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Dengue in the Americas. 1980—1987

Worldwide dengue is by far the arbovirus disease of man which causes higher impact in terms of public health. Every year millions of persons become infected with dengue viruses in countries of Asia, Africa, Pacific islands and the Americas. The vast majority of these infections is associated with the classical form of dengue, undifferentiated fever or asymptomatic infections. In addition, several tens to hundreds of thousands of the more severe form of dengue —dengue hemorrhagic fever/dengue shock syndrome (DHF/DSS) are reported every year, most of which occur in South-East Asia. The case fatality rate among hospitalized cases can vary from less than 1% to about 5% in different countries. DHF/DSS is among the ten leading causes of hospitalization and death in children in at least eight tropical Asian countries which reported at least 1,5 million hospitalizations and 33,000 deaths due to the syndrome since the 1950s [1].

In the Americas, dengue-like illness was first recognized in the 18th century [2] and in the Caribbean epidemics of dengue recorded since 1827 [3]. Clearly, dengue activity in the Americas has increased considerably in the past 25 years. The first laboratory documented pandemic occurred in the Region in 1963 and was caused by dengue serotype 3. Subsequently, up to 1977, several dengue outbreaks associated with dengue serotypes 2 and 3 were confirmed in the Caribbean and in the northern part of South America. It is estimated that in Colombia alone almost 1.5 million persons were affected by the epidemics of the 1970's [4]. Also in the 1960's dengue types 2 and 3 have been determined to be endemic in Haiti, the Dominican Republic and Puerto Rico.

In early 1977, dengue-1 virus was introduced in Jamaica where it caused an extensive outbreak. Virtually all the islands of the Caribbean were subsequently strucked by the virus. In South America, epidemics broke out in Colombia, French Guiana and Venezuela, while in Central America epidemics were reported in Honduras, El Salvador, Guatemala and Belize. Spreading to the north, dengue-1 was introduced into Southern Mexico at the end of 1978 and during 1979-1980 the epidemic spread through many Mexican states [5,6]. In the second half of 1980, the virus spread to the State of Texas in the United States of America, where autochthonous cases were confirmed for the first time since 1945 [6,7]. About 702,000 cases of dengue were reported by countries from those years (1977-1980) in which dengue-1 was practically the only serotype circulating in the Region. Although that figure is clearly an underestimate of the real incidence, it nevertheless demonstrates the magnitude of the epidemic. This report summarizes the main events of dengue activity in the Americas during the present decade.

IN THIS ISSUE...

The Situation of Dengue During the 1980s

Dengue circulation in the Americas during the present decade manifested as explosive and severe epidemics, as small epidemics or in certain occasions relatively silent. Thus far only dengue serotypes 1, 2 and 4 have been recovered from indigenous cases in the Americas during the 1980s. Undoubtedly, the DHF/DSS outbreak due to dengue-2 in Cuba, in 1981, was the most significant event of the decade, as it was responsible for the worst human impact ever observed in the dengue history of the Americas. Dengue-4 was introduced in the Americas in 1981, probably originated from French Polynesia. After causing a series of outbreaks in the Caribbean, Central America, Mexico and northern South America, particularly during 1981-1983, dengue-4 became endemic in the Region. Illness associated with dengue-4 has been self-limited and generally mild [8,9,10]. In 1980 and from 1984 through mid-1988 most dengue outbreaks have been associated with dengue-1. Large and extensive outbreaks of classic dengue associated with this serotype occurred in several countries and territories including Aruba, Bolivia, Brazil, Ecuador, Nicaragua and Mexico.

As seen in Table 1 most cases in 1982-84 were reported from Mexico, Colombia, Puerto Rico and El Salvador. The increase of dengue activity in 1985 was mainly due to epidemics in Aruba and Nicaragua which contributed with almost half of the cases reported in that year. During the two subsequent years, extensive epidemics in Brazil were responsible for the high number of reports, and this country alone contributed with 53.1% and 69.4% of cases notified during 1986 and 1987, respectively.

United States of America. Indigenous dengue transmission in the continental USA during the present decade has been documented in Texas in 1980 and 1986 [11] (Gubler, D.J., personal communication, 1988.) About 50 autochthonous cases were reported in these two years and infections were associated with dengue-1 serotype. Apart from these, all dengue cases reported in the USA during the 1980s were imported cases. Most of these have travelled to the Caribbean but there were also confirmed patients who visited Central America, Africa and Asia [11,12] (Gubler, D.J., personal communication, 1988.)

Mexico. Mexico experienced several epidemics of dengue during the 1980s. Large epidemics of dengue-1 occurred in 1980 and 1982 and for the first time in many years, cities of the Pacific and Mexico's Gulf coastal areas were affected. Evidence of dengue-2 and 4 transmission was also detected in 1982 in the States of Tamaulipas (northeast) and Oaxaca (southeast) [13,14]. From 1983 to 1986, virological data demonstrated the circulation of dengue-1, 2 and 4, and in 1987 only dengue-1 was isolated. Dengue outbreaks occurred in cities and suburban areas from east, west, north, south, and central Mexico, and 24 of the 32 Mexican states were affected. The intensity of these outbreaks varied in different years, and most of them were associated with dengue type 1. Interestingly, since 1986 dengue transmission in Oaxaca and Puebla has been documented at altitudes higher than 1,200 meters. Most of the illness has been of the classical dengue fever type, although eight cases of haemorrhagic dengue associated with dengue-4 infection were reported in 1984 [13] (Zárate, M.L., personal communication, 1988.)

Central America. A major epidemic occurred in Nicaragua in 1985, with two periods of dengue activity. The initial wave was observed in the first part of the year and only dengue-1 was isolated at this time. Virus activity reappeared in August and both dengue-1 and 2 were recovered from cases, although the majority of isolates were dengue-1. A total of 17,483 cases, including some fatalities, were notified by Nicaragua in 1985 [15]. In El Salvador outbreaks associated with dengue serotype 4 occurred during 1982-83; after a period of relative quiescence from 1984 to 1986, an outbreak of dengue illness was reported during the second half of 1987, which was associated with dengue-1, 2 and 4, although the last serotype was more frequently isolated. In Honduras both dengue-1 and 2 were isolated from cases in San Pedro Sula in 1984 and 1986 [16,17], and an outbreak was observed from May to August 1987 in the southern part of the country with an estimated 8,300 cases in the city of Choluteca, although only 261 cases were officially notified in this year. This outbreak was caused by dengue-4, but dengue-1 was also isolated from febrile cases in northern Honduras [18]. Guatemala reported less than 200 dengue cases during 1980-83 and no cases during 1984-86; in 1987, however, several dengue outbreaks occurred in the country with 2,318 notified cases. Dengue-1 was isolated from several patients.

