EARTHQUAKE IN GUATEMALA: EPIDEMIOLOGIC EVALUATION OF THE RELIEF EFFORT

C. de Ville de Goyet, E. del Cid, A. Romero, E. Jeannée, and M. Lechat

Initial recovery from the February 1976 earthquake in Guatemala was greatly enhanced by effective national and international relief efforts. This experience is examined from an epidemiologic standpoint and possible ways for further improving responses to such events are suggested.

Introduction

Disasters, defined as ecological disruptions exceeding the adjustment capacity of an affected community and calling for outside assistance (1), occur daily. Major disasters involving international aid (with its own set of related problems) are reported several times a year. Great earthquakes (Table 1) are less common, but because of their extremely sudden impact and heavy death toll, they are especially apt to make a deep impression on the public and to evoke an irrational and counterproductive response.

Over the last decade epidemiologists and health administrators have shown increasing interest in health problems associated with disasters, particularly earthquakes. Before then little was known about the propensity of various health disorders to attack survivors or the postdisaster incidence of major communicable diseases. Since then various major types of health mismanagement in times of emergency have been identified and investigated (2), and the findings of these studies have been progressively integrated into the predisaster plans of leading relief organizations. Progress has been slow, since the latter process requires broad diffusion of information to both decision-makers and the public, as well as medical instruction on the newly developed concepts in both relief-providing and disaster-prone countries. In this context, the 1976 Guatemala earthquake and the response to it have provided some encouraging signs of appropriate disaster management; at the same time, they have helped to reveal areas where further improvement is needed.

Background

Guatemala has an area of 131,800 km² and a population of about 6,000,000. Its capital, Guatemala City, is situated in one of the

Table 1. Major earthquakes, 1960-1976.

<table>
<thead>
<tr>
<th>Year</th>
<th>Principal country affected</th>
<th>Estimated no. of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>Morocco</td>
<td>12,000</td>
</tr>
<tr>
<td>1962</td>
<td>Iran</td>
<td>10,000</td>
</tr>
<tr>
<td>1968</td>
<td>Iran</td>
<td>11,588</td>
</tr>
<tr>
<td>1970</td>
<td>Peru</td>
<td>66,794</td>
</tr>
<tr>
<td>1972</td>
<td>Nicaragua</td>
<td>6,000</td>
</tr>
<tr>
<td>1974</td>
<td>Pakistan</td>
<td>5,900</td>
</tr>
<tr>
<td>1975</td>
<td>China</td>
<td>unknown (very high)</td>
</tr>
<tr>
<td>1975</td>
<td>Turkey</td>
<td>3,000</td>
</tr>
<tr>
<td>1976</td>
<td>Guatemala</td>
<td>22,778</td>
</tr>
<tr>
<td>1976</td>
<td>Italy</td>
<td>918a</td>
</tr>
</tbody>
</table>

* Provisional data.
country's largest valleys. There is a large Indian population, most of it concentrated in the Sierra Madre, a mountain chain that crosses the southern part of Guatemala in an east-west direction.

At two minutes past three on the morning of 4 February 1976 Guatemala's most heavily populated regions experienced the first and most destructive earth shock in a long series of over 1,500 tremors. Caused by a geological fault in the Motagua River region in the northern part of the country, the quake affected a third of the national territory. Three distinct geographic areas were involved: the western highlands, the central region, and the northeast. The main shock, which lasted 30 seconds and measured approximately 7.5 on the Richter scale (3), released over 30 times more energy than the Managua earthquake of 1972. (The latter registered 6.25 on the Richter scale.)

Destruction was spread over a vast region of hilly terrain. To make matters worse, numerous landslides isolated hard-hit villages and small cities, delaying relief teams, disrupting communications, and preventing full knowledge of the disaster's extent.

Health Statistics

Mortality

Commenting on the 1962 earthquake in Iran, Saidi (5) noted that “the exact number of deaths and injured could not be ascertained in the first week after the catastrophe. Mortality and morbidity figures had to be steadily revised upward as reports from distant villages came in.” This observation can be applied to most rural earthquakes.

