

MEMORANDUM

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL

TO: Dr. David J. Sencer, Director
Center for Disease Control

DATE: April 26, 1976

THROUGH: Dr. William H. Foege, Special Assistant to the Director, CDC *WHF*
Dr. Robert L. Kaiser, Director, Bureau of Tropical Diseases, CDC *R.L.K.*
Dr. Roger A. Feldman, Director, Central America Research Station, CDC *R.A.F.*

FROM: Dr. Carlos C. Campbell *CC*
Dr. Harrison C. Spencer *HS*

SUBJECT: Epidemiological assessment of earthquake relief, Guatemala
February 4 - March 10, 1976

I. Introduction

In the early morning of February 4, 1976, a major earthquake struck Guatemala. At 08:00 Virginia Worsley, medical coordinator, Foreign Disaster Relief Center (FDRC), USAID, Washington, was in contact with Dr. William Foege, Assistant to the Director, CDC, requesting a medical epidemiologist to assist in the acute relief effort. At 12:00 Dr. Robert L. Kaiser, Director, BTB, notified Dr. Roger A. Feldman, Director, Central America Research Station (CARS), El Salvador, requesting that Dr. Carlos C. Campbell, medical epidemiologist, CARS, depart for Guatemala. Dr. Campbell arrived in Guatemala City at 17:15.

Based upon the evidence that the damage was severe and widely dispersed geographically, Dr. Campbell telephoned San Salvador at 06:30, February 5, to request that:

1. Dr. Harrison Spencer, medical epidemiologist, CARS, be assigned to assist in the relief assessment, and
2. Dr. Feldman pass through Guatemala to advise on the coordination of the assessment activities.

Drs. Feldman and Spencer arrived in Guatemala at 13:00, February 5. Dr. Feldman departed Guatemala on February 8.

Dr. Foege was the primary CDC contact for the epidemiology team. Beginning on February 8, daily medical status cables were sent to the FDRC from the epidemiology team.

II. Background

Guatemala is the 2nd largest Central American country. The central region from north to south is mountainous with numerous volcanoes rising above 10,000 feet. The Atlantic coastal and northern Peten areas are flat and of low elevation. The majority of the population is concentrated in the central mountainous zone of the country.

The population of Guatemala is comprised of two distinct cultures. Ladinos (65% of the population) are those persons who are not culturally Indians, principally those with Spanish ancestry. Ladinos live in the larger towns throughout the country, in the coastal lowlands, and the eastern highlands. The government and commerce of Guatemala are controlled by ladinos.

The Indian culture is directly descendent from the Mayans. Most Indians live in the rural highlands. The Indian culture is distinctive in its adherence to separate dialectic languages, its native religion that influences all aspects of Indian life, its isolation from governmental programs including preventive and curative health.

In the central mountains the average daily high temperature is 75-89°F and the low temperature in 55-65°F; there is little yearly variation in these averages. There is a clearly delineated rainy season extending from mid-May to November.

Health care in Guatemala is delivered through 4 different systems. The more affluent 5% of the population has access to private physicians and hospitals, mainly in the larger cities. An additional 7-10% of the population, lower middle class urban workers and finca (farm) employees are eligible for the prepaid Social Security (IGSS) system of clinics and hospitals. The majority relies upon national health services administered by the Ministry of Health (MOH), which extends from voluntary health "promotors" in many rural areas to health centers in town to general and specialty hospitals in the larger cities. The 4th health source is the native medicine practiced in the Indian culture. Native practitioners, curanderos, are the principal resource for the Indians.

III. Earthquakes

The Motagua fault (Figure 1) which bisects Guatemala east to west is one of the principal fault lines in Central America. The most recent previous earthquake occurred in 1917 at which time most of Guatemala City was leveled. At 03:04, February 4, 1976, there was an earthquake with an epicenter at the border between the departments of Izabal and Zacapa, to the south of the eastern tip of Lake Izabal on the Motagua fault. It had an intensity of 7.5 Richter and lasted for 35 seconds.

A zone of intense physical destruction radiated 25-50 miles perpendicular to the 145-mile length of the Motagua fault, roughly from north of Lake Atitlan to just east of Puerto Barrios, the major Guatemala port (Figure 2). Damage to buildings in the zone of greatest intensity occurred primarily to housing of adobe construction, which predominates in the rural areas. The adobe and the wooden supports for tile or tin roofing collapsed. At the periphery of the zone of greatest destruction most buildings constructed of concrete block remained standing.

