66

Public Health Aspects of Disaster Management

William H. Foege

Disasters throughout history have had significant impact on the numbers, health status, and life-style of populations Despite smaller populations and incomplete reporting in the nineteenth century, there were known to have been 9 million deaths due to floods, 900,000 due to earthquakes, and more than 600,000 deaths in hurricanes, typhoons, and tornadoes.[1] Individual disasters have resulted in high mortality. For example, 900,000 died in the 1887 flood in China; 300,000 died in the 1737 earthquake in Calcutta, India; 1600 deaths resulted from the 1917 explosion in Halifax Harbor, Canada.[2]

The toll of disasters continues. In Latin America, three major earthquakes occurred between 1970 and 1976, volcanic activities resulted in the evacuation of a large number of the inhabitants of Guadeloupe (1975 to 1976) and St. Vincent (1979), and periodic hurricanes and floods have severely influenced many countries in the region.[3] The earthquake on July 28, 1976, in Tangshan, China, has been described as "the greatest earthquake disaster in the history of mankind." Estimates of the deaths range as high as three quarters of a million, and rebuilding of the city required at least 6 years.[4]

Americans may consider significant disaster to be primarily a problem for developing countries; however, the American Red Cross reports that disasters resulted in more than 36,000 deaths in the United States between 1924 and 1977.[5]

Although experts may differ in their definitions of disaster, many public health practitioners would characterize a disaster as a sudden, extraordinary calamity or catastrophe which affects or threatens health. Disasters include tornadoes, fires, hurricanes, floods, snowstorms, earthquakes, landslides, severe air pollution (smog), heat waves, epidemics, building collapse, toxicological accidents (e.g., release of hazardous substances), nuclear accidents, explosions, civil disturbances, water contamination, and existing or anticipated food shortages.

OBJECTIVES

Appropriate application of current technology can prevent much of the death, injury, and economic disruption resulting from disasters. Although morbidity and mortality resulting from disasters differ according to the type and location of the event, in any disaster, prevention should be directed toward reducing (1) losses due to the disaster event itself and (2) losses resulting from the mismanagement of disaster relief. Therefore, the public health objectives of disaster management can be stated as follows:

1. Prevent unnecessary morbidity, mortality, and economic loss resulting directly from the disaster.
2. Eliminate morbidity, mortality, and economic loss directly attributable to mismanagement of disaster relief efforts.

LESSONS FROM THE PAST

Overall Morbidity and Mortality Associated with Disasters

Nature and Extent of the Problem

Morbidity and mortality which result from a disaster situation can be classified into four types: injuries, emotional stress, epidemics of diseases, and increase in indigenous diseases. The relative numbers of deaths and injuries differ depending on the type of disaster. Injuries usually exceed deaths in explosions, typhoons, hurricanes, fires, famines, tornadoes, and epidemics. Deaths frequently exceed injuries in landslides, avalanches, volcanic eruptions, tidal waves, floods, and earthquakes.

Disaster victims often exhibit emotional stress or the "disaster shock" syndrome. The syndrome consists of successive stages of shock, suggestibility, euphoria, and frustration. Each of these stages may vary in extent and duration depending on other factors.[6]

Epidemics are included in the definition of disaster, however, they can also be the result of other disaster situations. Diseases which may be associated with disasters include specific food- and/or waterborne illnesses (e.g., typhoid and cholera), vectorborne illnesses (e.g., plague and malaria), and diseases spread by person-to-person contact (e.g., hepatitis A and shigellosis) or by the respiratory route (e.g., measles and influenza).[6]

The current status of environmental sanitation, disease surveillance, and preventive medicine has led to a significant reduction in the threat of epidemics following disasters. Of the illnesses which might generally follow disasters, Europe and North America are usually at risk of relatively few, i.e., food poisoning, sewage poisoning, nonspecific diarrhea, hepatitis A, shigellosis, and influenza. The low risk of other illnesses is due to the disappearance of the illnesses from the population (e.g., smallpox, plague), high immunity levels from vaccines (e.g., measles, whooping cough, tetanus), availability of antimicrobial agents (e.g., streptococcal disease, tuberculosis), and a significant reduction in the prevalence of the illnesses (e.g., typhoid fever).[6] Therefore, immunization programs are rarely indicated as a specific postdisaster measure. A disaster is often followed by an increase in the prevalence of diseases indigenous to the area due to the disruption of medical and other health facilities and programs.

