemiological data, rapid diagnosis and reporting of cases, and criteria for initiating emergency vector control.

a. Analysis of risk - vector

1. Limited baseline data are available but surveys done by SNEM the Vector Control Project, and OPS indicate that Ae. aegypti is found throughout the country. No area surveyed was found negative. The most recent SNEM surveys were from Santo Domingo, Santiago and Puerto Plata. Detailed street maps exist for these cities. The 1986 SNEM contingency plan lists groups of cities by risk-priority and this is still valid (Table 1).

2. The SNEM contingency plan estimates 270,931 houses in Santo Domingo and 247,643 houses in other populated areas. The house index is estimated to vary from 20-77% in sectors studied but in some areas it probably is close to 100%. Container indices are equally high with major breeding sites being stored water tanks, small containers and tires (Table 2).

   Collections of adult mosquitos by net sweeps inside houses (expressed as number collected in 10 minutes per house per man) indicates adult densities extremely high (up to 100+ per house) with almost every house infested.

3. Ae. aegypti adults are still susceptible to malathion and larvae to Abate (=temephos). However, testing should become routine, especially in dengue risk areas.

b. Analysis of Vector Control Programs

1. Institutions

   - SNEM is involved in malaria control with little priority given to Ae. aegypti. Some staff from the Epidemiological Unit are doing surveys or are

seconded to the USAID/GODR Proyecto de Control de Vectores. Both Chief of Epidemiology and Chief of Operations have participated in OPS workshops to prepare contingency plans for emergency control of Ae. aegypti. There is ongoing training of SNEM staff. The budget is not adequate and it is concluded that SNEM is not presently capable to effectively deal with an epidemic of dengue.

- USAID/GODR Proyecto de Control de Vectores has excellent staff seconded to them from SNEM and is capable of providing local training in taxonomy, insectary management, care and maintenance of space spray equipment and in community participation in vector control. It has arranged for SNEM and staff from other institutions to attend short courses at the University of South Carolina-Wedge. They have the expertise, basic equipment and finances to do research in vector biology and control.

c. The potable water delivery system is poor and most dwellings have some facilities to store water. Solid waste collection is extremely inadequate even though they recently acquired new trucks and equipment. Without improvement of these agencies, routine vector control will be expensive and inefficient. Community-based volunteer programs aimed at source reduction and personal health protection exist but unless solid waste collection is better organized the potential is limited.

2. Inventory of Resources

a. There are about 300 staff in SNEM, but the designated duties are malaria related. Expertise in entomological surveillance and use of space spray equipment exists but additional training and staff are needed and supervision is weak so training is not effective. A rapid response emergency Ae. aegypti control unit of about 27 staff is needed besides the existing staff used by the epidemiological section for surveillance. Additional staff for vector control is

possible from the military and civil defense. Labor intensive source reduction and application of chemical larvicides should be done with community- based assistance.

b. Application equipment and spare parts are inadequate. Most space spraying equipment of SNEM, except for a vehicle mounted thermal sprayer and a hand-operated mini-Leco of the Vector Control Project, are broken. Portable backpack sprayers are in Zone Offices but most are broken. Parts to repair them are either not available locally or on order. The Armed Forces Hospital Environmental Health have 1 vehicle and 3 portable ULVs. The USAID/GODR have 4 LECO 500's and some portable equipment but not enough pick-up trucks. SNEM has about 30 vehicles with about 10 under repair at any one time. The level of preventive maintenance does not warrant stockpiling of equipment at SNEM.

c. Small amounts of Actellic and malathion ULV formulations are on hand. These insecticides are being used and are not budgeted to be replaced. DDT is available and ordered every year for malaria vector control, but it would not be of use for Ae. aegypti control. Abate Sand Granules are on hand but have not been used because of odor. Since these chemicals could be supplied within 24 hours from the United States, large- scale stockpiling is not recommended.

d. The vehicles from SNEM are old and undependable and should not be considered in an inventory for emergencies. Military or civil defense vehicles could be considered for emergency ULV operations. The military would be the source for fixed winged aircraft of helicopters for ULV aerial applications. The military representative to the committee would be the contact point. Arrangements have been made to use a military helicopter for a ULV trial in Santo Domingo July 5-15, 1988 to be conducted by the USAID/GODR Proyecto de Control de Vectores.

4. Medical Emergency Requirements

a. Hospital beds

Using the 1981 Cuban dengue epidemic as a model for a worst case scenario, the potential exists for hospitalization with dengue of 1 person out of every 100 over a 3 to 5 month period. Thus, as many as 60,000 persons in RD may require hospitalization. In Cuba, almost 45% and 40% of patients were hospitalized over a 1 month period and 1 day, respectively. Proportionately in the RD, 27,000 patients may be hospitalized in 1 month and 2,400 patients in 1 day. The average hospital stay of patients in Cuba was 5 days and over 17,000 hospital and non-hospital beds were needed to cope with the patient load. The RD may, therefore, need to identify 10,000 hospital beds for a major dengue epidemic.

b. Laboratory Equipment

Every hospital should have available the following laboratory equipment for diagnosis and clinical monitoring of patients:

- Microcentrifuge, capillary tubes, hematocrit reader, and sterile lancets.
- Equipment for platelet counts including a microscope, hemocytometer and pipettes.
- Equipment for blood drawing: Tubes syringes, needles, tourniquets and pipettes.
- A refrigerator with a -20 C freezer for serological specimens.
- Biochemistry and hematology laboratory services.