In the rural areas, there was massive sliding of the dry, loose soil. Many landslides covered the road from Guatemala City to Puerto Barrios, which in conjunction with the collapse of the bridge at Aguas Calientes, blocked the major land route to the Atlantic. Landslides in other areas blocked rivers, damming the water into lakes.

Guatemala City was at the southern periphery of the zone of intense damage. In the northern zones of the city (some of the poorest) many houses were destroyed and still more were structurally damaged and uninhabitable. The business center, the newer residential areas, and the airport were not severely damaged. No major fires occurred, except for an explosion which gutted the INCAP laboratory building. Electricity was out in the northern zones. Water to 40% of the city was disrupted as a result of damage to a major pumping plant and the rupture of water mains.

In the 36 hours following the February 4 earthquake, the extent of the destruction in rural areas was not fully appreciated. As the death and injury figures began to reflect the magnitude of the problem in these rural areas, a 2nd major earthquake, 5.75 - 6.0 Richter, occurred at 12:20, on Friday, February 6. The epicenter was at El Plantar, eight miles east of Guatemala City. While there was further damage to many structures, the zone of damage was not expanded by this earthquake, although a considerable number of additional landslides occurred. The emotional impact of the 2nd earthquake was great; many intact buildings were abandoned and the general state of shock was intensified.

Figures concerning deaths, injuries, and persons homeless, compiled by the Guatemalan Government, are summarized in Table 1. There were an estimated 77,000 injuries, 6,000 of which were classified as serious. The actual death count was estimated to be in excess of 25,000. As expected for an earthquake, the number of deaths exceeded the serious injuries by 4:1 (Karl Western, M.D., Thesis on Epidemiology of Disasters).

In the 6 weeks following the initial earthquake there were several thousand aftershocks, 5 with an intensity of 5.0 Richter or greater. Following February 6, no significant damage was associated with the aftershocks.

IV. Coordination of acute relief activities

In the aftermath of the earthquakes the following factors were critical to the United States' relief strategy:

1. Within hours of the 1st earthquake a Guatemalan coordinating committee (CNE) was appointed with the minister of defense as director. The CNE was composed of army officials, and the health advisor to the CNE was not from the MOH.

The CNE remained isolated from other groups within the government. Particularly in the area of medical supplies, the CNE resisted attempts by the MOH to determine what medicines and hospital facilities had arrived and were controlled by the CNE. With the return of the minister of health to the country on day 5, the MOH made considerable gains in coordinating the distribution of medicines, supply of hospitals, and planning for health needs related to food, shelter, and water.

The Guatemalan Government received information about the disaster via the army radio system and helicopters. At the onset, the CNE had the potential for gathering very complete data as to the proportions of the disaster. If such information was accumulated, it was not disseminated until the 2nd week.

2. Within the U.S. Mission, the Ambassador and the USAID director jointly directed the relief operation. On day 5 of the disaster, the USAID established a command headquarters at the U.S. Military Group offices at the international airport. This move was a result of the increasing problems with medical relief supply. Coordination within the U.S. Embassy was maintained by daily briefing sessions at which time the activities of the various consultant groups were reviewed.
3. As a result of a decision by the CNE on day 2, the U.S. relief effort was concentrated in the Department of Chimaltenango. In general the United States did not deal with the eastern area of destruction, except in relation to rebuilding the road to Puerto Barrios.
4. Neither the Government of Guatemala nor the U.S. Embassy were greatly affected physically, or in terms of injuries or deaths.
5. Land routes north to Mexico and south to Honduras and El Salvador were clear.
6. The international airport was in full operation, and Guatemala is a 2-hour airlight from the United States.
7. Telephone communications with foreign countries were overloaded but functional.