Measurement Criteria

Investigation and analysis of past disasters have led to the use of numerous objective criteria for the measurement of disaster situations. These tools can be employed to ascertain how a current disaster compares with others in the past and how the disaster and its effects are changing over time.

Some physical measurements, such as the height of a river above flood stage, the level of pollutants in the air, the amount of toxic material in food or water, or the levels of radiation in areas surrounding a site of a nuclear accident, can be used to assess the magnitude of a disaster. The Richter scale is a proven and widely used method to specify the intensity of earthquakes. Other items measure the biological effects of a disaster. The number of deaths by age is a commonly used statistic for evaluating disasters. Age-specific case and death rates over time are a standard measure of an epidemic of communicable disease. Laboratory typing of organisms, biochemical testing of affected individuals, and environmental tests may all be necessary. The extent and intensity of a famine can be determined by calculating height/weight ratios for children in the affected areas. These tools and others permit more objective assessment and communication of the effects of a disaster.

Morbidity and Mortality from Mismanagement of Relief

Ideally, attempts to mitigate the results of a disaster would not add to the negative consequences; however, there have been many instances in which inappropriate and/or incomplete management actions taken after a disaster contributed to unnecessary morbidity, mortality, and a waste of resources. According to the United Nations Economic and Social Council, many of the casualties and much of the destruction occurring in a natural disaster are due to ignorance and neglect on the part of individuals and public authorities.

There is a plethora of literature describing the inappropriate actions taken to manage past disasters. Many of the same mismanagement problems tend to recur. Physicians and nurses have been sent into disaster areas in numbers far in excess of actual need.[6–8] Medical and paramedical personnel have often been hampered by the lack of the specific supplies they need to apply their skills to the disaster situation. In some disasters available supplies have not been inventoried until well after the disaster, resulting in the importation of materiel which is not used or needed.[8]

The Peruvian earthquake of 1970 and the Nicaraguan earthquake of 1972 provide two examples of inappropriate actions taken in managing disaster-relief operations. After both earthquakes, disaster relief hospitals (portable, prefabricated facilities) were provided, although they were not needed.[7,8] Relief goods were sent to the countries, but no provision was made to transport them to the specific areas where they were needed.[1,7,8]

It is likely that this failure to transport relief supplies to needy areas resulted in unnecessary morbidity and mortality.

Many volunteers who went to Peru after the 1970 earthquake neither spoke Spanish nor had any disaster relief experience. They added to, rather than reduced, the problems of the Peruvian authorities.[1] Personnel from more than 70 volunteer and official agencies went to Managua after the Nicaraguan earthquake of 1972, but there was no coordination and little cooperation among these groups.[8]

Inappropriate timing of the response to a disaster was evident following the hurricanes in British Honduras, Yucatan, and Tampico in 1955. Supplies to treat traumatic casualties were brought into the disaster area 48 hours after the disaster. By that time traumatic cases had been cared for or had died.[9]

In a study of past disaster mismanagement problems and their causes,[10] these problems were categorized as follows.

1. Inadequate appraisal of damages
2. Inadequate problem ranking
3. Inadequate identification of resources
4. Inadequate location of resources
5. Inadequate transportation of resources
6. Inadequate utilization of resources

Among 22 U.S. disasters in this study, 93 instances of inappropriate management activities were identified. Some disasters were accompanied by more than 20 such instances. The analysis indicated that most disaster mismanagement problems occurred because relief managers did not know what all of the relief activities were or how they should be accomplished. Although extensive information is available on the various components of disaster relief and a variety of disaster relief plans exist, only in recent years have good regional and global guidelines been available. The Pan American Health Organization has developed a series of guides for surveillance, health management, environmental health management, and vector control after natural disasters.[11-15] The United Nations High Commissioner for Refugees has developed an easy to use *Handbook for Emergencies*,[19] and the National Governors Association has provided a manual for emergency management.[17] Disaster managers now have thoughtful and helpful aids to help avoid past mistakes.

DISASTER RELIEF

An effective plan for public health and other personnel during a disaster situation would outline activities designed to minimize the effects of the catastrophe. These efforts can be summarized as situation analysis and response; the two types of activities are closely interrelated. Although many relief workers may be needed to obtain surveillance information, analyze the data, provide relief services, evaluate results, and provide information to the public, it is essential that a single person with managerial experience be placed in absolute charge of the entire disaster relief operation.