After the earthquake in Guatemala the official death toll rose from 800 on day 1 to 22,778 on day 18 (Figure 1). Although the numbers could only be estimated roughly for some localities, the latter figure can be regarded as fairly realistic. Nominal rolls were being compiled in towns and villages at the time of this survey, but they had only been completed and made available in three localities.

Mortality ranged from a low of virtually zero in marginally affected areas to a high of 21.5 per cent in Santa Apolonia, a village of 4,000 inhabitants that was reduced to rubble. Some of these mortality rates seem surprisingly low in view of the severity and extent of the structural damage involved. For instance, up to 90 per cent of the houses in Chimaltenango Department (population 194,735) were totally destroyed, but the death rate was “only” 7.1 per cent.

In this heavily affected department no information was available concerning the direct cause of the deaths reported or the time elapsed between the seismic shock and each death. But in the moderately affected eastern city of Jalapa medical records were available
for each of the 17 deaths known to have occurred. In the latter case the bodies of all the victims were removed from collapsed houses within 12 hours; multiple lesions were noted. Although this sample is extremely small, it suggests that death was rapid if not instantaneous. More data are obviously required to associate the types of destruction observed with the direct cause of death. Such data are likely to have a significant impact on the planning of future rescue activities.

Age-specific mortality rates in the towns of Sumpango and Patzicia in Chimaltenango Department, where nominal rolls were available, revealed profiles similar to the one observed by Sommer et al. (6) after the cyclonic storm of 1970 in Bangladesh. In Patzicia peak death rates well above the overall rate of 3.5 per cent occurred in two vulnerable age groups; specifically, mortality among the 5-9 year group was 5.6 per cent, and among persons 60 or over it was 5.5 per cent (Figure 2). A similar profile was obtained from the Sumpango data (Figure 3). In both towns observed mortality was lower among infants and children 1-4 years old than in the 5-9 group, suggesting that parents took special care of their younger and more defenseless children. The low rate noted among inhabitants 20-39 years of age (the heart of the work force) has major implications for rehabilitation and reconstruction activities.
Morbidity

As of day 18 the Guatemalan National Emergency Committee's official estimate indicated that 76,504 persons had been injured. The reported morbidity rates varied from nil in some places to over 30 per cent among residents of the most severely affected areas.

Unfortunately, the reliability of the reporting system under emergency conditions was very low. In many instances the data included patients attending mobile clinics for diseases unrelated to the earthquake, and in the most severely affected areas it was only possible to make a rough guess as to the number of injured persons receiving care. This guesswork provided only the most approximate figures—set at 3,000 in Chimaltenango, 7,000 in Tecpán, and 6,000 in Comalapa.

Scientific literature on the relative frequency of various earthquake-related lesions is scanty (5, 7, 8). For one thing, since so many people need help, investigative epidemiology in the middle of a disaster is often viewed as a callous preoccupation. There is, however, no inherent contradiction between acting and observing (1). Unfortunately, little time could actually be spared for collecting and interpreting the incidence data that were scattered through the registers of the first aid posts and campaign hospitals observed.

On day 1 a total of 157 patients from the city of Jalapa were referred to the modern hospital there, which is equipped with X-ray facilities. A significant number of these patients (11.5 per cent) were found to have fractured clavicles (Table 2). This type of lesion suggests that most of the persons in question were injured by falling roofs or walls while they were standing up, but more data are needed to confirm this hypothesis. In other localities spine and pelvic fractures were regarded as “common,” but no indication of their relative frequency was given. Among the 76,504 persons injured there were 116 cases of total paraplegia.

People rescued after being buried under debris for several hours are apt to develop a "crush syndrome" within a short time after their release. Nevertheless, despite repeated inquiries about subsequent crush syndromes, no documented cases were brought to the authors' attention. This is consistent with the fact that very few crush syndrome cases were reported after the Peru and Nicaragua earthquakes of 1970 and 1972.

