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DengueNet Implementation *in the* Americas

Report of a WHO/PAHO/CDC Meeting

SAN JUAN, PUERTO RICO
9 - 11 JULY 2002

World Health Organization

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DEPARTMENT OF COMMUNICABLE DISEASE SURVEILLANCE AND RESPONSE (CSR)

PAN AMERICAN HEALTH ORGANIZATION
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Dengue/DHF - global public health burden

The geographical spread of both the mosquito vectors and the viruses has led to the global resurgence of epidemic dengue fever/dengue haemorrhagic fever (dengue/DHF) in the past 25 years with the development of hyperendemicity in many urban centres of the tropics. Globally, 2.5 billion people live in areas where dengue viruses can be transmitted. The number of countries with epidemic DHF is continuing to rise. A pandemic in 1998, in which 1.2 million cases of dengue fever and DHF were reported from 56 countries, was unprecedented. Data for 2001-2002 indicate a situation of comparable magnitude. It is estimated that 50 million dengue infections occur each year with 500 000 cases of DHF and at least 12 000 deaths, mainly among children. Only a small proportion of cases are reported to WHO. The challenge for national and international health agencies is to reverse the trend of increased epidemic dengue activity and increased incidence of DHF.

Rationale for global surveillance of dengue/DHF

Epidemiological and laboratory-based surveillance is required to monitor and guide dengue/DHF prevention and control programmes, regardless of whether the form of control used is mosquito control or possible vaccination if an effective and safe vaccine becomes available. The reporting of dengue/DHF however is not standardized. Epidemiological and laboratory data are often collected by different institutions and reported in different formats, resulting in delay and comparability problems at regional and international levels. To address these problems WHO has created DengueNet, an Internet-based central data management system to collect and analyse standardized epidemiological and virological data for the global surveillance of dengue/DHF and to provide national and international public health authorities with epidemiological and virological indicators by place and time that can guide public health prevention and control actions.

DengueNet WHO's Internet-based system for global surveillance of dengue/DHF

The DengueNet system responds to the WHO resolution on dengue fever/DHF prevention and control adopted at the 55th World Health Assembly in May 2002, asking Member States "to build and strengthen the capacity of health systems for surveillance, prevention, control and management of dengue and DHF" and emphasizing the critical importance of strengthening laboratory diagnosis in affected countries. It is compatible with the principles developed by PAHO for epidemiological and laboratory surveillance of dengue/DHF in the Americas as outlined in the Resolution CD43.R4 and the Working Document CD43/12 adopted by the PAHO Directive Council in September 2001.

At present, global dengue statistics from 1955 to 2001 can be accessed on DengueNet. When fully implemented, public health authorities and the general public will have immediate access to important indicators such as incidence data, case fatality rates (CFR) for DHF, frequency and distribution of dengue and DHF cases, number of deaths, and distribution of circulating dengue virus serotypes based on data that have been entered into the DengueNet database via the Internet directly by national health officials. In addition, the historical and current data contained in DengueNet will be useful for public health researchers to support their research and for national and international agencies for advocacy purposes.

A key objective is to ensure that data of the highest possible quality is reported in a timely manner to DengueNet. This can be achieved by implementing standards for surveillance, laboratory procedures and quality control by establishing a strong

partnership between the national programmes, WHO collaborating centres (WHO CC) and the WHO country, regional and global levels.

DengueNet implementation

The first meeting on DengueNet implementation in the Americas was held jointly with WHO/PAHO and the WHO collaborating centre for dengue at CDC on 9-11 July, 2002 in Puerto Rico, USA. The objective was to describe and demonstrate DengueNet to prospective users and launch pilot testing by building on the existing reporting systems and network of dengue laboratories in the Americas.

Purpose and objective

Forty participants (surveillance epidemiologists and laboratory specialists) from 15 countries participated in this first meeting on implementation of DengueNet. The focus of the technical discussions in the plenary was (1) the challenge and need for global epidemiological and laboratory surveillance of dengue and dengue haemorrhagic fever (DHF); (2) the national epidemiology and laboratory surveillance systems in participating countries in the Americas; and (3) presentation of DengueNet and a "hands-on" session with the Internet site. Two working groups were convened. The first defined the epidemiological data and reporting requirements for DengueNet, modifications needed to its present format, identification of countries for pilot testing and the roles and responsibilities of national and international partners. The second group reviewed laboratory standards and quality control issues for dengue serological diagnosis and virus isolation building on the recommendations of the two previous WHO meetings on dengue laboratories in the Americas.

Meeting outcomes

This first meeting marks the start of the phased implementation of DengueNet starting with the Americas in 2002 and expanding to the WHO South-East Asia and Western Pacific Regions in 2003. There was very active participation by representatives from national programmes and laboratories, WHO collaborating centres and WHO/HQ, PAHO and country offices. The key outcomes are summarized below.

Data will only be provided by the central level of each country (one source of data per country). DengueNet will link to the country web pages for additional information.

Countries will provide this data by epidemiological week at state/department level for the large countries and at the island level for island countries. The data reported in DengueNet will include the clinical categories of dengue fever, DHF, both suspected and confirmed cases, and only confirmed dengue deaths.

Virus serotype data will be provided for the entire country as the number of isolations of each serotype in the country. DengueNet will display this data and the calculated proportion of each serotype as a percentage of the sum of all four serotypes isolated in the country for any given time period.

Roles and responsibilities of the partners in this network

Countries will collect, validate, and provide epidemiological and laboratory data. They will designate the participating centres. The WHO collaborating centres will continue to provide technical laboratory support, reagents, proficiency panels and training to national laboratories. PAHO will support the country implementation activities and WHO HQ will maintain and

moderate the DengueNet web site. Both PAHO and WHO/HQ will seek financial support for dengue surveillance activities.

Country participation

A major outcome of the meeting was that all the representatives of countries in the Americas expressed interest in participating in DengueNet pilot test, and the representatives of South-East Asian countries indicated interest in having the system expanded to include their region. The participants will follow up with their country authorities to obtain official authorization to participate in DengueNet. WHO Country representatives will support the participants in presenting the DengueNet proposal to the country authorities. The pilot testing of DengueNet in the Americas will be conducted over a 3-6 month period. The lessons learned will be built into the implementation framework for high-burden countries in the South-East Asian and Western Pacific Regions in 2003.

1. Introduction

This meeting on DengueNet implementation in the Americas was organized by the World Health Organization Department of Communicable Disease Surveillance and Response, Global Alert and Response, (WHO/CSR/GAR) jointly with the Pan American Health Organization Division of Communicable Disease Prevention and Control (PAHO/HCP/HCT) and the WHO Collaborating Centre (WHO CC) for Dengue Reference and Research at the Dengue Branch, Division of Vector-Borne Infectious Disease (DVBID), US Centers for Disease Control and Prevention (CDC) in Puerto Rico.

1.1 Welcome

Dr Gary Clark welcomed the participants at the WHO CC in Puerto Rico and gave a brief description of the Dengue Branch/CDC facilities and programme and the WHO CC activities related to national programme support, provision of laboratory training, reagents, quality control and reference services, and assistance to countries during epidemics.

1.2 Meeting objectives and expected outcomes

Dr Ray Arthur outlined the meeting objectives and expected outcomes. The meeting was convened to:

- Present DengueNet, WHO's global surveillance system for dengue/DHF, to prospective users and allow participants to have "hands-on" experience with the Internet site;
- Identify modifications and specific tasks that are required before implementation/pilot testing of DengueNet;
- Review the national systems for dengue/DHF surveillance in the Americas as these relate to implementation of DengueNet; including epidemiological surveillance and reporting systems, laboratory diagnosis and virus characterization, communication and information flow;
- Review and update the recommendations of the two previous WHO meetings for dengue laboratories in the Americas relative to diagnostic testing, laboratory standards and quality control for serology, PCR, virus isolation, serotyping and characterization;
- Identify countries for DengueNet pilot testing and the respective roles and responsibilities of countries, WHO Collaborating Centres, WHO country offices, PAHO and HQ.

The overall objective was to develop a framework for the implementation of DengueNet with emphasis on data quality and active participation of national programmes and to launch pilot testing in the Americas by building on the existing reporting systems and networks of dengue laboratories.

The expected outcomes of the meeting are:

- Recommendations for modifications to be made to the present version of DengueNet;
- Definition of epidemiological and laboratory data and reporting requirements for DengueNet;
- Identification of potential participation of countries and time frame for the pilot testing;
- Definition of the roles and responsibilities of national and international partners.