Caribbean Region. The most significant dengue event during the present decade in the Americas was the severe epidemic of DHF/DSS, which occurred in Cuba in 1981. During this outbreak there was an estimated 24,000 cases of DHF, approximately 10,000 shock cases and 158 deaths [19,20]. Most cases occurred during a three-month period. The outbreak was rapidly brought under control using anti-*aegypti* measures and since then Cuba has been free of dengue [21]. So far, this was the only outbreak of

Table 1. Number of reported cases of dengue by country in the Americas 1980-1987.

Subregion Country	1980	1981	1982	1983	1984	1985	1986	1987	Dengue Serotypes
REGIONAL TOTAL	66,889	385,502	55,054	46,298	38,965	69,010	89,145	128,769	
LATIN AMERICA [a]									
Bolivia	...	...	...	...	...	...	...	1,994 (1)	(1)
Columbia	9,894 (1,2)	7,790 (1)	6,790 (1,2,4)	14,081 (1,2,4)	7,540 (1,4)	7,797 (1,2)	6,048 (1,2)	17,538 (1,2,4)	(1,2,4)
Venezuela	...	... (1)	...	...	... (1,2)	... (1,2,4)	...(1,2,4)	58 (2,4)	(1,2,4)
BRAZIL	...	...	... (1,4)	...	...	...	47,370 (1)	89,394 (1)	(1,4)
CENTRAL AMERICAN ISTHMUS									
El Salvador	2,055	5,170	5,095 (4)	3,814 (4)	560	425	916	2,836 (1,2,4)	(1,2,4)
Guatemala	30	104	33	2	...	...	...	2,318 (1)	(1)
Honduras	2,078	1,612	1,217	729 (1)	378 (1,2)	307 (4)	569 (1,2)	261 (1,4)	(1,2,4)
Nicaragua						17,483 (1,2)	484	87	(1,2)
MEXICO	51,398	17,046 (1)	30,904 (1,2)	23,510 (1,2,4)	27,312 (1,2,4)	16,182 (1,2,4)	21,975 (1,2,4)	7,698 (1)	(1,2,4)
LATIN CARIBBEAN									
Cuba	169 (1)	344,203 (2)	...	...	...	...	...	...	(1,2)
Dominican Republic	54	619	435 (4)	538 (4)	260 (1,4)	92 (2,4)	6 (1,2,4)	20 (1,2,4)	(1,2,4)
Haiti	255	44 (4)	211 (1)	483 (1)	328 (1,2)	20 (2)	... (1)	...	(1,2,4)
Puerto Rico	921 (1)	8,350 (1,4)	9,536 (1,4)	2,789 (4)	1,865 (1,2)	2,376 (1,2,4)	10,659 (1,2,4)	5,835 (1,2,4)	(1,2,4)
CARIBBEAN									
Aruba	...	...	...	...	...	24,000 (1)	...	...	(1)
Barbados	...	6 (1)	99 (1,4)	63 (4)	63	...	...	78 (2)	(1,2,4)
Belize	4	9	482	26	137 (1)	...	1	...	(1)
Bonaire	...	...	...	...	...	6 (1)	...	...	(1)
French Guiana	...	... (1)	... (4)	...	...	...	229 (2)	...	(1,2,4)
Guadeloupe	...	...	sporadic	sporadic	339	216	120	344	
Martinique	...	...	sporadic (4)	sporadic	sporadic	sporadic			(4)
Jamaica	9	47 (2,4)	21 (2,4)	26 (2,4)	12 (2)	3	3	3 (2)	(2,4)
Saint Martin	...	...	...	...	...	2 (2)	...	...	(2)
Suriname	...	22 (1)	25 (1,4)	...	...	...	54 (2)	1 (2)	(1,2,4)
Trinidad and Tobago	...	14 (1,2,4)	16 (1,2,4)	118 (2,4)	31 (1,4)	7 (1,2)	145 (2)	125 (2)	(1,2,4)
Virgin Islands (USA)	...	127 (1,4)	2 (1,4)	1	73 (1)	43 (1)	74 (2)	77 (1,2,4)	(1,2,4)
Other Caribbean [b]	7	138 (1,4)	44 (1,2)	11	4	3 (2)	170	7	(1,2,4)
NORTH AMERICA									
United States [c]	15	201 (1,4)	144 (1,2,4)	107 (1,2,3,4)	63 (1,3)	48 (1,4)	322 (1,2,4)	95 (1,3)	(1,2,3,4)

Source: Country reports to PAHO. The data from the U.S.A., Puerto Rico, the Virgin Islands, Aruba, Bonaire, St. Martin and French Guiana were obtained from Dengue Surveillance Summary, San Juan Laboratories, CDC, Puerto Rico. The source of the data from Colombia, 1981-1984, was Boshell, J. et al., Dengue in Colombia, *Biomedica* 6(3/4):101-106, 1986 (figures reported to the Ministry of Health, Colombia.) The source of the data from the Dominican Republic, 1981, was CAREC's Review of Communicable Diseases in the Caribbean, 1982.

( ) virus serotypes.

a French Guiana, Guyana, and Suriname included in the Caribbean.

b Anguila, Antigua and Barbuda, Dominica, Grenada, Saint Christopher and Nevis, Saint Lucia, Saint Vincent and the Grenadines are included in Other Caribbean.

c Imported cases.