Burns caused by earthquake-induced fires were also rare. Adobe walls and tile roofs did not provide suitable fuel, and the initial impact occurred when the population was still asleep.

Obviously, more ought to be known about the type and frequency of traumas associated with earthquakes. Data on specific attack rates could be of great use in planning the provision of appropriate rescue supplies.

Morbidity/Mortality Ratio

The ratio of the number of injuries to the number of deaths is comparable to morbidity/mortality ratios resulting from other major earthquakes of this decade (Table 3). In general, approximately three injury cases have been recorded for each death; in Guatemala this ratio was 3.4.

The reported number of deaths is usually a far more reliable figure than the reported number of injured persons requesting medical attention. The definition of injury is often loose and generally encompasses all afflictions handled during the emergency, whether related to the disaster or not. Moreover, when the same individual seeks care at various levels

<table>
<thead>
<tr>
<th>Reason for admission</th>
<th>No. of patients affected</th>
<th>% of total patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fractured pelvis</td>
<td>4</td>
<td>2.5</td>
</tr>
<tr>
<td>Fractured clavicle</td>
<td>18</td>
<td>11.5</td>
</tr>
<tr>
<td>Fracture of the lower extremities</td>
<td>10</td>
<td>6.4</td>
</tr>
<tr>
<td>Fracture of the upper extremities</td>
<td>5</td>
<td>3.2</td>
</tr>
<tr>
<td>Other causes</td>
<td>120</td>
<td>76.4</td>
</tr>
<tr>
<td><strong>Total patients</strong></td>
<td><strong>157</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Table 3. Morbidity/mortality observed after four major earthquakes.

<table>
<thead>
<tr>
<th></th>
<th>Morbidity</th>
<th>Mortality</th>
<th>Morbidity/mortality ratio</th>
</tr>
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<tbody>
<tr>
<td>Peru (31 May 1970)</td>
<td>143,331</td>
<td>66,974(^a)</td>
<td>2.2</td>
</tr>
<tr>
<td>Nicaragua (23 December 1972)</td>
<td>20,000</td>
<td>6,000</td>
<td>3.3</td>
</tr>
<tr>
<td>Pakistan (28 December 1974)</td>
<td>15,000</td>
<td>4,700</td>
<td>3.2</td>
</tr>
<tr>
<td>Guatemala (4 February 1976)</td>
<td>76,504</td>
<td>22,778</td>
<td>3.4</td>
</tr>
</tbody>
</table>

\(^a\) Of the 66,974 deaths reported, about half were caused by landslides that buried two towns, leaving almost no survivors.

of the health emergency services, it is always possible that multiple recording will occur.

A Disaster Relief Chronology

According to Western (2), the aftermath of a disaster can be conveniently divided into four phases: impact, emergency, rehabilitation, and reconstruction. Each of these phases is associated with specific activities, and consequently with specific material and personnel needs.

- The impact phase is the period during which deaths, injuries, and destruction are taking place. In Guatemala the main impact was sudden and very short (about 30 seconds). As is usual in the case of earthquakes, it was followed by frequent after-shocks, some of them strong enough to raise the toll of human injury and death, cause new disruption of road communications, and give the people a strong sense of vulnerability.

- The emergency phase is the period during which life-saving measures are taken—including the rescue of buried or trapped persons, the administration of first aid, the provision of emergency medical care for the injured, etc. The emergency phase is often subdivided into two periods, one characterized by isolation and the other by outside rescue and relief measures.

During the isolation period the stricken community is completely on its own. Authorities do not know which areas are most severely affected because communications are cut off. This period ends with the arrival of the first rescue workers from unaffected areas. However, several days are often required to reach remote smaller communities, with the consequences that people are either recovering or dead when medical care becomes available.