1.3 Participants, agenda and documents

The meeting chairman was Dr Robert Shope and Dr Scott Halstead was rapporteur. Forty participants from 15 countries included surveillance epidemiologists and laboratory specialists from:

- National programmes of high-burden countries in the Americas: Brazil, El Salvador, French Guyana, Guatemala, Nicaragua, Mexico, Puerto Rico, Venezuela;
- CAREC, WHO's sub-regional surveillance network for twenty island countries in the Americas, located in Trinidad;
- WHO Collaborating Centres for dengue, arbovirus and viral haemorrhagic fevers located in Argentina, Brazil, Canada, Cuba and the United States of America;
- Indonesia, Thailand, and Viet Nam - these 3 participants attended the meeting to benefit from the discussions and to assist WHO in organizing a DengueNet implementation meeting in 2003 for high burden countries in South-East Asia and the Western Pacific;
- WHO HQ, PAHO and Country offices in Brazil and Nicaragua.

The agenda, list of participants and background documents are presented in Annexes 1, 2 and 3 respectively.

1.4 The challenge of dengue/DHF epidemiological and laboratory surveillance

Dr Duane Gubler gave an overview of the challenges in dengue/DHF epidemiological and laboratory surveillance.

The geographic spread of both the mosquito vectors and the viruses has led to the global resurgence of epidemic dengue fever/dengue haemorrhagic fever (dengue/DHF) in the past 25 years with the development of hyperendemicity in most urban centres of the tropics and emergence of epidemic DHF in these areas. The challenge for national and international health agencies is to reverse the trend of increased epidemic dengue activity and increased incidence of DHF.

Surveillance is an important component of a dengue/DHF prevention programme. Unfortunately, surveillance for these clinical syndromes is not effective in most endemic countries. Generally, only passive surveillance systems are used, and only severe disease is reported leading to a gross under-reporting of dengue illness. In addition, even though WHO has had a standardized case definition for DHF for many years, many countries do not use it for reporting purposes. The result is that we do not know how much dengue illness actually occurs in the world.

There are several principal challenges to implementing effective surveillance for dengue/DHF. The first and perhaps most important is to obtain the funding to develop and support surveillance in all dengue endemic countries. To achieve this, it is important to educate policy-makers and institutional funding agencies about the extent of the public health and economic problems associated with epidemic dengue/DHF. Adequate resources and support will only come after dengue/DHF is elevated to a higher priority as a public health problem.

Another challenge will be to implement both passive and active surveillance in endemic countries. Passive surveillance systems should be mandated by law and should report both dengue fever and DHF using standard WHO case definitions. Active surveillance should be laboratory-based and have both virologic and serologic support, at least at the national level.

Case reports should be transmitted electronically from the local to the state/provincial level to the national level, and from there to WHO for international use. The DengueNet system could be ideal for this type of reporting. Emphasis should be placed on the inter-epidemic period using an active surveillance system, and should focus on monitoring dengue virus transmission in the catchment area in order to know at any point in time, where dengue transmission is occurring, what serotypes are involved, and what type of illness is associated with the virus serotypes present.

Dengue vaccine development has made excellent progress in recent years. Active, laboratory- and population-based surveillance will be required in selected sites to monitor vaccine efficacy trials. In summary, effective, laboratory-based surveillance will be required to monitor and guide dengue/DHF prevention programmes, regardless of whether the form of control is mosquito control or vaccination.

2. Proceedings - Outline of meeting sessions

Five sessions were conducted during the meeting. Sessions 1-3 were organized as plenary sessions with presentations followed by a discussion led by a moderator.

On the first day, the meeting was held at the CDC dengue branch in San Juan. Two plenary sessions were conducted: the first on national systems for surveillance of dengue/DHF in the Americas moderated by Dr Jorge Arias and the second on DengueNet for global surveillance moderated by Dr Ray Arthur. Eleven computers connected to the Internet were made available to participants in groups of 4 for a hands-on experience with the DengueNet Internet site before the second session opened for discussion. The day ended with a visit of the centre's epidemiology, laboratory and entomology facilities.

Day 2 included the third plenary session during which (1) Dr Ray Arthur summarized the day 1 discussions on DengueNet for the benefit of participants who joined the meeting on day 2 and (2) Dr Gary Clark presented a review of the recommendations of the 1994 and 1996 WHO meetings on dengue laboratories in the Americas. During the fourth session the meeting participants divided into two working groups one on epidemiology and the second on laboratory issues for dengue/DHF surveillance as these relate to DengueNet.

Session 5 on day 3 was a plenary session and included reports from the two working groups followed by discussions and presenting consensus on the meeting recommendations. The first defined the epidemiological data and reporting requirements for DengueNet, modifications needed to its present format, identification of countries for pilot testing and the roles and responsibilities of national and international partners. The second group reviewed laboratory standards and quality control issues for dengue serological diagnosis and virus isolation building on the recommendations of the two previous WHO meetings on dengue laboratories in the Americas.

2.1 Session 1: National laboratories and reporting systems for dengue/DHF in the Americas

Moderators: Dr Francisco Pinheiro and Dr Jorge Arias

This session reviewed selected national systems for epidemiological and laboratory surveillance of dengue/DHF in the Americas in relationship to the proposed implementation of DengueNet and identified topics requiring further discussion to define the data on dengue/DHF cases and deaths and on circulating dengue virus that will be reported to DengueNet.

2.1.1 Questionnaire survey of national dengue/DHF laboratories & reporting systems

Prior to the meeting, WHO developed a comprehensive questionnaire for dengue/DHF surveillance and reporting systems and dengue laboratories. Dr Jorge Arias from PAHO conducted the questionnaire survey for countries and collaborating centres in the Americas participating in this meeting. Preliminary results of the survey were presented at the meeting based on an analysis of the completed questionnaires received from 7 national programmes, and 8 collaborating centres including CAREC in the Americas. They show that dengue testing is mandatory in 8 countries, DHF notification is mandatory in 7 countries and the frequency of dengue reporting during epidemics is daily. Most collaborating centres and country health ministries maintain a website. All countries are in regular communication with PAHO, but require authorization to share epidemiological data. Reports are sent electronically, by fax, post and telephone from the periphery to national level and from there to the regional/ international level. All countries are willing to participate in DengueNet. All collaborating centres and most countries are able to isolate and identify dengue viruses. Six centres and 2 countries have the capability to produce dengue antigens and provide them for other users. Four countries participate in a quality control programme. The number of regional laboratories in member countries varies from 1 to 33.

2.1.2 Dengue/DHF lab based surveillance DHF system in Puerto Rico

Dengue surveillance in Puerto Rico is a laboratory-based, population-based surveillance system, with close co-ordination between the epidemiology and laboratory components and the Puerto Rico Department of Health (PRDH) and the US Centers for Disease Control and Prevention (CDC) respectively. A reported case is defined as any person whose illness is considered compatible with dengue by a health care professional in Puerto Rico, and whose diagnostic sample is sent to the CDC Dengue Branch for testing. WHO/PAHO case definition is used for DHF. The routine laboratory methods are virus isolation, IgM and IgG (ELISA) tests, and immunohistochemistry for antigen detection in autopsy samples. The predictive value that a reported case is dengue is at least 75%.

The objective is to provide early and precise information on when and where transmission is occurring, the serotypes present, the associated disease severity, and guide clinical and vector control interventions. Key attributes of the surveillance system include simplicity, acceptability, flexibility and high coverage. Timeliness is constrained by the characteristics of disease transmission and diagnostic methods.

2.1.3 Dengue fever in Brazil: Past, present and perspectives

In Brazil 70% of the population corresponding to l 174 million people live in the north-east and the south-east regions where the majority of dengue cases occur. Brazil has experienced its largest epidemic ever in the first four months of 2002 with 560 000 cases reported to date (preliminary data), and 53% of these occurring in the state of Rio de Janeiro.

This epidemic has been caused by the recent introduction of the dengue 3 serotype that was first detected in the state of Rio de Janeiro in 2000.

Dengue 1 serotype was first detected in Rio de Janeiro state in 1986 and dengue 2 serotype in 1990. Dengue incidence increased during the 90's and in 1998, Brazil reported over 530 000 cases. Following the current major epidemic this year, a national programme for dengue prevention and control has been developed with stringent objectives to reduce dengue incidence and *Aedes aegypti* indices, to prevent dengue outbreaks and to reduce the case fatality rate for

DHF. Key components of this programme include improved case and laboratory based surveillance, integration of these with vector control activities, continuous training of field staff and of health care personnel for case management of DHF, integrated health education and community participation and improved legislation.