V. Methods - Roles

The medical epidemiology team consisted of 4 Spanish-speaking American physicians; 2 epidemiologists sent by AID from CARS/CDC, a senior AID medical officer stationed at the U.S. Mission (Dr. E. Croft Long) and an AID preventive medicine consultant (Dr. Eugene R. Boostrom). Their roles were as follows:

1. Dr. Long, in his role as senior counselor for health problems in the U.S. Mission, contended with many problems related to disaster relief and assisted the CDC epidemiologists in their surveillance activities.
2. Dr. Boostrom dealt with problems of supplies, hospitals and transportation.
3. One CDC epidemiologist acted as the spokesman for the group in those areas which are detailed in the methods section, and
4. The second CDC epidemiologist developed the surveillance systems.

This report concerns only those phases of the relief activities with which the CDC epidemiologists were directly involved, along with a discussion of how their involvement might have been more effective. The epidemiologists had little interaction with the CNE; rather, they worked with the MOH, particularly the Director General of Health and the National Epidemiologist whom they knew previously. Similarly, there was little direct work with the myriad of volunteer agencies represented in Guatemala following the earthquake. An assessment of the effectiveness of the overall relief effort, including major facets such as the work of the CNE and the volunteer groups, will be important, but this will be left to someone with a broader view of the disaster, such as the FDRC.

The team chose or were assigned the following roles:

1. To serve as general medical and preventive health consultants:
 - A. To aid in assessment of the disaster situation in the health sector. On days 1-3, all hospitals and public health centers in Guatemala City were visited to assess the extent of physical damage. Although the initial evaluation in the rural areas was done by the Special Forces Disaster Assessment Team (DAST), the epidemiology team assisted in specific areas to assess the extent of damage to health facilities, numbers and types of injuries, and estimates of the medical aid required.
 - B. To suggest ways in which assistance could be most effective in dealing with potential public health problems -- in particular, through use of data to identify what assistance was appropriate and to help limit unnecessary aid.

- C. To evaluate the relief efforts in the health sector.
 - D. To evaluate reports of epidemic disease by tracing rumors and/or traveling to the site of reported epidemics to determine the real facts.
2. To interact with the Guatemalan Ministry of Health (MOH) and other local health agencies to:
- A. Rapidly assess health resources including hospitals, medicines, medical supplies, and physicians available following the earthquake.
 - B. To assist in the exchange of information between the MOH and U.S. Mission. One or more team members attended all the planning meetings held at the MOH during the acute phase.
 - C. Exchange disease surveillance information with the MOH, Pan American Health Organization (PAHO), and other agencies.
3. To rapidly assess immediate health hazards by initiating an acute surveillance system in the affected area:
- A. Basic information required included accurate estimates of hospital capacity, geographical area from which patients came, sex and age of patients. Diagnoses recorded were trauma, diarrhea, upper respiratory illness, fever, and "others."
 - B. The information was collected utilizing registration and summary forms prepared at the MOH. In Guatemala City, a team of 3 Peace Corps nurses visited daily the 5 major hospitals, the public health clinics, and the IGSS Polyclinic. The records were examined daily for cases of measles, dog bites, typhoid fever, meningitis and tetanus but for simplification these were counted as "others." Results were tabulated and analyzed daily in a report given to the MOH, PAHO, and sent by cable to the FDRC, Washington.
 - C. A similar surveillance system was instituted in all hospitals in the Chimaltenango area including the 47th U.S. Army Field Hospital. Data were collected by the preventive medicine team from the U.S. Army Hospital and Peace Corps nurses.

4. To determine the specific types and quantity of medicines and medical supplies needed in Guatemala was the initial task assigned to the medical epidemiology group.
 - A. Two USPHS pharmacists, Lts. Ezekial Mendieta and James Moore, were assigned to work with the epidemiology team beginning on day 6. They worked directly with the CNE in the medicine warehouse.
 - B. Many sources for such supplies were available to the U.S. Mission: stockpiles in Panama, private U.S. donors, volunteer agencies, and private Guatemalan retailers. At the USAID command center, personnel were available to monitor what relief supplies arrived. From day 4-14, USAID maintained a limited stock of medicines consigned to the U.S. for distribution by medical teams.
5. To serve as consultants to the MOH in the establishment of an intermediate weekly system of disease surveillance to operate for 4-6 months following the earthquake. The purposes of this system are:
 - A. To reconstruct the MOH surveillance system which existed prior to the earthquake.
 - B. To extend disease data collection to the local level within the disaster area by using local health "promoters" to report disease symptoms.
 - C. To focus on specific diseases (e.g.: childhood exanths, diarrhea, rabies) that might occur with increased frequency following the earthquake.

