

Post Hurricane Mitch Rehabilitation & Laboratory Capacity Study

Final Report

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History and Background:

Hurricane Georges struck the Eastern Caribbean, the Dominican Republic and Haiti in August, 1998 and Hurricane Mitch hit Central America in October 1998 with an impact consistent with the kind of hurricane that emerges only once in a 100-200 year period. Hurricanes Mitch and Georges left behind unprecedented levels of destruction and hundreds of thousands of shattered lives. The countries affected by the hurricanes sustained enormous damage to their entire public health infrastructure, including their public health laboratory capacity.

In 1999, the US Congress passed an emergency appropriations bill to aid the countries that sustained the greatest damage in rebuilding basic infrastructure and developing plans to address future emergencies. The money was awarded to the US Agency for International Development (USAID). USAID entered into an interagency agreement with the Centers for Disease Control and Prevention (CDC) to collaboratively address the public health issues. The CDC through the National Centers for Environmental Health (NCEH) in turn contracted with the Association of Public Health Laboratories (APHL) to develop and work on the Public Health Laboratory Reconstruction and Capacity Building portion of the program.

In March 2000, APHL entered into a two-year cost reimbursable contract with CDC-NCEH to work in seven countries, Costa Rica, Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, and Nicaragua.

The negative consequences of the hurricanes on public health laboratory infrastructure included the following:

- ◆ Physical impact of the hurricanes on laboratory infrastructure,
- ◆ Increased demand for laboratory services as a result of contamination of drinking water supplies, infectious disease outbreaks, and disruption of services, and
- ◆ New and emerging disease and exposure threats as a result of the hurricane that required expertise and technology not yet available in the affected countries.
- ◆ Laboratory facilities and equipment damaged or destroyed resulting in decreased testing capacity and long-term deficits to laboratory infrastructure
- ◆ Demand for laboratory services increased as a result of contamination of drinking water supplies, infectious disease outbreaks, and disruption of food safety and public safety services, and
- ◆ Risk of new diseases emerging due to disruption of environmental conditions and increased exposure to endemic diseases, many of which require testing technologies not available in the affected countries.

These countries required improved laboratory capacity for many endemic diseases of priority health concern, including: diarrheal diseases, malaria, dengue fever, acute respiratory infections, parasitic diseases, cholera, Venezuelan equine encephalitis (VEE), leptospirosis, schistosomiasis, yellow fever, and hantavirus. In addition, rapid testing methods and surge capacity were required to provide sufficient laboratory diagnostic

support for outbreaks of malaria, cholera, and leptospirosis which followed the hurricane. And finally, food and water safety had been jeopardized by the devastation of the hurricane.

Public health laboratory and disease surveillance systems suffered great setbacks from the disastrous effects of Hurricane Mitch. It was critical to not only repair the damage to the public health laboratory infrastructure, but also put in place a cooperative strategic and emergency laboratory network. Ensuring a well-equipped, well-trained network of public health laboratories in the Central America region and linking this network with the public health laboratory network in North America will strengthen the capacity and capabilities of this critical health resource. Further, a cooperative network would serve to promote information sharing and strengthen preparedness for response to future emergencies. The physical damage reported by news media, health organizations, relief agencies and others indicated that rehabilitation and capacity building were critical needs for the public health infrastructure in the countries affected by Mitch and Georges.

The World Health Organization recommends that all countries should have the ability to provide laboratory diagnosis of “common” diseases endemic in their areas and the ability to refer specimens for testing of suspected “uncommon” diseases to an appropriate laboratory. However, even prior to the devastation of Hurricane Mitch, laboratory infrastructure in the region was deficient, as shown by laboratory assessments carried out in the region in recent years by PAHO and the Association of Public Health Laboratories (APHL). Following the hurricane, an assessment of the public health laboratory situation in Honduras was conducted. Specific needs that were identified included facilities improvement, basic equipment, staff training, reference materials and practice guidelines. Basic laboratory infrastructure must be built so that all countries have basic technical capacities to support government response to health emergencies such as was faced with Hurricane Mitch.

Each affected country had special conditions that were considered for effective laboratory rehabilitation, capacity building and improvement of surveillance capabilities. Designated central or national laboratories for each country were the primary focus for rehabilitation and training in order to build a foundation for sustainable improvement in laboratory and epidemiological services.

Methodology

APHL’s cost reimbursable contract with CDC-NCEH was to address a portion of an overall project coordinated through the CDC Epidemiology Program Office (EPO). All public health laboratory activities were classified as Intermediate Result 3 (IR3). APHL was given two years to complete the objectives outlined in our project proposal.

APHL established a committee of Country Liaisons to serve as the technical advisors for the project. APHL Laboratory Directors were paired with each country to develop plans to address the needs outlined after brief assessments were conducted in the seven project countries. These proposals included objectives that fell under the project’s three focal areas: training, purchase of equipment and supplies, and rehabilitation of key laboratories. These focal areas were chosen because training would not be deemed

successful unless the labs had the appropriate equipment and equipment could not be properly installed if there was not adequate space or electrical current.

Each country submitted a proposal to USAID, subsequently had the proposals approved, then APHL received copies of the proposals to begin work on IR3.

To implement activities APHL developed the following strategy:

1. Countries would propose activity or submit equipment request
2. APHL Country Liaison would review request, discuss it with the project contact in country and approve or deny the request
3. Upon approval APHL staff would coordinate with the appropriate party to implement the activity or purchase the equipment

Training was conducted both at US labs and in country. Training needs were assessed, curricula developed and laboratory technicians identified for training in focal disease areas such as Dengue, Measles, Cholera etc. Training in the US was organized through the Country Liaisons. An appropriate lab was identified, the Country Liaison and Country contact worked to develop the curriculum, and outline was provided to the training participant. APHL staff made logistical and travel arrangements for training participants.

Training at the country level was to either replicate methodologies learned in the US lab training, or develop new training using local resources such as Universities and PAHO in country staff. For example in Nicaragua, the Laboratory staff worked with the Country Liaison to develop a three-month basic bacteriology course that was administered to 32 laboratorians.

Equipment purchases were conducted in two ways. First, APHL contracted with Fisher Scientific to purchase laboratory supplies and reagents in bulk. Countries developed equipment lists; APHL Country Liaisons approved the lists, and APHL staff worked with Fisher Scientific to fill orders. The second way that equipment was purchased was through local vendors. APHL worked with laboratory staff to identify local providers to purchase office equipment, computers, laboratory furniture, and reagents and test kits that Fisher Scientific was unable to supply.

Laboratory Rehabilitation projects were also conducted using local vendors. APHL worked with the laboratory to identify two to three companies that would be able to conduct the work. APHL asked for written estimates as well as legal documentation certifying the companies' legitimacy. APHL worked with the lab to choose the best estimate, wrote a contract with the provider and work was initiated.

Overall Key Accomplishments

APHL is proud of the successes in the seven project countries. A detailed summary of activities in each country will be outlined in the next section. In the three focal areas APHL has accomplished the following:

Training

- Provided training in laboratory methods in TB, influenza, Dengue serology, production of Dengue antigens, Hantavirus, Measles, Cholera, E. Coli, and other bacterial infections
- Provided training in Core Functions of public health laboratories
- Provided training in the shipment and transport of hazardous materials
- Developed four 3-month courses in Basic Microbiology
- Developed a basic course in Virology
- Provided training in ISO 2000 standards of Quality Assurance
- Collaborated with PAHO to develop and provide sub regional training in Laboratory Management, Quality Assurance, Quality Control, Biosafety and Preventive Maintenance External Quality Control, and Technical Aspects of Quality Assurance and Laboratory Auditing
- Worked with countries to develop Standard Operating Procedure Manuals in various disease areas as well as in Biosafety and Preventative Maintenance

Equipment Procurement & Installation

- Purchased appropriate laboratory equipment with maintenance contracts for central labs as well as peripheral labs in each country
- Purchased of reagents and laboratory supplies for diagnostic testing
- Locally purchased basic equipment including refrigerators, training tools, etc.
- Installed Information Systems hardware and software for surveillance uses
- Installed internet service in Honduras

Laboratory Infrastructure

- Completed rehabilitation of virology laboratory in Costa Rica
- Completed rehabilitation of media preparation area in Guatemala's National Public Health Lab as well as work in the TB lab
- Completed rehabilitation of CENCET lab in Dominica Republic
- Completed basic refurbishment of two labs in Haiti
- Purchased and installed Electric Inverters for labs in Haiti
- Installed basic infrastructure needs (electricity, plumbing) in Honduras
- Refurbished laboratory benches that were water damaged in Honduras

A final key accomplishment, and one that APHL feels is the most important, is the development of strong relationships among the laboratories in the sub region. Prior to the project the countries did not communicate regularly, despite sharing similar challenges. As a result of this project, the countries have rallied together to develop a proposal that would establish an association of laboratory directors for Central America and the Caribbean. Electronic communication between the countries occurs regularly. Laboratories have begun to provide one and other with back up during disease events in order to handle surge capacity. Additionally, in a few years the laboratories plan to have

established a strong network in order to serve as reference labs for one and other on a regional level. Laboratory directors in the sub region have begun work to identify funding sources and gather support from Ministries of Health and PAHO to implement this new vision.

Country Background and IR3 Successes

*Costa Rica*¹

Costa Rica is a country located in the Central American region, with a territorial area of 51100 Sq Km and an estimated population of 3,768,900 for 1998. An important feature of its socioeconomic development has been the investment the Government has made in the social sphere; accordingly, if we analyze evolution of the social development indicators since the nineteen seventies, we find that they have improved during the period, although they remained stabilized during the decade of the nineties (Table 1).

Costa Rica has undergone significant changes in its population structure during recent decades, as a result of reduced mortality in young ages, diminished fecundity and migratory tendencies which indicate a heavy flow of immigrants from the neighboring countries, and in particular, Nicaragua. It can be seen in Table 2 that the population structure of Costa Rica reduced the relative weight of the youngest groups (0 to 14 years) from 46% in 1970 to 32.7% in 1998 and increased the proportion of persons age 65 or older, which rose from 3.2% to 5% during the same period. Accordingly the ratio of demographic dependency decreased by 40% between 1970 and 1998, going from 1 to 0.6.

With regard to the international migratory tendencies, by reason of armed conflict and the deterioration of economic and social conditions in neighboring countries such as Nicaragua, Costa Rica has recorded an increase in immigration. The precise magnitude of this inflow has not been determined, but it has been estimated at about 600,000 Nicaraguans. Some light is cast on this situation by the increase in number of births to foreign mothers, which increased from 4129 in 1990 to 9839 in 1998, which represents a 138% increase. Of these births to foreign mothers, 85.4% are the children of Nicaraguan parents.