The rescue and relief period begins with the arrival of teams, initially uncoordinated but later organized, with relief supplies and medical equipment. This is when the first outside medical treatment is administered to the injured. However, it should be noted that at this point plasma, blood, and emergency drugs, so urgently needed in well-equipped hospitals, will be able to save very few lives in outlying areas beyond the range of immediate relief. Disposal of the dead is expeditiously carried out because of a generally unsubstantiated fear that epidemic diseases will be transmitted by decaying bodies.

Over all, the emergency phase encompasses what has been called the "convergence" of relatives, friends, and general "volunteer" workers (9). With regard to assisting victims, the greatest good (or in some cases the greatest harm) is done during this phase. Following the 1972 Nicaragua earthquake, this phase was over after day 5. "The hospital population reflected this fact, in that the types of patients more closely paralleled those in any general hospital during more normal times, as opposed to an acute disaster situation" (8).

- The rehabilitation phase has already gotten underway during the emergency phase. In it, priority is shifted to the delivery of essential routine services in temporary facilities—such as provision of water by
The ruins of San Raymundo Church stand as bleak testimony of the earthquake’s impact.

A temporary shelter is hastily erected in front of a house collapsed under its traditional tile roof. Adobe bricks have been salvaged for reuse.

A boy in Sumpango pitches in to clear up the rubble.
Families in San Pedro line up for aid at an emergency station.

A tent hospital near Antigua provides medical treatment for the injured.

(Photos courtesy of C. de Ville de Goyet)
tank-trucks and delivery of routine health care in tent hospitals. Emphasis is placed on environmental measures, sanitation, and creation of emergency shelters.

The reconstruction phase is the most exacting in terms of resources and efforts needed, and it is the one with least appeal to international solidarity. This phase can provide opportunities for improvement and for reforms aimed at greater preparedness in the event of recurrent disasters. On the other hand, there are cases in which the long-term disruptive effects of a disaster have been allowed to become permanent by loss of interest or lack of external funding during this period.

Emergency Medical Care

Within a few minutes of the first tremors, several thousand severely injured people were demanding immediate medical care. Casualties were spread over a large part of Guatemala.

In response, all local resources were rapidly mobilized by the Ministry of Public Health and Social Welfare and the National Emergency Committee, and foreign assistance began entering the country almost at once. By the afternoon of day 1 (4 February, the day the earthquake struck) a Nicaraguan field hospital with 18 physicians and 24 nurses was being erected in Chimaltenango 30 miles from the capital. On day 2 foreign emergency hospitals were set up in various localities: in El Progreso, a Panamanian Red Cross hospital; in Zone 6 of Guatemala City, a Mexican emergency hospital; and in Tecpán, a Costa Rican Red Cross field hospital. These installations, operated by self-supported teams from neighboring countries, succeeded in meeting medical needs in the respective localities. Also on that day a 100-bed U.S. Army field hospital was requested; within 48 hours it had been installed and made operational near the city of Chimaltenango, the central point of the most devastated region. This tent-hospital, equipped with X-ray and surgical facilities, served as the first-line hospital for primary treatment of patients with major injuries, who were subsequently transferred to health services in Guatemala City. On day 3 a particularly strong after-shock prompted the authorities to evacuate several hospitals considered unsafe because of structural damage. The decline in available hospital beds, together with an increasingly more efficient relief operation in remote areas, contributed to a "second wave" of trauma patients on days 3-6 in the emergency hospitals. At this point 16 hospitals and 92 first aid posts or medical teams were complementing the severely disrupted medical facilities in the affected areas.

The level of activity in the U.S. field hospital, given its specialized function and its location in the most severely affected area, gave a good reflection of the time-trends in the needs for acute emergency medical care. From day 9 onward the rate of both admissions and occupancy fell dramatically. For example, on days 10 and 11, respectively, 35 and 15 beds were occupied in the 100-bed hospital (Figure 4). This decline, together with the drop in referrals from remote areas,
where eight mobile U.S. medical teams had been sent to conduct search and rescue activities, led to the decision to close the hospital down.