Every subcenter or outpatient clinic seeing patients with acute fever should have the above equipment for performing hematocrits and pediatric and adult sphygmomanometers for taking blood pressure and doing screening tourniquet tests. An attempt to obtain microscopes for platelet counts would also be advisable. Rural clinics should at the very least have pediatric and adult blood pressure cuff.

c. Medical Supplies

Every hospital should have readily available supplies for treatment of patients with hypovolemic shock and hemorrhage.

The OMS Technical Guide estimates that most hospitalized patients will require intravenous fluids, about 20-25% would

benefit from additional colloidal volume expanders, and about 10% of patients will need whole blood. For each 100 cases, the hospital will need about 300 liters of normal saline or Ringer's lactate and 10 units of whole blood. Five percent dextrose and water should also be available. In a worst case scenario, the fluid and blood requirements of the RD over 1 month for hospitalized dengue patients could be 81,000 liters of normal saline, 6,800 liters of plasma or colloidal volume expander, and 2,700 units of whole blood.

Each hospital will necessarily have to assess its individual supply requirements based on anticipated patient census during an outbreak.

Other medical treatment supplies which will be required include:

- Oral rehydration solution
- Analgesics-paracetamol or acetaminophen
- Sedatives-chloral hydrate
- Diuretics-furosemide
- Oxygen and equipment for delivery

5. Vector Control Emergency Requirements

   a. Items now available are not dependable. Space spraying equipment is broken. Portable mist-blowers are inadequate. Availability of insecticide application equipment from agriculture will depend on seasonal use and most have nozzle systems not suited for public health use. Hotels have equipment but these would be used in the immediate vicinity of the hotel. Private agricultural spraying companies have single engine aircraft. The USAID/GODR Proyecto de Control de Vectores maintains contact with this source of equipment. The Abate Sand Granules should be chemically analyzed by USPHS-CDC in Atlanta before being considered available.

   b. Items to be stockpiled should include sanitary education material (video cassettes, training slides, posters, brochures, etc.). SNEM should begin to collect this material through contact with CDC-San Juan laboratory, OPS (WR-Panama attention Dr. M. Nelson and Caribbean Program Coordinator in Barbados) and USAID-VBC Project in Washington. Consideration should be given for SNEM to maintain at least one 55 gallon drum of ULV formulation of malathion (deodorized) and 500 kilos of Abate Sand Granules, in addition to that of the Rapid Response Unit, at all times. More

than this amount is now available but this amount should be the minimum on hand. The four vehicle mounted ULV machines should be repaired if possible or replaced and 10 new portable ULV machines purchased and kept available in working order. These items need not be stockpiled but can be in use as long as good preventive maintenance is available. They should be assigned to the Rapid Response Unit along with about 1,400 gallons of malathion ULV formulation.

c. Items to be obtained upon entry into "Alert Phase" or "Emergency Phase" are outlined in the 1986 SNEM Contingency Plan for national coverage as follows:

- Abate Granulado	42,800 Kg.
- Malathion ULV Formulation	100 tanques de 55 gals.
- Equipos portátiles de mochila	20 equipos
- Máquinas Leco	3
- Vehiculos	3 - 6

Arrangements should begin now to locate trucks for source reduction campaigns and agriculture and military aircraft for aerial ULV applications. It is understood that above estimates are for localized dengue/DHF activity not for a general nation-wide epidemic.

6. Inventory of Medical Resources

a. Hospital Beds

Public sector hospitals serve about 65% of the population according to a 1985 A.I.D. study. There are 8,708 hospital beds in the public sector in the RD (Table 1). To date, data from the private sector is incomplete. A conservative estimate would be additional 500 beds in the private sector. Thus, in the neighborhood of 9,000 hospital beds currently exist in the country. According to 1987 statistics, 1651 of the SESPAS beds are designated as pediatric. Dr. Jesus Feris, Chief of Infections Diseases at Clinical Infantil Robert Reid Cabral (RRC), indicates that 3 pediatric facilities, RRC, Hospital Los Minas, and Hospital Arturo Grullon, with about 700 beds in total would be the likely major referral centers for children with DSS. Officials from the Social Security Hospitals and the National Direction for Emergencies and Disasters state that 90-95% of hospital beds are generally full. The normal bed reserve of the Dominican hospital systems is probably not more than 1,000 beds.

The National Direction of Emergencies and Disasters has identified in some areas schools, sports centers, and hospital grounds where additional temporary beds could be placed. However, these beds are not available in the country.

b. Laboratory Equipment

Interviews conducted suggest that public sector hospitals, have laboratory equipment to perform serial hematologic studies including hematocrits, biochemical studies including electrolytes, and blood drawing equipment. Platelet counts and arterial blood gases can be done but are not routinely performed in much volume. Additional technician time would probably be necessary if requests for these tests rise significantly.