VI. Results - Activities

1. In their role as general medical and public health consultants, the epidemiology team was involved with the following:
 - A. Vaccinations

As anticipated, an initial response of many countries, volunteer agencies, and private organizations was to send vaccines. Typhoid, DPT, measles, tetanus, BCG, and polio vaccines arrived. Many U.S. personnel requested typhus, plague, or typhoid vaccinations. The Peace Corps vaccinated all of its personnel against typhoid irrespective of the date

of last vaccination. It is impossible to estimate the quantity and quality of vaccines sent to Guatemala but many vials received had passed the expiration date and many vials were ruined because of inadequate refrigeration.

The MOH began a massive vaccination campaign on day 6 using DPT, measles, polio, BCG, and typhoid vaccines already in the country. This campaign was the 3rd annual cycle scheduled to have begun on February 18, 1976. The immense logistical problems of transport and refrigeration following the earthquake greatly limited the campaign.

Although there was a constant demand for vaccinations and pressure from the contributors of the vaccine to promote their use, general mass campaigns were discouraged because:

- a. Epidemics of vaccine-preventable disease were unlikely.
- b. Such campaigns would monopolize scarce financial and manpower resources.
- c. The population receiving vaccine is often quite different from the population requiring vaccination. In Guatemala, the Indian population has the lowest vaccination levels and was a major group affected by the disaster yet lived in isolated villages which were inaccessible.
- d. Vaccine resources can be better utilized as a specific response to cases detected by a surveillance system.
- e. With respect to typhoid vaccine, improving the quality of the water sources was of greater importance.

B. 47th U.S. Army Field Hospital

The decision to request the 100 bed "MASH" hospital was made on day 1 with minimal input from the epidemiology team. This decision was based more on "felt need" than "measured need," and important information lacking at that time included:

- a. Type and severity of injuries. The DAST arrived on day 1 and had preliminary estimates of total injuries by day 3, but little data on the numbers of injuries requiring surgery and hospitalization were available in 24-48 hours.

- b. Status of health facilities in the disaster area and Guatemala City and possibility of evacuating patients to existing facilities.
- c. Specific information on location of persons requiring hospitalization.
- d. Alternative mobile hospital facilities available from the United States. It was later learned that field dispensaries, smaller hospitals, and portable operating rooms were available, and each could have been deployed in Guatemala.

The field hospital began functioning near Chimaltenango on day 4 of the disaster. In Chimaltenango, 2 other hospitals were functioning: the Behrhorst Clinic and the health center supplemented by a Nicaraguan field hospital. The 47th hospital admitted serious or surgical trauma cases while the other 2 hospitals cared for minor trauma and routine medical complaints. This delineation of roles was made to capitalize on the traumatology expertise of the Army unit.

The number of admissions to the Army hospitals by date were:

<u>Date</u>	<u>No. Admissions</u>	<u>% Trauma Admissions</u>
Feb. 7	26	92
8	38	82
9	57	81
10	38	84
11	40	83
12	30	87
13	13	54
14	5	60
Total	247	82

To assess the "cost-benefit" of the 47th field hospital requires knowledge of both medical and nonmedical factors. It can be seen, though, that maximum hospital utilization was for less than 1 week. This did not reflect on the capabilities of the hospital or its staff. Rather, beginning in the 2nd week of the earthquake there were few remaining concentrations of seriously injured persons that could be readily transferred to Chimaltenango in helicopter airlift or overland by ambulance.

A U.S. Army preventive medicine team, consisting of a well trained professional and field staff, was assigned to the field hospital in Chimaltenango. This unit could have been instrumental in the evaluation of public health problems in communities in the Chimaltenango area. However, it did not have a clear mandate to work outside the 47th hospital nor language or vehicle support for such activities.

C. Foreign medical personnel

As has occurred following most major disasters, many nurses, physicians, medical students, nursing students arrived by air and land hoping to assist. Medical teams from Nicaragua, Venezuela, Mexico, and Costa Rica arrived early in the 1st week. Due to their language ability, and perhaps to a clear comprehension of the need for rapid trauma care in rural areas, these groups appeared to be quite effective. Most of the volunteers from the United States arrived in the 2nd week after the earthquake at a time when the Guatemalan medical community had the acute medical emergency under control. Many arrived without support (food, water, camping equipment or lodging) and were unable to speak Spanish. Often these volunteers had no clear idea as to where they were going and were dependent upon official resources for transportation, communication, and supplies.