DHF/DSS recorded in the Americas. Epidemics of dengue fever in the Caribbean during the 1980s were due mainly to dengue virus type 4, and affected many islands during 1981-82, including Curacao, Dominica, Grenada, Guadeloupe, Haiti, Jamaica, Martinique, Puerto Rico, St. Barthelemy, St. Christopher and Nevis, St. Lucia, St. Martin, St. Thomas, and Trinidad and Tobago. Many isolates of dengue-4 were obtained from patients in these islands but the actual number of reported cases was small, perhaps due to the relatively mild course of the infection. A significant outbreak of dengue fever associated with dengue-1 virus, occurred in Aruba from November 1984 to March 1985. Data obtained

from surveys indicated the occurrence of an estimated 24,000 cases; two laboratory proven fatalities associated with haemorrhagic disease were documented among members of a family. Apart from these outbreaks, no major dengue activity was reported from the Caribbean, although isolation of one or more dengue serotypes were obtained from cases in these islands. In Trinidad, for instance, dengue-2 virus has been recovered from patients every year from 1981 through 1987 (except 1984), particularly during 1986 when a large number of isolates was obtained. Evidence of circulation of dengue-2 in Jamaica has been documented by virus isolation during 1981-84 and in 1987. A small outbreak associated with dengue-2 was recorded in Barbados late 1987; 15 strains of dengue-2 were isolated from febrile patients during this year. All three virus serotypes have been circulating in the Dominican Republic and in Haiti, but a small number of dengue cases were reported by the two countries. In contrast, the number of cases reported from Puerto Rico varied from about 921 in 1980 to 10,659 in 1986 (Table 1) and infections have been associated with all three dengue serotypes. These figures probably reflect the active laboratory-supported surveillance carried out in Puerto Rico. Although most cases were of classic dengue, cases of DHF/DSS were also recorded in Puerto Rico, particularly during 1986-1987.

South America. Endemic dengue virus circulation continued to be observed in Northern South America. All three serotypes were detected in Colombia, Venezuela and Suriname. Dengue-2 and 4 were also reported in French Guiana. Several outbreaks occurred in Colombia, Suriname and Venezuela, but case reports came almost exclusively from Colombia (Table 1). At least 10 per cent of the population of Paramaribo, Suriname, suffered dengue-like illness in 1982; both serotypes 1 and 4 circulated in Suriname during this year. A small outbreak of dengue occurred in Caracas, Venezuela in 1987 which was associated with dengue-2 and 4, but predominantly with serotype 2; no dengue outbreaks have been reported by Venezuela since 1978 [22]. Apart from this, four countries which had been free from dengue for a long period of time were affected by the virus during the 1980s. A summary of these outbreaks is presented in the next section of this report.

Newly Affected Countries

Major outbreaks of classic dengue associated with serotype 1 were recorded in Bolivia, Brazil, Ecuador and Paraguay during the 1980s These four countries had not experienced dengue activity for several decades or had not had previous record of the disease.

In Brazil the first outbreak was recorded in 1982, in the city of Boa Vista, in the Northern part of the country near to Venezuela. The outbreak was associated with serotypes 1 and 4 and over 10,000 persons were estimated infected [23,24]. Vector control measures were implemented and the outbreak was interrupted. No dengue activity has since been reported in this area. In 1986-87 Brazil suffered extensive outbreaks due to dengue-1 [25]. The first and largest outbreak was registered in the State of Rio de Janeiro, and was recognized in the first semester of 1986 [25, 26]. The States of Alagoas and Ceará, located in the northern seacost of the country wy, in the States of Minas Gerais, Bahia and São Paulo [25]. Nearly 140,000 cases of dengue were reported in Brazil during 1986-87, most of which in the State of Rio de Janeiro. However, serological surveys suggest that over one million persons became infected in this State. Intensive vector control efforts were implemented and by the end of 1987 most dengue activity in Brazil had ceased. Only 97 cases were reported in the first half of 1988.

In Bolivia the epidemic of dengue-1 occurred between December 1987 and March 1988 and affected the Departments of Santa Cruz and Tarija, particularly the city of Santa Cruz. A total of 6,861 cases were notified between December 1987 and March of 1988 (1,994 cases in 1987). Estimations based on house to house surveys suggest that some 125,000 persons developed dengue-like illness in the city of Santa Cruz and 23,000 persons in nearby rural areas; and 4,000 persons in the village of Villamontes, Department of Tarija.

The outbreaks of Ecuador and Paraguay were recorded in the first half of 1988. Dengue-1 virus was isolated from several patients in both countries. In Ecuador the city of Guayaquil was the main epidemic site and most cases occurred during March-May. By late May the epidemic was practically over. A random serological survey for detection of anti-dengue IgM antibody conducted in eight of Guayaquil's 14 "parroquias" revealed attack rates which ranged from 7.0% to 57% in the various "parroquias." Based on this data, it was estimated that about 422,000 dengue infections occurred in Guayaquil [27]. Clinically, the illness in Guayaquil was rather mild classical dengue fever and none of the severe cases reported, including some deaths, were confirmed as dengue. In Paraguay the outbreak apparently was not explosive and it was rapidly controlled through the prompt implementation of vector control measures; a total of 396 cases

was reported from March to June 1988 by the Ministry of Health.

The Increase of Cases of DHF/DSS in the Americas

Prior to the DHF outbreak in Cuba suspected cases of DHF in the Americas were reported on four occasions, from Curacao, Puerto Rico, Jamaica and Honduras. During a 1968 outbreak due to dengue-2 in Curacao, transient epistaxis, hematemesis and petechiae were observed together with thrombocytopenia as low as 10,000/mm in some patients. Some cases were first infections and others were reinfections after a previous epidemic, in 1964, during which dengue-2 was isolated and dengue-3 might also have been present [28]. During the 1975 dengue epidemic in Puerto Rico three dengue confirmed patients developed haemorrhagic manifestations. None of them went into shock and none died. Only one of the patients had disease that resembled DHF as observed in South-east Asia [29]. Two non-fatal cases suggestive of dengue shock syndrome were reported in Jamaica during an outbreak of dengue-1 which occurred in the island in 1977 [30]. In Honduras, in 1978, five fatalities were reported as suspected cases of DHF during a dengue-1 outbreak, but no clinical data were available nor were specimens submitted for laboratory examination [31].