Rural and urban outpatient clinics can do blood pressure determinations. However, a survey of the availability of appropriate pediatric-size blood pressure cuffs should be done by local subcommittees. Outpatient clinics may or may not have equipment to perform hematocrits and generally do not have the ability to do platelet counts. One exception to this is the policlinicos of social security.

c. Medical Treatment Supplies

Rural health centers generally do not provide intravenous fluid to children while subcenters may do so. Moderate supplies of normal saline, Ringer's lactate and whole blood are kept in one of the major pediatric hospitals (RRC), but these supplies are probably inadequate to treat a sharply increase number of patients with hyporotemic shock. Plasma expanders such as plasmanate and dextran are not available because of cost and plasma itself is in short supply.

The Red Cross has centers in Santo Domingo, San Francisco and Santiago. The Red Cross has a reserve of about 600 units of whole blood over a month's time. To fill blood requirements of 2,000 units or more in a massive DHF/DSS outbreak, a general plea to public for increased donations would need to take place.

The largest producer of intravenous fluids in the RD, Indoquimica, indicates that the capacity to produce adequate amounts of Ringer's lactate and normal saline does exist. Indoquimica could provide 10,000 liters on short notice and could produce 50,000 liters each of Ringer's lactate and normal saline in a month with 2 weeks lead time to permit proper quality control. The company will be increasing its production capacity in October of this year such that general 100,000 liters could be made in 1 month. The cost per liter is about $1 (U.S.).

7. Procurement of Necessary Medical Items

Resource should be sought to provide pediatric blood pressure cuffs in all outpatient clinics and microcentrifuges in as many clinics as possible before an epidemic occurs. As mentioned, surveys on health clinics and hospitals by local dengue medical committees to establish the need for diagnostic equipment and supplies mentioned above. Again, the most important laboratory test is the hematocrit for which the most expensive item is the microcentrifuge, about $4,000 pesos.

Sources of payment for such items could include the SESPAS budget, religious and private donating agencies and organizations, and international governmental agencies such as A.I.D. and OPS.

Funds from A.I.D. and OPS would be more likely available for purchase of emergency supplies once an emergency has officially been declared. Such aid could assist in purchase of large quantities of intravenous fluid and support for field hospitals.

The United States Regional Disaster Stockpile is in Panama. They stockpile field hospitals, equipment and supplies. Civil Defense can request these. The advisability of a contingency contract for purchase of intravenous fluids should be explored. Emergency assistance does not address the problem of inadequate clinical laboratory equipment.

8. Procurement of Necessary Vector Control Items

a. Emergency budget: SNEM and other regular budgets would be initially used. Upon official declaration of a dengue/DHF by the Government and formal requests through diplomatic channels, additional funds might be available. Any external funding for vector control would be best used for insecticides, application equipment and perhaps vehicles or to cover contracting of aerial ULV application equipment, insecticide and aircraft.

b. Sources of equipment locally are difficult to predict. The National Committee should keep lists of commercial supplies of insecticides and application equipment (see yellow pages in telephone directory for: químicos agrícolas, insecticidas y maquinarias, fumigación e implementos agrícolas). Military and police might have vehicles and aircraft available if requests were directed officially at Ministry level.

c. Equipment at the international level might be made available from Caribbean basin countries once an emergency is declared. OPS has the mechanism to coordinate this request. The United States Navy has a rapid response team at Jacksonville, Florida but must be approached through normal government diplomatic channels. The Mosquito Research and Control Unit, Grand Cayman Island has offered to assist countries through the loan of equipment, consultants and training. OPS and USAID maintains expertise in procurement of equipment. Up-to-date lists of manufacturers and suppliers are published yearly in the Pest Control Magazine. Some companies such as TIFA International have made a standing offer to loan equipment through OPS. USAID, JICA, GTZ and embassies from countries with assistance projects on-going in the Dominican Republic should be officially contacted once a dengue/DHF epidemic is declared.

d. Sources of human resources include primarily staff of SNEM and SESPAS. Civil Defense and military should be contacted through channels designated by the National Committee. CEDOIS has a directory of private non-profit social agencies which should be kept in the office of the Secretary of the National Committee. USAID has a list of 54 organizations working in primary health care. CDC San Juan laboratory and the Department of Health of Puerto Rico are sources of vector control expertise. USAID-VBC and the University of South Carolina have consultant list.

e. Funding agencies. USAID and OPS should assist in identification of multilateral - bilateral donor sources. Internally national tourist and hotel associations might assist funding as epidemics adversely affect tourism. The National Disaster Committee (Civil Defense) should be contacted for assistance (Ing. Cabral tel: 689-3808 or 689-3818).

f. Contingency contracts for consultants: At present, such contracts are not necessary as contact exists with CDC-San Juan Laboratory, USAID/USC-GODR Proyecto de Control de Vectores, OPS and USAID/Dominican Republic.

9. Special Medical Training in Preparation for an Emergency

As mentioned previously, it is essential that local dengue medical committees continually train and evaluate the results of educational efforts directed toward physicians and nurses in the community. Occasional simulation exercises or perhaps just discussions at a meeting of local physicians should emphasize and review the plan of patient triage to appropriate clinics or hospitals based on relative severity of illness. The national and local communities should also keep up communication and periodically review the mechanism for assistance in obtaining additional hospital beds and medical supplies.

10. Special Vector Control Training in Preparation for an Emergency

a. Courses are on-going and planned by the USAID/GODR Proyecto de Control de Vectores for improvement of medical entomology and vector control. These courses should continue. The Proyecto anticipates continued interest of Dominican vector control staff, SESPAS and Military participation in short courses at the Wedge and academic training at USC School of Public Health. Training is flexible and could meet future needs.

