

A Program for Prevention and Control of Epidemic Dengue and Dengue Hemorrhagic Fever in Puerto Rico and the U.S. Virgin Islands¹

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The ongoing resurgence of Aedes aegypti in the Americas—abetted by poor mosquito control, urbanization, and increased air travel—has led to dengue hyperendemicity, more frequent dengue epidemics, and the emergence of dengue hemorrhagic fever (DHF). This article describes a program developed to cope with this situation that emphasizes disease prevention rather than general mosquito control measures.

Dengue is currently the most important vector-borne viral disease afflicting humanity, in terms of both morbidity and mortality (1, 2). Repeated epidemics of dengue and dengue hemorrhagic fever (DHF) involving up to several million people occur annually in tropical areas of Asia, Africa, the Pacific, and the Americas—and may extend into temperate areas inhabited by the *Aedes aegypti* mosquito vector (3). Case-fatality rates associated with early DHF epidemics were as high as 30–40%, and in South-East Asian countries where the disease has become endemic it is one of the leading causes of hospitalization and death among children (4).

Fortunately, DHF can be effectively

treated; and if it is recognized early, most deaths can be prevented. In those areas where physicians have a high awareness of the disease and have been trained to diagnose and treat DHF, case-fatality rates are generally below 5% (4).

DENGUE IN THE AMERICAS

In recent years, the epidemiology of dengue in the Americas has changed dramatically (5, 6). Over the past 15 years epidemics caused by all four dengue virus serotypes have occurred with increasing frequency in the Caribbean Basin. The increased disease incidence, combined with the increased frequency of epidemic dengue caused by multiple virus serotypes, has increased the risk of epidemic DHF. In fact, sporadic but growing numbers of DHF cases have been occurring in several American countries.

The first DHF epidemic in the Americas struck Cuba in 1981 (7). On that occasion, Cuban health authorities managed to prevent high mortality through intensive physician education and mass hospitalizations (116,143 people were hospitalized in a three-month period) (8). Even so, there were 24,000 cases of hemorrhagic disease, 10,000 cases of dengue

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shock syndrome (DSS), and 158 deaths. The most recent DHF epidemic in the Americas, which occurred in Venezuela in 1990, produced 3,108 known DHF cases and 73 deaths.

The sequence of events taking place in the Americas in the 1980s was very similar to that which occurred in southeast Asia in the late 1950s and 1960s (5). This strongly suggests that if there is no effective intervention, the disease pattern associated with dengue in the Americas has the potential to evolve as it did in South-East Asia, resulting in major epidemics of severe and fatal hemorrhagic disease.

Besides the damage they do to public health, dengue and DHF/DSS have a significant economic impact. For instance, a 1977 dengue epidemic in Puerto Rico appears to have cost between US\$6 and \$16 million in medical services and lost work alone (9). No attempt has been made to measure the impact of epidemic dengue on the tourist industry, but it must be equally great. Recent estimates have put the cost of epidemic dengue in Puerto Rico since 1977 at US\$100–150 million (5).

Lack of effective mosquito control and increasing urbanization in most parts of tropical America have placed extensive vector mosquito infestations in close contact with large human populations, providing ideal conditions for mosquito-borne disease transmission. In addition, an increasing volume of air travel has provided an ideal vehicle for transporting dengue viruses between tropical population centers. The result has been repeated introduction of dengue viruses into areas well-suited to dengue transmission, a circumstance virtually guaranteeing that epidemics of dengue and perhaps DHF/DSS will occur frequently in the Americas (5, 6).

To help cope with this increasing threat in the absence of effective emergency mosquito control measures, we have developed a broad, community-based, inte-

grated program designed to prevent major epidemics of DHF/DSS in Puerto Rico and the U.S. Virgin Islands. This program focuses not on mosquito control but upon disease prevention. If successful, it could serve as a useful model for other countries.

PREVENTION AND CONTROL OPTIONS

The options available for prevention and control of epidemic dengue are rather limited. They include the following: *Aedes aegypti* eradication, ultra-low-volume (ULV) insecticide application, regulation of air travel, development and use of dengue vaccines, preventive measures keyed to improved surveillance, and routine mosquito control efforts.