The emergency phase—that is, the period of acute need for emergency primary care—was over within 10 days after the initial tremors, and at this point medical priorities were shifting toward the provision of nursing care and convalescent beds. As of day 14, five 200-bed packaged disaster hospitals (PDHs) had arrived in the country, and 10 more were expected shortly. The PDHs were designed in the United States for civil defense purposes in case of atomic attack. Although fully equipped for emergency medical care and surgery, they came without either tents or hospital personnel.

Of course, the fact that the acute need for emergency care had ended did not mean that all the injured were receiving proper attention. An active search carried on by extremely dynamic teams consistently turned up severely injured persons in small hard-to-reach settlements. As late as 20 days after the initial shock, fractures of the pelvis, femur, and upper extremities were still being diagnosed and brought in for medical care by national and foreign volunteers. A deeply rooted fear of hospitals and a distrust of official medicine had prevented many people of Indian heritage from calling for outside assistance. Before being allowed to help, rescuers first had to gain the confidence of these people.

Sanitation and Communicable Disease Control

Water Supply

After an earthquake very high priority should be given to water supply restoration. In Guatemala 75 urban water systems were partially or totally destroyed and in rural areas the water supply was affected in 242 localities. The objective is a return to normality, i.e., to the situation prevailing before the disaster. No attempt should be made to go beyond that. In other words, the emergency phase is not an appropriate time to undertake the provision of high-quality water in remote places where the water supply, whatever its previous bacteriologic quality, had been left untouched by the quake.

In Guatemala City waterworks were extensively damaged by the ground movements. Cross-connection of water lines with sewerage could not be ruled out, and fecal contamination had to be regarded as a potential health hazard in the capital. Conflicting reports on water quality were issued by different sources: on the one hand, daily bacterial counts were said to be within accepted norms; on the other, municipal water supplies were at times considered so grossly contaminated that even hyperchlorination was deemed ineffective. Still, the results of daily bacteriologic and chemical analysis by the Water Authority (Empresa de Agua) did not indicate any massive contamination of the main system during February, although secondary contamination was detected in some emergency reservoirs in temporary refugee camps. Unfortunately, these hard data were not always available to all foreign agencies.

In smaller urban communities the situation was often worse than in the capital. Costly emergency measures taken to ensure the provision of a minimum supply of safe water were well justified. Rubberized tankers and tank trucks were used extensively to alleviate the shortage.

In small rural communities the problem was ill defined and in some cases misjudged. Small villages had their own water sources—such as private wells and municipal springs—which in some localities were left basically unchanged by the earthquake. In the absence of any sewers or waterworks, cross-contamination cannot occur. Detection of contaminated water in such places after a disaster may simply reflect a permanent problem rather than a temporary one resulting from the event. Emergency air-lifting of 3,000-gallon rubberized tankers by helicopter (at US$850
per flying hour) does not seem a reasonable way to tackle chronic problems of this kind.

Among 18 remote sites (with a total population of about 30,000) surveyed by U.S. mobile teams, only one village reported a lack of water. This result suggests that water supply did not constitute a major disaster-associated problem in small rural localities.

**Mass Immunization Campaigns**

"The general attitude to disasters is that they are inescapably linked with epidemics. There is pressure to vaccinate against all kinds of diseases" (11). Generally the risk is grossly exaggerated. Furthermore, as Western has observed (2), mass immunization is not the best method of disease control.

Some of the reasons put forward to explain this latter point are:

- Mass campaigns are often unnecessary.
- They drain off valuable manpower and resources.
- The logistics of mass campaigns often pose impossible problems after a disaster.
- The groups at greatest risk are usually missed.
- Typhoid fever and cholera vaccines afford a low level of short-lived individual protection that plays little if any role in reducing disease transmission and preventing epidemics.

In the first days after the quake a program was developed for the purpose of preventing and controlling water-borne diseases. It included provision for the prompt treatment and rehydration of affected persons, especially children under 5.