Following the Cuban outbreak, however, every year (except 1983) confirmed or suspected cases of DHF have been reported in the Americas. Nine countries or territories reported cases of DHF/DSS, which occurred among children and adults. All cases notified by Aruba, Brazil, Colombia and Nicaragua were among adults and fatal. Most cases in Puerto Rico were children under 15 years of age and the case in St. Lucia was in a 6-year old child. The cases from Suriname occurred during an outbreak of dengue-1, they were three males over the age of 45 years whom developed shock without haemorrhagic manifestations, although all had thrombocytopenia and hemoconcentration and all three had serological evidence of unspecified dengue infection; one died a month later from bleeding of esophageal varices. During an epidemic of dengue-4 in Mérida, Mexico, in 1984, over 5,390 cases were reported, including nine cases of haemorrhagic disease, four of which had a fatal outcome. Eight of these (including the four fatalities) were laboratory confirmed as dengue, three of which by virus isolation and five by serology [16,32]. Only one patient met WHO's criteria for DHF [32]. The cases in Aruba occurred among two sibling adult cases whom manifested an haemorrhagic disease and died. Diffuse acute liver necrosis was observed in both patients and from one of them dengue-1 virus was isolated. All seven cases from Nicaragua occurred among adults and dengue-1 virus was isolated from one of them [15]. The patient from Colombia was a 19 year old male who presented fever, jaundice, skin and internal haemorrhages, hepatosplenomegaly and death; a secondary serological reaction to dengue antigen was detected by HI and MACELISA but clinically the case did not fulfill WHO criteria for DHF [33]. The Brazilian cases were persons above 15 years of age who developed haemorrhages, shock and died; dengue-1 virus was isolated or dengue antigen was detected from organs of these patients; one of the patients was a 17 year old boy who had juvenile rheumatoid arthritis and microspherocytosis (unpublished data from Superintendencia das Campanhas (SUCAM), Ministry of Health; Fundação Oswaldo Cruz (FIOCRUZ) Rio de Janeiro; Municipal Health Department, Niterói, and Instituto Evandro Chagas (FSESP) Belém, Brazil). The case of St. Lucia was a 6 year old girl, who developed severe haemorrhagic disease, thrombocytopenia and haemoconcentration; the diagnosis was made serologically and the infecting serotype was not determined [34]. The cases from El Salvador were diagnosed on clinical grounds and only a few were serologically confirmed as dengue; the fatal case was said to fulfill WHO criteria for DHF. Of the 48 cases of DHF documented in Puerto Rico during 1985-1987, 46 occurred in 1986 and 1987 (Gubler, D.J., personal communication, 1988). All these cases met WHO criteria for DHF. Most cases were among patients under 15 years of age. Four were fatal. The two cases in 1985 were proven by virus isolation, one being a strain of dengue-1 and the other a strain of dengue-2. Of the 21 cases notified in 1986, six were diagnosed by virus isolation (3 isolates each of dengue-2 and dengue-4) and the remaining cases by serology. The 1987 cases were associated with infections due to serotypes 1 and 2. It should be noted that there were many more cases of haemorrhagic disease observed in Puerto Rico that were clinically compatible with DHF, but no adequate clinical and/or laboratory data for diagnostic confirmation was obtained [22,35,36,37].

Comments

Dengue has caused a major impact in the Americas, especially during epidemic periods when hundreds of thousands of persons are affected by the disease. The costs caused by loss of work, medi-

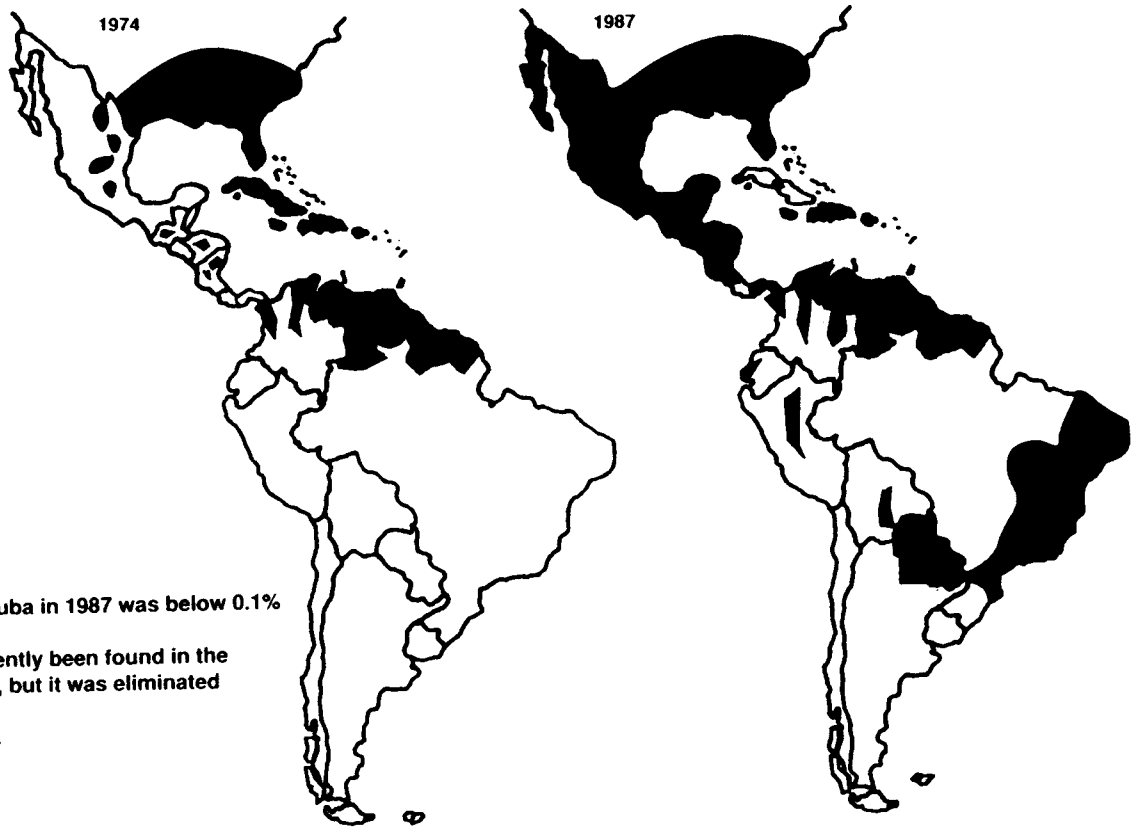
cal treatment as well as the decrease in tourism probably amounts to hundreds of millions of dollars. Moreover, the occurrence of an extensive epidemic of DHF/ DSS in Cuba with devastating consequences raises considerable fear that dissemination of this major public health problem may take place in the Hemisphere, such as observed in Asia. In that Region, the recognition of DHF in the Philippines in 1953 was followed by its appearance in other Asian countries in subsequent years [38]. The increase in incidence and dissemination of dengue observed in the Americas associated with the circulation of multiple serotypes of dengue virus, certainly contribute to increase the potential spreading of DHF in the Region. With respect to this, it is noteworthy that cases of DHF have been reported in the Americas practically every year after the Cuban epidemic in 1981.