Costa Rican life expectancy remains unaltered since 1990 at 76.7 years. This lack of variation is the result of two factors: stabilization of the infantile mortality rate, which, while it shows oscillations in the present decade, manifests no tendency toward reduction; and the proportional increase, since 1985, shown by the mortality rates for some pathologies such as tumors, external causes and certain diseases of the circulatory system.

The most significant mortality rate variations in Costa Rica were produced during the seventies, when a reduction was shown in deaths due to communicable diseases (from 31.7% in 1970 to 10.7% in 1980) and poorly defined disorders (from 10.9% to 8.4%) and an increase was experienced in the relative weight of circulatory system diseases (from 19.5% to 23.8%), tumors (from 9.9% to 16.4%) and external causes (from 6.6% to 13.2%). That same tendency, while less accentuated, was observed from the eighties to the nineties; communicable diseases continued their descent to 7.5%, circulatory system pathologies increased to 27.9% and the percentage of deaths due to tumors increased to 9.8%. Nevertheless, the decade of the nineties is characterized by stabilization in the proportional mortality.

¹ Excerpted from "Health in the Americas 1998" a publication of the Pan American Health Organization
ON LINE: Country Health Profiles last updated 10/20/1999 <http://165.158.1.110/english/.sha/prflnic.html>

Despite a variety of efforts, diseases whose reporting is mandatory have not been adequately monitored. During recent decades there has been a resurgence of infectious diseases that had been thought to be in the process of eradication: malaria, dengue fever, tuberculosis, etc. With regard to sexually transmitted diseases, as a result of implementation of several strategies of sexual education, epidemiological control of contacts and improved efficacy of treatment measures, a reduction was observed in gonorrhea and syphilis. There was, however, an alarming increase in the number of congenital syphilis cases (47 cases in 1991 increased to 111 in 1996). Furthermore, in 1990, the first cases (3) of perinatally transmitted AIDS were recorded; by 1996 the total cases had increased to 19.

Costa Rica's greatest health successes were achieved during the nineteen seventies, a period in which the country formulated and implemented an integral health policy which established fundamental principles such as health universality, solidarity and equity. The extension of services at all levels of health care permitted elevation of the coverage of the fundamentally preventive rural and community health programs (administered by the Ministry of Health) and those of disease care, as a responsibility of the Costa Rican Social Security Savings Bank [Caja Costarricense de Seguro Social] (CCSS). This fact was reflected in increased coverage of primary health care, of sickness and maternity insurance, of hospital childbirth care, of handicap, old age and death pensions, among others.

At the end of the eighties, the country recognized the need to introduce changes into its health system, including reform of the care model, which the CCSS must assume at all levels of care, and with an integral health approach, so as to reinforce the administration by the Ministry of Health. This is a process whose results are to be obtained in the mid- and long-term, which reinforces the principle of deconcentration, equity and solidarity in the right to health and universality. In this context, the need emerges to reform the functions of the CCSS personnel, who have traditionally carried out activities with an individual and curative approach, to advance in the direction of more generalized care, in which prevention, vigilance and health evaluation will be an essential element.

Hurricane Mitch did not directly hit Costa Rica, but its health resources were severely strained after an influx of Nicaraguan refugees came into the country following the disaster. As a result Costa Rica saw the need to improve laboratory surveillance.

IR3 in Costa Rica

The National Centers of Reference (INCIENSA) and the national network of 85 laboratories (CCSS) were deficient in their analytical, quality assurance and training capability, as well as in the management of information for an efficient epidemiological vigilance of infectious diseases. To this end Costa Rica proposed the establishment of an information system among the public health laboratories, which satisfies the essential requirements for an adequate epidemiological vigilance, response to disease outbreaks and planning. Additionally Costa Rica wanted to improve TB diagnostics testing and surveillance, diagnostics and surveillance for food born pathogens, and refurbish the virology area in INCIENSA as well as the remodeling of the sample reception area and the storage facility. Additionally Costa Rica wanted to increase its reporting capabilities by developing and publishing a monthly bulletin.

To meet this need APHL:

- Provided hardware for development of the electronic information system in the National Centers of Reference (INCIENSA) and accelerate implementation of the information system among the laboratories of the national diagnostics network.
- Contracted with a local provider to design and implement an information system appropriate to the needs of INCIENSA and compatible with the existing systems in the Ministry of Health and the CCSS
- Trained the laboratories' scientific personnel in the use of databases and the laboratory database staffs in their use and maintenance
- Sent two laboratorians to INDRE in Mexico City for training in TB AFB Smear Microscopy
- Provided Costa Rica with AFB training materials in Spanish to replicate the training received abroad
- Provided training at INDRE for confirmation of the species *Vibrio*, *Salmonella*, *Shigella*, pathogenic *Escherichia coli*, *Leptospira* and susceptibility to the Antimicrobials
- Worked with INCIENSA to develop training materials for the network laboratories in biosafety and laboratory method aspects
- Contacted with a Columbian professional to expand INCIENSA's capability in the production of educational and training bulletins and reports that are now published monthly via the internet
- Acquired the equipment necessary to permit expansion of the analytical, confirmation, training and quality assurance activities in the Centers of Reference for Cholera and Diarrheic Diseases and in that of Febrile Diseases through Fisher Scientific
- Remodeled 400 sq m of the INCIENSA physical space to expand the laboratory's virology area, the USEC (reception of samples area), and the reagent storage area

Positive Outcome

As a result of the work initiated through IR3 Costa Rica now has a functional laboratory surveillance system. Moreover the monthly bulletin developed and designed through the project is being produced and disseminated regularly both in hard copy and via the Internet. This bulletin was well received by other countries in the project and Costa Rica would like to begin developing a regional bulletin within the next year.

*Dominican Republic*²

The Dominican Republic occupies the eastern two-thirds of the Caribbean island of Hispaniola, which is located west of Puerto Rico. Its only border is with Haiti. The Dominican Republic has an area of 48,400 km², and its population was estimated at 7.8 million in 1995. For political and administrative purposes, the country is divided into three regions and seven sub regions, which together contain the 29 provinces and the National District.

Over the last two decades the service sector has led the economy, particularly economic and financial services related to tourism and industrial free-trade zones, which by 1995 accounted for more than 70% of exports. The shift came with major dislocations and economic and social imbalances. The macroeconomic adjustments of the 1980s served to substantially reduce social spending and redirect expenditures toward investment, especially in infrastructure. Annual per capita expenditures on education during 1987–1990, adjusted for inflation, were 40% of what they had been in 1980, and the expenditures on health were 7.5% lower. Together, the health and education sectors received less than 5% of public spending between 1986 and 1990.

The estimated general mortality rate has gradually declined, falling to 5.5 per 1,000 population for the 1990–1995 period. It is expected to be 5.2 per 1,000 population for 1995–2000. Decreases have occurred in both sexes and in all age groups. This trend is related to longer life expectancy at birth, which rose from 53.6 years in 1960–1965 to 69.6 in 1990–1995 and is projected to be 70.9 for 1995–2000.

The registered infant mortality rate was 19.1 per 1,000 live births in 1990 and 11.5 per 1,000 in 1994. In 1994, infants under 1 year old accounted for 10.9% of all registered deaths. According to two estimates—one by the Latin American Demographic Center (CELADE) and PAHO, and another based on the ENDESA 96 health survey—under registration may be some 72% to 75%. Intestinal infectious diseases represented 15.9% of deaths; nutritional deficiencies, 15.3%; acute respiratory infections, 12.5%; unspecified injuries, 9.4%; and congenital abnormalities, 5.5%.

Communicable diseases, along with nutritional deficiencies, are the country's leading health priorities. In 1994 communicable diseases accounted for 16.8% of all diagnosed deaths. Notable among the communicable diseases are diarrheal diseases, which in 1994 represented 4% of all diagnosed deaths and 30.4% of the deaths from communicable diseases. More than half (51.3%) of the deaths from acute diarrhea occurred in infants under 1 year of age, and 16% were in children aged 1 to 4 years. Diarrheal diseases were the second leading cause of diagnosed mortality in infants under 1 year of age (15%) and ranked in first place among children aged 1 to 4 (16%), followed by nutritional deficiencies. According to data from the ENDESA 96 survey, only 39.1% of all diarrheal episodes were treated with some form of oral rehydration, although in recent years this proportion has gone up slightly. As far as cholera is concerned, even with close surveillance of diarrheal cases and the thorough investigation of suspicious cases of diarrhea, not a single case of the disease was diagnosed during the current pandemic.

² Excerpted from "Health in the Americas 1998" a publication of the Pan American Health Organization
ON LINE: Country Health Profiles last updated 10/20/1999 <http://165.158.1.110/english/.sha/prfldr.html>

In 1994 acute respiratory infections accounted for 3.6% of all diagnosed deaths and 30.9% of the deaths from communicable diseases. Acute respiratory infections were the sixth-ranking diagnosed cause of mortality in infants under 1 year of age and the third-ranking cause in children aged 1 to 4. Episodes of diarrhea and respiratory infection were the most frequent reasons for medical consultation, emergency treatment, and hospitalization in 1995. Tuberculosis accounted for 2% of all diagnosed deaths and 15% of the deaths from communicable diseases. Meningitis was responsible for 0.6% of all diagnosed deaths and 5.2% of the deaths from communicable diseases.

Every year some 300 cases of bacterial meningitis are reported, 60% to 70% of them in infants under 1 year of age. The most common agents are *Haemophilus influenzae* B (about 50%), *Streptococcus pneumoniae* (around 15%), and, less often, *Mycobacterium tuberculosis* and *Neisseria meningitidis* serogroups C and B.

Sexually transmitted diseases are a serious health problem. More than 10,000 new cases are reported each year. Nevertheless, in recent years there has been a marked decline in the reported frequency of cases, probably linked to measures to prevent HIV transmission. In 1995 the rates were as follows: gonorrhea, 34.5 cases per 100,000 population; syphilis, 24.4; chancroid, 3.4; and lymphogranuloma, 0.8. In recent years there has been an increase in the prevalence of HIV infection among pregnant women in patients seen at venereal disease clinics and, to a lesser extent, in sex workers. Some estimates indicate that by the year 2000 there will be about 50,000 HIV carriers in the country.

Rabies is endemic, due to foci in the wild (mongooses), numerous street dogs, and extensive impoverished urban areas. Up until the 1970s the epidemiological pattern was cyclic, with major outbreaks every four or five years. Since then, the annual frequency has been related more to control measures, vaccination coverage of dogs, epidemiological surveillance, and perifocal control efforts. In recent years the number of cases in dogs has remained at around 5 per 100,000 (canine population) and the number of human cases at about 2 per year, with both of these indicators trending upward.

