Mission of the Pan American Health Organization

The Pan American Sanitary Bureau is the Secretariat of the Pan American Health Organization (PAHO), an international agency specializing in health. Its mission is to cooperate technically with the Member Countries and to stimulate cooperation among them in order that, while maintaining a healthy environment and charting a course to sustainable human development, the peoples of the Americas may achieve Health for All and by All.

NATURAL DISASTERS: Protecting the Public's Health

Scientific Publication No. 575

Pan American Health Organization
Pan American Sanitary Bureau, Regional Office of the
World Health Organization
525 Twenty-third Street, N.W.
Washington, D.C. 20037, USA

Also published in Spanish with the title:
Los desastres naturales y la protección de la salud
ISBN 92 75 31575 2

PAHO Library Cataloguing in Publication Data

Pan American Health Organization
Natural disasters: Protecting the public's health.
Washington, D.C. : PAHO, ©2000.
xi, 119 p.—(Scientific Publication, 575)

ISBN 92 75 11575 3

I. Title II. (Series)
1. NATURAL DISASTERS 2. HEALTH EFFECT OF DISASTERS
3. DISASTERS PLANNING — organization and administration
4. EMERGENCIES IN DISASTERS — organization and administration
5. INTERNATIONAL COOPERATION

NLM HV553

The Pan American Health Organization welcomes requests for permission to reproduce or translate its publications, in part or in full. Applications and inquiries should be addressed to the Publications Program, Pan American Health Organization, Washington, D.C., U.S.A., which will be glad to provide the latest information on any changes made to the text, plans for new editions, and reprints and translations already available.

©Pan American Health Organization, 2000

Publications of the Pan American Health Organization enjoy copyright protection in accordance with the provisions of Protocol 2 of the Universal Copyright Convention. All rights are reserved.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the Pan American Health Organization concerning the status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The mention of specific companies or of certain manufacturers' products does not imply that they are endorsed or recommended by the Pan American Health Organization in preference to others of a similar nature that are not mentioned. Errors and omissions excepted, the names of proprietary products are distinguished by initial capital letters.

CONTENTS

Preface vii

Introduction ix

Acknowledgements xi

Chapter 1. General Effects of Disasters on Health 1
- Health Problems Common to All Natural Disasters 2
- Immediate Health Problems Related to the Type of Disaster 5
- Myths and Realities of Natural Disasters 9

Chapter 2. Structuring Health Disaster Management 11
- National Disaster Management Agencies 12
- National Health Disaster Management Program 13
- Health Disaster Coordinator 13
- Assessing Risk 14
- Training 14
- Evaluation of the Health Disaster Management Program 16

Chapter 3. Disaster Preparedness 17
- Preparedness in the Health Sector 17
- Risk Analysis and Development of Realistic Scenarios 17
- Health Policy and Legislation on Disasters 18
- Preparation of Disaster Plans 18
- Coordination Mechanisms 19
- Relations with the Media 20
- Technical Health Programs 20

Chapter 4. Disaster Mitigation in the Health Sector 24
- Health Sector Disaster Mitigation Programs 24
- Vulnerability Analysis in Health Facilities 25
- Disaster Mitigation in Health Facilities 26
- Disaster Mitigation in Drinking Water Supply and Sewerage Systems ... 27

Chapter 5. Coordination of Disaster Response Activities and Assessment of Health Needs 30
- National Emergency Committee 30
- Health Emergency Committee 31
- Assessment of Needs 31
- Methods of Gathering Information after Hazard Impact 34

Chapter 6. Mass Casualty Management 38
Prehospital Emergency Care 38
Hospital Reception and Treatment 40
Redistribution of Patients between Hospitals 40

Chapter 7. Epidemiologic Surveillance and Disease Control 43
Risk of Outbreaks Following Disasters 43
Setting Up a Disease Surveillance System 44
Presentation and Interpretation of Collected Data 46
Laboratory Services 46
Vaccination and Vaccination Programs 47
Transmission of Zoonoses 48

Chapter 8. Environmental Health Management 50
Priority Areas for Intervention 50
Water Supply 53
Food Safety 55
Basic Sanitation and Personal Hygiene 55
Solid Waste Management 56
Vector Control 56
Burial of the Dead 57
Public Information and the Media 57

Chapter 9. Food and Nutrition 59
Expected Consequences of Disasters on the Food Chain 59
Possible Adverse Effects of Large-Scale Food Distribution 60
Setting Priorities 60
Immediate Relief 61
Estimating Food Requirements 61
Procurement 62
Surveillance 63