Obviously, the most effective preventive measure would be eradication of the *Ae. aegypti* vector. Unfortunately, experience in the Americas and elsewhere indicates that eradication is not a very realistic option at this time. To begin with, even though the technology is available, such eradication is a very expensive process. Moreover, in order to be effective over the long run, eradication must be achieved by all countries in the Region. That is not likely to occur any time soon. Finally, previous experience has shown that the large vertically structured programs which succeeded in eradicating *Ae. aegypti* from much of Central and South America in the 1950s and 1960s were not sustainable because ultimate responsibility for continued control was not transferred from the central government to local community residents (10).

A second option is to continue spraying insecticides, using ultra-low-volume (ULV) applications, to kill adult mosquitoes. This has been the recommended way of controlling epidemic dengue for nearly 20 years (4). However, recent work in Puerto Rico, Trinidad, and

Jamaica has shown ULV spraying to have little lasting impact on the natural wild mosquito population (11–13). This conclusion is supported by the fact that over the 20 years ULV spraying has been the recommended epidemic dengue control method, the distribution of DHF has expanded into the Pacific, Central America, and South America, and the incidence of severe and fatal hemorrhagic disease has increased dramatically (3, 6, 10). Hence, the available evidence strongly indicates that we should not continue to rely on this approach.

A third possibility might be to improve quarantine measures for air travelers, since we know that most dengue viruses are introduced into new areas by people who have visited places where those viruses are endemic. In the 1990s, however, that is probably not a viable option.

Ultimately, prevention of epidemic DHF may depend on vaccination. At present, however, no vaccines against dengue viruses are available for general use. Although several laboratories are working on development of both live attenuated and genetically engineered vaccines (14), the best available estimates suggest it will take at least 10 years before a safe, effective, and economical vaccine becomes available. That leaves only improved surveillance and integrated community-based mosquito control measures. Our program in Puerto Rico is based on making effective use of these options—by developing a proactive surveillance system sensitive enough to provide “early warning” of an impending dengue epidemic (15) and by establishing a rapid-response emergency vector control program that can supplement routine community-based mosquito control when evidence of a pending epidemic surfaces. Such an approach may not interrupt dengue transmission, but it doesn’t have to. Rather, the goal is to prevent major dengue epidemics by reduc-

ing dengue incidence, the rationale being that if we can decrease incidence, we will automatically reduce the likelihood of DHF/DSS occurring in the Puerto Rican population.

The program in Puerto Rico and the U.S. Virgin Islands has five components: proactive surveillance; rapid-response emergency vector control; long-term, integrated community-based mosquito control; education of the medical community; and an emergency hospitalization plan. These components are being developed as described below.

Proactive Surveillance

Surveillance for dengue and DHF/DSS can be of two basic types, reactive or proactive (15). Most endemic countries conduct reactive surveillance, with health authorities waiting until the medical community recognizes transmission before reacting to implement control measures. Unfortunately, this type of surveillance is very insensitive—because in the absence of epidemic transmission there is a low index of suspicion among physicians, and dengue is rarely diagnosed. Indeed, in most cases epidemics are near peak transmission before they are recognized and confirmed as dengue. By then it is generally too late to implement effective preventive measures that impact on transmission and thus on the course of the epidemic.

Our program seeks to employ a proactive surveillance system that will permit prediction of epidemic dengue (15). The most important component of this proactive system is virologic surveillance that is designed to monitor dengue virus transmission on the island, especially during interepidemic periods, and to continually provide information on where transmission is occurring, what virus serotype or serotypes are involved, and what type of illness is associated

with the dengue infection. If this type of information is available, then without too much delay we should be able to detect the introduction of new dengue virus serotypes.

During periods of low dengue activity, cases of dengue-like illness are frequently not recognized as suspected dengue; many dengue infections present clinically as nonspecific viral illness, and physicians tend not to be on the lookout for dengue during interepidemic periods. For all these reasons, the surveillance program cannot rely on the medical community to monitor dengue virus introductions and transmission. Instead, the program depends upon regular monitoring of patients with viral syndrome to provide increased sensitivity and detect changes in the dengue virus picture.

Each week throughout the year, regardless of dengue activity, Puerto Rico Health Department clinics are asked to take blood samples from selected patients with viral syndrome whose illnesses had their onsets three to 14 days earlier. These samples are picked up by Puerto Rico Health Department employees and taken to the laboratory, where they are processed on a weekly basis to isolate dengue virus and detect the presence of dengue-specific IgM antibody (15, 16).