2.1.4 Dengue/DHF surveillance in CAREC - regional surveillance network

The PAHO/WHO Caribbean Epidemiology Centre (CAREC) provides epidemiology and laboratory reference services to 21 member countries in the Caribbean ranging from 4 000 to 2.5 million people per country and for a total population of 7.2 million people. CARISURV the surveillance system for the collection, analysis, interpretation, reporting and dissemination of Caribbean public health information has 12 components. Dengue surveillance is based on three components : EPISUM (the communicable disease database), LABIS (the laboratory information system) and PHLIS (the public health laboratory information system). The larger CAREC member countries have three reporting levels for communicable diseases, and in the smaller countries, the functions of level 2 are split between levels 1 and 3. All member countries use the same case definitions for dengue fever, dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS). Laboratory methods used are IgM ELISA, dengue virus isolation and PCR, and haemagluttination inhibition (HI). The objectives of laboratory surveillance are to identify new serotypes, identify spread of the epidemic into new areas and to monitor severe, complicated and fatal cases attributed to dengue fever. During epidemics, a limited number of probable cases are tested and laboratory confirmations of new dengue serotypes are reported immediately.

2.1.5 Characteristics of national dengue/DHF surveillance programmes

Four countries (El Salvador, Mexico, Nicaragua, Venezuela) presented their national programmes with a focus on the surveillance objectives, data collected, information flow and epi-lab coordination, weaknesses and challenges. Key points in the description of characteristics are summarized below:

- The principal objective of the national surveillance programmes in the four countries is to provide quality and timely information to decision-makers to facilitate disease prevention and control activities.
- The four countries collect data/information on different types of dengue cases (such as dengue fever, dengue haemorrhagic fever, hospitalizations, deaths, laboratory-positive cases) through different and parallel systems, usually weekly, but daily during epidemics.
- Regarding the information flow, the epidemiological and laboratory data collected by the several systems used in each country usually comes together at the epidemiology office at the central level that coordinates the data collection, analysis and feedback. All countries post the surveillance data on a website.
- Although one country indicated that the principal challenges in its system were to speed the movement and improve the quality of information, most countries indicated that the lack of human and material resources was the principal obstacle for surveillance.

2.1.6 Discussion

The discussion points concerning the participation of national programmes in DengueNet and the standards for reporting case-based and virological data to this global dengue/DHF surveillance system are included in the reports and recommendations of the epidemiology and laboratory working groups.

2.2 Session 2: DengueNet for global surveillance of dengue and DHF

Moderator: Dr Ray Arthur

2.2.1 Why global surveillance for dengue and DHF?

Globally 2.5 billion people now live in over 100 countries/territories where dengue viruses can be transmitted. The rapid spread of viruses through travel and trade has led to the global resurgence of epidemic dengue fever//DHF) in the Americas, South-East Asia, the Eastern Mediterranean and the Western Pacific.

The public health burden is due to the increase in both incidence and severity of dengue/DHF. Before 1970, only nine countries had experienced epidemic DHF. Now, the number has increased more than fourfold and continues to rise. A pandemic in 1998, in which 1.2 million cases of dengue fever and DHF were reported from 56 countries, was unprecedented. Data for 2001-2002 indicate a situation of comparable magnitude.

It is estimated that 50 million dengue infections occur each year with 500 000 cases of DHF and at least 12 000 deaths, mainly among children. Only a small proportion of cases are reported to WHO. The challenge for national and international health agencies is to reverse the trend of increased epidemic dengue activity and increased incidence of DHF.

Epidemiological and laboratory-based surveillance is required to monitor and guide dengue/DHF prevention and control programmes, regardless of whether the form of control used is mosquito control or possible vaccination if an effective and safe vaccine becomes available. The surveillance system should monitor dengue virus to show at any point in time, where dengue transmission is occurring, what serotypes are involved, and what type of illness is associated with the virus serotypes present.

Case reports should be transmitted from the local to the state/provincial to the national level and from there to WHO for international reporting and use. The reporting of dengue/DHF however is not standardized. Epidemiological and laboratory data are often collected by different institutions and reported in different formats, resulting in delay and comparability problems at regional and international levels. To address these problems and the rising disease burden,WHO has created DengueNet , an Internet-based central data management to:

- Collect and analyse standardized epidemiological and virological data in a timely manner and present epidemiological trends, as soon as new data are entered; and
- Display in real-time important indicators such as incidence data, case fatality rates (CFR) for DHF, frequency and distribution of dengue and DHF cases, number of deaths, and distribution of circulating dengue virus serotypes.

DengueNet will provide national and international public health authorities with epidemiological and virological information by place and time that can guide public health prevention and control actions. Being able to monitor virus transmission and circulating serotypes by place and time in the inter-epidemic periods will be useful for an early warning of dengue activity in neighboring states and countries to plan dengue prevention or control strategies; this is particularly important in the American region characterized by unstable dengue epidemic activity with emerging DHF cases.

The system also provides information on CFR by place and time and this can be used effectively to target training to countries and regions that need to improve the hospital-based

DHF case management to reduce CFR; this is particularly important in South-East Asia, where all four dengue viruses are endemic and DHF cases occur year after year and CFR are used to monitor progress in hospital case management and public education campaigns.

In addition, DengueNet contains valuable historical and current data that may be useful for public health researchers to support their research and that could be used by national and international agencies for advocacy purposes.

2.2.2 PAHO Resolution CD43.R4/working document CD43/12 for dengue prevention and control

http://www.paho.org/english/gov/cd/cd43.r4-e.pdf and
http://www.paho.org/english/gov/cd/cd43_12-e.pdf

The DengueNet system is compatible with the PAHO strategy and guidelines for epidemiological and laboratory surveillance of dengue/DHF in the Americas as described in the PAHO Resolution CD43.R4 and Working Document CD43/12 adopted by the Directive Council in September 2001.

2.2.3 WHO Resolution WHA55.17 for dengue fever/DHF prevention and control

http://www.who.int/gb/EB_WHA/PDF/WHA55/ewha5517.pdf

DengueNet is directly responsive to the resolution adopted at the 55th World Health Assembly in May 2002, asking Member States "to build and strengthen the capacity of health systems for surveillance, prevention, control and management of DF and DHF" and emphasizing the critical importance of strengthening laboratory diagnosis in affected countries.

2.2.4 DengueNet WHO's web-based global surveillance system for dengue/DHF

http://www.who.int/wer/pdf/2002/wer7736.pdf

DengueNet has been developed in collaboration with the WHO Collaborating Centre for Electronic Disease Surveillance for Public Health at the INSERM in France with seed financial support from NASA and TDR and based on the previously developed FluNet for global surveillance of influenza, also a collaborative development with this centre.

The main features of this Internet-based global surveillance system are:

- User friendly password-protected remote one standard data input by all DengueNet partners worldwide, with data updated on a real-time basis;
- Inclusion of the state/province subdivisions of the countries for which data will be entered and indicators such as incidence calculated;
- Dynamic query facility with analysis and presentation real-time information about epidemic activity and circulating serotypes in graphic, tabular, map and free-text formats ;
- Use of GIS tools to provide real-time map of the epidemiologial situation;
- Links to the dengue web pages of WHO offices, countries, collaborating centres, research and medical institutions working worldwide on dengue/DHF prevention and control;
- An up-to-date directory of national and international partners in the DengueNet network;
- Dengue news, information and document centre
- Available information accessible in the public domain.

At present, global dengue statistics from 1955 to 2001 can be accessed on DengueNet. As countries begin entering data into DengueNet, real-time updates of standardized epidemiological and virological data will become available. When DengueNet is fully implemented, public health authorities and the general public will have immediate access to epidemiological data on dengue, DHF cases and deaths based on standardized case definitions, and virological data on the circulating dengue virus serotypes, Den 1, 2, 3 and 4 that have been entered into the DengueNet database via the Internet directly by national health officials.

A key objective is to ensure that data of the highest possible quality is reported in a timely manner to DengueNet. This may be achieved by standards for surveillance, laboratory procedures and quality control that are supported by a strong partnership between the network partners involved including the national programmes, WHO collaborating centres and WHO country, regional and global levels.

2.2.5 Practical "hands-on" session with DengueNet

www.who.int/denguenet

A practical "hands-on" session with DengueNet was conducted and participants in groups of 2 to 4 were able to query DengueNet on the official data reported to WHO from 1955 to date from countries worldwide. They also reviewed the restricted data entry site in DengueNet.

2.2.6 Discussion

The discussions centred on the DengueNet website, the modifications and further developments needed, the target audience and the added value that this site provides. The roles and responsibilities of the users and providers were also discussed. Key points from discussions are included in the recommendations of the epidemiology working group.

2.3 Session 3: 1994 and 1996 WHO meetings on dengue labs in the Americas

Moderator: Dr Francisco Pinheiro

2.3.1 Summary of day 1

Dr Ray Arthur presented a summary of day 1 for the benefit of participants who joined the meeting on day 2.