Other training should include liaison with training programs for medical doctors about dengue/DHF. This should follow information as presented in Dengue hemorrágico: diagnóstico, tratamiento y lucha (see Section IIIA.2. Training of trainers for community participation in Vector Control should be expanded and should include a training module with slides, text and other educational material. Health Education should help coordinate this but SNEM staff should be involved.

Courses should be developed on source reduction and personal protection for community groups and school children. Health Education, SNEM and CDC-San Juan laboratories should do this.

b. Simulations should be considered once the National Committee is organized. Advise on this exercise should be solicited from the Disaster Committee and CDC-San Juan laboratory. Dr. D. Gubler of CDC should be requested as a consultant for the first simulated epidemic and possibly follow-up exercises.

c. Pilot studies on new control methodologies have been outlined in the trip report of R. Tonn. These and other studies should be planned and

implemented by the USAID/GODR Proyecto de Control de Vectores. If successful training courses should be developed for SNEM and other control staff.

11. Community Awareness of DHF/DSS

Local volunteer agencies such as women's organizations, religious and non-religious organizations with programs in child health should be recruited to assist the Department of Human Resources (Health Education), the Child Survival Program, and professional medical organizations to educate parents about the risk of DHF/DSS. The message about the disease which should be emphasized is the need to bring children with fever and rash, bleeding problems, restlessness or abdominal pain to medical attention immediately. This heightened awareness of the risks of dengue on the part of the community may help motivate the local population to assist in mosquito breeding source reduction efforts.

B. The Alert Phase

1. Medical Alert

If a DHF/DSS outbreak is identified in Puerto Rico or Haiti or if surveillance suggests a significant increase in dengue transmission, the Dominican medical community should be informed through telephone notification of local dengue medical committees as well as through normal bulletins and newsletters. Efforts should be taken to intensify surveillance and training efforts in such a situation. Inventories of medical supplies should be reviewed and efforts should begin to seek mechanisms of payment for needed materials.

2. Vector Control - Plan of Action

a. Dengue, DHF on DSS in a nearby country

- Intensive sanitary education through mass - media of dengue situation in nearby country with comparison of Ae. aegypti problem in Dominican Republic. Suggest personal protection measures.

- Contact community-based volunteer organizations to organize source reduction campaigns in cooperation with solid waste collection at municipal level.

3. Consider larviciding of domestic water storage containers with 1% Abate Sand Granules either by SNEM or volunteers distributing pre-packaged insecticide.

4. Begin contingency plan for epidemic

   a. Seek funds for application equipment and insecticide.

   b. Alert civil defense, schools, military, etc., of potential danger.

   c. Begin expanding sanitation education.

   d. Ensure operation of ULV equipment of vehicles in SNEM and Rapid Response Unit and arrange for loan of additional materials.

   e. Set-up weekly or daily meetings of key members (epidemiology, laboratory and vector control) of National Committee and produce update on situation for others.

   f. Dengue, DHF or DSS in Dominican Republic.

      - Begin monitoring criteria to declare an emergency and alert political and technical contacts.

      - Intensive mass media information on exact location of cases, symptoms, medical centers, with what communities and individuals are doing or could do. Posters and other education brochures on solid waste, source reduction and personal protection should be distributed.

      - Contact community-based volunteers organizations, schools, civic-social clubs, etc., on danger of dengue, source reduction campaigns and location of local health facilities.

      - Begin larviciding with Abate Sand Granules in risk areas and adulticiding around schools, hospitals and other institutions in area of transmission.

      - Begin contingency plan for epidemic.

      - If case reporting is rapid, number of cases few and fairly isolated consider focal ULV treatment of 100m or more radius around houses having cases.

- Inform CDC San Juan and OPS of situation and request consultant assistance in Ae. aegypti control.

C. The Emergency Phase

1. Criteria for determination of an emergency Criteria will vary with changes in the dengue/DH situation in the Caribbean and as epidemiological, vector control and emergency experience is advanced.

The following are suggested surveillance criteria which if met should trigger emergency vector control measures and disease alert notification to the medical community and the general public:

a. 50% seropositivity rate in sera collected from at least 2 sentinel surveillance hospitals.

b. Occurrence of 1 serologically documented case of DHF/DSS meeting OMS criteria or 3 cases meeting the OMS clinical definition.

c. A cluster of deaths documented to be due to dengue whether or not the cases meet the OMS clinical criteria.

d. A doubling of the seropositivity rate to at least 30% among sentinel surveillance blood specimens from at least 3 sites between 2 consecutive months.

e. A serologically documented outbreak of dengue outside of the sentinel surveillance area.

f. Entomological - Because of wide spread distribution of Ae. aegypti and high densities of adults mosquitos inside housing, entomological indicators will not be considered.

g. These criteria should be refined and revised as surveillance data accumulates which define base-line levels of dengue transmission in the RD.

2. Declaration of an Emergency

If the above criteria are met, or other ominous surveillance data raise concerns, the national committee shall meet, and reach a consensus whether to recommend that a declaration of emergency be made. The chairman of the committee informs the Secretary SESPAS who will follow appropriate official channels to inform other Government Agencies, International Agencies, etc.

If an emergency is declared, capable full time clerical assistance should be assigned to the committee from SESPAS. Requests for vehicles and other special needs of the committee should be given high priority.