In addition to this clinic work, a collaborative program with a small group of selected private physicians who are interested and who provide high-quality specimens and information has been initiated. All collaborators, both private physicians and clinics, are also asked to take samples from any patient with classical dengue or hemorrhagic manifestations in addition to viral syndrome.

This is a very hard type of surveillance to maintain, because many physicians refuse to take blood samples from patients they are "sure do not have dengue infection." It requires constant communica-

tion and encouragement, and even then many physicians do not take the blood samples requested. It is, however, the most critical part of a proactive surveillance system designed to detect new virus introductions.

Because dengue frequently presents as nonspecific febrile illness, especially in children, another component of the proactive system is surveillance designed to detect increased febrile illness in the community (15). Through a network of nurse epidemiologists, physicians, and environmental health workers on the island, any observed increase in febrile illness is reported and investigated immediately. Blood samples are obtained from representative cases, taken to the laboratory, and processed to isolate dengue virus and detect dengue-specific IgM antibody.

The proactive surveillance system also monitors all cases of hemorrhagic disease and all cases of viral illness that have a fatal outcome (17). This is done working in close collaboration with infectious disease physicians who would normally see such cases of severe and fatal disease. All cases reported are investigated, and blood specimens—as well as tissue specimens in fatal cases—are obtained for virologic and serologic study. Fresh-frozen tissue and formalin-fixed tissue may be examined by immunofluorescence, immunoperoxidase, or specific hybridization probes for specific dengue viral antigen.

Each of the above surveillance components has limitations and may not be very sensitive by itself. Collectively, however, they provide a relatively good early warning capability that has been sensitive enough to predict epidemic dengue activity in Puerto Rico. It should be noted that entomologic surveillance is not routinely carried out as part of this program because *Ae. aegypti* densities are usually well in excess of the level needed for epidemic transmission.

Rapid-response Emergency Vector Control

The rationale for rapid-response emergency vector control depends on two points. These are as follows: (1) routine mosquito control will not reduce vector populations below the threshold levels required for epidemic transmission; and (2) there is a "lag time" of one to six months between introduction of a new dengue virus and peak epidemic transmission (17). Hence, to follow up on the surveillance program's early warning—if that program is sensitive enough to detect new viruses shortly after their introduction, or to detect increased dengue activity well in advance of epidemic transmission—we must have an effective emergency vector control capacity that can be activated quickly. The aim of this activity is to contain an incipient epidemic in a limited area before it spreads to other parts of the island.

Baseline data required for this work include delineation of the most important and productive *Ae. aegypti* larval habitats in every major town and city, species associations with other potential mosquito vectors, and identification of major problem areas. This island survey was completed in 1985, and the results of the survey were computerized to improve rapid access to information on mosquito breeding sites in all major towns and cities in Puerto Rico and the U.S. Virgin Islands (San Juan Laboratories, unpublished data).

At the time of this writing (1991), details of the rapid-response program had not been fully elaborated. Unfortunately, the principal emergency control method, ULV application of insecticide for adult mosquito control, does not work very well (10–13). So, while research to improve the efficacy of adulticiding is under way, we must rely on other approaches as well.

The basic method employed is as follows: When surveillance data suggest increased dengue transmission or introduction of a new dengue virus serotype or strain, the situation is investigated immediately. Epidemiologic data are collected in an attempt to determine where the infection or infections occurred and where it or they may have been transported. At the same time, a fully integrated mosquito control effort is launched on the basis of information taken from the computerized survey results.

This latter control activity, conducted by the environmental health program of the Puerto Rico Department of Health, is directed at the whole community. It uses radio, television, and newspaper public service announcements to inform the people of the problem and what to do about it. A targeted source reduction program is undertaken that emphasizes removing those larval habitats that are the most productive and treating those that cannot be removed with ABATE or other insecticide. In addition, ULV malathion spraying of the entire city where the case was detected may be carried out using truck-mounted equipment. Perifocal ULV spraying in the vicinity of the case, as is done in many countries, is not recommended because it is felt likely that by the time a case is detected and a response mounted the infection will have spread to a wider area.

Other government and civic organizations such as Civil Defense, the Civil Air Patrol, the Boy Scouts, primary and secondary schools, and Rotary clubs are used in those communities where they are active and agree to participate. Specifically, these organizations help by distributing educational material and providing the public with information about where mosquitoes can be found and how to control them so as to prevent transmission.