2.3.2 1994 Cincinnati Meeting on diagnostic methods and commercial assays

Representatives from laboratories in Europe, Asia, Africa and the Americas met to review the diagnostic methods used and the commercial tests available for dengue diagnosis. Discussion centered on the ways to standardize and improve these techniques and on creating panels of well characterized sera for evaluating/validating new tests and commercial assays. Research priorities for WHO CCs included development of accurate and inexpensive rapid tests, evaluation of expression products as possible antigens in diagnostic tests and development of dengue serotype-specific serological assays. Expanding proficiency testing to include all dengue laboratories in the Americas was recommended and considered an important role of the WHO CCs (meeting report available).

2.3.3 1996 Rio de Janeiro Meeting on dengue laboratories in the Americas

At this meeting, an ad hoc committee of 12 dengue virologists met to review the capability and capacity in dengue laboratories in the Americas. A laboratory survey, including a PCR survey, was conducted in 16 countries in the Americas by PAHO, to focus on developing strategies to ensure the availability and quality of diagnostic reagents, validation of kits,

improving laboratory quality control, training and communications. Detailed recommendations that were developed on these issues are available in the meeting report. Recommendations include establishing of laboratory and surveillance networks, training, communications, reporting and feedback (meeting report available).

The preliminary survey of national laboratories, surveillance and reporting programmes conducted for this meeting showed that all countries have serological and virological testing capabilities but more attention needs to be given to availability of reagents, laboratory standards, continuity in service training and quality control programmes.

2.4 Session 4: Working groups on dengue epidemiology and laboratory

The participants, epidemiologists and laboratory specialists, divided into two working groups, one on dengue epidemiology and the other on laboratory, that convened for this session on day 2.

2.4.1 Working group on dengue laboratories

The laboratory working group included representatives from the following countries or jurisdictions in the Americas: CAREC, El Salvador, Guatemala, Mexico, Nicaragua, and Venezuela. Puerto Rico was represented by CDC Dengue Branch staff. The 6 collaborating centres were also represented. Two participants had also participated in the 1994 Cincinnati and the 1996 Rio de Janeiro WHO meetings on dengue laboratories in the Americas. The moderators were Dr Francisco Pinheiro and Dr Vance Vordam. The rapporteurs were Dr Delia Enria, Dr Luiza de Souza and Dr Rosa Alba Salas. The task of the laboratory group was to review the laboratory standards and quality control issues for dengue serological diagnosis and virus isolation building on the recommendations of the two previous WHO meetings on dengue laboratories in the Americas.

2.4.2 Working group on dengue epidemiology

The epidemiology working group included representatives from the following countries or jurisdictions in the Americas: French Territories, Brazil, El Salvador, Guatemala, Mexico, Nicaragua, and Venezuela. Puerto Rico was represented by CDC Dengue Branch staff. The three participants from Indonesia, Thailand, and Viet Nam also attended. The moderator was Dr José Rigau. The rapporteurs were Dr João Bosco Siqueira and Dr Enid Garcia. The task of the epidemiology group was to define the epidemiological data and reporting requirements for DengueNet, modifications needed to its present format, identification of countries for pilot testing and the roles and responsibilities of national and international partners.

2.5 Session 5: Reports on working groups on dengue epidemiology and laboratory

Moderator: Chairman and Dr Ray Arthur

The working groups presented their reports in a plenary session on day 3 followed by discussion and consensus on the recommendations and action points of each group.

2.5.1 Report of the working group on dengue laboratories

The meeting recommendations and action points for the laboratory topics considered, included an update of the1994 and 1996 meetings recommendations for these topics.

Reagents

a. Collaborating Centers (CCs) at CDC, UTMB, IEC, IPK will continue to support national laboratories capable of producing reagents such as antigens. This support includes technical assistance activities such as provision of protocols, seed virus, cell lines, consultation and training at CCs or at national laboratories. These activities will continue to be funded as previously by PAHO and WHO country offices.
b. PAHO should provide funds to CCs for reagent production, but national laboratories are encouraged to become self sufficient in supplies. For non antigen-producing labs use of kits is an option.
c. CDC will continue to do research on recombinant antigen to alleviate this problem.
d. CDC will continue to provide conjugate and monoclonal antibodies (and hybridoma cell lines to labs that have capacity for local production of MAbs) for ELISA and FA tests.

Quality control of antigen produced at country level

a. CCs will provide small amounts of standard reference antigen to the national labs for calibrating their locally produced reagent.
b. Every lab/country producing antigen is encouraged to send a vial from each batch produced to any of the CCs at CDC, IEC, IPK, and UTMB for quality control.

Proficiency tests

a. The CCs at CDC, IPK will continue to make proficiency tests for serology available. Feedback on results and recommended actions will be provided to individual laboratories. Results will guide PAHO in directing training and other support activities.
b. Participation in proficiency tests will be required to participate in DengueNet.
c. National laboratories are encouraged to request a test at least once a year.
d. National reference laboratories are encouraged to maintain in-country proficiency tests on a continuing basis. Consultations and technical assistance for establishing proficiency test procedures and panels can be obtained from the CCs. Proficiency tests for serology should be composed of at least 33% negatives, and the remainder of low to intermediate positives. Samples of various specificities should be included if available.
e. Proficiency tests for virus isolation/identification and PCR should be attempted within constraints of shipping regulations. CDC can import virus isolates for confirmation, however, exportation of live virus to collaborating countries is more difficult and time consuming.

Commercial kits

a. Diagnostic kits should be evaluated before they are used in national programmes. Mid-level evaluations ($\pm$200 samples) of kits, as they become known, will be performed at the CCs at CDC/Puerto Rico and UTMB/Texas and possibly also at the CCs at IPK/Cuba, IEC/Brazil and the National Microbiology Laboratory/Canada. Summaries of results will be available on request.
b. National and local laboratories are encouraged to perform low-level evaluations ($\pm$20 samples) to ensure that individual lots of kits are functional and that lab personnel is performing the test properly.
c. Attempts should be made to coordinate kit evaluations with WHO/TDR.

Training

PAHO should continue to support training in laboratory diagnostic techniques at the CCs and on site visits to the laboratories.

PCR

It is strongly recommended that laboratories using PCR for primary testing confirm positive results by cell culture isolation if possible, serologically, or by an independent set of primers before results are reported.

Detection of other flaviviruses and specific serologic diagnosis

a. Surveillance for YF, SLE, WN and other flaviviruses should be incorporated into dengue diagnostic protocols. These would include isolates positive with flavivirus group-reactive reagents, and negative in dengue-specific tests. Laboratories using PCR as screening tests should include flavivirus universal primers along with type-specific primer sets.
b. In anticipation of dengue vaccine trials and/or the appearance of new flaviviruses in an area, national laboratories are encouraged to acquire competence in the type-specific plaque reduction neutralization test (PRNT) for differential diagnosis. For those countries that have tissue culture capability, CDC can provide individual training in the PRNT.
c. In this regard, the evaluation of the specificity of serologic tests and antigen cross reactivity within the flavivirus genus was recommended.
d. Research programmes for the evaluation of the immune response in secondary flavivirus infections are encouraged.

Information exchange

It is recommended that countries should maximize coordination and electronic information exchange from laboratory to epidemiology sections in order to enable timely data entry into DengueNet.

Laboratory function

The primary function of national central laboratories should be disease surveillance rather than offering a diagnostic service. Accordingly, agreements should be made with public health authorities in advance that:

- the flow of samples from febrile patients during inter-epidemic periods should be maintained; and
- the laboratory will selectively test the highest priority samples during epidemic periods. High priority samples include fatal cases, DHF cases, hospitalized cases, and samples from areas not yet experiencing epidemic transmission.

Laboratory manual

Efforts will be made to arrive at a manual of standard laboratory procedures for virological and serological diagnosis of dengue virus infections as a reference for global use.

2.5.2 Report of the working group on epidemiology

The focus of recommendations and action points was on all topics that need to be considered for DengueNet pilot testing.

Country participation

All the representatives of countries in the Americas expressed interest in participating in the DengueNet pilot test, and the representatives of South-East Asian countries indicated interest in having the system expanded to include their region.

The representatives of countries in the Americas discussed the steps they would pursue to present DengueNet to country authorities, including national dengue committees and ministers of health. A two-month period (August - October, 2002) was considered adequate to obtain official authorization for the country's participation in the pilot programme.

It is expected that PAHO representatives in each country will support the meeting participants in presenting the DengueNet proposal, and that countries will send to WHO the electronic maps of their states or departments (with population data).

Additional time may be necessary before the start of the pilot testing with data entry, if there is need for installing any software or training personnel.