3. Responsibilities

a. Coordination will be the responsibility of the chairman and members of the National Committee for Control of Dengue Emergencies with responsible individuals identified in epidemiology, laboratory, hospitals, armed forces and SNEM. At least 1 representative from vector control, the clinical subcommittee, epidemiology and the National Virus Laboratory should meet daily to review activities during the emergency period.

b. Vector control and vector surveillance will be done by SNEM. At present, 3 staff of SNEM are on the National Committee. One of these should be appointed coordinator for SNEM Ae. aegypti activities, probably the chief of epidemiology. That individual should form a subgroup with resource membership from support agencies such as agriculture, tourism, private agricultural aerial spray companies, air force, health education and community-based volunteer and social organizations.

c. The medical subcommittee chairman will be responsible for arranging that physicians and local dengue medical committees throughout the country are immediately alerted to the dengue emergency. He/she will also monitor requirements for hospital beds and appropriateness of diagnosis and treatment in the affected area. Epidemiology may be helpful in the monitoring of morbidity and assessment of need. There may also be a need for emergency training sessions of physicians, nurses, and paramedical personnel.

4. Dissemination of Information

a. General information on educational/epidemiological and medical will be handled by the National Committee. There should be only 1 spokesperson, especially during an epidemic.

b. Informing of spraying operations, source reduction campaigns and other vector activities will be handled by SNEM with cooperation of community-based organizations.

c. Intergovernmental agencies and international organizations should be informed through official channels on a regular basis.

d. The health education subcommittee may wish to take responsibility for interacting with the media during the emergency. There is a vital need during an epidemic for mass media communication regarding the importance of early diagnosis and treatment. Updates should be given to media at regular intervals on the status of the outbreak.

e. A telephone hotline for the community could be set up to answer questions and ally fears about the epidemic.

5. Procurement and Organization of Necessary Manpower, Equipment and Supplies

a. Medical

Reporting of DHF/DSS cases should be closely monitored to anticipate need for hospital beds and supplies. Through appropriate channels OPS and A.I.D. should be informed immediately if additional temporary hospital beds and monetary assistance are needed. The Red Cross should be informed of blood supplies requirements. Manufacturers of intravenous fluid should be informed as soon as possible of the need to step up production and funds should be sought to pay for intravenous fluid supplies.

Civil defense personnel may assist in placement of additional temporary hospital beds medical and identification of field hospital sites. If additional medical manpower is needed, thought should be given to assigning pasantes and senior medical and nursing students to critically affected areas.

b. Insecticides and Equipment

Amount of insecticides and equipment will depend on distribution, prevalence and severity of the epidemic, unless resistance to malathion or Abate develops, these insecticide should be used. If there are shortages substitute insecticides can be ordered by consulting OPS or CDC-San Juan or the USAID/GODR Proyecto de Control de Vectores. Insecticides should meet WHO specifications and be compatible to the application equipment used. If donor funds are used, procurement of equipment and insecticides are sometimes placed on open bid, attempts should

be made to write order to fit types of equipment currently in use in country. Request part list and instruction in Spanish, add 10% to cost per equipment order for spare parts and 10% to insecticide order for contingency.

c. To determine Abate needs:

- Determine total number of houses to be treated.

- Determine average amount of Abate used per house.

- Consider treatment cycle of 8-10 weeks with 2 cycles total but second cycle only positive containers could be treated.

d. To determine ULV malathion needs:

- Follow research recommendations on equipment, dosage and cycles made by USAID/GODR Proyecto de Control de Vectores.

e. Human resource needs will depend upon control procedures. Source reduction through community action. Abate larviciding daily average for treating houses is 18-22 houses per man, suggest civil defense, boy scout or community based staff do Abate treatment. SNEM could coordinate and prepackage Abate. Backpack motorized equipment should have 2 men per machine, a team of 4-5 machines (8-10 men) and one supervisor is an effective control unit. They will need transportation.

6. Determination of Areas to be Treated

a. Affected areas.

- ULV ground, portable or aerial equipment at initial treatment cycle or cycles to reduce biting female Ae. aegypti until one or less parous adult is collected per house per 10 minute net sweep per man (subject to refinement through investigation). This level of infestation to be maintained until virus transmission stops.

- Source reduction at time of initial case reports and repeated every 4-5 weeks until virus transmission stops.

- Treatment of 55 gallon drums and other large drinking water containers with Abate Sand Granules for 2 cycles of 8-10 weeks. The second cycle only positive containers need to be treated.

b. Areas at Risk

- Entomologically those areas with high adult Ae. aegypti populations as determined by net sweeps, and by larval surveys. Also abundance of stored water containers, poor solid waste collections, lack of roads and human population densities should be considered.

- Source reduction, treatment of containers with insecticide, use of fish, community-based clean-up campaigns, sanitary and personal protection education directed towards school children, and community-based organizations should begin as soon as possible.

- Select ULV applications aimed at reducing adult mosquito population. Coverage and dosage procedures determined during preparatory and alert phase.

7. Plan for Vector Control Operation

a. Adult Control

- Ground application

- At present, one Leco vehicle mounted thermal fogger and four Leco 500 vehicle mounted ULV generators are operatable and 4 other vehicle mounted ULV generators are in need of repair. New ULV equipment acquired should be for heavier duty than the Leco 500.