Chapter 10. Planning, Layout, and Management of Temporary Settlements and Camps 64
Planning Settlements and Camps 64
Setting Up Camps and Settlements 64
Site Selection 65
Camp Layout 65
Camp Services 66

Chapter 11. Communications and Transport 67
Telecommunication 67
Transportation 73

Chapter 12. Managing Humanitarian Relief Supplies 75
Basic Principles 75
The Logistical Supply Chain 76
Supply Management 76

List of Essential Drugs 80
Requesting International Assistance 80

Chapter 13. International Humanitarian Assistance 82
Humanitarian Agencies 82
The Armed Forces 86
Obtaining International Disaster Relief 86
Coordinating International Humanitarian Assistance 88

Chapter 14. Reestablishing Normal Health Programs 91
Long-Term Health Effects Caused by Disasters 91
Reestablishing Normal Health Services 92
Assessment, Repair, and Reconstruction of Damaged Facilities and Lifelines 92

Annex I. Implementing a National Disaster Mitigation Program for Hospitals 95

Annex II. SUMA—A Humanitarian Supply Management System 97

Annex III. International Health Humanitarian Assistance 100

Annex IV. External Agencies Providing Health Humanitarian Assistance ... 102

Selected Bibliography and On-line Information Sources 111

PREFACE

Two decades have passed since the Pan American Health Organization published the first edition of these guidelines. In the intervening years, disaster prevention, mitigation, and preparedness has evolved in important ways. Clearly, it was time for us to revisit this publication.

Twenty years ago, disaster management was simply left to a few dedicated professionals. Roles were clear: rescue workers rushed to help victims and certain agencies stepped in to provide temporary shelter and food. And society at large, a while after the impact, erased the disaster from its memory—until the next one came to wreak new destruction.

Unfortunately, disasters in the Americas and throughout the world have provided ample opportunities to test the policies and recommendations set out nearly twenty years ago. Over time, the approach has changed.

Today, the management of humanitarian assistance involves many more and different players, and disasters are recognized as public health priorities in which the health system plays a significant role. Today, prevention, mitigation, and preparedness are part of the vocabulary of disaster administrators in national and international organizations and, more importantly, they are used to advance the cause of disaster reduction. Today, society's involvement in disasters both precedes the impact and remains alive long after. Finally, the interrelationship between human development and disasters is better understood today—how disasters can permanently damage a country's economy, but, at the same time, how the path toward development may put a country at greater risk to the destructive consequences of natural disasters.

We are pleased to offer these updated guidelines. They include all the principles and recommendations that have withstood the test of time and new concepts and understanding gleaned along the way. May they strengthen disaster prevention, mitigation, and preparedness in our countries. May they save lives.

George A.O. Alleyne
Director

INTRODUCTION

This publication echoes the 1981 *Emergency Health Management after Natural Disaster* (Scientific Publication No. 407), but it is a whole new book, with a fresh organization and much new content. It sketches the role the health sector plays in reducing the impact of disasters and describes how it can carry it out.

These guidelines aim at presenting a framework that an administratror can rely on to make effective decisions in managing the health sector's activities to reduce the consequences of disasters. It does not pretend to cover every contingency. In fact, some of the suggested procedures may need to be adapted to fill some local needs. We hope that this book will help to develop manuals that can be tailored to local conditions.

The book's 14 chapters and 4 technical annexes describe the general effects of disasters on health, highlighting myths and realities. Although every disaster is unique, there are common features that can be used to improve the management of humanitarian assistance in health and the use of available resources.

Chapter 2 is one of the main innovations. It summarizes how the health sector must structure itself and work with other sectors to cope with disasters. The chapter covers the health sector's activities for reducing the consequences of disasters that affect response, preparedness, and mitigation phases, pointing out where these are interdependent.

Chapter 3 deals with disaster preparedness—its multisectoral nature and its specific application in the health sector. It sets forth guidelines for preparing health sector plans, means of coordination, and special technical programs that cover every aspect of normal operations before a disaster hits.

Chapter 4 also includes new material. It deals with the disaster mitigation activities that the health sector must promote and put in place. Mitigation measures are designed to reduce the vulnerability to disasters in health establishements (including drinking water and sewerage systems) and to reduce the magnitude of the disaster's effects. Mitigation activities complement preparedness and response activities.

Chapter 5 deals with the response to disasters, as well as its coordination and the evaluation of health needs. Chapters 6 through 11, and Chapter 14, retain the organization of the 1981 guidelines, but they have been updated. Chapter 12, dealing with humanitarian supplies, and Chapter 13, dealing with humanitarian assistance also have been revised in-depth.

Finally, two of the four annexes—the one dealing with the management of supplies and the one dealing with the national mitigation program—are entirely new, the remaining two have been updated.