In Guatemala it happened that a yearly update and booster campaign of immunization against poliomyelitis, measles, and diphtheria-pertussis-tetanus had been scheduled for the second week of February, so that vaccines were ready for immediate use at the time of the earthquake. In view of the initial planning and the public demand for immunization, the Ministry of Public Health and Social Welfare decided to go ahead with its routine campaign. The public response was tremendous, leading sooner than expected to a relative shortage of vaccine. All in all, this decision to resume or initiate efficient routine control programs, rather than to indulge in impressive but ineffective crash campaigns, was highly praiseworthy.

The main difficulties encountered in carrying forward the vaccination program were:

- Problems in transporting vaccines and equipment to isolated rural areas owing to the impassable roads;
- Breakdown of the refrigeration network in the health centers and outlying posts, with permanent damage in some instances; and
- Inability to mobilize health personnel, scattered by the emergency and many of them with concerns of their own.

Many relief groups undertook blind mass immunization against typhoid fever. As a result, within a few days an estimated 85,000 persons were reported to have been inoculated. However, no record whatever was kept and no provision was made to identify persons ready for their second or third shot, thereby rendering the entire effort meaningless. The relief teams were apparently unaware or unaffected by the Ministry of Health’s view that massive campaigns were not worth undertaking and that water protection should be given first priority. As in the earlier experience in Nicaragua, interest in immunization faded away as soon as the subject of epidemics ceased to make front-page headlines in the press.

**Epidemiologic Surveillance**

An epidemiologic surveillance system was set up in order to have appropriate and timely information on morbidity and mortality in the disaster area. It involved the daily reporting of symptoms, according to age, sex, and locality, by hospitals, health centers, and units operating in towns and villages. Personnel from the Pan American Health
Organization and three epidemiologists from the U.S. Center for Disease Control participated actively in this undertaking.

To help determine the presence of epidemic outbreaks as quickly as possible, it was also necessary to reorganize the health laboratory services network. Five reference laboratories were set up, and area laboratories were organized in Chimaltenango, Zacapa, El Progreso, Antigua, and Santa Maria Cauqué.

Any hearsay of unusual disease occurrences in the wake of the disaster were investigated. Rumors of gastroenteritis outbreaks, severe measles epidemics ("up to 23 deaths"), and increased incidence of respiratory infection all proved to be unsubstantiated. Similarly, persistent reports of typhoid fever and even typhus were never supported by the results of bacteriologic analysis.

Because many people were living in the streets, data from all clinics in the capital clearly showed an increased incidence of dog bites (10). Although canine rabies was endemic in Guatemala, human rabies was not considered a major threat, and preventive immunization was discouraged. In the town of Gualán, Zacapa, the population experienced a sudden increase in vampire bat bites. Although some of the specimens taken were positive for rabies, no human cases of the disease were reported. The emergency surveillance system did play an important role in calming the public and in redirecting some of the relief effort toward reestablishment of the normal health care delivery system and routine communicable disease control programs.

As a second step after the emergency phase, a more sophisticated surveillance system was initiated. Extensive use of bacteriology laboratories was anticipated, involving the examination of several thousand cultures per month. For this reason, discovery and reporting of endemic disease cases unrelated to the disaster are likely to increase dramatically; however, lack of baseline data make analysis very difficult. Great caution should be exercised in attributing an "increased" incidence of disease to the environmental effects of the earthquake.

Medical Supplies

During disaster relief operations a problem is presented by the need to identify, sort, and distribute large amounts of donated medical supplies (8, 11, 12). Thus warehouse keepers and pharmacists may be able to render greater services than many physicians.

The terms "medical supplies" and "drugs" have magical connotations in emergency conditions that need to be demystified. A systematic approach is required to understand the nature of the problem. Specifically, drugs flown in following a disaster can be divided into several categories, as shown in Figure 5.