The sharp increase of dengue activity in the Americas over the past 25 years is greatly due to the increase and dissemination of *Aedes aegypti* populations. Unfortunately, despite the existence of political mandates adopted by the American countries to eradicate the mosquito, a constellation of problems have in fact decreased the effectiveness of vector control programs in our Region. The problem is illustrated by comparing the distribution of *Aedes aegypti* in the Americas in 1974 and 1987 shown in Figure 1, which clearly demonstrates the extensive dissemination of the vector during a 13 year period. This situation is potentially aggravated by the recent introduction of *Aedes albopictus* in the Americas. This mosquito is considered an accessory dengue vector in Asia. As *Aedes albopictus* can be prevalent in suburban and sylvatic environments, it could make the control of dengue considerably more difficult, and also become an efficient link between the jungle and urban epidemiologic cycles of yellow fever [39,40,41]. Established infestations of *Aedes albopictus* are presently known in Brazil and the United States of America.

Other factors are contributing to the increase of dengue activity in the Americas, namely, the rapid growth and urbanization of populations in tropical areas and the increased frequency and spread of human travel.

The pathogenesis of DHF/ DSS still persists as a challenge. Antibody-dependent enhancement of

Figure 1. Distribution of Aedes aegypti **in the Americas.**



The Aedes aegypti house index in Cuba in 1987 was below 0.1%

In Argentina Aedes aegypti has recently been found in the Provinces of Formosa and Misiones, but it was eliminated from the latter Province.
(Ministry of Health, Argentina, 1988).

dengue virus replication in cells of mononuclear phagocyte lineage has been considered as an important factor in the regulation of dengue disease in humans; and variation in virus antigenic epitopes may also serve to modulate infection [1]. Variation in virulence of dengue virus strains has also been claimed to determine severity of dengue infection [42-46]. Also, an integral hypothesis for the development of DHF/DSS has been presented, which takes into consideration individual and epidemiological risk factors, and also viral factors [46]. These hypothesis, however, do not explain why DHF/DSS appear in some areas while other areas apparently receptive to the disease have been spared. In any case, if we assume that the events which preceeded the DHF/DSS outbreak in Cuba are predictive of the threat of DHF/DSS, then several countries in South America are at high risk. These countries, namely Bolivia, Brazil, Ecuador and Paraguay were free of dengue for several decades, or never had dengue before, and then suffered outbreaks of dengue-1, a situation similar to that observed in Cuba. Therefore, should dengue-2 be introduced in those countries in the next few years, there is a possibility that this may result in the development of an epidemic of DHF/DSS, as observed in Cuba.

Immunization against dengue certainly may become in the future an important tool in the prevention of dengue infection. Live-attenuated dengue-1, 2 and 4 candidate vaccines are presently being evaluated in Thailand and efforts are being made to the development of a genetically engineered dengue vaccine [47]. Nevertheless, it may take several years until an efficacious dengue vaccine may be available for general use. Meanwhile, vector control measures persist as the main tool for the prevention of dengue infection.

(*Source*: Dr. Francisco P. Pinheiro, Communicable Diseases Program, PAHO.)

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Epidemiology and Leadership in Public Health

I would like to start by defining our terms. Epidemiology is defined broadly, as the study of the health of human populations. Its functions are:

1. To discover the agent, host and environmental factors which affect health in order to provide the scientific basis for the prevention of disease and injury and the promotion of health.
2. To determine the relative importance of causes of illness, disability and death in order to establish priorities for research and action.
3. To identify those sections of the population which have the greatest risk from specific causes of ill health in order that the indicated action may be directed appropriately.
4. To evaluate the effectiveness of health programs and services in improving the health of the population.

For a definition of public health, I have taken the liberty of using C.E.A. Winslow's 1920 definition, but altering it somewhat to conform to current concepts:

> Public health is the science and the art of preventing illness and disability, prolonging life, and promoting physical and mental health and efficiency through organized community efforts for the sanitation of the environment, the control of infectious and noninfectious diseases as well as injuries, the education of the individual in principles of personal hygiene, the organization of services for the diagnosis and treatment of disease and for rehabilitation, and the development of the social machinery which will ensure to every individual in the community a standard of living adequate for the maintenance of health [1,2].

The definition of leadership is found to be more alusive. One dictionary defines a leader as "a person who leads others along a way; a guide," and "one in charge or in command of others." This duality of definition appears again in its definition of leadership: "the position, office or term of a leader," and "the capacity to be a leader; ability to lead." Leadership, then, has two aspects which may or may not reside in the same individual, namely, who is in charge or in command, and who has the ability to lead or guide.

This presentation will cover three topics: (1) the importance of the public health movement, (2) the role of epidemiology in this movement, and (3) the need to train leaders in the fields of epidemiology and public health. Because time is limited, the discussion of these topics will also be limited; it will serve as an introduction to a more specific exploration of their implications for the countries of the Americas.

The Importance of Public Health

What is the importance of the public health movement? Returning to Winslow, in a report to the American Public Health Association as Consultant on Accreditation of Schools of Public Health, commented that:

> The American Public Health Association believes that the general plan and structure of our educational program is sound. It is based on a conception which we in the United States are apt to take for granted but which is strange and unfamiliar in most other countries. This is the concept that public health is not a branch of medicine or of engineering but a profession dedicated to a community service which involves the cooperative effort of a score of different disciplines. The fact that doctors and dentists and nurses and engineers and health educators and microbiologists and statisticians and nutritionists sit together in our schools and take the same degree is of incalculable importance. It is based on bold assumptions; but it has worked. It provides the only basis for true cooperative community service in the future [3].

Many years later, it has been pointed out, citing Winslow, that the common denominator of the terms "community, social, and preventive medicine" is "medicine," and that they are considered to be, and in fact are, a subdivision of the overall discipline. Indeed, they constitute a very minor subdivision of medicine, as measured by every parameter: financial support, numbers of personnel, prestige, political influence, etc.

> The concept of public health, on the other hand, is that of a major governmental and social activity, multidisciplinary in nature, and extending into almost all aspects of society. Here the key

word is "health," not "medicine," the universe of concern is the health of the public, not the discipline of medicine.

The two concepts—community, social and preventive medicine on the one hand, and public health on the other—are clearly contradictory. One considers public health to be a subdivision of medicine; the other considers medicine to be a subdivision of public health [4].