- One vehicle mounted ULV or thermal fog apparatus can treat about 70-80 city blocks per day. Street maps are needed to determine schedule and for supervision. Coverage depends upon meteorological conditions, size of equipment and traffic.

- Operation depends on manual of operation for specific equipment used and label instructions on insecticide. For general information see WHO/VBC/85.919.

- Inform residents of area when to expect vehicle. Ask residents to open doors and windows during application.

b. Backpack and other portable mist/aerosol/thermal application equipment can be used in areas not accessible to vehicle mounted equipment. Portable ULV equipment may be used inside dwellings and schools.

- One portable machine requires 2 people to operate (each works for about 30 minutes at a time). One portable machine can treat from 80-120 houses per day.

- Refer to operating manual and insecticide label for specific instructions.

- Inform residents as above (7-a-1-a).

c. Susceptibility tests indicate that malathion and Abate can continue to be used for control of Ae. aegypti. Preliminary information for Santo Domingo suggests that 5 fluid ounces per acre or more be used with ULV vehicle-mounted equipment. (This dosage will be verified through further investigations). Other types of ULV insecticides could be considered, e.g., dibrom has been used in Puerto Rico for aerial applications.

d. Operational guidelines will depend upon equipment and insecticide. Consult WHO/VBC/85.919 for information on dosage, droplet size, application timing, application speed and swath, maintenance of equipment, and personnel and public safety.

e. Frequency of applications will depend on efficacy of initial application and continued transmission of virus in the treated area. Initial reduction of female Ae. aegypti should be 90% or more of original population or 1 or less adult is captured by net per dwelling. Two or more cycles at two day intervals may be needed initially followed by 7-10 day cycles or until recovery has been 70% of original population or human case reports stop. Frequency should be related to pre - and post - spraying evaluations based on net

sweeps of houses, resting adult collection or ovitraps and revised on research.

f. Wind and rain are the major climatological limitations, if applications are done at recommended early morning and late afternoon times. Wind velocities should be less than 13 km/hour and sprays should not be directed against a wind velocity of more than 5 km/hour. (See equipment operation manual. This restriction does not hold for portable equipment used inside and around houses).

- Aircraft Application

a. The decision to use aerial applications should depend upon the number and distribution of DHF cases at the time the emergency is declared and the availability of ground and portable space spraying equipment and insecticide. Any decision should be based in part on results of aerial ULV trials projected for the Dominican Republic and those completed in Puerto Rico. Single engine aircraft are found equipped with application equipment for agriculture but these have T-jet nozzles. Beecomist or Micronair type equipment is recommended. Pilots of these aircraft are not trained to fly the altitude and spray width utilized for public health. Contact should be made with USAID or MRCU at Grand Cayman for consultants and possible aircraft. Helicopters and twin engine aircraft are available locally from the Dominican Air Force or International through official requests through Diplomatic Channels or from Commercial Companies in the United States that work under contract. Check American Mosquito Control Association for names and addresses of these companies.

b. See WHO/VBC/85.919 and bibliography references 11, 14 and 20 in Consultancy Report of R.J. Tonn for information on planning and implementation of aerial ULV applications.

c. Frequency of application should depend on entomological evaluations. One or two applications should be sufficient if other control measures are in operation.

- Larval Control

Various forms of community participation should be used to control larvae as it is labor intensive. Contact with community - based volunteer groups and civic - social clubs should be made in the preparatory and alert phase to enlist their assistance and train people in the community. Larval control is largely a preventive measure but should be used in emergencies to help maintain low densities of Ae. aegypti adults.

8. Evaluation of Emergency Control Measures

a. Operational

Ongoing frequent re-evaluation of emergency measures should be done as often as practical and dictated by the intensity of epidemic. The chairman of the committee or a designate should review the operational aspects of control activities with the assistance of the various subcommittee chairmen. Whether supplies and manpower are being effectively distributed should be assessed. If inefficiencies are identified, corrective action should be taken. Both problems and tasks well done should be well documented so that after the epidemic an assessment of the difficulties and successes can be made and used to assist those dealing with future outbreaks.

b. Epidemiologic courses and maps should be updated as often as necessary, probably daily during the height of the epidemic. Epidemiologic information on the distribution of cases, morbidity and mortality should be fed back at regular intervals to the medical community.

c. Studies

Careful clinical, virologic and epidemiologic studies should also be conducted because of the relative rarity of DHF/DSS in the Western Hemisphere to date. Risk factors for DHF/DSS are still incompletely understood. Assistance in conducting such studies may be requested from OPS or CDC.