In Guatemala relatively few of the drugs donated by foreign countries came already sorted—that is, in packing cases holding a single type of drug or in drug containers

![Figure 5. Classification of drugs donated for disaster relief, Guatemala, 1976.](image-url)
properly identified and marked. Furthermore, only a small proportion of the sorted drugs were needed at once; in this regard, it should be noted that vitamins, antacids, and nasal sprays are by no means "emergency drugs" worth rushing in by air. The timing also needs to be appropriate. For example, the plasma supply was overflowing in all the hospitals three weeks after the disaster occurred. If required, plasma is needed within the first few days. Despite these negative considerations, however, it is important to note that all the plasma and usable drugs received were appreciated and will eventually be utilized.

Unfortunately, the bulk of the donated medicines (up to 90 per cent) consisted of unsorted drugs. In general, after major disasters in less developed countries, lack of sorting is more the rule than the exception. In Guatemala the total weight of unsorted medicines in cartons of varying size received as of day 11 was estimated at roughly 30 tons, on day 14 it was 50 tons, and by day 16 it had reached over 100 tons. In all there were between 6,000 and 7,000 boxes. Huge volumes were still coming, and the rate did not appear to be decreasing even after the acute emergency period had been over for a week. A significant percentage of these supplies were useless—for example, drugs whose expiration dates for safe or effective use had passed, opened or partially used samples, and previously used disposable perfusion sets. Up to 40 students, supervised by three pharmacists, were working in shifts to sort between 25 and 50 boxes a day—a formidable task for the months ahead.

As a matter of fact, after day 4 no acute shortages of major drugs were observed in the outlying posts, an indication that the system for distributing Ministry of Health supplies and sorted donations was working satisfactorily. However, some frequently requested items were intermittently in short supply at the warehouses. These included benzathine penicillin (procaine penicillin, available in large quantities, was less convenient), disposable syringes and needles, casting material (which was also lacking at the U.S. field hospital), sterile gauze, and bandages.

Requests to potential donors were issued daily by the authorities. Antibiotics—even though their efficacy in preventing wound infections is questioned by many physicians—were the most frequently and urgently requested class of drugs. Coordinating institutions, such as the United Nations Disaster Relief Office (UNDRO) and the Pan American Health Organization (PAHO), assisted the Government in matching the requests against offers of drugs by bilateral donors and against existing supplies. (Little was known about these existing supplies; in one day alone over 20 international relief flights were unloading mixed cargoes, including unspecified amounts of medical supplies and medicines.)

The volume of medical supplies entering the country and the vast number of potential donors were simply too great for any organization to assimilate. The valuable and urgently requested items therefore risked being lost in the bulk of unsolicited worthless donations.

Adopting a realistic approach, some health officials based their requests on the projected requirements of the routine health care delivery system. In other words, they calculated in terms of replenishing their regular stock. The wisdom of this approach was soon borne out: within the first few days of the emergency the medicines used corresponded to a six-month supply. Without this foresight, the resumption of health programs would have been in jeopardy.

Foreign Volunteers

A very close relationship has developed among the national Red Cross societies in Central America, and their radio network permitted an almost immediate response to the recent earthquakes in Nicaragua and Guatemala. In the latter case field hospitals and mobile medical teams were operating within 24 hours in the areas designated by
Guatemala's National Emergency Committee. In addition, many South American countries have well-organized and experienced civil defense groups. One such organization in Venezuela contributed a 50-man team, which was put in charge of several warehouses at the military airport in Guatemala City. Those and many other teams that arrived in Guatemala were well-equipped and self-contained in terms of personal supplies: vehicles, communications, etc. Sharing the same culture and language, these workers from nearby countries had little if any problem in adjusting to the local situation.

Unfortunately, earthquakes attract individual volunteers with uncertain motives and dubious qualifications, and the Guatemalan case was no exception. The principal task of the National Emergency Committee was to coordinate and control the vast amount of medical aid, consisting of both personnel and supplies, that was streaming into the country. It soon became apparent that the number of physicians was sufficient to meet disaster-associated needs. Nevertheless, ingenious medical "tourists" (with a marked predilection for helicopters) succeeded in attracting official attention and in placing a heavy drain on overtaxed transport equipment.