Pilot programme

Given the seasonal nature of dengue and the need to have sufficient time for periodic data entry, feedback to countries and to WHO, and additional time to test corrections or refinements, it was suggested that the pilot programme should last from three to six months, depending on the system's performance. Participants proposed the period from November 2002 to April 2003 and the following timeline:

Year	2002					2003						
Month	8	9	10	11	12	1	2	3	4	5	6	7
Obtain approval from countries' Ministries of Health	X	X	X	X								
Pilot programme- Data entry				X	X	X	X	X	X			
Pilot programme- Feedback from and to countries				X	X	X	X	X	X	X	X	
Pilot programme- Evaluation								X	X	X	X	X

Data collection

The discussion of the data to be included in DengueNet was organized around the principal epidemiologic variables of time, place, and personal characteristics, with the addition of information about the virus.

<u>Time</u>

Six of the eight participants from the Americas produce reports of suspected cases by week of report of case, while Brazil produces weekly reports of suspected cases by week of onset of illness, and Nicaragua produces reports of confirmed cases by week of onset of illness.
It was therefore decided that information should be entered by epidemiological week of report of case, but two countries, Brazil and Nicaragua, will provide data by week of onset.

Place

Countries will provide data at state/department level (depending on the country's terminology), except for the Caribbean island countries that will provide island-wide data only.

Personal characteristics

a. Only three countries routinely collect data on whether the case is hospitalized.
b. Six countries collect case age data by age group, and unfortunately the groupings are not identical, therefore participants agreed that information on sex and age could not be provided at this stage. Nevertheless, the information is available on each country's health website, and DengueNet should inform users to use the link to each country's website.
c. The clinical categories to be reported are dengue fever (DF), dengue hemorrhagic fever (DHF) and fatalities. Participants were encouraged to report both suspected and confirmed cases, as recommended by the Resolution CD43.R4 adopted in September 2001.
d. All participating countries in the Americas adhere to the WHO / PAHO clinical case definitions, but the usage is as follows:
    - In most countries, although there is a DF case definition, DF cases are not reported with specific symptoms and signs, so it is not possible to verify the clinical diagnosis.
    - In contrast, in most countries all reported cases of DHF are investigated, and the clinical signs, symptoms, and hospital records (if any) are reviewed to determine if the criteria for DHF are fulfilled.
e. For most countries, confirmation of cases requires a positive laboratory diagnosis of dengue, but cases with only a single positive anti-dengue IgM antibody determination are also considered confirmed (according to the WHO / PAHO laboratory case definitions, such cases would only be classified as probable).

    Two countries, Guatemala and Venezuela will classify a case as confirmed in the absence of a positive laboratory diagnosis of dengue, but only after a committee composed of epidemiologists and clinicians evaluates all data on the case and considers that the clinical illness is compatible with dengue.
f. Countries will report only confirmed fatalities in DengueNet, meaning only laboratory confirmed cases, except for Guatemala and Venezuela who also confirm fatalities by clinical criteria.
g. The calculation of case fatality rate (CFR) was discussed, and the group recommended that DengueNet calculate CFR using confirmed deaths as numerator and confirmed DHF cases as the denominator: CFR = Confirmed Deaths / Confirmed cases of DHF

Virus serotype

a. This information will be provided for the entire country as it is available, not necessarily every week, and it will be entered in a separate box (see Sample Form below), which will include the number of isolations of each serotype in the country for a given time period.
b. It was requested that the DengueNet screen be programmed to calculate the percentage that each virus represents among all virus isolations, and that the screen also shows the date of last update.

General considerations

All participants agreed on the following points:

a. Data will only be provided by the central level of each country (one source of data per country).

b. Data should be provided weekly, if possible, but it is recognized that during epidemic periods may require different routines

c. Indications of alert or epidemic situations should only be defined or posted by the respective country, and not by the DengueNet system itself.

d. Additional data will be provided in the countries' web pages, and a link should be made in DengueNet.

e. Several general notes must be displayed in DengueNet during the pilot testing:

- The DengueNet screen must always show a disclaimer indicating that "2002-2003 data are not official country information," or "2002-2003 data are provisional - System being tested."
- It was recognized that the data are public (and most countries display it on their own Health websites), but that the DengueNet system being in construction, may show data incorrectly for a brief period if any programming error occurs.
- There should be an indication that countries apply the WHO/ PAHO clinical definitions, and the specification of what "confirmed" means regarding laboratory diagnosis of cases and the classification of cases and fatalities (as noted for specific countries above).

Sample DengueNet Data Entry Form

Epidemiologic week: ___

Epidemiologial activity (optional)

State / Dept	Dengue Cases Probable	Dengue Cases Confirmed	DHF Cases Probable	DHF Cases Confirmed	Deaths Confirmed

Note: WHO/PAHO definitions in Annex 5.

Country report (optional)

Number and frequency of virus serotype isolations in the entire country (separate box)
(last update: xx/xx/200X)

___ Den1 (__%)
___ Den2 (__%)
___ Den3 (__%)
___ Den4 (__%)

Display the distribution of each serotype as % of the sum of all four serotypes.

Annex 1: Agenda

Meeting on DengueNet Implementation in the Americas
Follow up of 1996 Rio de Janeiro and 1994 Cincinnati meetings of dengue laboratories
San Juan, Puerto Rico 9 – 11 July 2002

Venue: Tuesday 9 July, Centers for Disease Prevention and Control, Division of Vector Borne Infectious Diseases, Dengue Branch

Time	Tuesday 9 July 2002	Presenter/Moderator
8:30 - 8:45	Welcome & introduction of participants, chairperson and rapporteur	Gary Clark
8:45 - 9:00	Objectives, expected outcomes process of meeting, background papers	Ray Arthur
9:00 - 9:30	The challenge of dengue/DHF epidemiological and laboratory surveillance	Duane Gubler
Session 1	National labratories and reporting systems for dengue/DHF	Moderator: José Rigau
9:30 - 10:00	Questionnaire survey – objectives, analysis and results	Jorge Arias
10:00 - 10:30	**COFFEE**	
10:30 - 10:45	CDC-PR laboratory based surveillance programme	José Rigau
10:45 - 11:00	Dengue fever in Brazil – past, present and perspectives	João B. Siqueira
11:00 - 11:15	CAREC sub-regional network	Rosa Alba Salas
11:15 - 12:30	Characteristics of national programmes in the Americas	
	El Salvador, Mexico, Nicaragua, Venezuela	Romeo Humberto Montoya
	• Objectives of surveillance	Luis Anaya Lopez
	• Data collected - reporting and feedback	Wendy Idiáquez
	• Information flow – institutions and levels involved	Fátima Garrido
	• Epi-lab coordination	
	• Weaknesses	
	• Discussion	
12:30 – 13:30	**LUNCH**	
Session 2	DengueNet global surveillance network for dengue/DHF	Moderator: Ray Arthur
13:30 - 14:00	Why global surveillance for dengue/DHF	Ray Arthur
14:00 - 14:20	PAHO/WHO resolutions on dengue/DHF	Jorge Arias/Mike Nathan
14:20 - 15:00	Presentation of DengueNet - WHO's Internet based system for global surveillance of dengue/DHF	Renu Dayal Drager
15:00 - 15:30	**COFFEE**	

15:30-16:30	DengueNet hands-on session with the internet site	Gary Clark/
16:30-17:00	Discussion DengueNet system	Renu Dayal Drager
17:00-17:30	Centre visit and individual meetings	

VENUE: Wednesday 10 July – Thursday 11 July 2002
Condado Plaza Hotel, San Juan Puerto Rico

Time	**Wednesday 10 July 2002**	**Presenter/Moderator**
Session 3	Review of the 1994 &1996 WHO Meetings on Dengue Laboratories in the Americas	Moderator: Francisco Pinheiro
8.30 – 9:15	Presentation of recommendations, follow up and pending issues	Gary Clark
9:15 – 10:00	Summary presentation of day 1 discussions on Denguenet implementation/ pilot testing	Ray Arthur
10:00 – 10:15	Break up into two working groups process, objectives and outputs	Chairman/Renu Dayal-Drager
10:15 –10:45	**COFFEE**	
Session 4	Working groups on epidemiology and laboratory	
10:45-11:00	Participants, moderators and rapporteurs	Chairman/Renu Dayal Drager
	Working group 1: Epidemiology	Moderator: José Rigau
	Rapporteurs: João Siqueira & Enid Garcia	
	Working group 2: Laboratory Rapporteurs: Delia Enria & Rosa Alba Salas	Moderators: Vance Vordham & Francisco Pinheiro
11:00-12.30	Working groups	
12:30-13:30	**LUNCH**	
13:30-17:30	Working groups (cont.)	
18:00	Cocktail reception - bus from hotel	
Time	**Thursday 11 July 2002**	**Presenter/Moderator**
Session 5:	Reports of working groups in plenary session	
8.30 - 9:30	Report of working group 1: Epidemiology	João Siqueira
9:30 –10:30	Report of working group 2: Laboratory	Rosa Alba Salas
10.30 –11:00	**COFFEE**	
11.00- 12.00	Discussion, concensus and recommendations	Chairman/Ray Arthur
12:00 –12:15	Close Meeting	Chairman
12.15– 13:00	**LUNCH**	

Annex 2: List of participants

Meeting on Denguenet Implementation in the Americas
Follow up of 1996 Rio de Janeiro and 1994 Cincinnati Meetings of Dengue Laboratories
9 – 11 July 2002
San Juan, Puerto Rico

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Annex 3: Background documents

Participants received the following background documents at the meeting:

- 2002 WHO Executive Board report on dengue prevention and control;
- 2002 World Health Assembly Resolution on dengue;
- WHO dengue fact sheet;
- Dengue haemorrhagic fever, 2nd ed.;
- Reports of 1994 and 1996 WHO meetings on dengue laboratories in the Americas; DengueNet brochure.