On day 5 it was apparent that no additional medical personnel were required. This information was cabled to Washington and later appeared in a number of U.S. newspapers. Nevertheless, volunteers continued to arrive. The epidemiology team unavoidably spent many hours counseling these individuals.

D. Epidemic disease

Rumors of epidemics reached epidemic proportions in the 2nd and 3rd weeks. At various times epidemics of measles, typhoid fever, typhus, anthrax, rabies, hepatitis, influenza and dysentery were reported from the affected areas.

The epidemiology team had the responsibility of responding to these reports. Initially the response consisted of site visits and case detection. As the surveillance systems began to function it was possible to utilize these data to, in most instances, document the absence of epidemic disease. Increases in upper respiratory infections and dog bites were confirmed by the surveillance system (see below).

E. Food supplies

Information gathered by various agencies soon after the earthquake confirmed that acute food shortage was not an immediate public health problem. While a considerable amount of food was distributed by CARE and Caritas, the epidemiology team was not involved in the assessment of supplies or nutritional status.

F. Water

In Guatemala City approximately 40% of the existing water supply was cut by the earthquake. Initially it was reported that many rural areas were also without water. Two immediate public health problems existed: the absolute lack of water in an undefined segment of the affected population, and the possibility of gross contamination of the remaining water supply either by silt or fecal cross-contamination.

In the U.S. Mission, 2 sanitary engineers from the U.S. Army had responsibility for the water relief operations. Relief in Guatemala City centered on establishing water reservoir sites using 3,000-gallon water tanks to supply water tank trucks. In rural areas, similar water storage tanks were placed along with hardware for connecting such sources to a water supply. It is clear that this program provided a rapid water source for many persons who were otherwise without water.

From a public health standpoint several observations are important with respect to the water emergency:

- a. From teams that arrived in the rural areas from days 3-7, it appeared that the apparent water shortage in many areas consisted only of debris having covered an intact water source. In many areas, the source had been cleared by local residents before the arrival of a water tank.
 - b. In Guatemala City no data were available concerning the distribution of water either as to volume, number of sites operational, or the proportion of the population receiving adequate water via the emergency system.
 - c. Major emphasis was put on rendering the water potable by chlorination. Even though laboratory facilities were available, water cultures were not utilized to monitor changes in the quality of the water or the requirement for chlorination.
2. The CDC epidemiologists insisted that all health relief operations be coordinated with the MOH, in that the ministry would eventually have to carry through with any programs that were initiated in the

acute period. Consultants from PAHO worked with the MOH in collecting data on the availability of hospital beds, coordination of Guatemalan medical and nursing personnel, and long-term planning for hospital rebuilding. Dr. Arturo Romero, PAHO, epidemiologist, collaborated with the CDC team in planning and implementing the acute and intermediate surveillance systems. His experience was invaluable to the CDC epidemiologists.

3. In the surveillance operations, data were obtained both on the physical health facilities and their operations.

- A. Status of health facilities

Only the hospitals of the MOH and IGSS were surveyed; the military hospitals were not accessible in the post-earthquake period. Nevertheless, the vast majority of hospital facilities which cared for earthquake victims either directly in Guatemala City or as referrals from rural areas were surveyed. Following the earthquake of February 4 the 2 major general hospitals, Roosevelt (1,200 beds) and San Juan de Dios (1,100 beds), were in operation. Roosevelt was undamaged while San Juan de Dios had been structurally damaged and was treating patients in its courtyards.

Only 2 of the 4 major IGSS hospitals were operating after the February 4 earthquake: IGSS Trauma (800 beds) and IGSS Rehabilitation (500 beds). IGSS Maternity and IGSS General were evacuated, although the General continued to care for 50-100 inpatients and outpatients through the emergency room in an adjacent building.

In the 12 hours following the Wednesday earthquake, each of these 6 hospitals was deluged with injured persons and with bodies of the killed. It is estimated that in excess of 2,000 persons visited these 6 hospitals between 03:00 and 18:00 on February 4 (Figure 3). On February 5, with the initiation of hospital surveillance, it appeared that the acute demand for hospitalization was passing.