Once the acute emergency phase ended, the number of foreign physicians in the country dropped sharply. In San Martin Jilotepeque, a hard-hit town with some 30,000 inhabitants, only one from an original corps of 18 medical volunteers remained to assist the population after day 19. Few medical relief teams expected to contribute to the reestablishment of normal health care activities.

Emergency Shelters and Reconstruction

In the wake of the Guatemalan disaster over a million persons were left homeless. Many more were living in the street for fear of another quake. The weather was surprisingly cool, and everyone was mindful of the seasonal rains, which were due to start within a few months. Provision of temporary housing soon became the major official concern.

In hard-hit rural areas the "extended family system" was unable to absorb all the refugees, since often whole communities and entire families were homeless. Soon the people were digging up beams, adobe bricks, tiles, and other recoverable construction materials from the debris. Even though the adobe and the tile roofs had been justifiably incriminated as contributing to the high human death toll, these items were nevertheless salvaged and stored. In addition, barracks-type shelters and tent camps were erected, often without basic sanitary facilities. However, rural dwellers were generally reluctant to leave their plots of land, so that despite the small size and limited facilities of these camps, refugee overcrowding was not expected to cause major health problems.

In the capital homeless people settled in public squares, in parks, or even in wide streets. Their resourcefulness led to steady improvement in the quality of temporary shelters. Cardboard was soon replaced by wood or corrugated metal; before long kitchens began to be added to the original one-room dwellings. Despite such gains, however, resettlement of the urban homeless will clearly be a formidable task with important social, economic, and political implications.

In general, adobe and tile roofs are ideally suited to the Guatemalan climate. To be earthquake-resistant, however, buildings must include some cement, iron, timber, or corrugated metal, all of which are clearly more expensive. Unless there is massive material assistance and prompt action by the Government, the population will probably return to this traditional type of construction.

Conclusions

Over all, the international relief effort was clearly instrumental in helping the people and
the Government of Guatemala to overcome the effects of the recent disaster. However, the value of this assistance varied greatly. On one hand, it included priceless vital services such as air transportation, professional evaluation, specialized expertise, and prompt provision of fully equipped hospitals. But on the other hand, it also involved the dumping of useless "donations" such as expired medical samples, nylon underwear, and unmatched ladies shoes—help that was counterproductive, especially since the fuel for each aircraft's return flight was paid for by the assisted country.

It is also true that some of the foreign assistance was ill timed. Emergency situations change very fast, so that once a need has been identified it requires an immediate response. Neighboring countries can adjust their assistance relatively easily, but timing is impaired as distance increases. For example, the number of international relief flights bringing medical supplies reached its peak at around the end of the second week, a time when the priorities had already shifted from emergency medical care to temporary housing and sanitation. Despite the objective assessment of UNDRO, PAHO, the Red Cross, and other teams, decision-makers in donating countries tended to overlook this dynamic side of the situation and failed to allow for the lag between the time information was gathered and the time their decisions could actually be implemented. For the future, since disasters follow a somewhat predictable pattern, it would appear very desirable to anticipate needs to some extent and to inform prospective and remote donors accordingly.

The provision of emergency medical care is an overwhelming task in the immediate aftermath of a disaster. In the long run, however, it is only one problem among many that the health authorities must face. Beyond any doubt, in this case the response from the country was commendable and efficient, and much experience was gained in the field of disaster management. This experience must now be incorporated into contingency planning and into medical student training in disaster medicine so that the need to relive the recent lessons of disaster relief in Central America can be avoided.

SUMMARY

The damage wrought by the earthquake that recently struck Guatemala evoked a commendable and efficient national response. It also led to international relief activity that was clearly instrumental in assisting the country's short-term recovery efforts.

At the same time, this initial recovery period caused a good deal of experience to be gained in the field of disaster management. Some of the lessons derived from the experience are examined, and a number of approaches are suggested for measurably improving both national and international response to future disasters of this kind.

REFERENCES

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