Annex 4: Abstracts of presentations of national programmes

PAHO Survey of National Dengue Programmes and Laboratories
Dr Jorge Arias

A comprehensive questionnaire was developed for dengue national programmes and laboratories and a preliminary survey was conducted for participating countries and WHO Collaborating Centres. Preliminary results of the completed questionnaires are reported.

All laboratories surveyed have adequate equipment.

Dengue is of mandatory obligation in 8 of the countries, not obligatory in 3 and there was no response from one. This information includes the CC countries.

DHF is of mandatory notification in 7 of the countries, not obligatory in 4 and there was no response from one. This information includes the CC countries.

Dengue reporting frequency is variable depending on the country and the situation. During epidemics it is daily.

Dengue is notified by a wide array of methods; electronic, paper, mail, fax, telephone.

Table 1.- Number of questionnaires sent / received

	Sent	**Received**
Collaborating Centers (CCs)	8	8*
Countries	7	5**
Total	15	13

*includes CAREC ** one not included in results

Table 2.- Communication

	W/ internet	**Home pg.**
Collaborating Centers (CCs)	8	7
Countries	3	2**
Total	11	9

Table 3.- Human resources available

	Central lab.	**Other labs.**
Collaborating Centers (CCs)	2 to 21	--
Countries	8 to 26	2 to 124

Table 4.- Affiliation and financing

	Affiliation	**Financing**
Collaborating Centers (CCs)	Public Health University	Cent. Gov., Local Gov. PAHO, WHO, others
Countries	Public Health	Central Gov. PAHO, WHO, USAID

Table 5.- Training

	1999 - 2001	**Financing**
Collaborating Centers (CCs)	>150	CCs, various
Countries	2 - 41	CCs, Central labs, PAHO, FOGARTY

Table 6.- Communication with PAHO

	Yes / no	**Requires authorization Yes / no**
Collaborating Centers (CCs)	4 / 4	4 / 4
Countries	3 / 1	2 / 2

Table 7.- Want to participate in DengueNet?

	Yes / no
Collaborating Centers (CCs)	6 / 1 (1 nr)
Countries	3 / 0 (1 nr)

(nr = no response)

Table 8.- Are reference laboratories?

	Yes / no	**Level**
Collaborating Centers (CCs)	8 / 0	World, regional, national
Countries	4 / 0	National, state

Number of laboratories in the countries vary from 1 to 33.

Table 9.- Number of samples processed for:

	Surveillance	**Lab. capacity**	**Actual capacity**
Collaborating Centers (CCs)	7 adequate, 1 insufficient	6 adequate, 2 too many	5 as at present, 2 double actual, 1 no limit
Countries	4 adequate	3 adequate, 2 too many	3 as at present, 1 double

Table 10.- Identification of virus

	Number of isolates	**% success virus isolation**
Collaborating Centers (CCs)	200 to 37,000	14.5 to 25.8% (variable per year)
Countries	3,500 to 12,000	8.2 to 44% (variable per year)

Table 11.- Antigens

	Prepare their own	**Can supply**
Collaborating Centers (CCs)	7 yes, 1 nr	6 yes, 1 no, 1 nr
Countries	3 yes, 1 nr	2 yes, 2 no

Table 12.- Quality control

	Has internal QC	**Participates in external QC**
Collaborating Centers (CCs)	6 yes, 1 no, 1 nr	--
Countries	4 yes	4 yes

The dengue surveillance system in Puerto Rico http://www.salud.gov.pr/index.asp
José G. Rigau-Pérez, MD, MPH, Chief, Epidemiology Section, CDC Dengue Branch

Dengue surveillance in Puerto Rico is a joint effort of the Puerto Rico Department of Health (PRDH) and the US Centers for Disease Control and Prevention. A reported case is defined as any person whose illness is considered compatible with dengue by a health care professional in Puerto Rico, and whose diagnostic sample is sent to the CDC Dengue Branch for testing. For DHF, we adhere strictly to the WHO/PAHO definition. The routine laboratory methods are virus isolation, IgM and IgG (ELISA) tests, and immunohistochemistry for antigen detection in autopsy samples. At least 75% of reported cases are dengue (that is, the predictive value of a report is at least 75%).

The goals and objectives of the Puerto Rico dengue surveillance system are to provide early and precise information on when and where transmission is occurring, the serotypes present, and disease severity; and to predict transmission and guide implementation of clinical and vector control measures (anticipatory or proactive surveillance). This is a laboratory-based, population-based surveillance system, with close coordination of epidemiology and laboratory components. Physicians, laboratories, and hospitals send diagnostic samples and Dengue Case Investigation Forms (DCIF) from throughout the island. Voluntary reports of hospitalized suspected dengue cases are sent by the hospital Infection Control Nurses. We also review all death certificates from Puerto Rico that mention dengue. There is no routine entomologic surveillance, but the surveillance system is constantly evaluated. Diagnostic results are provided to the submitting source and to PRDH vector control staff, and epidemiologic analyses are disseminated through weekly surveillance reports with a solid statistical basis (for determination of deviations from expected trends). Early signals for increase in dengue activity include a virus isolation positivity rate greater than 9% in May (typically the month of lowest dengue incidence), and significant increases in reports (compared to baseline average, even if few cases) from municipalities or throughout the island.

Key attributes of the surveillance system include simplicity (submission of sample fulfils the legal reporting requirement), acceptability (there is no charge for transport and testing, and test results are returned to the submitting source), flexibility (during epidemics, alternate methods can be adopted), high coverage (samples are received from all 78 cities, all age-groups and socio-economic levels). Severity markers have high specificity (>95%) but low sensitivity (passive reporting identifies 7% of DHF cases). Timeliness is constrained by the characteristics of disease transmission and diagnostic methods, so that an average 17 days elapse from transmission to report (mosquito bite to onset of disease - 7 days, onset to delivery of sample - 10 days). No exact budget data are available to define the monetary costs incurred by the CDC and PRDH for dengue surveillance in Puerto Rico, but the system involves an estimated 25 persons (not full time; they have other responsibilities as well).

Dengue Fever in Brazil – past, present and perspectives www.funasa.gov.br
Dr João Bosco Siqueira Jr., Centro Nacional de Epidemiologia

Brazil is located in South America and has a population around 174 million people. The country has 27 states distributed in 5 regions: North, Northeast, Southeast, Central-West and South. Together the Northeast and the Southeast regions represent 70% of the population.

Dengue was first detected in 1986 in Rio de Janeiro state, with the introduction of dengue serotype 1. Dengue 2 was also detected in Rio in 1990. During the 90's the number of municipalities infested with *Aedes aegypti* had a major increase, especially after 1994. This led to an increase incidence of dengue in the second half of last decade. Initially cases were only

reported in the Northeast and Southeast regions. After 1994 cases started to occur in the Central-West and in the North regions as well, however the majority of the cases were still reported in the NE and SE regions. The highest incidence was observed in 1998 with over 530,000 cases.

Dengue 3 was detected in the state of Rio de Janeiro in December, 2000. This new serotype was responsible for Brazil's largest epidemic in the first four months of 2002 which to date has resulted in over 560,000 cases being reported (preliminary data). The state of Rio the Janeiro represented 53% of this total between January and March, 2002. Epidemics were also detected in the other regions except for the North which reported 60% fewer cases than the year before.