TABLE 1

VIVIENDAS EN ZONAS URBANAS EN CIUDADES
EN EL ORDEN PRIORIDAD = SNEM PLAN DE CONTINGENCIA

	Grupo A	Viviendas en Zonas Urbanas
1	Santo Domingo	283,126
2	San Pedro de Macorís	19,922
3	Puerto Plata	15,989
4	Barahona	15,328
5	Samaná	3,310
6	San Cristóbal (Haina y Villa Altagracia)	32,476
7	La Romana	21,393
8	Santiago	62,852
9	Dajabón	3,811
10	Valverde (Esperanza y Mao)	12,533
	Grupo B	
1	Bonao - Monseñor Nouel	
2	La Vega	28,028
3	San Juan de la Maguana	15,172
4	San Francisco de Macorís	
	Grupo C	
1	Higuey	
2	El Seibo	12,559
3	Monte Plata	
4	Espaillat	8,082
5	Monte Cristi	7,836
6	Peravia	10,673
7	Azua	11,846
8	Pedernales	1,780
9	Elias Piña	2,686
10	Independencia	3,997
11	María Trinidad Sánchez (Nagua)	7,084
12	Sánchez Ramírez (Cotuí)	5,785
13	Salcedo	3,553
14	Bahoruco	6,429
15	Santiago Rodríguez	3,464
	TOTAL URBANA	627,444
	TOTAL URBANA OCUPADA	587,115

TABLE 2

INDICES DE INFESTACION POR AEDES AEGYPTI
SANTIAGO, PUERTO PLATA Y SANTO DOMINGO
1987

Ciudad	Indice de Casas	Indice de Recipientes
Santiago	36.2	25.6
P. Plata	30.4	18.5
S. Domingo	50.3	32.6

Sources: Memoria anual, año 1987, Secretaría de Estado de Salud Pública y Asistencia Social. p. 41

Directory:

Malathion and Temephos (Abate)

American Cyanamid Co.
Bordan Ave.
Wayne, New Jersey 07470
Telef. 130400
Telephone (201) 831-1234

Marman
P. O. Box 22829
Tampa, Florida 33622

Space Spraying Equipment

Lowndes Engineering Co. (LECO)
125 Blanchard Street
P. O Box 488
Valdosta, Georgia 31601

London Fog, Inc.
P. O. Box 406
Long Lake, Minnesota 55356

Micro Gen Equipment Corp.
10700 Sentinel Drive
San Antonio, Texas 78217

TABLE 2 cont.

Agricultural Spraying

AGRICO AGRIASA
Octavio Carlos, Presidente
Ave. Benito Monción
Valverde Mao
567-3646

FUMIGADORA QUISQUEYANA
Ave. Francia No. 18
Santo Domingo
682-1352

Trabajos Aeroagrícolas Técnicos C. por A. (ATECA)
Bienvenido Rojas de Taváres, Presidente
Calle Managua 29
Santo Domingo
566-7240 y 565-5067

TABLE 3

HOSPITAL AND HOSPITAL BEDS IN THE DOMINICAN REPUBLIC

Public Sector	Number of Hospitals	Number of Beds
SESPAS	46	6,604*
IDSS	15	1,532*
Armed Forces	2	572**
Private (for profit)	170	?***
Private (non-profit)	?	?

*Memoria Annual, 1987, SESPAS
**Per Dr. Miguel Estepan, June 1988
***Unnamed 1982 survey

ANNEX 1

OUTLINE OF TRAINING MODULE FOR CLINICIANS ON DENGUE AND DHF/DSS

1. Introduction and Background

   1.1 Mosquito-borne viral disease characterized by fever, headache, myalgia and arthralgia, and rash.

      A. Also known as breakbone fever.

   1.2 History of dengue in the Caribbean and the Dominican Republic

      A. Increased frequency of epidemics in the 1970s and 1980s following failure of Ae. aegypti eradication program (SLIDE).

         1. Multiple dengue serotypes circulating (SLIDES).

         2. Sporadic cases of DHF/DSS documented in several countries.

         3. Current D.R. surveillance data.

      B. Epidemic of DHF/DSS in Cuba in 1981.

         1. 344,203 cases reported, 158 deaths, 116,143 hospitalization (SLIDE) over a five-month period.

   1.3 DHF/DSS in Asia since the 1950s.

      A. One of the 10 leading causes of hospitalization of children.

      B. Mortality was high in early epidemics, 20-50%; now less than 5% because recognized and treated early.

2. Virus

   2.1 Four serologically related RNA viruses in the Family Flaviviridae: Den-1, Den-2, Den-3, Den-4 (SLIDE).

   2.2 Flaviviridae family also includes yellow fever virus.

ANNEX 1 cont.

3. Epidemiology

3.1 Principal vector of dengue and urban yellow fever - Ae. aegypti (SLIDE).

A. Species breeds around human habitations in water collected in artificial containers.

B. Mosquito-Man-Mosquito Cycle (SLIDE).

1. Incubation period in man after mosquito bite, 3-15 days, usually 5-8 days.

2. After biting viremic human, mosquito becomes infective in 6-10 days and remains infective for life.

4. Clinical Manifestations

4.1 Spectrum of illness (SLIDE) as many as 1/3 of infections are asymptomatic.

4.2 Classic dengue fever - seen in adults and older children.

A. Sudden onset of fever, headache, and body pain (SLIDE).

1. Also joint pain, nausea and vomiting and anorexia.

2. Distinctive Symptoms

a. Retroorbital pain accentuated with eye movement.

b. Peculiarity or absence of taste sensation.

3. Respiratory symptoms and diarrhea infrequently reported but can occur.

B. Sign of Classic Dengue Fever

1. Fever lasting 3-7 days, sometimes biphasic curve.

ANNEX 1 cont.

2. Rash in about 50% of patients.

   a. Early on, a flushing of face, neck, and chest.

   b. Erythematous maculopapular rash begins on second to sixth day - 2 patterns (SLIDE).

   c. Pruritus and desquamation may occur at termination of rash.