In 1944, Winslow also said that "It seems certain that the organized public health profession rather than the private medical practitioner is responsible for a major part of the gains which have been made during the past forty years [5]." Winslow was commenting on the first epidemiologic revolution, the conquest of many of the infectious diseases. The same comment can be made with regard to the second epidemiologic revolution, the conquest of major noninfectious diseases. These too will be conquered primarily by public health—by altering the physical and social environment—rather than by medicine.

Epidemiology and Public Health

It is perfectly clear that epidemiology played a key role in enabling the public health movement to conquer infectious diseases. It is also clear that epidemiology has played a key role in enabling the public health movement to fulfill its present task, the conquest of the major noninfectious diseases.

What is not well known is the fact that it was the public health movement that made it possible for epidemiology to shift to the noninfectious diseases. It has been written recently:

> Why did this change occur first in Great Britain and the United States rather than in continental Europe? The hypothesis is developed that a major inhibiting factor in Europe was the concept that public health is a medical discipline; there were no independent public health centers in which epidemiology, biostatistics and other public health disciplines could collaborate. The London School of Hygiene and Tropical Medicine served as such a center in Great Britain. In the United States, the Public Health Service played a primary role in the development and transformation of epidemiology, together with a number of outstanding state and local health departments and the 23 multidisciplinary schools of public health. The mutual dependence of epidemiology and the public health movement is emphasized [2].

This was hardly a novel judgement. In exploring the history of epidemiology in the 19th century, Abraham and David Lilienfeld concluded:

> Our excursions in the historical development of epidemiology have led us to realize that epidemiology is closely interwoven with the public health movement, and our study of the evolution of the public health movement has indicated that its roots must be firmly implanted in an epidemiologic base. In order to continue with the past successes of both movements, they must be constantly nourished by each other. It is only unfortunate that one must explicitly and continuously note the relationship of epidemiology with public health. For without public health, there is no epidemiology [6].

The Tasks of Public Health

As mentioned earlier, one dictionary states that "a leader is a person who leads others along a way; a guide." To discuss leadership in epidemiology and public health, one must define which "way" we have in mind.

What are the tasks of public health today in the Americas? Tables 1 and 2 provide a good part of the answer. The leading causes of death in the Americas are: 1) diseases of the heart, 2) malignant neoplasms, 3) cerebrovascular disease, 4) accidents, 5) perinatal conditions, 6) pneumonia and influenza, 7) intestinal infections, and 8) homicide, legal intervention and war. *Every one of these causes of death can be either greatly or considerably reduced by appropriate public health actions based on current epidemiologic knowledge.*

The main tasks of public health in the Americas today are, first, prevention of the major noninfectious diseases and injuries, and second, prevention of the major infectious diseases. A third major task is health promotion, the achievement of positive health in terms of ability to function, through improved nutrition, better working and living conditions, greater opportunities for rest and recreation, higher levels of education, and other social changes. A fourth major task is to improve medical care and rehabilitation of the sick and disabled.

The Role of Epidemiology

What is the role of epidemiology in the Americas? Of the functions presented earlier, the first one is of relatively minor importance, since the work has already been done for most of the major diseases.

Table 1. Five leading causes of death, some countries in the Americas, 1980-1984.

Country	Heart diseases	Cerebro-vascular disease	Malignant neoplasms	Acci-dents	Perinatal conditions	Pneumonia and influenza	Diabetes	Congenital anomalies	Intestinal infections	Homicide and war	Other causes
Argentina, 1981	1	2	3	4	5						
Bahamas, 1981	1	3	2	5		4					
Barbados, 1984	1	2	5		4						
Belize, 1984	1	4	2	3							
Canada, 1984	1	3	2	4		5					
Cayman Islands, 1983	1	3	4	2		5					
Chile, 1983	2	4	1	3		5					
Costa Rica, 1983	1	3	2	4	5						
Cuba	1	4	2	3		5					
Dominica, 1984	1	3	2		4			5			
Ecuador, 1980	3			2	5	4		1			
El Salvador, 1984	3			1	2			5	4		
French Guiana, 1983	2	2	3	1			5			5	4 (Chronic liver and cirrhosis)
Grenada, 1984	1	2	3	5			4				
Guatemala, 1981			4	5	2			1	3		4 (Other neoplasms)
Guyana, 1979	1	2	5	3							
Honduras, 1981	3		5	1	4			2			4 (Mental disorders)
Martinique, 1982	2	3	1	5							
Mexico, 1982	2		4	1		5			3		
Netherlands Antilles, 1981	2	3	1	5	4						
Panama, 1984	1	4	2	3	5						
Paraguay (information area), 1984	1	2	3			5			4		
Peru, 1982	4		5		3	1		2			
Puerto Rico, 1983	1	3	2	5		4					
St. Christopher & Nevis, 1983	1	2	3		5	4	5				
St. Lucia, 1981	1	2	3		4	5					
St. Vincent & Granadines, 1983	1	3	2		4		5				
Suriname, 1982	1	4	2	3				5			
Trinidad and Tobago, 1979	1	2	3	5			4				
United States, 1983	1	3	2	4		5					
Uruguay, 1984	1	3	2	4		5					
Venezuela, 1983	1	5	2	3	4					4	
Virgin Islands (US), 1980	1	3	5	2							

Source: Pan American Health Organization. *Health Conditions in the Americas, 1981-1984*, Volume 1. Washington, D.C., 1986.

Work still needs to be done, of course, for diseases of unknown epidemiology which have significant impact in one or another country.

Functions 2, 3 and 4 are of the utmost importance. This is the area of *applied epidemiology*, and it is in this area that the epidemiologists can and must play a crucial role.

Leadership

How do we move the countries of the Americas in this direction? Here leadership is all-important.

How do we achieve effective leadership? Two general principles are offered. First, we cannot achieve effective leadership in the future unless we ourselves *exercise leadership now*. This conference represents a good part of the intellectual leadership of public health in the Americas; it is our responsibility, therefore, not to pass the buck.

Second, leadership has to be achieved in both senses of the term. The leaders who are in charge must accept the new direction, and those who have the ability to lead must either be in charge, or convince and help those who are in charge to move in the new direction.

On the basis of these general principles, the following specific recommendations are offered for your consideration and action:

1. Support the development of governmental administrations that place a high priority on the health, education, and well-being of the population.

Table 2. Five leading causes of death. Some countries in the Americas, 1980-1984.