The epidemic in Rio de Janeiro forced the Ministry of Health to adopt additional control measures. A task force was organized and was temporally transferred to Rio. This consisted of 18 supervisors and a 1,000 dengue control field agents selected from other states. The Armed Forces also participated in this operation, sending 1,300 men to work in larvae source reduction along with the task force. Truck mounted and back pack ULV were used to reduce adult mosquito populations. Medical assistance / access were improved with the training of health care workers, increased staff availability and 24 hour outpatient clinics.

A dengue D-Day was also organized. For this day FUNASA´s Board of Directors moved to Rio de Janeiro. A Community Mobilization Committee and an intense media campaign (radio, TV, newspapers, posters, folders) were organized and coordinated with neighborhood associations, including: churches, local media, other institutions. Over 18 million pamphlets with information on household dengue prevention were distributed. A total of 30,536 civil servants and 714,445 volunteers participated in the activities. A total of 5,291 tons of garbage was collected and removed from strategic areas. At least 3,210 non-occupied residences were visited. The number of reported cases started to reduce in the end of February and now only few cases are being reported.

Eradication of *Aedes aegypti* cannot be achieved in a short term. All efforts must be to prevent disease instead of controlling outbreaks. The National Program for Dengue Control for the prevention and control of dengue will be presented to the minister in July 2002. This program strategy focuses on regional specificity (actions according to regional problems), integration of control activities (vector control, health education, community mobilization, surveillance, water supply problems and adequate garbage handling), continuous prevention actions and personnel training for surveillance, medical assistance and vector control activities.

The objectives are:

- To reduce dengue incidence dengue by 50% in 2003 and 25% for each following year.
- To prevent dengue outbreaks and reduce the case fatality rate DHF to below 1%.
- To reduce the infestation indexes of Aedes aegypti to below 1%

A brief summary of the program components is listed below:

- Surveillance – improve actions by integrating cases and laboratory based surveillance with vector control activities.
- Medical assistance – continuous training of health care works to handle DHF
- Vector control activities – training over 70,000 filed supervisors
- Integrated actions of health education and community participation
- Legislation – identifying and approving laws to deal with closed buildings
- Evaluation and follow up of the programme

The National Program of Dengue Control will soon be available on FUNASA's web page www.funasa.gov.br. Data on dengue cases for 2002 and past years is also available at this site.

Dengue Surveillance in CAREC Member Countries http://www.carec.org
Dr Eldonna Boisson, CAREC

The Caribbean Epidemiology Centre (CAREC) is a PAHO/WHO health monitoring and disease prevention agency, that provides laboratory reference and epidemiology services to 21 member countries in the Caribbean. These countries range in size from 21 to 4,411 square miles and have a total population of 7.2 million people, ranging from 4,000 to 2.5 million people per country.

CARISURV is a surveillance system for the collection, analysis, interpretation, reporting and dissemination of Caribbean public health and is comprised of twelve components. Three of these components have a focus on dengue surveillance, namely, EPISUM (the communicable disease database), LABIS (the laboratory information system) and PHLIS (the Public Health Laboratory information System).

CAREC member countries use the following case definitions for dengue fever, dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS):

Dengue fever

Probable case: A person with acute onset of fever and two or more of the following:

- Headache
- Retro-orbital pain
- Myalgia
- Arthralgia
- Rash
- Haemorrhagic manifestations
- Supportive serology (e.g. high single HAI titre)

Confirmed case

- Laboratory confirmed: A probable case with diagnostic laboratory findings
- Epidemiologically confirmed: A probable case occurring at the same location and time as a laboratory confirmed case *DHF*

Probable case: A person with fever or recent history of fever and evidence of:

- Haemorrhagic tendancies
- Thrombocytopenia (100,000 mm^3 or less)
- Plasma leakage

Confirmed case: Same as for dengue fever

DSS

Probable case: Evidence of circulatory failure manifested by all of the following:

- Rapid and weak pulse
- Narrow pulse pressure or hypotension for age
- Cold clammy skin and altered mental status

Confirmed case: Same as for dengue fever
Laboratory diagnosis of dengue is defined by one of the following:

- Detection of IgM antibodies to the dengue virus by capture ELISA
- Isolation and identification of dengue virus from acute serum
- Dengue virus in clinical material in PCR
- Fourfold or greater rise in flavivirus antibody titres between acute and convalescent phase serum specimens by the HI test

The objectives of laboratory surveillance are to identify new serotypes, identify spread of the epidemic into new areas and to monitor severe, complicated and fatal cases attributed to dengue fever. As such, during an epidemic, laboratory surveillance occurs on a limited number of probable cases and all laboratory confirmations on new dengue types are reported immediately.

The larger CAREC member countries have three reporting levels for communicable diseases, in many of the smaller countries the functions of level 2 are split between levels 1 and 3.

The functions of Level 1 are to:

- Identify probable cases
- Complete case investigation forms
- Collect acute blood samples
- If necessary, report outbreaks to level 2
- Forward laboratory results to level 2

The functions of level 2 are to:

- Conduct epidemiological investigations of all cases reported by level 1
- Forward weekly reports to the national level

The functions of level 3 are to:

- Collate country reports
- Institute control measures if necessary
- Report summary data to CAREC

Surveillance of dengue vectors is done via:

- Measurement of container indices (House index, Breteau index, container index)
- Collection of eggs by ovitrap
- Collection of adults by backpack aspirator

Since 1991, there has been an upward trend of reported cases of dengue and DHF/DSS from CAREC member countries. The disease has also been seasonal, with greater numbers of cases being reported in the rainy season.

Between 1977 and 1994 dengue viruses type 1, 2 and 4 have been circulating in the Americas. Dengue virus type 3 was first introduced into the Caribbean in 1997 and to date almost all member countries have reported cases of DEN-3.

Information on Epidemiological Surveillance of Dengue in El Salvador (Summary)
http://www.mspas.gob.sv/vigilancia_epid2002.htm
Dr Romeo Humberto Montoya/Ministerio de Salud de El Salvador

Surveillance objectives

Maintain a surveillance system of national reportable diseases, with emphasis on quality and timeliness, especially for dengue since this has become a public health problem in El Salvador from the beginning of the 1970s. The objective is to provide information for adequate decision-making to our authorities at national, state and local levels.

Data collection

There is a weekly epidemiological report for several diseases including dengue and DHF that includes data on sex, age, facility, department or state.

There is also daily surveillance for dengue, which is compulsory during epidemics. Data collected include: name, age, sex, address, department, municipality, date of start of symptoms, date of sampling (IgM), symptoms, laboratory tests, contacts of patient.

Information flow

Begins when the patient comes into contact with the physician in the health centre or hospital and is clinically suspected to have dengue, in accordance with the case definition established by the national standard for dengue. The physician fills the sheet with case reporting form and reports via fax to the higher level (Basic Comprehensive Health System - SIBASI). In turn, SIBASI reports to the central level (National Unit of Epidemiology) where the information is entered into a database (EpiInfo) for analysis.

Actions against dengue are initiated from the first clinical suspicion without waiting for the laboratory confirmation as this takes between 1 to 2 weeks.

Coordination between epidemiology and laboratory

We coordinate closely with the laboratory, not only for epidemiological surveillance of dengue but for others diseases. Joint projects include the establishment of the network of viral dengue surveillance in border areas and in the interior of the country.

Weaknesses and challenges

The principal weakness is understaffing of the epidemiology unit and the shortage of epidemiologists in the SIBASI. We are addressing this by training epidemiologists with the support of the CDC. At present 80 have been trained in basic epidemiology, 40 graduates in epidemiology , and 6 are being trained in field epidemiology. The second group is being trained, in order to strengthen the basic and intermediate levels.

Epidemiological dengue surveillance system in Mexico

http://busqueda.yupimsn.com/categorias/salud/enfermedades/infecciosas/dengue/

Dr Luis Anaya Lopez, Subdireccion de vigilancia Epidemiologica, Direccion General de Epidemiologia, Ministerio de Salud

Surveillance Objective

Provide quality and timely information to support the health personnel and activities of the National Program of Vector-borne Disease Prevention and Control.

Data Collection and information flow

Epidemiological surveillance is legally based on the 4th Constitutional Article, of the general health law that is the basis of the Mexican Official Standards/Norms (NOM). NOM 017 deals with epidemiological surveillance and another NOM for the prevention and control of Dengue.

In Mexico the National Center of Epidemiological Surveillance oversees the General Bureau of Epidemiology, the Institute of Epidemiological Reference (surveillance laboratory), and the National Program of Disease Prevention and Control. Within this scheme, the General Bureau of Epidemiology is in charge of the National Epidemiological Surveillance System (SINAVE).