Following a disaster, the desire to provide immediate relief may lead to hasty decisions which are not based on the actual needs of the affected population. In order that disaster relief managers can determine the actual needs of the population and make responsible relief decisions, reliable information must be obtained on problems occurring in the disaster-stricken area, relief resources available, and relief activities already in progress. Thus, surveillance systems must be set up immediately.

The objective of surveillance in a disaster situation is to obtain information required for making relief decisions. The specific information required will vary from disaster to disaster, but a basic, three-step process includes: (1) collect data, (2) analyze data, and (3) respond to data.[18]

The collection of data involves obtaining denominator as well as numerator data, for example, the number of people at risk of injury as well as the number of people injured. Without denominator data, one cannot realistically determine the magnitude of a problem. One hundred deaths in a city of 1 million population would be interpreted quite differently from that number of deaths in a small town.

The analysis involves collating and interpreting the data and can include asking such questions as the following:

- What problems are occurring? Why are they occurring?
- Where are problems occurring?
- Who is affected?
- What problems are causing the greatest morbidity and mortality?
- What problems are increasing or decreasing?
- What problems will subside on their own?
- What problems will increase if unattended?
- What relief resources are available?
- Where are relief resources available?
- How can relief resources be used most efficiently?
- What relief activities are in progress?
- Are relief activities meeting relief needs?
- What additional information is needed for decision making?

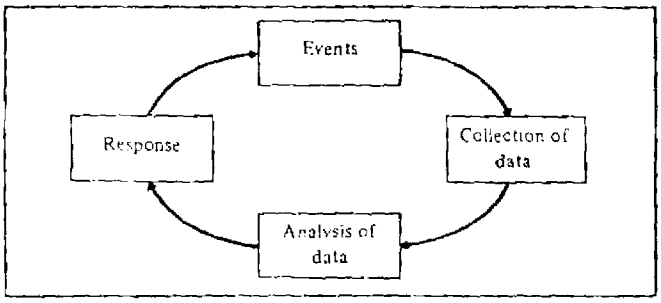

Figure 66–1. The surveillance cycle.

After answering such questions one can carry out the third part, i e, planning an appropriate response to the situation described in the surveillance data. In developing this plan one will decide what types of relief responses are appropriate and what the relative priorities are among the relief activities.

Analysis also consists of measuring the results of various relief activities and determining how these relief responses should be updated to better address the changing disaster situation. The analysis also includes identifying information to be collected in order to evaluate the modified responses. This three-step process of data collection, analysis, and response can be described as a closed feedback system (Fig. 66–1) involving reevaluation of relief needs and their effects. Surveillance following a disaster evolves in phases: (1) immediate assessment ("quick and dirty"), (2) short-term assessment, and (3) ongoing surveillance. The surveillance cycle described in Figure 66–1 applies to each of these phases; however, the information obtained in each phase differs in reliability and level of detail, largely because of the speed with which the initial assessments must be conducted. Each phase builds upon the previous one. The information obtained in the immediate phase is analyzed to determine the forms of relief needed immediately and the information required as part of the short-term assessment. The information collected during the short-term assessment is used to make relief decisions and to determine further surveillance needs. The later surveillance indicates with more precision how relief activities should be maintained or changed.

Immediate Assessment ("Quick and Dirty")

The object of this phase of surveillance is to obtain as much general information as possible and as quickly as possible. The most basic information needed at this point is the following: (1) the geographical extent of the disaster-stricken area, (2) the major problems occurring in the area, and (3) the number of people affected. This information can be obtained by whatever means seems most efficient. Listening carefully and asking questions is often the best way to begin.

An aerial survey may be useful in defining the geographical extent of the disaster-stricken area and in observing major damage and destruction. Census data can be examined to determine how many people previously lived in the disaster-stricken area and thus were at risk. Hospitals, clinics, and morgues which are in operation may be able to obtain numbers of known deaths and injuries. It is useful to determine the most frequent causes of death and types of injuries in order to predict whether demands for medical care will be increasing or decreasing.

Some problems likely to occur after a disaster can be predicted according to past experience with that particular type of disaster. For example, experience has shown that disruption of water supplies has often been a problem following earthquakes. New types of disasters, such as chemical emergencies and nuclear accidents, still present many unknowns. As more disaster research is done, disaster relief managers will become better equipped to predict the types of problems that are likely to result from different kinds of disasters.

When a general picture of the disaster situation has been obtained, a rapid analysis should be made. There are two major questions to be answered:

- Is the information already obtained sufficient to determine immediate relief needs?
- What additional information is needed for decision making?