Causes of Death	Score[1]	Order 1	2	3	4	5	Other
		No. of Countries					
1 Diseases of the heart	146	23	5	3	1	—	1
2 Malignant neoplasms	98	3	13	7	3	4	3
3 Carebrovascular disease	84	—	8	13	4	1	7
4 Accidents	73	4	4	6	6	7	6
5 Perinatal conditions	28	—	1	2	6	6	18
6 Pneumonia and influenza	26	1	1	—	4	9	18
7 Intestinal infections	25	2	2	1	1	2	25
8 Homicide and war	20	—	—	1	2	1	29
9 Diabetes mellitus	10	—	—	—	3	4	26
10 Chronic liver disease & cirrhosis	8	—	—	—	1	—	32
10 Benign neoplasms, carcinoma in situ	8	—	—	—	1	—	32
10 Mental disorders	8	—	—	—	1	—	32

[1]Score = 5 x no. of 1s + 4 x no. of 2s + 3 x no. of 3s + 2 x no. of 4s + 1 x no. of 5s.

Source: Pan American Health Organization. *Health Conditions in the Americas, 1981-84.* Volume 1. Washington, D.C., 1986.

2. Support the appointment of leaders of health departments, schools of public health, and departments of community, social and preventive medicine who are committed to the new direction, namely, an epidemiologic and preventive approach to the major health problems of the Americas, rather than the current overemphasis on treatment services.

3. Educate the incumbent public health leadership, as well as the politicians, the public, and the health professions, on the importance of implementing the second epidemiologic revolution, the conquest of the major noninfectious diseases. Such activity on our part is indispensable if we are serious in our aims; it would offer real leadership, to guide and help others along a new and necessary way.

4. Attract the best young people into the field of epidemiology and public health by enhancing its attractiveness as a career: paying salaries that are equal to the incomes of practitioners in the various health, engineering, administrative, statistical and social science professions; providing adequate budgetary support so that real accomplishments can be achieved, progress can be maintained, and job satisfaction assured; and removing bureaucratic obstacles to their creative ideas and programs.

5. Strengthen the schools of public health through increasing their budgetary support; revamping curricula to move in the new direction; infusing the faculty and student body with new and vigorous recruits from the health, engineering, statistical, social science and other public health disciplines; creating an atmosphere of intellectual excitement, inquiry, experimentation, and exploration of new ways to protect the health of the public; emphasizing the development of true professionals dedicated to public health goals rather than the production of narrow technicians; and above all, forging close working relationships with national, regional and local health departments. The ivory-tower complex of some of our U.S. schools is to be avoided at all costs.

6. The Americas need more well-trained noninfectious disease epidemiologists. It is necessary to send promising young people—physicians, statisticians, social scientists and others—to the centers capable of providing such training. In doing so, we must be conscious of two problems. First, those who return from their training must have jobs available where they can put their knowledge to effective use. Second, some will have been infected by the "pure scientist" virus so prevalent among academic epidemiologists; they will wish to retreat to the comfort and security of their computers rather than dirtying their hands with applied epidemiology, working with their colleagues in health departments, and training a whole new generation of noninfectious disease epidemiologists in the countries to which they return.

7. The departments of community, social and preventive medicine need to be greatly strengthened to become major departments in the medical schools, with increased funding to provide more faculty, salaries equal to the income levels of their colleagues in the clinical departments, and curriculum time and prominence commensurate with their importance. Some of these departments can and should move to become multidisciplinary schools of public health, in fact if not in name. It is essential that they follow the new direction toward epidemiology and prevention of major diseases, and that they, as well as others, reject the siren song of international foundations that offer large sums of money for so-called "clinical" epidemiology; this has nothing to do with epidemiology but everything to do with clinical diagnosis and treatment, and can only result in diverting attention, resources and talent from the urgent need to prevent the major causes of illness, disability and death in the Americas.

Finally, let me emphasize the key role of the Pan American Health Organization. I am very proud to be one of the authors of PAHO's book on landmarks in epidemiology, *The challenge of epidemiology: Issues and selected readings* [7], together with Drs. Carol Buck of Canada, Alvaro Llopis of Venezuela, and Enrique Nájera of Spain. I am also very proud to having been associated in this project with PAHO Staff, who helped and encouraged us at every turn, and who demonstrated that they have not only positions of leadership but, as the dictionary says, the capacity to be a leader, the ability to lead.

I am convinced that the future of epidemiology and public health in the Americas is in good hands. Finding a new direction is not easy, and implementing it will be far more difficult. But we have good leadership, and we have made a good start.

(*Source*: Presentation by Dr. Milton Terris at the XIV Conference of the Latin American and Caribbean Association for Public Health Education [ALAESP], held in Taxco, Mexico, from 15 to 20 November, 1987.)

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Diseases Subject to the International Health Regulations

Cholera, yellow fever, and plague cases and deaths reported in the Region of the Americas as of 31 May 1988.

Country and administrative subdivision	Cholera cases	Yellow fever		Plague cases
		Cases	Deaths	
BOLIVIA	—	*92*	76	—
Beni	—	*1*	1	—
Cochabamba	—	*86*	70	—
La Paz	—	*3*	3	—
Santa Cruz	—	*3*	3	—
BRAZIL	—	*1*	—	—
Minas Gerais	—	*1*	—	—

AIDS Surveillance in the Americas

Cumulative number of cases[a] and deaths as of 31 May 1989.