Within the SINAVE is the Single Information System for Epidemiological Surveillance (SUIVE), which generates morbidity information using three formats. The SUIVE 1 form collects weekly data of over 90 diseases including DENGUE. This is part of passive surveillance. The SUIVE 2 form is the epidemiological case reporting form and is used to collect data for the confirmed cases of DENGUE. The SUIVE 3 form collects data on outbreaks.

Mortality within the SINAVE is analysed within the framework of the Epidemiological and Statistical System of Deaths (SEED). Death certificates are the source of information for this system. Each death from DENGUE is investigated by the Jurisdictional Epidemiologist and can be confirmed or rectified.

Another component of the SINAVE is hospital based surveillance, that is carried out through the Hospital Network of Epidemiological Surveillance (RHOVE). In this case information on the management of cases hospitalized by DENGUE is produced.

The SINAVE has a pyramidal organization, the base is the local level, consisting of medical units (around 16,000). The next level is the jurisdictional formed by 256 health jurisdictions throughout the country. The following level is the state level consisting of 32 states, and the top level is the national level. The information flows from local to national level following this structure

Weaknesses and challenges

The challenges are to improve both the quality and the timeliness of the information. With regard to the timeliness, the principal problem is communication among the levels, and to improve this an Internet system will be established at the end of this year. With regard to the improving quality of the information, training and other projects are being instituted to improve adequate filling of the forms and strengthening laboratory capacity.

Epidemiological Surveillance of Dengue Nicaragua http://www.minsa.gob.ni/

Dr Wendy Cecilya Idiáquez Mendoza, Vigilancia Epidemiológica de Dengue, Dirección General de Salud Ambiental y Epidemiología

Surveillance objectives

Obtain timely information in order to carry out the actions of disease prevention and control. Information for the action.

Data collection

Information is obtained through the forms for compulsory notifiable disease (ENO) and information for 1st and 2nd sample.

Information flow

This is originated by the attending physicians at the different levels of care, then transmitted to municipalities, then to the departments (in Nicaragua these are called SILAIS local systems of comprehensive health care), and from there to national level.

Analysis is carried out at the central and SILAIS levels. The SILIAS have autonomy to carry out the prevention and control actions. The national level carries out technical assistance and supervision.

The software SISNIVEN is used for epidemiological surveillance, including dengue, allows data entry from the municipal level upwards.

Starting in July, work is being done on the decentralization of the diagnosis of dengue in three regional laboratories.

The feedback of the information is provided through the weekly Epidemiological Bulletin available in hard copy and online.

Coordination between epidemiology and laboratory

There is good coordination between epidemiology and laboratory.

Weaknesses

Budgetary
Laboratory reagents
Personnel training
Laboratory equipment
Sample transportation
Automation of the laboratory information
Medical consumables
Consubables for vector control
Incorporation of data into software on a weekly basis not daily.

There are geographical remote localities with difficult access to health units. As dengue diagnosis continues to be centralized in the CNDR, the SILAIS are struggling with limited budgets to cope with the costs of shipment of lab specimens. To improve this situation, in mid June, we have initiated a process of decentralization of the serological diagnosis of dengue.

Strengths

Location of Epidemiology in the organizational chart of the Ministry of Health.
Level of organization of Epidemiological Surveillance.
Existence of a Software with alert applications.
Feedback of the Surveillance System.
Personnel trained in field activities.
Programmatic ínter coordination
Functional system that regularly reports the cases and outcomes.

Challenges

Strengthening of Epidemiological Surveillance with human and financial resources.
Improvement of the currently used surveillance software.
Strengthening of hospital monitoring

Epidemiological Surveillance of Dengue Venezuela
http://www.msds.gov.ve/msdsweb/Index.html
Dra Fatima Garrido Epidemiólogo de la Dirección de Vigilancia Epidemiológica y Análisis Estratégico, Ministerio de Salud y Desarrollo Social (MSdS), Venezuela

Objective

To obtain a timely picture of the health situation in Venezuela to implement appropriate strategies of intervention to maximize a positive impact.

Data collection

Most cases of dengue are notified by the physicians from both private and public healthcare facilities. Venezuela also has a 800 telephone number for the public to report suspected cases of dengue which are then investigated by health authorities. The DHF cases are notified through case report forms that include: age, sex, hospital, state, symptoms, lab results, date of notification, date of onset, date sample were taken.

Information flow

Suspected dengue cases are reported by the examining physician (ambulatory, hospitals, private health care centers) to the district health authorities. At this level the malaria Unit is alerted to take control actions including treatment of the cases, health promotion, and monitoring the clinical course of patients. The district epidemiologist reports notifications and analysis to the regional level on a daily, weekly, monthly basis. The districts report to the epidemiology central unit (MSDS).

Coordination between epidemiology and laboratory

The cooperation is very good. There is dengue laboratory diagnostic capability in all the states. The reference laboratory (INH) is in Caracas.

Weakness and challenges

There is a general problem of understaffing in the epidemiology services including for dengue. Communication with remote states and parishes is difficult (no fax). Need to improve diagnosis for DHF.

Annex 5: Case definitions dengue/DHF

Epidemiological Bulletin, Vol. 21 No. 2, June 2000

Dengue: Rationale for surveillance

Dengue fever, including Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS), is the most significant arthropod-borne viral disease worldwide. It occurs in over 100 countries and territories and threatens the health of over 2,500 million people in tropical and subtropical regions. Dengue fever is a severe disease with high epidemic potential. An estimated 500,000 patients, 90% of them below the age of 15, are hospitalized with DHF/DSS every year. The World Health Organization (WHO) aims to accelerate the final development of an attenuated dengue vaccine.

Recommended case definition Dengue fever

Clinical description: An acute febrile illness of 2-7 days duration with 2 or more of the following: headache, retro-orbital pain, myalgia, arthralgia, rash, hemorrhagic manifestations, leucopenia.

Laboratory criteria for diagnosis:

One or more of the following:

- Isolation of the dengue virus from serum, plasma, leukocytes, or autopsy samples,
- Demonstration of a fourfold or greater change in reciprocal IgG or IgM antibody titers to one or more dengue virus antigens in paired serum samples,
- Demonstration of dengue virus antigen in autopsy tissue by immunohistochemistry or immunofluorescence or in serum samples by EIA,
- Detection of viral genomic sequences in autopsy tissue, serum or CSF samples by polymerase chain reaction (PCR).

Case classification

Suspected: A case compatible with the clinical description.

Probable: A case compatible with the clinical description with one or more of the following:

- Supportive serology (reciprocal hemagglutination-inhibition antibody titre greater than 1280, comparable IgG EIA titre or positive IgM antibody test in late acute or convalescent-phase serum specimen);
- Occurrence at same location and time as other confirmed cases of dengue fever.

Confirmed: A case compatible with the clinical description, laboratory-confirmed.

Criteria for Dengue Hemorrhagic Fever/Dengue Shock Syndrome:

Dengue Hemorrhagic Fever:
A probable or confirmed case of Dengue and Hemorrhagic tendencies evidenced by one or more of the following:

Positive tourniquet test
Petechiae, ecchymoses or purpura
Bleeding: mucosa, gastrointestinal tract, injection sites or other
Haematemesis or melaena
and thrombocytopenia (100 000 cells or less per mm3)
and evidence of plasma leakage due to increased vascular permeability, manifested by one or more of the following:
more than 20% rise in average hematocrit for age and sex
more than 20% drop in hematocrit following volume replacement treatment compared to baseline signs of plasma leakage (pleural effusion, ascites, hypoproteinemia)

Dengue shock syndrome:

All the above criteria, plus evidence of circulatory failure manifested by rapid and weak pulse, and narrow pulse pressure (less than 20 mm Hg) or hypotension for age, cold, clammy skin and altered mental status.

Recommended types of surveillance

Areas where no dengue transmission has been detected but where Aedes aegypti occurs: surveillance of suspected cases with investigation of clusters of suspected cases for dengue.

Countries where disease is endemic with seasonal variations in transmission, and areas where epidemic dengue occurs: routine weekly/monthly reporting of aggregated data of suspected, probable and confirmed cases from peripheral to intermediate and central levels.

Recommended minimum data elements

Case-based data at the peripheral level
Case classification (suspected/probable/confirmed), serotype, DHF/DSS present (Yes/No)
Unique identifier, name of patient, age, sex, geographical information
Date of onset
Hospitalized (Yes/No)

Outcome
Travel history during past 2 weeks
Aggregated data for reporting
Number of cases by age group
Number of confirmed (and serotype)
Number of DHF/DSS cases by age group
Number of hospitalizations and deaths

Principal use of data for decision-making

Target high risk areas for intervention.
Monitor changes in serotype and rate of DHF/DSS.
Monitor trends in endemic disease or re-emergence of disease.

For copies, please contact:
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World Health Organization
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CH-1211 Geneva 27
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