Dengue is endemic because of the high proportion of urban households infested with *Aedes aegypti*. In 1993 there were 60 new confirmed cases, 226 in 1994, and 249 in 1995, followed by a drop to about 50 in 1996. It is not known which of the virus serotypes are in circulation. The number of cases of dengue hemorrhagic fever also increased in 1994 and 1995, to 46 and 38 cases, respectively. The number of deaths declined from five in 1994 to only one in 1996.

Given its geographic location, climate, heavy tourist travel and migratory movements, and widespread poverty, the country is extremely vulnerable to the introduction and circulation of infectious agents and to outbreaks of epidemics.

The policy that has guided the Secretariat for Public Health and Social Welfare since 1992 is the primary health care strategy. This policy recognizes that health is a fundamental right exercised through free and equal access to the actions that seek to satisfy it. The policy also mandates that the State give priority to the most disadvantaged and vulnerable groups. Central to the policy are democratization, universal health services, equity, humanistic modernity, effectiveness, and efficiency. The main strategies

are dispersion and decentralization, societal participation, intra- and intersectoral coordination, and the development and management of knowledge.

According to the Public Health Code, the Secretariat for Public Health and Social Welfare is the agency in charge of health services and is responsible for applying the Code. The Secretariat provides health care, health promotion, and preventive health services and is structured on three levels: central, regional, and provincial. The role of the central level is essentially standards setting. Eight regional offices direct the services and oversee the health areas, or units, at the provincial level. The health areas have rural clinics that each cover from 2,000 to 10,000 inhabitants and are staffed with medical interns or assistants, nurse's aides, a supervisor of health promoters, and the health promoters themselves. Most of the provincial capitals have either a second- or third-level hospital with outpatient, inpatient, and around-the-clock emergency services. Some of the provinces also have health sub centers with inpatient beds, emergency services, and general adult medical care, as well as pediatric and pregnancy care.

The Secretariat's programs are structured at the central and regional levels. The most fully developed are those for the control of malaria, dengue, and other vector-borne diseases and for the prevention and control of rabies and zoonoses; the national tuberculosis program; immunization; family planning and reproductive health; and basic sanitation. There are epidemiological services at the national level and also units at the regional and local level.

IR3 in Dominican Republic

Hurricane Georges struck the Dominican Republic with brutal rage for 16 long hours on September 22, 1998. Heavy rains and furious winds, which reached up to 130 miles per hour, covered nearly 70 percent of the country. Heavy rains, particularly in the western part of the country, produced mudslides and heavy and prolonged flooding. Hurricane Georges killed over 200 persons and left a path of destruction critically affecting the lives of over half the population and setting back the country's human, natural resource, and physical infrastructure base. Its most critical impact is evident in terms of four elements of the Dominican Republic's social and economic setting, especially in the area of public health.

The hurricane seriously worsened the health of already vulnerable segments of the DR's population living both in and outside its destructive path. Its impact practically wiped out the availability of potable water and sanitation facilities in many rural communities and poor urban centers, critically reduced the local capability to provide basic health services, and seriously deteriorated environmental health conditions. Subsequent crowded and unhealthy conditions in improvised shelters worsened the situation. The combined effects of these factors have led to a significant increase in the health risks that the population faces.

Water and food contamination increased, causing increased rates of diarrhea, especially among high-risk groups such as children and the elderly. Hurricane Georges also disrupted the implementation of ongoing vector control activities and fostered the creation of new habitats and optimal conditions in which vectors multiply.

The hurricane also brutally pounded the DR's physical infrastructure. The storm destroyed or critically damaged the road network, bridges, water systems, power plants, schools, hospitals, clinics, homes, airports, aqueducts, sanitation facilities and irrigation systems. Total costs of direct damages is now estimated to be close to \$2 billion (12% of GDP). For the DR, one of the poorest countries in the Caribbean, these losses are staggering.

For IR3 the Dominican Republic wanted to address several areas, training, decentralization of dengue diagnostics, production of standard operating procedure manuals and the integration of epidemiology and laboratory services.

To meet these needs APHL:

- Purchased and installed appropriate laboratory equipment
- Trained two technicians in Dengue serology and PCR
- Purchased computers for dengue diagnostics
- Remodeled the CENCET laboratory
- Supported training in basic Public Health Functions and Core Functions of Laboratories
- Supported the participation of one laboratorian in the International training on TB in Peru

Positive Outcome

Dengue diagnostic was a top priority for the DR. As a result of IR3 testing is now taking place in more than one location and the CENCET is ready to handle surge capacity.

Challenge

Until closer to the end of the project it was never exactly clear who the main point of contact in the DR should be. APHL often found itself in the position of playing mediator between the different players from the MoH who did not necessarily communicate amongst themselves. Despite repeated requests for specific information the DR often did not get to benefit from the same amount of training and rehabilitation work as other countries. It was not until near the end of the project that formal request to APHL was made in the format specified at the beginning. As a result not all requested activities were completed prior to the project end date.

*El Salvador*³

In mid-1995 the Salvadorian economy began to decelerate. In 1992 and 1993 the gross domestic product (GDP) had attained a real growth (adjusted for inflation) of more than 7%, but in 1994–1995 it grew only 6%, and by 1996 the rate had fallen to 3%. This reduction in the growth rate was associated with a reduction in internal demand and a slowdown in exports of goods and services as well as a major shift in the business outlook. The result was a sizable cutback in gross domestic investments by the private sector, which went from 16.6% of GDP in 1995 to 11.9% in 1996.

During 1990–1995 the driving force behind economic growth was the internal demand generated by the steady increase in consumption. This was financed with the influx of foreign currency following the Peace Accords, the growing stream of money sent home by Salvadorians residing in the United States and Canada—about US\$ 1 billion a year—and the expansion of credit in the private sector.

As a result of the stabilization policy, inflation dropped to 7.4%, the lowest it had been since 1975. The policy of free convertible currency remained in place in 1996, and the nominal exchange rate was 8.75 Salvadorian colones per US\$ 1.00. Net international monetary reserves increased to US\$ 1,100 million, the equivalent of 81% of the monetary base or five months' worth of imports. This was possible because of a reduced deficit in the balance of trade and in the current account of the balance of payments. Domestic savings and investments have returned to levels of 16% and 18% of GDP, respectively, similar to the levels of the 1970s.

The deceleration clearly affected the economy of the working population. According to a report of the Central American Monetary Council, the rate of open unemployment in 1996 was 10%, whereas two years earlier it had been as low as 7.7%. Nominal minimum wages did not change in 1996, but when the figures are adjusted for inflation, they declined by 6.7%.

In the political arena, the most noteworthy developments in recent years have been the advances toward reforming and modernizing the State, the progress in political and electoral participation, and the end of the period for compliance with the Peace Accords.

There are major gaps and marked inequalities in basic sanitation between urban and rural areas. Coverage is very low, and the services provided are usually deficient. The data available (1995) indicate that 53% of the population has access to the public water supply. Coverage of the urban population is 86% (80% with household connections and 6% through access to a public tanks) and of the rural population, 17% (16% with household connections and 1% through access to a public tank). Excreta disposal is available to 69% of the population: 57% of the urban population is connected to a sewerage system and 25% has access to latrines, while in rural areas 56% of the population depends on latrines.

Poverty indicators have significantly improved, from levels of about 60% in 1990 to 47.5% in 1995. As part of its strategy to combat poverty, the Government has promoted a policy of local development aimed at stimulating the economy for small producers by

³ Excerpted from "Health in the Americas 1998" a publication of the Pan American Health Organization
ON LINE: Country Health Profiles last updated 10/20/1999 <http://165.158.1.110/english/.sha/prflnic.html>

encouraging them to work together in alliances at the local level so that they can compete with local businesses.

The war, which lasted from the 1970s until 1992, when the Peace Accords were signed, caused an abrupt change in Salvadorian population dynamics. During those years, higher mortality in men, combined with migration to other countries and the separation of couples, all contributed to lower fertility. In 1997 the population was estimated at 5.91 million inhabitants, of whom 49.0% were males and 51.0% were females. The annual population growth rate was 2.1%.

Of the country's 14 departments, the most heavily populated is San Salvador, where 30.7% of the population resides. The concentration of urban population is steadily increasing. In 1996, 56.7% of the population was living in urban areas and 43.3% in rural areas. In 1995 the urban population growth rate (2.6%) was double the rate in rural areas (1.3%). The Salvadorian population is predominantly young, and for every 100 persons of working age there are 72 who depend on them. In 1996 children under 5 years of age represented 13% of the population; those aged 5 to 14 years, 24%; those aged 15 to 19, 12%; those 20 to 24, 11%; those 25 to 59, 34%; and seniors aged 60 and over, only 6%.

IR3 in El Salvador

In late October 1998 Hurricane Mitch pounded the Honduran coast, and generated intense rainfall across Central America. By November 1, the level of precipitation reached its maximum as Mitch, down graded to a tropical storm, stalled over the region. In El Salvador, this extreme precipitation fell on highly deforested land, already saturated by abnormally high rainfall in the month of October, triggering widespread flooding and landslides.

The Government of El Salvador (GOES) reported that 374 people died or are missing. The government opened 147 emergency shelters to accommodate another 55,864 people who were displaced. Twelve of the country's fourteen departments suffered significant damage. Roughly 65,200 hectares were flooded. Estimates of damage from the storm range from \$132.5 million (GOES estimate) to \$1.7 billion (U.S. Army Corps of Engineers (USACE)). The government estimates another \$124.8 million in indirect losses from reduced markets for exports, reduced sales of agricultural commodities, and lingering health issues. The GOES estimates that GDP growth in 1998 was cut by half of one percent due to the combined impact of Hurricane Mitch and the El Nino. Twenty-two small health units and some equipment were damaged or destroyed at a cost of close to \$2.0 million.

The Ministry of Health's rapid and thorough response to the disaster was crucial in minimizing the outbreak and severity of diseases. Health promoters from other regions and 30 nurses assistants, funded by USAID, helped staff health clinics around the clock to attend to the needs of flood victims. The Ministry's efforts were complemented by the Academy for Educational Development, a USAID contractor, which launched an extensive campaign in the affected areas to educate people on how to treat contaminated water. The Ministry recorded 109,038 medical cases related to Mitch attended to between October 31 and November 18, 1998. Respiratory infections accounted for 23 percent of the cases, followed by skin ailments, diarrhea and conjunctivitis as the principal complaints.