This book is aimed primarily at health sector professionals who participate in disaster preparedness, response, and mitigation. The intersectoral perspective is now so essential, however, that anyone interested in disaster reduction will find here a useful primer. Public health students and professors also can rely on this book as a manual for formal or informal courses.

ACKNOWLEDGMENTS

The drafting and technical review of this publication has benefited from the cooperation of many persons, both within and outside the Pan American Health Organization.

This book would not have been possible without the excellent work of the following experts at the Pan American Health Organization: Dr. Claude de Ville de Goyet, Dr. Hugo Prado Monje, Dr. Jean Luc Poncelet, Dr. Luis Jorge Pérez, Dr. Dana Van Alphen, Dr. José Luis Zeballos, Mr. Claudio Osorio, Mr. Adrianus Vlugman, Mrs. Patricia Bittner, and Mr. Ricardo Pérez. Dr. Miguel Gueri, expert in food and nutrition; Dr. Edgardo Acosta, executive director of FUNDESUMA; and Mr. John Scott, expert in telecommunications and disasters, also made invaluable contributions.

We also wish to thank many other experts for their important comments and critiques: Dr. Stephen J. Corber, Dr. Gustavo Bergonzoli, Dr. Alejandro Santander, Dra. Rocio Saenz, and Mr. Homero Silva, all from PAHO/WHO, and Dr. Raul Morales Soto, from Peru, and Mr. Edgardo Quiros, consultant at FUNDESUMA.

The excellent contributions contributions from other WHO regions and other international organizations have given this book global scope. We are especially grateful fo Dr. David L. Heyman, Dr. M.C. Thuriaux, Dr. Maria Neira, Dr; Eric K. Noji, and Dr. Xavier Leus, all from WHO.

Many others from national, subregional, and regional organizations, mostly from the Region of the Americas enriched this text with their comments and recommendations. To all of them, many, many thanks.

Finally, we wish to acknowledge Liz Stonaker's untiring and diligent editorial work.

CHAPTER 1.
GENERAL EFFECTS OF DISASTERS ON HEALTH

In the past, sudden-impact disasters were believed to cause not only widespread death, but also massive social disruption and outbreaks of epidemic disease and famine, leaving survivors entirely dependent on outside relief. Systematic observation of the effects of natural disasters on human health has led to different conclusions, both about the effects of disaster on health and about the most effective ways of providing humanitarian assistance.

The term "disaster" usually refers to the natural event (e.g., a hurricane or earthquake) in combination with its damaging effects (e.g., the loss of life or destruction of buildings). "Hazard" refers to the natural event, and "vulnerability" to the susceptibility of a population or system (e.g., a hospital, water supply and sewage system, or aspects of infrastructure) to the effects of the hazard. The probability that a particular system or population will be affected by hazards is known as the "risk." Hence, risk is a function of the vulnerability and the hazard, and is expressed as follows:

$$\text{Risk} = \text{Vulnerability} \times \text{Hazard}$$

Though all disasters are unique in that they affect areas with different levels of vulnerability and with distinct social, health, and economic conditions, there are still similarities between disasters. If recognized, these common factors can be used to optimize the management of health humanitarian assistance and use of resources (see Table 1.1). The following points should be noted:

1. There is a relationship between the type of disaster and its effect on health. This is particularly true of the immediate impact in causing injuries. For example, earthquakes cause many injuries requiring medical care, while floods and tidal waves cause relatively few.
2. Some effects are a potential, rather than an inevitable, threat to health. For example, population movement and other environmental changes may lead to increased risk of disease transmission, although epidemics generally do not result from natural disasters.
3. The actual and potential health risks after a disaster do not all occur at the same time. Instead, they tend to arise at different times and to vary in importance within a disaster-affected area. Thus, casualties occur mainly at the time and place of impact and require immediate medical care, while the risks of increased disease transmission take longer to develop and are greatest where there is overcrowding and standards of sanitation have declined.

TABLE 1.1. Short-term effects of major disasters.

Effect	Earthquakes	High winds (without flooding)	Tidal waves/flash floods	Slow-onset floods	Landslides	Volcanoes/ Lahars
Deaths[a]	Many	Few	Many	Few	Many	Many
Severe injuries requiring extensive treatment	Many	Moderate	Few	Few	Few	Few
Increased risk of communicable diseases	Potential risk following all major disasters (Probability rising with overcrowding and deteriorating sanitation)					
Damage to health facilities	Severe (structure and equipment)	Severe	Severe but localized	Severe (equipment only)	Severe but localized	Severe (structure and equipment)
Damage to water systems	Severe	Light	Severe	Light	Severe but localized	Severe
Food shortage	Rare (may occur due to economic and logistic factors)		Common	Common	Rare	Rare
Major population movements	Rare (may occur in heavily damaged urban areas)			Common (generally limited)		

[a]Potential lethal impact in absence of preventive measures.