Many persons had been discharged. The Roosevelt cleared an entire wing of the hospital in anticipation of an additional influx of patients, and the IGSS Rehabilitation was able to accept some convalescent patient referrals.

On February 6 the combined forces of the 2nd major earthquake on Friday and the recognition of the scope of the rural disaster changed the assumption that the hospital crisis had passed. Following the 2nd earthquake, San Juan de Dios was evacuated to the Industrial Park, suspending all admissions for 1 week. IGSS Trauma was evacuated to temporary facilities for a 5-day period. As a result, Roosevelt Hospital became the principal referral center for trauma cases; for a 3-week interval the majority of all admissions there were surgical cases from rural areas.

Despite the anticipated shortage of hospital beds, the increase in trauma referrals was spread over a 2-week interval, thereby averting a crisis. The 47th field hospital in Chimaltenango definitely handled many patients who would have otherwise been referred to Guatemala City.

The 4 public health clinics and the IGSS Polyclinic suffered no major structural damage although several were without water for 3-5 days. The consults in these clinics following the earthquake are displayed in Table 2. By February 21, all clinics had returned to pre-earthquake routines. In addition, Centro No. 1 stopped serving as a primary care facility on March 1 and returned to its function as the major center for vaccine programs.

In the most affected rural area the 4 public health hospitals had 50% or greater damage; 3 had to be evacuated. Fourteen of 37 public health centers were unusable and others had suffered major damage. No data were available as to the number of patients treated by fixed health facilities or volunteers in the rural disaster area. Consequently, it is not possible to determine if an acute health care shortage existed either quantitatively or qualitatively.

B. Disease incidence

Data collection in the hospitals was facilitated by incorporating the data sheet as the registration form in most facilities. Due to the lack of a fixed patient population, all data are expressed as a percentage of total consults on a particular day.

Results from urban hospitals are shown in Figure 4. As expected during the first 3-4 days there was an increase in trauma cases. No increase in the actual number or proportion of cases of diarrhea, upper respiratory illness or fever was detected.

The data from the urban clinics are similar to those observed in the hospitals (Figure 5). There was an increase in upper respiratory illness, but this was not greater than the pre-earthquake level.

The only epidemic noted in the city was an increase in numbers of dog bites during the 2nd week (Figure 6). Canine rabies is quite prevalent in Guatemala and there was 1 case of human rabies reported in 1975. Dog vaccination programs conducted in Guatemala City during 1974-1975 reportedly reached approximately 70% of the street dog population.

Following previous earthquakes in Latin America, an increased incidence of dog bites has been seen beginning in the second week (personal communication, Dr. Escalante, PAHO, Zone Veterinary) with an increase in human rabies. However, no increase in human rabies was observed. The response of the Guatemalan MOH was to institute a combined program of canine vaccination and elimination of stray dogs. The efficacy of this program cannot yet be evaluated.

In the rural areas 12 public health centers in the Department of Chimaltenango, excluding the 47th field hospital, were surveyed from days 5-17. Surveillance forms were utilized in the posts for a varying number of days; completed forms were collected at the health center in Chimaltenango. Most of the health posts were temporary facilities with staff changes every 2-3 days. In addition, land and voice communications proved to be a major impediment to centralizing the surveillance data. As a result, much more reliance was placed on periodic site visits to these centers by a member of the epidemiology team. While there were many reports of epidemic disease, as already noted, each of these reports was pursued, and none materialized.

4. Relief supplies

During the initial 3 weeks of the relief operation, in excess of 100 tons of medicines arrived at the airport in Guatemala City. An additional inestimable volume of blankets, clothing, and food were received. In the early days, control of these commodities was of prime importance. The military, through the CNE, stockpiled medicine in 5 warehouses in Guatemala City. Initially neither the MOH nor private groups had access to these warehouses.

As the USPHS pharmacists began to work with the CNE in classifying the medicines, several major problems surfaced. The fundamental impediments to distribution of the medicine were:

- A. The sheer volume of the stockpile forced the CNE to sort the medicine in various warehouses, thereby making it difficult to

package assorted groups of drugs together.