The initial assessment may not have yielded enough information to warrant an immediate decision as to what relief resources must be ordered or what relief activities must take place. Obviously, if fires are raging and threatening to spread, the fires must be put out. But if one knows only that crops have been destroyed, one would collect more information before deciding to provide food relief. Whatever relief decisions are made at this point, a decision must always be made as to what further information is needed.

Short-term Assessment

The short-term assessment involves more systematic methods of collecting data and is likely to result in more detailed, reliable information on problems, relief resources, and relief activities in progress. One way to organize data collection during this phase of assessment is to divide the disaster-stricken area into smaller areas or "blocks" to be surveyed simultaneously by different workers or teams of workers. Simple reporting forms can be developed and workers sent out to survey the different areas and report at a specified time.

Following is a list of the kinds of information which may be needed in order to make relief decisions. Only those items which are truly needed should be requested from the data gatherers.

1. The geographical extent of the affected area as defined by streets or other clear boundaries.
2. The number of persons known to be dead, possibly according to age group and sex
3. The estimated number of persons severely injured and/or requiring medical care, possibly according to age group, sex, and type of injury or medical problem
4. Estimated numbers of homes destroyed, homes uninhabitable, and homes which are still habitable
5. Condition of schools, churches, public buildings, etc.
6. Condition and extent of water supply
7. Condition and extent of food supply
8. Condition of roads, bridges, communication facilities, and public utilities
9. Location and condition of health facilities
10. Estimates of medical personnel, equipment, and supplies available
11. Descriptions of relief activities already in progress (e.g., search and rescue, first aid, food relief)

In order to simplify and speed up the data collection and analysis, the information requested during this phase should be as brief and specific as possible. Every item on every reporting form should have a purpose. For example, the purpose of determining the condition of schools and churches might be to find out what facilities in the area could be used as shelters. On the other hand, there would be no reason for surveying public utilities if the responsible companies were already doing their own investigations and repairs.

The types of information needed and the simplicity of reporting forms are only two factors influencing the amount of time which must be allowed for short-term assessment Other factors are:

- The size and terrain of the disaster-stricken area and the distances between areas to be surveyed
- The types and numbers of personnel available to obtain and analyze the needed information
- The methods of communication and transportation available and usable in the area

Depending on such factors as the above, short-term assessment may take as little as 4 to 5 hours or as much as 2 to 3 days. A reasonable reporting time should be estimated and set so that data will be returned and analyzed as quickly as possible.

As early as possible, relief priorities should be determined, resources ordered, and full-scale relief activities initiated. All channels of public information should be used to disseminate the information obtained and explain relief actions to be taken. The information to be obtained during the next phase of surveillance depends largely on the nature and extent of problems caused by the disaster, as well as the relief decisions made at this point. For example, if it was decided to provide hot meals at churches in three of the affected areas, one would need to set up a system of monitoring the food relief provided and determining the effects of the relief action

Ongoing Surveillance

Once the short-term assessment is complete and appropriate relief is in progress, surveillance becomes an ongoing system. Efforts at this time are directed at monitoring disaster-associated problems, determining the effects of relief activities on those problems, and identifying how the overall program of relief should be altered to correspond to the current situation.

During the phase of surveillance, several methods of data collection can be used. Monitoring of relief facilities and activities has already been mentioned. In addition, a system of rumor control may be set up; house-to-house or random surveys may be conducted as needed; and data on the predisaster situation may be examined more thoroughly than was previously possible.

When monitoring relief facilities such as clinics, hospitals, or food distribution centers, it may be best to assign someone already working at the facility to report regularly. An inspector can be sent from time to time to double-check the reports or to investigate problems which are reported. For example, if a shelter reported a case of measles, an investigation and possibly immunizations would be required. Investigation should also take place if no reports are received from a facility. A rumor-control system involves the screening of rumors reported by the public or by officials and the investigation of those that seem most prevalent and/or serious.

When information obtained by ongoing surveillance is analyzed, new problems may become apparent, requiring investigation. The cycle of data collection, analysis, and response continues. One response that becomes very important is the distribution of a regular surveillance report. Through these reports one can provide the data collectors with the feedback they need in order to continue reporting carefully and regularly. Not

only should surveillance reports be sent to the data collectors, but also to decision makers involved in the different relief activities. The surveillance report is one way of coordinating different agencies and preventing duplication of relief efforts.