El Salvador is a country in epidemiological transition. Accompanying the high frequency of chronic and degenerative diseases is a high incidence of endemic/epidemic diseases such as cholera, dengue, leptospirosis, pneumonias and others. In these conditions, it is imperative to count on a modern and efficient diagnostic laboratory. Diagnostic errors could produce grave consequences within the health system; those performed in an incorrect manner could lengthen community infectious disease problems. To this end El Salvador wished to reinforced operational capacity of the laboratories at all levels, develop capacity to take charge of emergency situations in collaboration with epidemiology, create Standards and procedures and have them revised and disseminated, train central laboratory personnel in focal disease areas, Operationalize safety and bio-safety systems, and create policies for specimen management standards and procedures.

To meet these needs APHL:

- Purchased and installed appropriated laboratory equipment for the central laboratories as well as local laboratories
- Trained two laboratorians in Dengue serology, antigen production and PCR
- Rehabilitated the central lab after structural damage from earthquakes made areas unsafe
- Supported the development, publication and dissemination of a Biosafety Standard Operating Procedure Manual
- Purchased and installed computers in the Central laboratory to be used in conjunction with MOH surveillance software
- Supported in country training for 100 professionals in basic bacteriology
- Supported in country training for 50 professionals in TB
- Supported in country training for 50 professionals in Malaria
- Supported in country training for 100 professional in Biosafety and Preventative Maintenance
- Trained two laboratorians in the US in TB and Anthrax
- Trained two laboratorians in Hantavirus at INDRE
- Supported the participation of one laboratorian in the International training on TB in Peru

Positive Outcome

In the wake of the hurricanes two earthquakes hit El Salvador. As a result the lab was inundated with new disaster related outbreaks. New equipment and training came in handy when faced with new cases to test. Additionally the lab was better prepare to handle surge capacity by turning to other countries for assistance through the relationships forged through IR3 activities.

Guatemala⁴

The Republic of Guatemala has a land area covering 108,889 km², bordered on the north and northeast by Mexico, on the east by Honduras and El Salvador, on the northeast by

⁴ Excerpted from "Health in the Americas 1998" a publication of the Pan American Health Organization
ON LINE: Country Health Profiles last updated 10/20/1999
<http://www.paho.org/English/SHA/prflgut.htm>

Belize, and on the south by the Pacific Ocean. It is divided politically and administratively into 22 departments, which include 330 *municipios*. The departments are grouped into eight regions. In 1995 the population was estimated at 9.98 million, with an annual growth rate of 2.8%. Sixty-five percent of the population lives in rural areas, where 80% of the people live in settlements of fewer than 500 inhabitants.

During the present decade Guatemala has been slowly resuming its economic growth rate. Between 1990 and 1996 the gross domestic product (GDP), adjusted for inflation, increased at rates of 3% to 5%, and the GDP per capita grew only 0.1% to 1.9%. In 1994 the per capita gross national product (GNP) was US\$ 1,190.

Total unemployment has remained steady at around 37%. Open unemployment, which was 6.5% in 1990, dropped to 2.5% in 1993 and then rose again to 5% in 1996. Inflation fell considerably during 1990–1996, as evidenced by the fact that the annual variation in the consumer price index went from nearly 60% to between 8% and 14%. Favorable macroeconomic indicators are not matched by a decline in poverty, which afflicts three of every four Guatemalans.

According to data from 1989, the proportion of the population living in conditions of poverty was 75% for the country as a whole, with 58% living in extreme poverty. Both poverty and extreme poverty are higher in rural areas and among the indigenous population, 93% of whom were living in poverty and 91% in extreme poverty in 1989. By contrast, among the nonindigenous population the proportions were only 66% and 45%, respectively.

In 1994 the literacy rate was 71% in men and 57% in women, with an overall national rate of 64%. The total rate of enrollment in primary school was 79% in 1991, 83% in 1992, and 85% in 1995.

The northern, northeastern, and southeastern regions are relatively less developed than the rest of the country. Almost half the population lives in these regions, and the population is largely indigenous. Twenty-two percent of the people live in the national capital.

The birth rate was 37.3 per 1,000 population in 1995, and total fertility was 5.1 children per woman (6.2 in rural areas and 3.8 in the urban population). The fertility rate in the indigenous population remained steady between 1986 and 1995, whereas in the nonindigenous group it dropped from 5.0 children per woman in 1987 to 4.3 in 1995. In 1994 under registration of births was estimated at 3%.

In 1992 life expectancy at birth was 62.4 years for men and 67.3 years for women; by 1995 it was 64.7 for men, 69.8 for women, and 67.1 for the population as a whole. In 1995 females represented 49.5% of the population and women of reproductive age, 22%. The Guatemalan population is very young: 45% are under 15 years of age and only 3% are older than 60.

In 1995 the crude death rate was 7.4 per 1,000 population. During the period 1985–1995 infant mortality was 51.0 per 1,000 live births (neonatal mortality, 26.0 per 1,000; post neonatal mortality, 25.0 per 1,000).

In 1994 a total of 65,535 deaths were reported, for a crude death rate of 6.8 per 1,000 population. Of all deaths, 27.3% were in infants under 1 year old; 3.9% in children 1 to 4 years of age; 2.7% in the population aged 5 to 14; 21.8% among those aged 15 to 59; and 36% in the 60 and over bracket.

Indigenous peoples, classified linguistically into more than 21 different groups, represent 43% of the country's population. Speakers of Quiché represent 29% of the total indigenous population; Kakchiquel, 25%; Kekchí, 14%; Mam, 4%; Pocomchi, Pocomam, and Tzutuhil, 24%; and other languages, 4%. About 32% of the indigenous population speaks only a Mayan language.

Since 1987, when the process of voluntary individual repatriation began, there has been a steadily increasing return of Guatemalans who had been living for years in neighboring countries, especially Mexico. It is estimated that some 20,000 people returned between 1993 and 1995 and since 1996, after the Peace Accords were signed, people have been returning in much larger numbers. For the most part, those who have come back have made their homes in remote jungle areas, where they are living in precarious conditions without basic services.

In 1994 a formal negotiation process got under way following the agreement to reinstate the peace talks. The Peace Accord was signed on 29 December 1996 by representatives of the Government and the guerrilla forces. This new state of peace led to a thorough institutional modernization of the State with a view to substantially improving efficiency and management capacity, addressing the delicate question of public finances, and effectively implementing social programs that would support the processes of peace and economic development.

Health policies come under the program for economic modernization of the Government, which includes reforms aimed at increasing State income, controlling the national debt, and raising expenditure in the social sectors. An important complement to these policies has been the reforms in the allocation of funds to the *municipios*. Of the amounts that the Government gives to the municipalities—namely, 8% of the national budget—at least 90% is supposed to go for programs in education, preventive health, infrastructure, and public services to improve the quality of life.

The Government has formulated a set of health policies for 1996–2000, which incorporate, orient, and support various aspects of the reform and the peace accords. These policies address seven areas: (a) reorganization, integration, and modernization of the health sector; (b) increased coverage and improved quality of basic health services, with emphasis on the prevention and control of priority problems; (c) improved management of hospitals; (d) promotion of health and a healthy environment; (e) increased coverage and improved quality of drinking water and extended coverage of basic environmental sanitation in rural areas; (f) social participation and oversight as part of public management of the services; and (g) coordination of international technical cooperation to support the activities determined to have priority in the health policies and in the sectoral reform process.

The health sector is made up of both public and private institutions, nongovernmental organizations, and a large sector of traditional medicine surviving from the Mayan culture, which is found mainly in rural areas among the indigenous population.

At the national level, institutional coverage of the population is as follows: Ministry of Public Health and Social Assistance, 25%; IGSS, 17%; Military Health Service, 2.5%; nongovernmental organizations, 4%; and the private sector, 10%. Less than 60% of the population has the benefit of some form of health service coverage, and this coverage has not increased substantially since 1990, when it was 54%. This was one of the reasons why the Government decided to change the traditional care model by reforming the sector. A Comprehensive Health Care System (SIAS) was designed, which is now being implemented and intends to provide basic health care to the entire population that currently is without access to health services. Existing resources will be used for this purpose within a context of community organization and participation that will generate and bring about changes in the health situation.

In the field of public health, all the country's departments have epidemiologists with varying levels of training. There is a shortage of sanitary engineers and specialists in health economics, even at the central level of the Ministry. Education for the health professions is given at the University of San Carlos (USAC), Francisco Marroquín University, and the University of Valle. The latter two institutions are private, while the USAC belongs to the State. In 1995 a master's degree program in public health was introduced at USAC that will train staff from various government institutions in management, environmental studies, research, and epidemiology. Public health priorities for Guatemala include, HIV/AIDS, Dengue, Food Borne Illness, which is still a major cause of morbidity and mortality, and Rabies and other zoonoses.

IR3 in Guatemala⁵

In the throes of recovering from years of civil war and conflict, Guatemala encountered new short and medium term challenges when Hurricane Mitch struck in late 1998. Despite an impressive response by Guatemalan emergency agencies which minimized loss of life, Mitch dealt a severe blow to Guatemala, causing vast economic and social dislocations, and diverting valuable human and financial resources away from the transition to peace and sustainable development priorities. The Government of Guatemala and the United Nations estimated rehabilitation and reconstruction costs at \$550 million.

Mitch hit hard the south coast, the central and north west river valleys of Polochic and Motagua near Lake Izabal, and the Caribbean coast -- an area the size of El Salvador. While loss of life was minimal due to preventive evacuation of populations most at risk, direct damages to infrastructure, crops, housing, schools and health clinics was estimated at \$550 million plus \$280 million in foregone revenues from exports and reduced economic growth. The estimates of damage included 268 dead, 106,600 evacuees, and a total of 750,000 people affected.

The Guatemalan Government mobilized its emergency response apparatus, which had already been trained and tested during 1998 with the forest and brush fires of the Spring and small floods in the Summer. They evacuated some 10,000 people before the storm hit and another 25,000 right after. This action saved untold lives. A total of 54,725 people were provided with temporary shelter for several weeks following the storm. The Ministry of Transport working with over 80 private firms cleared the major roads, most

⁵ Adapted from a USAID Report "USAID/GUATEMALA Hurricane Mitch Special Objective" ON LINE: <http://hurricane.info.usaid.gov/spogua7.html>

of which were reopened within four days. The Ministry of Health took preventive measures to control the spread of endemic disease. These actions, supported by relief teams and helicopters from the U.S. and Mexico as well as technical and financial contributions from other donors, made it possible to move from emergency relief to rehabilitation and reconstruction efforts in about six weeks.