- B. Neither the CNE nor other government groups had the manpower to sort and distribute the medicine.
- C. The majority of medicines which were received were either inappropriate (diet pills, birth control pills), outdated, or partially used.
- D. The overwhelming problem was that even the useful medicines were frequently unclassified or poorly packed.

The pharmacists devised a basic classification system for the warehouses, which was implemented by staff from the School of Pharmacy. This scheme was, however, useful only for those drugs which arrived already classified. To date the vast amount of unclassified medicine has not been processed.

5. Intermediate surveillance system

The intermediate surveillance system has been implemented at 3 levels in the area of earthquake damage.

- A. Local - villages with volunteer health technicians. Data by symptoms and age are collected and a weekly summary form sent to the nearest health center.
- B. Intermediate - public health centers with either a senior medical student or a physician. Data are collected by diagnosis and age, and sent to the central level weekly.
- C. Central - Guatemala City, MOH, Division of Epidemiology where information is tabulated weekly, analyzed and reported. A similar system is functioning in the city hospitals and clinics. The Division of Epidemiology also has the responsibility to respond to any epidemics detected.

The diagnostic laboratory facilities of the MOH, Roosevelt Hospital, the University of San Carlos, and INCAP have merged to support the interim surveillance system. These laboratories will provide microbiological diagnoses, particularly for diarrheal illness.

VII. Discussion

The acute relief effort in Guatemala was a complex undertaking, even within the confines of the U.S. Mission. For the epidemiologists, the scope of

their activities as described in the methods section of this report resulted as a compromise between the demands of the various public health issues and the time and personnel limitation of the epidemiology team. Clearly, for issues such as disease surveillance, vaccination programs, and care of the injured, the CDC epidemiologists were well prepared. In estimating medical supply requirements and the need for portable hospitals, the team was basically unprepared; although with additional information the team could have contributed to decisions on these issues. Finally, with respect to the water relief program, the epidemiologists could have contributed significantly in providing surveillance of both water quantity and quality had they pressed their viewpoint more strongly from the beginning.

Communication channels for the epidemiologists also evolved during the 1st week, rather than being clearly delineated by the FDRC, the U.S. Mission, or the CDC. Within the Mission, there was a 3-day interval before the epidemiology team established a reliable channel to the USAID Director or the Ambassador. Daily written reports or position papers became immensely important in conveying information and supplementing verbal briefings.

During the past 10 years the CDC has participated in the medical assessment of several acute disaster relief operations. Medical epidemiology is now recognized as a legitimate, if not indispensable, element of disaster relief. By reviewing the Guatemala experience it should be possible better to anticipate the CDC's role in the response to future disasters. Since various groups (DAST, CDC) are now prepared to provide disaster assessment, it is important to reconsider what information is required, when it is required, and to provide the administrative capability to make decisions based upon data. During the early disaster, emotions and political necessities strongly affect decisions. Certain key decisions, however, could reasonably be postponed until basic data are available, assuming that there is a reliable data-gathering operation. The experience of the CDC epidemiologists in Guatemala suggests that there are at least 3 distinct activities during the acute phase of relief which logically are in the domain of a medical epidemiology team.

Medical epidemiology activities

1. Spokesman

Irrespective of the size of the CDC group, one person must be designated as "the epidemiologist" and serve as spokesman for the entire team. In the confusion of the post-disaster period, the effectiveness of a unified approach can easily be undermined by too many advisors on a single topic. During the disaster, the leader would have primary responsibility to the senior U.S. official, generally the Ambassador, and to the FDRC.

The initial task of the leader is to present to the Ambassador the role of his team in the disaster relief, including to:

- A. Review health issues which can be expected to develop, particularly the threat of epidemics such as rabies, typhoid, and diarrhea.
- B. Outline sound preventive health measures in response to the epidemic potential.
- C. Describe the role of surveillance and data gathering in decision making in health issues.

Within the local government, the team spokesman should contact, with the assistance of the health representative in the U.S. Mission, the principal health officials in the government (MOH). The purpose of this contact is to:

- A. Establish the base for communications between the United States relief efforts and the MOH.
- B. Identify with the national epidemiologist what surveillance activities and information existed prior to the disaster.
- C. Determine what are the priorities for the MOH and to understand the decision-making process in the MOH.