As part of the ongoing phase of the surveillance cycle, the relief in progress would be evaluated and perhaps modified. A relief plan, developed during any of the surveillance cycles, might include some or all of the following activities:

1. Rescue of victims
2. Provision of emergency medical care
3. Elimination of physical dangers (e.g., fires, gas leaks, etc.)
4. Evacuation of the population (chemical and nuclear emergencies)
5. Provision of preventive and routine medical care
6. Provision of water
7. Provision of food
8. Provision of clothing
9. Provision of shelter
10. Disposal of human waste
11. Control of vectorborne disease
12. Disposal of human bodies
13. Disposal of solid waste

To ensure that the above activities could be carried out, a relief plan would also need to address the following support activities:

1. Coordination of volunteer assistance
2. Management of facilities
3. Storage and distribution of material
4. Management of the communication system
5. Management of transportation
6. Management of public information and rumor control services
7. Management of registration inquiry services
8. Traffic and crowd control

EVALUATION

Evaluation of any endeavor should consist of comparing what actually happened with what was intended and should be an integral part of the entire relief operation. In the case of disaster management, the evaluator would be looking at the "actual" versus the "desired" on two levels—the overall outcome of disaster management efforts and the impact of each discrete category of relief efforts (e.g., provision of food, shelter, management of communications, etc.).

A critical step in the management of any disaster relief effort is the setting of objectives which specify the intended outcome of the relief. The general objectives for disaster management, i.e., the elimination of unnecessary morbidity, mortality, and economic loss directly attributable to mismanagement of disaster relief efforts, could be made more specific for a particular disaster situation by estimating the levels of morbidity, mortality, and economic loss which would be consistent with appropriate management of disaster relief and the current levels of scientific, technical, and operational knowledge.

Specific and measurable objectives can also be established for each of the operational categories of disaster relief. For example, those responsible for provision of food in a particular disaster might specify an objective of providing x number of people with a minimum of y amount of food in z amount of time. Once these objectives have been specified, evaluation requires the gathering of the information necessary to compare with the objectives to assess whether they were met. This information is obtained as part of surveillance.

The comparison of actual with desired is the first, critical step of evaluation. If the objectives were met, those who participated in the relief have demonstrated that they accomplished what they set out to do. On the other hand, if the objectives were not met, it is desirable for those conducting the evaluation to continue with the evaluative process, identify the reason for the discrepancy, and suggest corrective action. Only in this way can such deviations from the intended effects be prevented in the future. In many cases, simulated disaster operations should be undertaken to test the various components before actual needs arise.

DIRECT RESULTS OF DISASTERS

The major portion of this chapter has dealt with the management of disaster relief. The elimination of morbidity, mortality, and economic loss resulting from mismanagement of relief is of primary public health concern since the consequences of disaster mismanagement are totally amenable to prevention. Public health authorities, however, also need to prevent losses directly attributable to disasters.

Existing knowledge that might reduce the undesirable effects of disasters is often not applied. Hurricane and tornado warning systems; legislation preventing building in flood plains, requiring mobile home tiedowns, or tornado cellars in mobile-home parks; aseismic housing codes for earthquake-prone areas; and other similar procedures are frequently underutilized.

The difficulties of implementing these procedures are readily apparent, e.g., cost, lack of legislation. The benefits, however, remain largely unknown because of a lack of sufficient studies of past disasters to identify and quantify avoidable situations which have led to injury, illness, death, and economic loss.

A surveillance procedure has been suggested for managing disaster relief (Fig. 66–1). This same basic procedure can be applied to increase the probability that preventable effects of disaster do not occur. Data on the problem can be gathered, analyzed, and interpreted, and actions in response to the situation described can be developed and implemented.

One disaster provides an example of the application of this procedure. On April 10, 1979, a series of tornadoes occurred in Wichita Falls, Texas, resulting in 44 dead, 1871 injured, 6000 families left homeless, and more than $300 million in damages. A study of the deaths indicated that in 16 of the 25 deaths associated with passenger vehicles, the individuals had gotten into their cars specifically to avoid the tornado; the homes of 11 of these individuals escaped major damage.

An analysis of the relative risks of various protective measures revealed that those who sought shelter indoors were at little risk of fatal injuries, even when their homes were directly hit by a tornado. In contrast, individuals in the open or in vehicles were at a higher risk of such injuries.[19] This study leads to the conclusion that some deaths associated with tornadoes may be prevented in the future by ensuring that individuals know to stay in their homes or other structures, even if the structure is in the path of a tornado.