The Guatemalan Government formulated a 100 day reconstruction effort on November 12, 1998 aimed at three objectives: (1) restoring normal living conditions for Mitch victims; (2) repairing damaged infrastructure; and (3) recovering productive capacity. It identified 1,643 priority rehabilitation projects in 12 target areas: food security, health, water/sanitation, housing, schools, replacement textbooks and desks, road repair, electricity, irrigation, land leveling, environmental evaluation and disaster mitigation, and economic recovery/employment generation. The estimated cost was \$116.3 million, of which the government has spent about \$100 million, covering about 66% from its own resources while the international community has provided 33%, mostly in food aid.

Guatemala, like the rest of its Central American counterparts is a country in epidemiological transition. In addition to high levels of chronic disease, the country has experienced outbreaks of endemic/epidemic diseases such as Dengue and Leptospirosis and frequent problems with preventable food borne illnesses. A strong diagnostic laboratory system is key to the success of public health prevention programs.

Among the results hoped for by the Guatemalan team were: strengthening the capacity of the Central Laboratory to serve as a reference lab for the country; training Central Laboratory staff; Develop curricula based on training to disseminate to Network labs; develop standards and procedures; rehabilitate the Bio-safety system; rehabilitate the Laboratory Media preparation area; and develop and disseminate specimen management and transport standards.

To meet these needs APHL:

- Supported the rehabilitation of the Media preparation area of the Central Laboratory
- Supported the rehabilitation of the TB and virology areas of the Central Laboratory
- Supported the development and production of Biosafety manuals
- Supported the production of Standard operating Procedure Manuals for Dengue and TB
- Supported in country training for TB
- Supported in country training for Malaria
- Supported in country training for Quality Assurance practices
- Trained two laboratorians in dengue serology, PCR and antigen production
- Trained two laboratorians in Measles serology
- Trained two laboratorians in TB and Anthrax

- Trained two laboratorians in food born pathogens and *E. coli*
- Trained two laboratorians in respiratory illnesses
- Provided 40 copies of AFB Smear Microscopy training materials
- Purchased and installed equipment for the central lab as well as eight local laboratories
- Purchased computers to be used for surveillance needs
- Purchased equipment to be used in training courses (LCD projector, laptop)
- Purchased local office equipment (chairs, fax machine, desks)
- Supported the participation of one laboratorian in the International training on TB in Peru
- Supported the training of one laboratorian in Leptospirosis in Venezuela

Positive Outcome

Prior to IR3 Guatemala current laboratory practices include the need to purchase dengue antigens from outside sources such as Cuba. This had proven cumbersome and expensive. As part of the dengue program, the national laboratory identified in-house production of antigens as a priority. After receiving training at the CDC lab in Puerto Rico, Guatemala has implanted a program to produce antigens internally, thereby saving time and money.

Haiti⁶

The Republic of Haiti occupies the western third of the Island of Hispaniola, which it shares with the Dominican Republic. The country is divided into nine departments ("*départements*"), 133 municipalities ("*communes*"), and 561 districts ("*sections communales*").

Water supply and basic sanitation services are very deficient. No city has a public sewerage system, and there only are isolated wastewater treatment units throughout the country. Solid waste management is a serious problem; bad excreta disposal practices are polluting almost all water sources supplying Port-au-Prince.

The major trends in the Haitian economy over the past decade indicate a steady decline in the actual gross domestic product and a net rise in unemployment. Economic sanctions that were imposed in 1991 further deteriorated the economy. The gross domestic product in 1994 had decreased back to its pre-1980 level. This was paralleled by a population growth rate of 2.1% and a steep decline in per capita income from 1990 to 1995. The

⁶ Excerpted from "Health in the Americas 1998" a publication of the Pan American Health Organization
ON LINE: Country Health Profiles last updated 10/19/1999 <http://165.158.1.110/english/.sha/prflnic.html>

4.2% growth rate in GDP reported for 1994–1995 could not offset that indicator's 25% decrease during the embargo (1991–1994), thus maintaining Haiti's position as the poorest country in the Western Hemisphere. According to World Bank figures, per capita GDP was US\$ 220 in 1994, equivalent to US\$ 896 adjusted according to purchase power parity (PPP), making it one of the lowest in the world. The inflation rate averaged 25.4% between 1991 and 1994 and rose to 27% in 1995. The unemployment rate is estimated at 70%.

Population projections, developed by the Haitian Institute for Statistics and Information Technology in conjunction with the Latin American Demographic Center, estimated the population of Haiti at 7,180,296 inhabitants in 1995. Persons younger than 15 years of age account for 40% of the total population; children under 5 years of age account for 15%. Persons of working age, between the ages of 15 and 64 years, represented 56% of the population. The population aged 65 years old and older accounted for only 4% of the total.

Projections for 1995–2000 place the crude birth rate at 34.1 per 1,000 and the crude death rate at 10.72 per 1,000. The fertility rate was estimated at 4.8 children per woman. Based on these estimates and an anticipated population growth rate of 2% per year, it was estimated that the population will reach 8 million by the year 2000. Haiti has one of the highest population densities of all Latin American countries, with 260 inhabitants per km² as of 1995 and 885 inhabitants per km² of cultivated land.

The percentage of urban population in 1994 was 33%, the lowest in the Hemisphere. However, it has increased in recent years with rapid proliferation of shantytowns in Haitian cities (Le Cap-Haïtien, Gonaïves, Les Cayes). More than one-third of the total population (34.7%) lives in the capital, Port-au-Prince. The rural exodus has overburdened the housing situation, particularly in Port-au-Prince. Haphazard housing construction resulted in the erection of many dwellings in drainage areas, riverbeds, and protected water resource developments.

Haiti's health system includes the public sector, the semi-public sector, and the private sector. The public sector was seriously affected by the country's political crisis, which led all foreign aid to be channeled through nongovernmental organizations (NGOs). The Ministry of Health is structured into central, departmental, and community levels. Through its central directorates and units, it sets standards. Planning, monitoring, and supervision are the responsibility of the heads of the nine sanitary departments. One-third of the country's 663 health institutions belong to the public sector. The semi-public or mixed sector encompasses nonprofit institutions that are supported mainly by NGOs. Staff is paid in whole or in part by the public sector, but is managed by the private sector.

In 1994 there were 49 hospitals and 61 other inpatient facilities, with an estimated 90 beds per 100,000 population. Of the country's total health care facilities, 32% are operated by NGOs. The private, profit-making sector is comprised of physicians, dentists, and other private practice specialists who mostly work in Port-au-Prince and in private health care facilities. Public and private establishments function completely independent of one another with very little networking. Differences in access to adequate health care are further magnified by the uneven geographical distribution of centers and hospital beds.

The estimated per capita expenditure in health for 1995 was G15.7 (US\$ 2.0); it represented a decrease compared with that of 1990, which was G24.8 (US\$ 3.4). Total per capita expenditure on health reached US\$ 9, representing 3.5% of GDP in 1995. According to these estimates, in 1996 the government budget represented about 16% of the total expenditure; external donor agencies, which are mostly channeled through the Ministry of Health and NGOs, 28%; NGOs, 20%; and private expenditures, 36% in 1996.

A large share of expenditure in health came from foreign aid, particularly for capital outlays and operating expenses. International aid represented more than 50% of total public spending, reaching 78% in 1994–1995. Most NGOs operate independently.

The health care infrastructure and medical equipment are seriously impaired by a lack of maintenance and timely repairs. The deterioration in the condition of installations and equipment in public health care facilities was compounded by the nation's three-year-long crisis. Between October 1994 and March 1996, a total of US\$ 1,310,525 was spent on rehabilitation projects in 46 health care facilities and 5 hospitals, including the Haitian State University Hospital. A total of US\$ 8,278,610 was invested for the partial rehabilitation of 88 health care facilities and 5 hospitals, including the University Hospital.

As of 1996, there were 4 drug manufacturers, 50 importers and suppliers, and 200 authorized private pharmacies in the Port-au-Prince area. UNICEF imports EPI vaccines and provides them free of charge; vaccines are stored at and distributed from the PAHO warehouse. Only a few reagents, such as stains for TB control, are prepared locally.

Until 1991, only four diseases—poliomyelitis, neonatal tetanus, AIDS, and cholera—had specific surveillance systems in place. Between late 1992 and 1995, several NGOs supported the establishment of a simplified epidemiological surveillance system that relies on monitoring simple operational indicators for principal diseases gathered through a network of private or semi-public sentinel facilities. In September 1996, the Ministry of Health created a committee to design and support the implementation of a new National Health Information System. The committee's 16 members include representatives from the Ministries of Public Health, of Finance and Planning, and of External Cooperation; one NGO, and three technical cooperation agencies.

IR3 in Haiti

In October 1998, the Central American and Caribbean region experienced the devastating effects of Hurricanes Mitch and Georges. Hurricane Georges struck the eastern Caribbean (St. Kitts and Nevis and Antigua and Barbuda) on September 20 and 21 and the Dominican Republic and Haiti on September 22, 1998. The storm resulted in infrastructure damage and loss of life throughout the region, particularly in the Dominican Republic and Haiti. The extent of damage throughout the region indicates that it could be several years, before life returns to a completely normal state.

The Haitian Civil Protection Directorate reported 147 deaths, 34 serious injuries, 40 missing persons, and 167,500 affected individuals as a result of the hurricane. It has been estimated that over \$180 million in total damages occurred, including indirect and secondary losses in Haiti. With the loss of many dwellings, thousands of people became evacuees and refugees. Economic losses were monumental.

Haiti is a country struggling to define and develop a framework within which to build a foundation for their public health laboratory structure. In general, in the event of natural disasters the laboratories work separately, each of its own accord, with no program to guide them. As most of the peripheral laboratories of the provincial towns and the capital do not have personnel qualified in certain areas of microbiology nor suitable facilities and equipment, a large number of infectious diseases cannot be biologically diagnosed. Medical interventions after catastrophes and decision-making are sometimes carried out in an arbitrary manner for lack of reliable statistical data and suitable structures. It is proving to be important to put in place a control and prevention program for infectious diseases and environmental illnesses in order to cope with new possibilities, considering Haiti's geographical situation, always exposed to each hurricane season.

Faced with the numerous gaps in their information system, the absence of efficient management due to numerous factors and the inexistence of a laboratory network guaranteeing the quality of diagnoses of illnesses that occur throughout the country and the severe risk of epidemic they can represent for the populations exposed to risk factors in normal or particular conditions (natural disasters), the Haitian indicated that it was important to work out and implement a plan to restructure the national health system (SNS) and put in place the medical information system (SIS).