In the initial phase of the relief operations he should determine what other major medical relief efforts are being conducted, whether by volunteer agencies or other countries. Of particular importance is close coordination with the WHO/UN (PAHO in Latin America).

2. Medical Supplies

The second function for a medical epidemiology team is that of assessing physical medical needs and resources. The following factors should be assessed:

- A. Quantity of medical supplies available for immediate dispersal within the country.
- B. Utilizing estimates of injuries to project the volume and type of medical supplies required during the acute emergency.
- C. Supervise a system for monitoring (a) the medical supplies which arrive consigned to the U.S. Mission, (b) medical supplies from other international sources consigned to the affected country.

- D. Supervise a system for monitoring the dispersal of U.S. medical supplies within the country.
- E. Determine the number of hospitals and beds available to receive disaster injuries with classification as to type of facility: trauma, general medicine/pediatrics, convalescence.
- F. Based upon the projected number of injuries and the medical resources available in the country following the disaster, assist the U.S. Mission in determining if portable hospital facilities from the United States are required. Variables such as the accessibility of the injured, the type of injuries, the rapidity with which facilities can be deployed from the United States, and the various types of facilities (hospitals, dispensaries, etc.) which are available, particularly from the U.S. Army.
- G. If a U.S. hospital facility is deployed, to serve as liaison between the U.S. Mission and the hospital/dispensary director. To make certain that hospital statistics are maintained and to assist in coordination with other medical facilities in the area.
- H. In future disasters a pharmacist should be assigned in the initial response to work with the epidemiologist coordinating medical supplies.

3. Surveillance

In previous natural disasters in Latin America, the rapid assessment has been made by the DAST from the Southern Army Command in the Canal Zone. To date, the CDC epidemiologists have had a workable yet casual relationship to the DAST; occasionally the DAST has provided its own medical component. A restructuring of the role of the epidemiologic team vis-a-vis the DAST should be considered. Based upon the Guatemala experience, the following data should be generated within 48 hours of the initiation of the relief assessment:

- A. The geographical extent of the area of destruction.
- B. The number, geographical distribution, and severity of injuries.
- C. Status of fixed health facilities in the area of destruction.
- D. Status of communication by voice (telegraph, telephone, radio) and by land.
- E. The condition of the water supply, initially whether it has been disrupted and what immediate repairs are required to make water available.

One CDC epidemiologist from the team should be assigned to work exclusively with the DAST commander for 48-72 hours in formulating the initial assessment. The epidemiologist would assist directly in gathering data on items B, C and E. In addition, if the extent of the disaster were great, specific epidemiological techniques such as sampling might be utilized to gather representative data on all the above points. One motive for the merging of DAST and CDC efforts would be to provide data on injuries so that estimates of medical supplies and hospital utilization could be made early and accurately. Some areas of the DAST assessment, such as number of open graves, deaths, and food supply, can best be deferred.

The FDRC should also identify other decisions which will be based on specific data supplied from the field. After the initial evaluation, the epidemiologist handling the surveillance operation should concentrate on assessing whether pre-existing surveillance systems are functional and adequate to generate acute data on injuries, diarrhea, dog bites, typhoid, childhood exanthems, etc. If an interim surveillance system is required, he should marshal whatever manpower is required to implement the system, basically assisting local health officials to collect and analyze their own data. As was demonstrated in Guatemala, however, it is not sufficient for the CDC representative to recommend that surveillance be undertaken. In the midst of the acute disaster the person in charge of surveillance must be prepared to assume an active role in collecting and analyzing health data.

As outlined, the CDC team should consist of 3 persons, 2 physicians and a pharmacist. While the availability of health personnel in the U.S. Mission or PAHO could greatly facilitate the work of the CDC team, they cannot automatically replace external, epidemiology aid because (1) they may lack sufficient training, or more likely, (2) they may be immersed in their personal recovery from the disaster.

Now that the CDC has several epidemiologists with disaster assessment experience, it should strive to assign an experienced team leader. The delicate and perhaps complicated communications in disaster relief are vital for effectiveness and should not be left to chance. Foreign language capability, particularly in the team leader, is indispensable.

The CDC should also consider formalizing disaster relief in the form of a written document prepared with the FDRC in which the role of the CDC epidemiology component is detailed. Our experience

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