SUBREGION Country	Cases thru 1986	Cases year 1987	Cases year 1988	Cases year 1989	Cum. total cases	Total deaths
REGIONAL TOTAL	43,546	29,788	31,413	6,267	111,014	61,498
LATIN AMERICA b)	3,539	3,961	4,819	372	12,691	4,739
ANDEAN AREA	189	243	340	19	791	384
Bolivia	3	2	11	0	16	12
Colombia	81	107	120	0	308	98
Ecuador	11	19	15	0	45	26
Peru	9	60	68	19	156	82
Venezuela	85	55	126	0	266	166
SOUTHERN CONE	101	133	258	38	530	260
Argentina	69	72	174	27	342	170
Chile	23	45	55	2	125	52
Paraguay	1	7	1	3	12	8
Uruguay	8	9	28	6	51	30
BRAZIL	1,467	1,810	2,313	122	5,712	2,850
CENTRAL AMERICAN ISTHMUS	79	139	301	39	558	265
Belize	1	6	4	0	11	8
Costa Rica	20	23	50	0	93	41
El Salvador	7	16	48	0	71	27
Guatemala	18	16	13	0	47	36
Honduras	15	66	130	39	250	108
Nicaragua	0	0	2	0	2	2
Panama	18	12	54	0	84	43
MEXICO	793	838	714	6	2,351	602
LATIN CARIBBEAN c)	910	798	893	148	2,749	378
Cuba	0	27	24	0	51	12
Dominican Republic	115	294	292	148	849	71
Haiti	795	477	577	0	1,849	295
CARIBBEAN	441	386	454	90	1,371	804
Anguilla	0	0	3	0	3	0
Antigua	2	1	0	0	3	2
Bahamas	86	90	93	39	308	156
Barbados	31	24	15	14	84	60
Cayman Islands	2	1	1	0	4	2
Dominica	0	6	0	0	6	6
French Guiana	74	29	28	0	131	78
Grenada	3	5	3	0	11	5
Guadeloupe	45	36	5	0	86	46
Guyana	0	14	36	0	50	25
Jamaica	11	33	30	22	96	52
Martinique	20	19	19	0	58	25
Montserrat	0	0	0	0	0	0
Netherlands Antilles	0	23	3	0	26	16
Saint Lucia	3	7	1	0	11	8
St. Christopher-Nevis	1	0	17	0	18	9
St. Vincent and the Grenadines	3	5	6	0	14	6
Suriname	4	5	2	0	11	11
Trinidad and Tobago	149	82	158	0	389	265
Turks and Caicos Islands	3	3	1	0	7	6
Virgin Islands (UK)	0	0	1	0	1	0
Virgin Islands (US)	4	3	32	15	54	26
NORTH AMERICA	39,566	25,441	26,140	5,805	96,952	55,955
Bermuda	51	21	28	11	111	84
Canada	1,081	745	659	130	2,615	1,495
Unites States of America c)	38,434	24,675	25,453	5,664	94,226	54,376

a) Differences or changes in case definition may lead to discrepancies with other published data.
b) French Guiana, Guyana, and Suriname included in Caribbean.
c) Puerto Rico included in USA.

Meeting on Uses of Epidemiolgy in Support of Health for All Strategies

In May 1988 the forty-first World Health Assembly adopted resolution WHA41.27: (i) urging Member States to make greater use of epidemiological data, concepts and methods in preparing, updating, monitoring and evaluating their health-for-all (HFA) strategies; (ii) appealing to schools of medicine, public health and other health sciences to ensure training in modern epidemiology that is relevant to countries' needs regarding their HFA strategies and, in particular, the needs of developing countries; (iii) requesting the Director-General to convene as soon as possible a group of experts, including adequate representation from developing countries, to define the desired nature and scope of epidemiology in support of HFA strategies; (iv) requesting the Director-General to report to the Executive Board on the outcome of this meeting. (see *Epidemiological Bulletin* Vol. 9, No. 2, 1988)

In response to this resolution, a meeting of experts was held in Geneva from 31 October to 4 November 1988. Its objectives were:

(i) to define the role and contributions of epidemiology in support of HFA policies and strategies;
(ii) to assess the implications for epidemiological information, research and training in epidemiology in support of HFA;
(iii) to identify the implications for countries, nongovernmental organizations (NGOs), and WHO, and suggest lines of action.

A preliminary session discussed the area of "Epidemiology and health policy," and three working groups respectively discussed the topics of information needs for decision-making in primary health care (including district level); for decision-making in equity of care and for health policies. The working group discussions were complemented each day through plenary sessions.

Recommendations

Recommendation 1

For the development and implementation of public health policies in support of HFA, the contribution of epidemiology is essential. The meeting recommended that a more active use of epidemiology be promoted in WHO and the Member States at all levels.

The meeting also recommended that WHO, together with appropriate partners, should give priority to assisting Member States in ensuring the existence of a set of capacities in epidemiology, in order to achieve the goals of HFA. The essential capacities include, but are not necessarily limited to:

- measurement of the health status of the population and its trends (this implies measurement of rates of mortality by age, sex, cause, geographic area and socioeconomic characteristics; insofar as possible, selected aspects of morbidity and disability should also be measured);
- assessment of levels and trends in exposure to underlying factors (biological, social, economic, ecological, cultural, political) that affect health;
- detection and investigation of health problems in order to initiate appropriate remedial measures;
- measurement of the use of the health services and trends in such use, by age, sex, cause, and geographic area and socioeconomic characteristics;
- measurements of those variables which affect the operation and use of health services;
- formulation, design and implementation of policies and interventions to improve health status;
- measurements of the impact of policies and interventions;
- analysis and interpretation of information, the communication of results to policy-makers and the public in a manner that is optimally useful and timely, and the incorporation of the findings in health policy.

Recommendation 2

Few countries systematically apply essential epidemiological capacities (see recommendation 1 above) to their activities and programs in support of HFA, and progress towards the establishment of these capacities is slow. All countries should strive towards this goal, as the lack of capacity and pro-

gress are major constraints to national policy-making and resource allocation in the health sector, and represent serious obstacles to the achievement of HFA.

The meeting recommended that WHO should, in cooperating with countries to achieve these capacities:

- support, with appropriate assistance from other organizations and agencies, the formulation and implementation of country activities (including training and research as appropriate) for the enhancement of epidemiological capacities in countries where rapid progress may be particularly desirable and reasonably expected;
- enhance communication between Member States and institutions on the use and promotion of epidemiological approaches.

The outcome of such activities would provide examples and models for future development in other countries.

Recommendation 3

WHO, in collaboration with nongovernmental organizations, should:

- support Member States in developing the application of epidemiological research to the identification of health needs and the design of programs to reach their goals for HFA;
- support Member States in encouraging researchers to take part in problem-solving research in support of those goals;
- support Member States in developing the application of epidemiological research for the assessment and monitoring of progress towards the goals of HFA;
- support development, in the health ministries and other institutions of Member States, of the capacity to commission and implement epidemiological research, interpret and disseminate its results, and promote the application of these results in health system management.

Recommendation 4

- A systematic analysis should be undertaken of the epidemiological knowledge and skills required for individuals employed in health services delivery, health resources allocation, and training in health matters at all levels. This must be undertaken both for Member States and for WHO itself.
- An inventory of current training programs in epidemiology will assist in determining how they meet identified needs and how to adapt current and future programs.

WHO, its Member States, and appropriate scientific and professional organizations should cooperate in the various stages of such an analysis.

Recommendation 5

WHO, together with other appropriate international bodies and nongovernmental organizations, should consider establishing a joint advisory group or other body to monitor progress in implementing those recommendations.

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