Among the results hoped for by the Haitian laboratory team were:

- Reinforced operational capacity of the laboratories at all levels
- Providing of inputs necessary for operation of the laboratories at all levels
- Developed capacity to take charge of emergency situations in collaboration with Epidemiology
- Standards and procedures revised and disseminated
- Supervision reinforced
- Central laboratory personnel trained
- Operationalize a safety and bio-safety system
- Specimen management standards and procedures disseminated
- Epidemiologists, lab technicians and motorcycleists trained

To meet these needs APHL:

- Provided training in the Core Functions of Public Health laboratories
- Supported two laboratorians for virology training in Montreal
- Supported Dengue training for two laboratorians
- Purchased and installed basic laboratory equipment
- Supported two training courses in basic bacteriology
- Supported the development and production of a Bio Safety manual
- Refurbished small sections of two peripheral laboratories
- Purchased electrical inverters and air conditioners for six labs
- Purchased \$50,000 worth of HIV test kits
- Supported a training course in Quality Assurance practices
- Supported training for the transport and management of hazardous materials

Positive Outcome

As a result of IR3, the concept of “public health” and public health laboratory significance in Haiti has been more widely accepted. While nothing definitive has occurred, the Ministry of Health has promised to identify and build a new laboratory, independent of the university hospital, specifically for the purpose of public health surveillance.

*Honduras*⁷

Honduras has a surface area of 112,492 km² and a population density of 46 inhabitants per km². In urban areas, the population density is 184 inhabitants per km². The terrain is predominantly mountainous, with 19 watersheds. The country's principal environmental problem is deforestation. Between 1964 and 1990, forests were reduced by some 25,899 km² (34%). It is estimated that between 1992 and 1993, as much as 7% of the forest cover reported in 1990 was lost, which indicates a deforestation rate of more than 1,000 km². The country is divided into 18 departments and 297 municipios with 3,730 towns and 27,764 small rural communities. With the adoption of the Municipal Government Law (1990), decentralization was strengthened and 5% of Government revenues were transferred to the municipal governments.

In 1990 a program for structural adjustment of the economy was established and policies and incentives were gradually put in place to promote the most efficient use of resources, coupled with social compensation programs, such as the Honduran Social Investment Fund, the Family Allocation Program, and the Social Housing Fund. These programs are designed to relieve the effects of the adjustment in the poorest segments of the population. The share of these three programs in social spending increased from 3.6% in 1990 to 13.6% in 1995.

The per capita gross domestic product (GDP) was US\$ 702.7 in 1990 and US\$ 722.0 in 1995, with an average annual growth rate of 0.58%. In the same period, the country's total foreign debt increased 23.5%, climbing from US\$ 3,517.8 million in 1990 to US\$ 4,343.5 million in 1995; public debt accounted for 90% of this amount.

The predominant economic activities continue to be agriculture, forestry, hunting, and fishing, Honduras experienced sustained growth in the manufacturing industry (export processing and assembly) in the 1990s; this economic activity generated some 44,000 jobs as of 1994. The economically active population (EAP) makes up 35% of the total population. In 1995 the underemployment rates were 34% in rural areas and 17% in urban areas. In 1993 women made up 31% of the EAP: 40% of the urban EAP and 22% of the rural EAP. Twenty-four percent of households are headed by women and 65% of those are poor. In 1994, unemployment and underemployment affected 73% of young men and 69% of young women aged 15–19 years. Among those aged 20–29, in contrast, the percentages were 43% among males and 45% among females; in the group aged 30–44 years 29% of males and 40% of females were unemployed or underemployed.

During the 1990–1994 period, illiteracy declined from 31.3% to 22.8% in 1994; illiteracy in rural areas remained 49% higher than in urban areas. The average level of educational attainment for the total population in 1994 was 4.2 years; it is estimated that 60% of the EAP has fewer than three years of schooling.

Based on the last population census, carried out in 1988, the estimated population in 1996 was 5.6 million, with a growth rate of 2.8%. In 1996 the population aged 0–4 years made up 15.7% of the total; the population aged 5–9 years, 14.2%; the population aged 10–14

⁷ Excerpted from "Health in the Americas 1998" a publication of the Pan American Health Organization
ON LINE: Country Health Profiles last updated 10/20/1999
<http://www.paho.org/English/SHA/prflgut.htm>

years, 12.9%; the population aged 15–19 years, 11.5%; and the population aged 60 and over, 5.1%.

It is estimated that in 1995 urban dwellers made up 43% of the total population. Most of the urban population is concentrated in two cities: Tegucigalpa and San Pedro Sula (32.9% and 16.2% of the total urban population, respectively). There is a significant geographic/sex differential in this migration: females tend to migrate primarily to the major urban centers, whereas males migrate mainly to agricultural areas. In 1995, the total estimated net rate of internal migration was –1.6% (–1.7% for males and –1.4% for females). Most migrants are between 15 and 44 years of age, and the largest proportion are in the 20–29 age group. Emigration also has been increasing: in 1989 the net emigration rate was –1.1% (–1.3% for males and –1.0% for females).

Life expectancy at birth, which was 64 years for the total population in the period 1985–1990, was estimated at 71 years for women and 66 years for men in 1996. The estimated total fertility rate, according to the 1995–1996 National Epidemiology and Family Health Survey (ENESF), was 4.9, 6.3 in rural areas, and 3.9 in urban areas. The birth rate per 1,000 population was 33.4 in 1996.

In 1990, the last year for which information is available, an estimated 44.2% of deaths went unreported. According to estimates of the Secretariat for Planning, the crude death rate in 1996 was 5.8 per 1,000 population; a total of 32,666 deaths occurred, of which 18,510 were males and 14,156 were females. Of the total number of deaths, 15% (5,355) were reported in connection with hospital discharge figures.

In 1990, the five leading causes of death in the general population were ischemic and hypertensive diseases, diseases of pulmonary circulation, and other forms of heart disease (19.0%); accidents and violence (13.0%); diseases of the respiratory system (9.5%); intestinal infectious diseases (9.0%); and malignant neoplasms (8.2%). The leading causes of infant mortality in 1990 (1,624 registered deaths with 638 attributed to ill-defined conditions) were intestinal infectious diseases (28.2%); diseases of the respiratory system (21.8%); and certain disorders originating in the perinatal period (20.6%).

Because of the aforementioned problems with the registration of deaths, the country relies on other sources to calculate mortality figures. These include national surveys conducted on specific subjects and population censuses carried out in certain geographical areas, which provide mortality databased on various methodologies. The data on maternal mortality are considered reliable and are based on prospective studies carried out in 1990, which indicate a rate of 221 maternal deaths per 100,000 live births. The infant mortality rate decreased from 50 per 1,000 live births in 1990 to 42 per 1,000 in 1994.

Between 1994 and 1997 the Ministry of Public Health stepped up the process of decentralizing functions to health areas and to municipal government agencies. The Ministry also enlisted other key players in the promotion of the process of increasing access to health services as a fundamental aspect of health reform.

The national access initiative, which seeks to address these problems by extending service coverage and transforming the country's basic health institutions—under the

leadership and regulation of the Ministry of Public Health—encompasses three basic strategies: adaptation of local health systems, with an emphasis on health areas; social control of the management of health systems; and development and improvement of human resources.

The Ministry of Public Health has promoted specific policies, such as rapid extension of services through universal access to basic health packages; coordination of international cooperation; reorganization of the health system, with an emphasis on the local levels; environmental and health protection; health financing; food security; development of institutional and community human resources; and shortages of drugs and medical supplies.

The health services are provided mainly by the Ministry of Public Health, which functions as both a service provider and a regulatory agency, the Honduran Social Security Institute, and to a lesser extent, the Armed Forces Health System; the National Social Welfare Agency; and the Department of Occupational Medicine, Hygiene, and Safety within the Ministry of Labor. The public health subsystem also oversees the National Autonomous Water Supply and Sewerage Service (SANAA). The private subsystem provides care to 10% of the total population.

The services provided by the Ministry of Public Health are organized in six levels of care, linked in a weak referral system. The Ministry has organized nine health regions, which, in turn, are divided into 41 health areas; this division does not mirror the country's political-administrative division. In 1994 the Ministry's network of services consisted of 978 establishments, including 28 hospitals, 214 physician-staffed health centers, 727 rural health centers, and 9 maternal and child clinics. Of the 28 hospitals, 6 are considered national reference hospitals, 6 are regional hospitals, and 16 are area hospitals.

The Ministry of Public Health oversees various disease prevention and control programs, among them the programs for control of cancer, STDs and AIDS, rabies, vector-borne diseases, tuberculosis, and leprosy.

The epidemiological surveillance system has maintained coverage levels of under 60% for weekly national reporting of diseases, although there are significant differences among the various health regions of the country. The system encompasses diseases under international surveillance (cholera, plague, smallpox, yellow fever, influenza, and malaria), as well as diseases under surveillance by the national disease alert system and the Expanded Program on Immunization: typhoid fever, dengue, meningitis, and encephalitis. Most of the control programs have established their own information systems, but they are not linked together. Honduras participates in epidemiological monitoring of diarrheal diseases, amebiasis, tuberculosis, rabies, leishmaniasis, and AIDS.

The laboratory network is made up of 28 hospital laboratories, 8 regional laboratories, and 1 central reference laboratory.

On average, there are 6.5 physicians per 10,000 population (33% in the public sector); 2.4 professional nurses (48% in the public sector); 8.4 auxiliary nurses (87% in the public sector), and 0.2 dentists (18% in the public sector). There are insufficient numbers of

human resources in the public sector for the majority of the professions. The situation is exacerbated by the unequal geographical distribution of resources; in some communities in the country, the job market for health personnel is saturated, whereas in others—generally those that are most inaccessible—many positions are vacant. The public sector, including IHSS, employs 69% of all health workers in the country.

There is little applied research in health and most studies are conducted by the United States Agency for International Development (USAID), the Japanese International Cooperation Agency (JICA), PAHO/WHO, the World Bank, and the Governments of the United Kingdom and Sweden.