In general, it is felt that the response to

news of a threatening epidemic should involve community participation. Ultimate success of the program will depend on community participation and cooperation by citizens (most transmission occurs in the home) (10). Therefore, considerable effort is being placed on community education.

One major problem with this approach is the need for government approval in order to use the above community mobilization methods to help control the mosquitoes. Most governments are regrettably reluctant to give such approval, because they like to be 100% sure there is an epidemic before declaring an emergency. This type of thinking must change before an effective emergency response can be mounted.

Contingency Planning

Education of the medical community. Because the above long-term program for prevention and control of epidemic dengue will take several years to implement and refine, it has been necessary to develop contingency plans in case a DHF/DSS epidemic should occur before the program is effectively established. One important aspect of these plans is education of the medical community—to make physicians in Puerto Rico and the U.S. Virgin Islands more aware of dengue and to train them in DHF/DSS diagnosis and treatment.

An international seminar on DHF in the Americas was organized in 1985 and was followed by a series of local seminars in all major Puerto Rican cities that gave emphasis to the need for clinical diagnosis and treatment of DHF/DSS. A program continuing these seminars, which has been under way ever since, now relies primarily on a "peer education" system that recruits and trains highly respected physicians in a community to become the local DHF/DSS experts.

These physicians give lectures and seminars employing visual materials provided to them by CDC/PRHD, including a video on clinical diagnosis and treatment of DHF/DSS written by us and produced by the San Juan Rotary Club for use by physicians and medical associations.

Current plans call for maintaining this program indefinitely. Fortunately, evidence including the improved quality of clinical data received by the surveillance program indicates that progress has been made. In contrast to the situation prevailing in 1985, many physicians now routinely do the clinical laboratory tests critical for early diagnosis of DHF/DSS. The program has also turned out to have a worthwhile added benefit—in that informed physicians are themselves helping to educate the lay community.

Emergency hospitalization plan. A second contingency plan dealing with emergency hospitalization has sought to pave the way for making the most effective use of hospital and treatment facilities in case a DHF/DSS epidemic should occur before the medical community is fully aware of the disease and ready for it. This program is being implemented as follows: First, an overall emergency hospitalization plan (see Annex) that outlines basic principles and requirements based on the WHO Technical Guide (4) was drafted and sent to each of the island's eight medical regions. Second, hospitals and potential treatment centers in each region have been identified according to the type of facility and number of beds available. Plans call for entering the names of physicians and paramedics in the area into a computer data base and keeping the list current at the regional level.

Each region will use this information to develop a contingency plan for a "worst case" situation where there is one DHF/DSS case for every 100 cases of dengue

infection. If adequate numbers of beds are not available in hospitals and public clinics, plans will be made to convert other public buildings into temporary treatment centers. Each region is responsible for determining needed equipment and supplies and ensuring that these are available in an emergency. Finally, a central committee advises and consults with regional committees appointed to oversee the program.

Long-term, Integrated, Community-based Mosquito Control

Ultimately, prevention of epidemic dengue and DHF/DSS will depend upon effective, long-term mosquito control. To be cost-effective and sustainable, such control must be achieved through integrated community-based action.

Community participation in Puerto Rico depends upon effective communication with a public that is diverse in terms of its socioeconomic and ethnocultural backgrounds (10). To develop effective community participation, the program seeks to inform the people of Puerto Rico and the U.S. Virgin Islands about DHF/DSS, the potential dangers and consequences of epidemic DHF/DSS, the fact that major epidemics can be prevented, and the fact that it is their responsibility to see that preventive measures are effective. Specifically, the message that must be communicated to all citizens is that (1) DHF/DSS is now endemic in Puerto Rico and the U.S. Virgin Islands; (2) the islands are at high risk of epidemic DHF/DSS because of the high *Ae. aegypti* densities in all major cities; (3) most dengue transmission occurs in and around the home; (4) this happens because people accumulate excessive trash around their homes, thereby creating mosquito breeding places; (5) dengue can be prevented by controlling these domestic larval habitats, but only the people involved can ef-

fectively clean up the areas around their own homes to prevent mosquito breeding; (6) control must be a community effort, because mosquitoes can fly from house to house; (7) insecticide spraying is expensive, is ineffective for routine mosquito control, and at most should only be used in emergency situations; and (8) it is the responsibility of the people, not the government, to prevent epidemic DHF/DSS in Puerto Rico and the U.S. Virgin Islands.