3. Other common findings - conjunctival injection, lymphadenopathy, bradycardia, slightly inflamed pharynx.

4. Bleeding usually mild, but may be severe- any site, commonly petechial, gums, nose bleeds, menorrhagia.

C. Most patients recover in about one week, but convalescence may be prolonged, accompanied by weakness and depression

D. Small children may have fever and non-specific findings.

E. Laboratory Findings

   1. Absolute neutropenia

   2. Atypical lymphocytes

   3. Decreased platelet count

   4. Mild elevations of liver enzymes and mild proteinuria sometimes detected

4.3 Neurologic Findings Associated with Dengue

A. Mild-headache, irritability, depression (SLIDE)

B. Meningoencephalitis/encephalopathy (SLIDE)

   1. Convulsions, lethargy, coma, stiffspaceneck, paresis.

ANNEX 1 cont.

2. CSF cell counts normal, and no virologic, serologic or histopathologic confirmation of CNS infection to date.

4.4 DHF/DSS

A. Leaky capillary syndrome occurring after 2-7 days of fever (SLIDE).

B. Usually seen in children <15 years of age, but can be seen in adults.

C. WHO criteria - hematocrit increased 20%, platelet count <100,000, 4 grades (SLIDE).

1. Tourniquet test - useful for screening (SLIDE). Describe how to perform.

D. Signs and Symptoms

1. Restlessness, irritability, epigastric pain.

2. Petechial or ecchymosis (SLIDE).

3. Hepatomegaly may or may not be present.

4. Right-sided pleural effusion on physical exam or chest-x-ray is common.

5. <u>Sudden</u> development of shock-narrow pulse pressure (<20 mm Hg), rapid pulse, cool extremities, cold clammy skin, circumoral cyanosis.

6. Critical period of 24-48 hours in which patient may go into and out of shock, until patient becomes afebrile.

7. Patients with prolonged shock and acidosis have a poor prognosis.

E. Laboratory Findings

1. Thrombocytopenia usually develops before hemoconcentration.

2. In some cases, a decrease in several coagulation factors and DIC (SLIDE).

ANNEX 1 cont.

3. May see a decrease in total serum protein and complement in severe cases.

F. Severe Hemorrhage, especially Gastrointestinal.

1. Presentation not uncommonly seen in DHF outbreaks but which does not meet WHO clinical diagnostic criteria.

G. Proposed Pathophysiology - Release of Vascular Mediators in Patients Experiencing Secondary Infections (Immunopathogenesis) or Virulent Strains of Virus

4.5 Differential Diagnosis

A. Classic Dengue

1. Other viruses - measles, influenza, rubella, enteroviruses, hepatitis.

2. Malaria, typhus, leptospirosis, typhoid.

B. DHF/DSS

1. Bacterial sepsis including meningococcemia, severe leptospirosis and rickettsial disease.

2. Because children can progress rapidly from Grade 1 to 4, DHF/DSS without overt hemorrhagic.

5. Treatment

5.1 Classic dengue and mild DHF without shock (SLIDE).

A. Supportive, no specific antiviral treatment.

B. Do not use aspirin because it may exacerbate hemorrhage.

5.2 DHF/DSS

A. Clinical diagnosis is essential so that appropriate therapy can be started.

ANNEX 1 cont.

B. Recognition of hypovolemic shock and treatment with volume expansion, normal saline, Ringer's lactate, or a plasma expander (SLIDE).

1. Frequent serial hematocrits and platelet counts using hemoconcentration as a guide to adequacy of volume replacement.

C. Correction of acid-base and electrolyte disturbances (SLIDE).

D. Blood transfusions in uncontrolled, massive bleeding.

E. Care not to fluid overload and produce pulmonary edema.

F. Mild cases of DHF/DSS

1. Hospitalization may not be considered, but is often not necessary unless patient lives too far away from hospital to return quickly if he/she deteriorates.

2. If not hospitalized, hematocrit should be done daily until temperature has been normal for 1-2 days.

G. Steroids have not been shown to be effective.

H. Emergency Hospitalization Plan.

1. Triage

6. Serologic and Virologic Diagnosis

6.1 Serology - paired samples preferable.

A. Hemagglutination - Inhibition (HI)

B. Complement Fixation (CF)

C. Neutralization

D. ELISA

ANNEX 1 cont.

E. Single blood sample presumptive diagnosis is possible with ELISA IgM and with HI in secondary infections - sample should be taken after the third day of illness.

6.2 Virus Isolation

A. Acute phase serum samples within five days on onset.

6.3 Taking and Sending Blood Specimens (SLIDES).

7. Prevention

Prevention should be emphasized because it will save money and lives.

7.1 Surveillance - provides early warning of an epidemic

A. Serologic and virologic sentinel surveillance.

B. Reporting of outbreaks of febrile illness.

C. Reporting of suspect DHF/DSS cases.

7.2 Education of Patients

A. *Aedes aegypti* bites during daytime, especially in early morning and late afternoon.

B. Stored water should have tight fitting lid and/or should be treated with larvicide (Abate).

C. Other potential breeding sites such as tires, cans and plants which hold water should be emptied of water regularly.

7.3 Immunoprophylaxis

A. Although research is ongoing, no vaccine is currently available.

B. Quadrivalent vaccine may be necessary to prevent DHF/DSS.