Health expenditures, as a proportion of GDP, increased from 2.7% in 1990 to 3.0% in 1995 and, as a proportion of total public spending, health expenditure has shown an erratic pattern: from 8.1% in 1990 to 6% in 1993 and to 9.2% in 1995. Similar fluctuations were observed in health spending as a percentage of total central government expenditures (10.4% in 1990, 9.0% in 1993, 13.4% in 1995). Health expenditure per capita increased from US\$ 18.9 in 1990 to US\$ 21.5 in 1995. Current spending decreased from 70.9% in 1990 to 61.4% in 1995; the greatest decline occurred in the category of compensation (40.5% in 1990 and 31.0% in 1995), and the category of goods and services expenditures increased more than the inflation rate. Capital spending has increased significantly: from US\$ 26.0 million in 1990 to US\$ 41.2 million in 1995, representing 29.1% in 1990 to 38.6% in 1995. Hospital service expenditures dropped from 40.1% in 1990 to 28.5% in 1995, while the share of spending on the communicable disease control program increased from 18.9% in 1990 to 22.4% in 1995.

Of the total resources available for the health sector during the period 1990–1995, 78% were public funds and 22% foreign. Bilateral cooperation accounts for 53.3% of international cooperation for health, and the United States is the largest donor (45.2%); however, since 1990 there has been a decline in the amount of bilateral assistance, which has been replaced by cooperation from agencies of the United Nations system and financial institutions such as the Inter-American Development Bank and the World Bank. In 1992, the three largest bilateral donors were the United States (US\$ 38.4 million), Italy (US\$ 37.4 million), and Japan (US\$ 19.4 million).

*IR3 in Honduras*⁸

Since 1821, when it gained independence from Spain, Honduras has endured hundreds of uprisings, civil wars and changes in government. Up until the middle of this century, U.S. companies controlled the economy through their ownership of banana plantations along the north coast. The military ceded formal power in 1981, and its role in the country has shrunk ever since. Honduras is the least developed country in Central America.

Hurricane Mitch was the second deadliest storm in the hemisphere's recorded history. It rained for days, as much as four inches (10 cm) an hour, over Honduras and northern Nicaragua. The devastation was widespread, immense, and tragic. While the damage in neighboring countries, was acute, in Honduras it was incapacitating. The country was literally broken, roads flooded or covered with mud, 189 bridges destroyed. It took weeks to reestablish ground links with many regions. Tegucigalpa bore some of the worst

⁸ Adapted from a USAID Report "USAID/Honduras Hurricane Mitch Special Objective" ON LINE: <http://hurricane.info.usaid.gov>

damage as the Choluteca River decimated entire neighborhoods. Estimates project that over three-fourths of Honduras' total population was affected by the hurricane with more than 5,000 dead; over 12,000 injured; and over 8,000 missing. Projections of total economic losses ranged beyond \$4 billion and included close to \$1 billion in agricultural losses.

A USAID/Honduras strategy responded to the changed development context after Hurricane Mitch and began to address the most critical hurricane reconstruction needs, e.g. economic reactivation, public health, education, shelter, environmental management, disaster mitigation, local government, and transparency and accountability. The six primary themes, which cut across the reconstruction program and which are incorporated into all aspects of reconstruction assistance, are poverty reduction, participation and self-help, environmental improvements, strengthened role for municipal governments, accountability and transparency, and rebuilding a better Honduras. The program also expanded the geographic scope and focus of activities in health, education, micro enterprise support and municipal development to reach those populations most affected by the hurricane.

Honduras received \$291 million in supplemental funds for hurricane reconstruction via USAID. An additional \$28 million is being provided through other U.S. Government agencies administering CACEDRF funds. The above-stated funds are in addition to over \$300 million provided during the emergency and recovery phases of this effort, of which Honduras received about half. Moreover, an additional \$12.27 million in dollar resources and \$8 million in local currency funds were reprogrammed from the ongoing assistance program for immediate relief and reconstruction.

During the May 25–28, 1999, consultative meetings in Stockholm, Sweden, bilateral and multilateral donors pledged over \$10 billion for Hurricane Mitch disaster assistance to Central America. Their pledges include emergency/humanitarian, reprogrammed, balance of payments/debt relief, the reconstruction and other unspecified assistance. Of the total amount pledged, approximately \$ 2.8 billion was designated to support emergency and hurricane reconstruction in Honduras. The pledging donors include: the Inter-American Development Bank (IDB) for \$730 million; the International Bank for Reconstruction and Development (IBRD or WB) for \$702.4 million; the World Food Program (WFP) for \$81 million; the European Commission (EC) for \$142.9 million; France for \$33 million; Germany for \$72.4 million; Italy for \$66.5 million; Japan for \$62 million; the Netherlands for \$28.9 million; Mexico for \$13.0 million; Spain for \$268.5 million; Sweden for \$99 million; Switzerland for \$14.9 million; and Taipei (China) for \$18.8 million.

The aftermath of Mitch caused an increase in the number of outbreaks of vector borne illness such as Dengue and diseases carried through contaminated water such as Leptospirosis. A strong diagnostic laboratory system is key to the success of public health prevention programs.

In Honduras the goal of IR3 was essentially to rebuild the devastated and decrepit central laboratory in order to strengthen capacity of the Central Laboratory to serve as a reference lab for the country.

To meet these needs APHL:

- Replaced the laboratory benches for sections of the Central Laboratory with new benches and Formica tops
- Replaced remaining section with metal constructed furniture
- Purchased and installed appropriate laboratory equipment
- Rewired the electrical system and installed a back up generator
- Retiled the laboratory ceiling
- Refurbished the plumbing system and built tanks to provide back up water supply
- Trained two laboratorians in TB
- Trained two laboratorians in virology
- Trained two laboratorians in Dengue PCR
- Trained two laboratorians in Respiratory illnesses
- Purchased local equipment (refrigerators, office supplies, furniture)
- Installed internet service for three years
- Purchased computers to use in surveillance efforts
- Supported in country training activities in Bio Safety and Quality Assurance
- Supported the laboratories efforts to gain recognition within the Ministry of Health

Positive Outcome

The laboratory in Honduras is essentially brand new. Problems that existed and were exacerbated by the hurricane have been resolved and as a result the lab is performing better diagnostic and surveillance testing.

Nicaragua⁹

Located squarely in the middle of the Central American isthmus, Nicaragua has the largest surface area of the sub region (130,682 km²). The country is made up of three distinct regions: the Pacific, the Atlantic Coast, and the central zone. The population is unevenly distributed, with the majority concentrated in the Pacific region. The Pacific zone, which encompasses the capital of Managua, occupies 15.3% of the national territory but has 61.5% of the total population (with poverty levels ranging from 5% to 24%) and 76.4% of the urban population. The central region, with 33.9% of the total area, has 32.6% of the population (with poverty levels ranging from 15% to 35%), with most inhabitants living in rural areas. The Atlantic Coast, which occupies 50.9% of the national territory, has only 5.9% of the total population (with poverty levels ranging from 35% to 45%).

The past ten years have seen great changes in the social, economic and political conditions in Nicaragua. The Government that was elected in 1990 inherited a country recovering from war, with a divided and polarized society. It had to address three major problems that demanded rapid solutions: putting a definitive end to the civil war, curbing inflation, and laying the foundation for sustainable economic growth, which entailed resolving property ownership disputes and promoting private sector investment.

As of 1996, the Nicaraguan economy was continuing to grow at a sustained rate, as it had since 1994. This growth is a reflection of government efforts to consolidate stabilization programs with economic growth. In this context, the gross domestic product (GDP) rose for the third consecutive year, increasing 5.5% in 1996, the highest growth rate in 17 years. At the same time, the GDP per capita grew 2.3%. Yet, Nicaragua remains the second poorest country in the Western Hemisphere (see Graph #2- annex III)

During the first half of 1996, the average monthly inflation rate was 0.92%, higher than during the same period the previous year (0.77%). The rise in inflation began to slow in July, and by the third quarter it had dropped to an average of 0.13%; nevertheless, in the month of October the inflation rate was 2.6%, basically because of increases in the prices of beans, rice, and butane gas. In late 1996, the cost of the basic urban market basket of 53 products in the city of Managua was C\$ 1,225.60—13.6% higher than in 1995.

In 1996 the wage policy in the public sector continued to be determined by the process of structural adjustment and reduction of spending that has been under way since 1991; salaries in the public sector have remained frozen. The per capita debt (US\$ 2,600) exceeds annual per capita income (US\$ 407).

The country's social policies have been guided by its economic adjustment policies and therefore have prioritized mechanisms to optimize social spending. Emergency social funds have been established to compensate for the reduction in earnings of the poorest groups, self-help activities have been promoted, and community efforts have become an important strategy for combating poverty. The Government has designed several programs to alleviate poverty, among them the Social Investment Fund, the National Reconciliation and Rehabilitation Program, the Action Fund for Oppressed Sectors, the Community Employment Fund, and the Cooperative Production Program.

⁹ Excerpted from "Health in the Americas 1998" a publication of the Pan American Health Organization
ON LINE: Country Health Profiles last updated 10/20/1999 <http://165.158.1.110/english/.sha/prflnic.html>

Nicaragua is subdivided into 16 departments, 2 autonomous regions, and 145 rural or semi urban *municipios*. Starting in 1990, in the context of State reforms, a process of decentralization was launched with a view to strengthening the *municipios* as the principal managers of local socioeconomic development and providers of basic services. According to the 1995 census, the population totaled 4,139,486 and women made up 52% of the total. As for age structure, 45.4% of the population belonged to the group aged 0–14 years, 51.8% to the group aged 15–64, and 2.8% to the group 65 and over. The results of a quality-of-life survey carried out by the National Statistics and Census Institute (INEC) in 1993 indicated that 75% of Nicaraguan households had one or more unmet basic needs and 44% lived in conditions of extreme poverty. In rural areas, the proportion of households in extreme poverty was 60%.

Life expectancy at birth increased from 48.5 years in the period 1960–1965 to 66.2 years in 1990–1995. In rural areas, life expectancy is almost 10 years lower, although females have a higher life expectancy than males. The estimated birth rate for the period 1990–1995 was 40.5 per 1,000, and the fertility rate was 5.0 children per woman.

Between 1940 and 1995, as a result of a steady migration from the country to the cities, the percentage of the population living in urban areas gradually increased from 30% to 57%. Nicaragua has thus become a predominantly urban country, although a large proportion of the population in the capital city is of rural origin.

IR3 in Nicaragua

After Hurricane Mitch struck, Nicaragua registered 3,500 deaths, and moreover, enormous damage to public health infrastructure, particularly in the safe water supply and sewage treatment systems. With the loss of many dwellings, thousands of people became evacuees and refugees. Economic losses were monumental.

The environmental changes provoked by the intense rains and floods notably increased the occurrence of diarrheal diseases and cholera, leptospirosis, diseases transmitted by mosquitoes (among these, dengue and malaria), acute respiratory illnesses, and skin diseases.