A major effort has been made to develop new and innovative educational materials that can effectively communicate this message to specific population groups. This effort has been based upon ongoing knowledge, attitude, and practices studies conducted by medical anthropologists, social scientists, and health educators who have been attached to the project since 1986 (10). The rationale here is to identify all the major ethnic, social, and cultural elements of the society, study their behavior and attitudes toward dengue and its prevention, and then develop educational materials directed at these groups. (Because one key population group is school-age children, major educational work has been directed toward the schools.) Details of the community-based component of this program will be reported elsewhere (San Juan Laboratories, unpublished data).

Disease control has historically been a responsibility of government. With a disease like dengue, however, most governments do not have the resources to maintain effective control. Because of certain resources available in the private sector, the influence civic organizations can have upon the public, and the marketing skills of those organizations, a plan was developed to involve the business community in dengue prevention and control (10). Briefly, civic organizations such as Rotary International have been encouraged to develop programs that will help govern-

ment agencies educate the public about its responsibility for environmental sanitation and how to effectively control mosquitoes in the community.

In summary, our approach has been to identify and involve all segments of the community in *Ae. aegypti* control. Our rationale is that only a program planned, directed, and financed by the community will be truly community-based and sustainable. This does not absolve the government of responsibility, because most of the world's dengue-endemic areas have many larval habitats that require government intervention. Therefore, the programs developed must be integrated to provide government support for the community-based efforts (10). Ultimately, the aim is to develop enforceable legislative control, such as has been successfully implemented in Singapore and Cuba (18, 19)—recognizing that in a democratic society the sort of control program envisaged can only be successful after the public has been educated to a point where it accepts its responsibility for playing the principal role in prevention and control of epidemic dengue and DHF/DSS.

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ANNEX: Hospitalization Contingency Plan for Epidemic Dengue Hemorrhagic Fever in Puerto Rico.

1. Background and Rationale

This section sets forth reasons for the contingency plan that are stated in the foregoing text.

2. Use of Outpatient Facilities and Indications for Hospitalization

In mild or moderate cases of dehydration or threatened dehydration, oral or parenteral fluid therapy can be given in an outpatient rehydration unit. Establishment of such units in diagnostic treatment centers (DTCs) would reduce the number of hospital beds required for management of the more severe cases. Patients cared for in an outpatient setting must, however, be carefully followed for deterioration and onset of shock, which usually appears toward the end of the febrile period.

Indications for hospitalization and immediate treatment are the following signs of shock:

- restlessness/lethargy
- cold extremities, circumoral cyanosis
- rapid and feeble pulse
- narrow pulse pressure (20 mm Hg or less) or hypotension
- elevated or rising hematocrit

3. Requirements for Inpatient Hospital Facilities

In the worst situations previously encountered, the incidence of seriously ill patients requiring hospitalization has approached one case per 100 dengue infections. This is the situation for which we should be prepared.

An overall population of approximately 3.5 million people translates into 35,000 persons hospitalized over a three-month period, or approximately 10,000 per month.

Each region should evaluate the number of beds available in existing hospitals and diagnostic treatment centers (DTCs). Based on regional population estimates, contingency plans should be developed to convert schools or public buildings to handle the excess if necessary.

4. Supplies and Equipment

1. For outpatient departments/treatment centers:

- 1-1. Diagnostic materials:

Blood pressure cuffs (adult and pediatric)

Thermometers

Hematocrit supplies (lancets, capillary tubes, reader)

Hematocrit centrifuge

Compound microscope and materials for white blood cell and platelet counts

Vacutainers or syringes/needles for obtaining dengue and other diagnostic test samples

1-2. Therapeutic materials:

Acetaminophen

WHO oral rehydration solution: 3.5 g sodium chloride (table salt), 2.5 g sodium bicarbonate (baking soda), 1.5 g potassium chloride, and 20.0 g glucose dissolved in 1 liter of potable water

Lactated Ringer's; 0.85% saline; 5% glucose in water

Tubing and needles for intravenous therapy

2. For hospitals:

2-1. Diagnostic materials and patient monitoring:

Same as 1-1, plus:

Laboratory test equipment and supplies for blood typing and crossmatching, for measuring arterial blood gases and pH, and for measuring serum electrolytes

Portable X-ray equipment

Central venous pressure monitoring kits

Arterial pressure and Swan-Ganz catheters and monitoring equipment when feasible

Intake-output monitoring charts

2-2. Therapeutic materials:

Same as 1-2, plus:

Plasma volume expanders (Dextran 40, plasmanate, fresh-frozen plasma, whole blood where available)

7.5% sodium bicarbonate for injection

Chloral hydrate

Paraldehyde

Oxygen

Hospitalized patients will require some amount of intravenous fluid therapy with lactated Ringer's or glucose/normal saline. Approximately 20% of all hospitalized patients will require intravascular volume expanders such as dextran 40, plasmanate, or plasma, and about 10% will require the administration of whole blood. The volume of intravenous fluid needed in an individual case will depend on the weight of the patient and the seriousness of the shock state. However, assuming that one-half of the patients are children, an estimate of the supplies required per 10,000 population (100 cases of DHF) in each region can be made:

280 liters of normal saline or lactated Ringer's

280 liters of 5% glucose in water

25 liters of volume expander

10 units of whole blood

5. Organization

A health department coordinating committee should be appointed to organize and advise the community during the emergency. One subcommittee should deal with clinical care. This committee should design and distribute appropriate protocols for the diagnosis and treatment of DHF/DSS, compile and distribute appropriate information and literature on DHF, help develop educational materials for multimedia programs, plan for and implement training programs for health care workers, and oversee usage of supplies and outcome of the clinical care program.

6. Triage

In the setting of an epidemic, triage of patients with appropriate treatment will be required.

1. *Patients with classical dengue fever* and without signs of dehydration, hemorrhage, or circulatory failure should be examined by blood pressure measurement, tourniquet test, and hematocrit. In the absence of clinical signs of dehydration, circulatory failure (see below), or hemorrhagic diathesis (positive tourniquet test), patients may be treated

with acetaminophen and released with clear instructions to return immediately should signs of decompensation (lethargy, restlessness, cold extremities, skin congestion, hemorrhage, or severe abdominal pain) occur, usually on the third or fourth day after onset.

2. *Patients with classical dengue fever and dehydration.* Patients with signs described above who are also manifesting severe vomiting, diarrhea, and clinical signs of dehydration, may be given oral or parenteral fluid therapy in the outpatient setting. Such patients should be followed carefully and admitted if clinical criteria are met (see below).

3. *Patients with signs of DHF/DSS.* Patients with clinical signs of circulatory failure (restlessness, lethargy, skin congestion, cool and clammy extremities, hypotension, narrowed pulse pressure <20 mm Hg, rapid and weak pulse) and with hemorrhagic manifestations (positive tourniquet tests, thrombocytopenia) or elevated hematocrit should be immediately admitted to the hospital.

4. Monitoring and treatment of all these patients should follow guidelines outlined in *Dengue Hemorrhagic Fever: Diagnosis, Treatment, and Control* (WHO, 1986). If properly instructed, nurses, medical students, and paramedical workers can carry out triage, but competent laboratory assistance is essential. Patients with similar degrees of severity of illness should be grouped together. Those with shock require intensive 24-hour nursing and physician care. Paramedical workers or parents can assist in oral fluid therapy or in monitoring the rate of intravenous fluid administration and general status of the patient.



World No-Tobacco Day 1991

The fourth World No-Tobacco Day was celebrated in the Member States of the World Health Organization on 31 May 1991. This year's theme, "Public Places and Transport: Better Be Tobacco Free," emphasized the right of all persons to breathe smoke-free air. The most recent scientific findings clearly show the hazards of "second-hand" smoke: Research indicates that in the United States of America, tobacco smoke in the environment is responsible for 20–30% of lung cancers among nonsmokers. In addition, a nonsmoker married to a smoker runs a 20–50% higher risk of lung cancer than a nonsmoker whose spouse does not smoke.

World No-Tobacco Day is intended to promote awareness among governments, communities, and individuals worldwide of the dangers of tobacco use. Activities included press releases, a video presentation on tobacco-free public places and transportation, and radio announcements by WHO experts on tobacco control. WHO Headquarters and the Regional Offices awarded a total of 36 "WHO Tobacco or Health Medals" to individuals and organizations involved in tobacco control activities.

Source: World Health Organization, WHO Features No. 157 (May 1991) and Press Release WHO/33 (31 May 1991), Geneva, 1991; Centers for Disease Control, "World No-Tobacco Day, 1991," *MMWR* 40(21):341, 1991.