Individuals and organizations in public health can contribute by collecting data on morbidity, mortality, and economic loss as well as the causes of those adverse consequences, following each disaster. By analyzing these data, investigators can determine the degree to which such adverse consequences could have been prevented. They can also identify geographical areas (e.g., fault areas, flood plains, coastal areas) and populations (e.g., the aged, individuals living alone, mobile home dwellers, those dependent on life-support systems) at greatest risk of losses form disasters. Specific interventions, e.g., aseismic housing codes, early warning, preparation, and/or evacuation procedures, can then be suggested to mitigate the negative consequences of disasters for these high-risk populations and areas.

Once these specific activities have been identified, public health professionals can assist other governmental authorities to implement the recommendations. Subsequent assessment of the impact of these interventions can lead to actions that are even more effective in preventing morbidity, mortality, and economic loss directly attributable to disasters.

SUMMARY

Disasters have resulted in significant morbidity and mortality. Public health is concerned with two objectives in disaster situations—the elimination of preventable consequences of the disaster itself and the prevention of losses due to disaster relief mismanagement. Investigation of past disasters had led to the identification of patterns of morbidity and mortality for different types of disasters and the development and use of objective criteria for measuring disaster situations. The extensive problem of mismanagement of disaster relief has also been described.

Appropriate disaster relief follows a specific pattern—gathering of information on the situation, analysis of this information, and developing and implementing an appropriate response. This pattern occurs on various levels (immediate assessment, short-term assessment, and ongoing assessment), each of which builds on the previous level. The same surveillance pattern can be used to identify and implement preventive action to reduce losses directly attributable to disasters. Through study of past disasters, their effects, and their relief efforts (what has been effective and what has been mismanaged), better plans are now available for effective disaster management as well as for the reduction of preventable losses.

REFERENCES

1. Kroger E: International Assistance in Natural Disasters: Experiences and Proposals. Dissertation, London School of Hygiene and Tropical Medicine, University of London, 1971
2. World Almanac. New York: Newspaper Enterprise Association, 1966
3. United Nations, Pan American Health Organization, Executive Committee of the Directing Council: Situation Report on PAHO's Disaster Preparedness Program in the Americas, May 17, 1979
4. China's Killer Quake. Time, June 25, 1979, p 41
5 American Red Cross: Statistics Compiled on Deaths by Type of Disaster. Washington, D.C , 1977
6. Western K: The Epidemiology of Natural and Man-made Disasters. The Present State of the Art. Dissertation, London School of Hygiene and Tropical Medicine. University of London, 1972
7. Rennie D. After the earthquake Lancet 2:704–707, 1970
8 Faich GA: Earthquake Disaster Assessment, Managua, Nicaragua, Memorandum Atlanta, Georgia· Centers for Disease Control, January 8, 1973
9. Sweeny EC: Medical department participation in disaster relief. Med Tech Bull 7:93–102

10. United States Department of Health and Welfare, Public Health Service, Centers for Disease Control: Disaster Mismanagement: A Study of the Problem and Its Causes. July 9, 1974
11. Pan American Health Organization· Emergency Health Management after Natural Disaster; A Guide to Emergency Health Management After Natural Disaster. Washington, D.C.: World Health Organization, Scientific Publication No. 407, 1981
12. Pan American Health Organization: Emergency Vector Control after Natural Disaster. Washington, D.C.: World Health Organization, Scientific Publication No. 419, 1982
13 Pan American Health Organization, Western KA: Epidemiologic Surveillance after Natural Disaster. Washington, D.C.: World Health Organization, Scientific Publication No. 420, 1982
14. Pan American Health Organization: Environmental Health Management after Natural Disasters. Washington, D.C.: World Health Organization, Scientific Publication No. 430, 1982
15. Pan American Health Organization: Medical Supply Management after Natural Disaster. Washington, D.C.: World Health Organization, Scientific Publication No. 438, 1983
16. United Nations High Commissioner for Refugees (UNHCR): Handbook for Emergencies, Part One: Field Operations. Ceneva: UN, 1982
17. National Governors' Association, Whittaker H (ed): 1978 Emergency Preparedness Project—Final Report. Washington, D.C.: GPO, No. 008-040-00080-0, 1979
18. Foege WH: Epidemiologic Surveillance of Protein Calorie Malnutrition and of Specific Deficiencies. Paper presented at Prince Leopold Institute of Tropical Medicine, Antwerp, Belgium, December 6, 1975
19. United States Department of Health, Education, and Welfare, Public Health Service, Centers for Disease Control: MMWR, May 4, 1979