Nicaragua is a country in epidemiological transition. Accompanying the high frequency of chronic and degenerative diseases is a high incidence of endemic/epidemic diseases such as cholera, dengue, leptospirosis, pneumonias and others. In these conditions, it is imperative to count on a modern and efficient diagnostic laboratory. Diagnostic errors could produce grave consequences within the health system; those performed in an incorrect manner could lengthen community infectious disease problems.

The CNDR¹⁰ is comprised of six laboratory modules, including Microbiology, Clinical Laboratory, Entomology, Biochemistry, Parasitology and Quality Control. In the Microbiology department, there are five main sections: Bacteriology, Mycobacteria, Microbiology, Virology (including food borne illnesses), and Media Preparation. One hundred and ten staff members, including administrative and accounting personnel, work at the CNDR. The facility, which was constructed in 1982, is well maintained. Most

¹⁰ Centro Nacional de Diagnóstico y Referencia

laboratory modules are similar in area and layout to the example in this diagram, which is an actual plan of the Bacteriology Laboratory Section.

Of the laboratories administered by the SILAIS, around 164 test for general fecal analysis, malaria, sputum smears, and blood analysis without hemoglobin. Annual production is unknown, except for malaria and tuberculosis. In 1998 75,410 sputum smears were tested with a 2.8% positivity index.

In the Health Centers, laboratory tests are requested by physicians who receive the results. The patient reports directly to the laboratory to deliver the specimen or for it to be collected there. Seriously ill patients with reportable diseases (Dengue, Meningitis, Malaria) are referred to the nearest hospital.

With the exception of Managua, the other 16 departments relate to a principal surgery hospital, which offer services to adults and children. Of these, all have laboratories that perform hematology, basic clinical chemistry, urinalysis, general fecal analysis, and blood supply analysis. Seven of the 16 hospitals have a bacteriology laboratory. Bacteriology is limited to urinalysis and blood cultures. The majority works with obsolete and damaged equipment. For example, they have only one autoclave to sterilize and eliminate infectious material. They do not have a pH meter for culture medium control and share a refrigerator with other laboratory areas.

In Managua, of seven state hospitals, all have laboratories for blood banks, hematology, basic clinical chemistry, urinalysis, and general fecal analysis. Only five have equally developed bacteriology. Only one hospital has good materials and equipment. At certain times of the year, the bacteriology laboratories close for vital equipment repairs such as autoclaves with incubators. Of these five labs, only two have a pH meter.

The CNDR is the national reference lab of Nicaragua. A variety of advanced diagnostic procedures are only provided by this source. These include IgM for dengue, measles, rubella, hepatitis B and C, as well as PCRs, virus cultures, and diagnostics for leptospirosis. The CNDR also functions as confirmation center for bacteriologic isolates.

For IR3 the CNDR proposed to strengthen laboratory diagnosis of infectious bacterial diseases, a core public health laboratory function. To this end Nicaragua wanted to train 32 laboratory technicians in bacteriological methods, quality control and preventive maintenance of laboratory equipment, provide essential laboratory equipment to regional laboratories and CNDR, and improve the knowledge and proficiency of bacteriologic technicians, improve public health disease reporting by increased testing and use of computers, and strengthen integration with clinical components of the medical systems.

To meet these needs APHL:

- Supported the development and implantations of four three month bacteriology

- Courses for 32 technicians
- Remodeled the bacteriology laboratory at the CNDR
 - Purchased equipment for the central lab as well as the bacteriology areas in 32 Local labs
 - Purchased computers to be used in the WHOnet system
 - Trained two laboratorians in TB
 - Trained one laboratorian in Antimicrobial resistance
 - Trained one laboratorian in *Leptospirosis*
 - Trained two laboratorian in *E. Coli*
 - Trained one laboratorian in *B. Pertussis*
 - Purchased local equipment and furniture (refrigerators, desks, storage lockers)
 - Provided two training courses in preventative maintenance and Bio Safety
 - Supported the production of teaching materials and Standard operating Procedure Manuals
 - Supported the participating of one laboratorian in the Internationals training on TB in Peru

Positive Outcome

The result of the intensive training in basic bacteriology can already be witnessed in many of the local labs. Prior to the training records were not well kept and test results showed a large number of false positive results. A visit in December of 2001 demonstrated that labs where technicians had already received training were functioning at a higher capacity, keeping better records, and cases of false positive results were declining.

Challenges

While APHL feels that overall IR3 has demonstrated some very exciting and tangible results, throughout the project there were many challenges that needed to be addressed.

Project Deadline

The first challenge was meeting the project deadline. APHL had a cost reimbursable agreement with CDC-NCEH. The agreement was signed in March of 2000 and was to span two years worth of activity. That meant that there was a three-month difference between the actual project deadline versus the contractual end date. All IR3 activities were programmed to end March 2002 and the three-month difference created some concerns that activities would not be completed in time. Fortunately the project was granted an extension through the term of the contract.

On the other hand two years proved to be too short a time periods in which to complete all activities. It was as though just as the project was picking up momentum, things had to end. All APHL coordinated activities through IR3 have been to build capacity within the public health laboratories to ensure that they can handle all of the testing and surveillance needs that may arise out of future disasters as well as increase capacity for day to day testing and surveillance. One of the outcomes of the project was to create an association of public health laboratories for the region. The premise of the relationships forged under this idea is that labs affected by disasters can turn to neighboring countries for assistance in addition to ensuring that ongoing communication and exchange of technical information occurs at all times. More time to further develop and assist the countries in firmly establishing this entity would have been nice. APHL hopes to explore ways to continue supporting this activity within the sub region.

Coordinating with Project Partners

The second challenge was coordinating all activities with the partner agencies involved in the overall Hurricane reconstruction project. First, while APHL's agreement was with CDC/NCEH all country laboratory work proposals had to be approved by USAID at the beginning of the project. This slowed the implementation of activities slightly since the role of APHL was not clear from the beginning.

Coordination was difficult with USAID at the country level because every mission office is different and required different information from APHL, this occasionally created unnecessary obstacles in APHL's ability to work in country. An example is the need for country clearance when traveling. As a contractor APHL was told that clearance was not necessary, but many of the missions required clearance for APHL staff to travel. The process was not the same from country to country and never completely clarified.

Additionally, APHL's contact with USAID and CDC was to ensure that laboratory and MoH activities were complimentary to other reconstruction efforts. MoH and Lab priorities occasionally differed from USAID mission office priorities. For example, the lab would want to purchase certain test kits for Hepatitis but USAID requests that tests kits be purchased for HIV. This added another step in the process because new discussion with the MoH had to occur and APHL technical advisors also had to agree that

the change in priority was of benefit to the lab and would meet the original objectives of the project.

Finally, coordination with CDC partners was challenging because while APHL's contract was with NCEH, all activities were coordinated through EPO. APHL's contract outlined different reporting mechanisms than EPO's agreement with USAID. This caused some confusions and added steps to the process of reporting both qualitative and financial information.

Pros and Cons of a Cost Reimbursable Contract

A cost reimbursable contract allowed for flexibility in APHL's ability to procure equipment, subcontract with local service providers within the countries, and have fewer restrictions placed on travel. While APHL has always worked within federal guidelines, a contract allowed for exceptions to be made when necessary. On the other hand a cost reimbursable agreement created challenges because it was critical for APHL to be reimbursed in a timely manner and prompt payment of invoices had not been occurring regularly. This delayed the execution of deliverables and challenged our ability to meet all objectives prior to the project end date.

Communication

Unclear communication with the countries with partners and occasionally internally created occasional obstacles.

Language barriers were often a problem at the outset of the project. APHL only had one full time staff member that was completely fluent in Spanish and had only basic knowledge of French. When this staff person was on travel or unreachable and problems in arose, they could not always be immediately resolved due to lack of understanding.

Additionally, it was difficult to find APHL members and member laboratories that were able to provide comprehensive training in the appropriate language. To resolve this APHL utilized translators and interpreters on many occasions.

Because of the various agencies involved in the overall execution of the project there sometimes was a lack of understanding of the role of APHL within the overall project. There was also a misunderstanding about the nature of the contractual agreement that APHL had with NCEH. While every effort was made to clarify and communicate, there were occasional questions. For example, APHL has been repeatedly asked for copies of budgets from each country. APHL never budgeted the project on a country by country basis. Instead APHL provided the countries with general guidelines stating that the limit for expenditures would be \$500,000. However depending on the level of activity in each country, APHL expended more funds in some countries than in others.

Finally, communication and coordination at the country level was challenging any time there was an internal change leadership. This was especially true for the Dominican Republic. Until closer to the end of the project it was never exactly clear who the main point of contact in the DR should be. APHL often found itself in the position of playing mediator between the different players from the MoH who did not necessarily communicate amongst themselves. Despite repeated requests for specific information the

DR often did not get to benefit from the same amount of training and rehabilitation work as other countries. It was not until near the end of the project that formal request to APHL was made in the format specified at the beginning. As a result not all requested activities were completed prior to the project end date.

Lessons Learned

APHL has had a very positive experience throughout its involvement in the Hurricane Reconstruction project. Overall there are many outcomes and lessons that will be taken from this experience and applied to future projects.

- In country relationships take time to build and foster, these relationships are key to the successful implementation of activities.
- Political changes and stability affect the implementation and outcome of projects. More proactive and clear plans need to be laid out in order to take this into consideration.
- APHL's cost reimbursable agreement had pros and cons, however a mechanism with more clear coordination between all agencies and partners should be established for future recovery projects from the beginning instead of making it up as you go along or as needed.
- Procuring and installing laboratory equipment and ensuring that there is a proper location, water and electricity for it to be utilized is vital to the success of any laboratory capacity building project but is a lengthy and complex process. In the future plans need to be in place ahead of time so that equipment is received, installed and personnel training in a timely fashion.
- US Agency priorities may not completely compliment local priorities and in order to ensure buy in and sustainability US agencies need to allow for more time and flexibility to allow for all partners to reassess priorities and make compromises.
- Evaluation is vital to determine the success of a project. Evaluation components are difficult to build into an emergency relief project, however this should be taken into consideration in the beginning of the project and time or funds should be allotted for evaluation either at the end of the project or further down the road.
- The relationship that APHL members and staff built with the lab directors from the project countries was a key component to the success of the project. As a result the countries are ready to establish their own APHL type organization and are in constant communication.
- APHL and PAHO coordinated regularly in training activities. This relationship worked because PAHO organized sub-regional activities and APHL was able to replicate these activities at the country level.
- APHL's members provided important laboratory expertise and guidance throughout the planning and implementation for activities.
- Coordination committee meetings with partner agencies helped address misunderstandings, clarify issues and ensure that activities were complimentary.