4. Disaster-created needs for food, shelter, and primary health care are usually not total. Even displaced people often salvage some of the basic necessities of life. Furthermore, people generally recover quickly from their immediate shock and spontaneously engage in search and rescue, transport of the injured, and other private relief activities.
5. Civil wars and conflicts generate a distinct set of public health problems and operational constraints. They are not covered in any depth in this publication.

Effective management of health humanitarian aid depends on anticipating and identifying problems as they arise, and delivering specific materials at the precise times and points where they are needed. The logistical ability to transport maximum numbers of supplies and personnel from abroad to disaster areas in Latin America and the Caribbean is less essential. Cash is the most effective donation, particularly since it can be used to purchase supplies locally.

HEALTH PROBLEMS COMMON TO ALL NATURAL DISASTERS

Social Reactions

After a major natural disaster, behavior only rarely reaches generalized panic or stunned waiting. Spontaneous yet highly organized individual action accrues as

survivors rapidly recover from their initial shock and set about purposefully to achieve clear personal ends. Earthquake survivors often begin search and rescue activities minutes after an impact and within hours may have organized themselves into groups to transport the injured to medical posts. Actively antisocial behavior such as widespread looting occurs only in exceptional circumstances.

Although everyone thinks his or her spontaneous reactions are entirely rational, they may be detrimental to the community's higher interests. A person's conflicting roles as family head and health official, for instance, have in some instances resulted in key relief personnel not reporting to duty until their relatives and property are safe.

Rumors abound, particularly of epidemics. As a result, considerable pressure may be put on the authorities to undertake emergency humanitarian work such as mass vaccinations against typhoid or cholera, without sound medical justification. In addition, people may be reluctant to submit to measures that the authorities think necessary. During warning periods, or after the occurrence of natural disasters, people are reluctant to evacuate, even if their homes are likely to be or have been destroyed.

These patterns of behavior have two major implications for those making decisions about humanitarian programs. First, patterns of behavior and demands for emergency assistance can be limited and modified by keeping the population informed and by obtaining necessary information before embarking on extended relief programs. Second, the population itself will provide most rescue and first aid, take the injured to hospitals if they are accessible, build temporary shelters, and carry out other essential tasks. Additional resources should, therefore, be directed toward meeting the needs that survivors themselves cannot meet on their own.

Communicable Diseases

Natural disasters do not usually result in massive outbreaks of infectious disease, although in certain circumstances they do increase the potential for disease transmission. In the short-term, the most frequently observed increases in disease incidence are caused by fecal contamination of water and food; hence, such diseases are mainly enteric.

The risk of epidemic outbreaks of communicable diseases is proportional to population density and displacement. These conditions increase the pressure on water and food supplies and the risk of contamination (as in refugee camps), the disruption of preexisting sanitation services such as piped water and sewage, and the failure to maintain or restore normal public health programs in the immediate post-disaster period.

In the longer term, an increase in vector-borne diseases occurs in some areas because of disruption of vector control efforts, particularly following heavy rains and floods. Residual insecticides may be washed away from buildings and the number of mosquito breeding sites may increase. Moreover, displacement of wild or domesticated animals near human settlements brings additional risk of zoonotic infections.

In complex disasters where malnutrition, overcrowding, and lack of the most basic sanitation are common, catastrophic outbreaks of gastroenteritis (caused by cholera or other diseases) have occurred, as in Rwanda/Zaire in 1994.

Population Displacements

When large, spontaneous or organized population movements occur, an urgent need to provide humanitarian assistance is created. People may move to urban areas where public services cannot cope, and the result may be an increase in morbidity and mortality. If much of the housing has been destroyed, large population movements may occur within urban areas as people seek shelter with relatives and friends. Surveys of settlements and towns around Managua, Nicaragua, following the December 1972 earthquake indicated that 80% to 90% of the 200,000 displaced persons were living with relatives and friends; 5% to 10% were living in parks, city squares, and vacant lots; and the remainder were living in schools and other public buildings. Following the earthquake that struck Mexico City in September 1985, 72% of the 33,000 homeless found shelter in areas close to their destroyed dwellings.

In internal conflicts, such as occurred in Central America (1980s) or Colombia (1990s), refugees and internally displaced populations are likely to persist.

Climatic Exposure

The health hazards of exposure to the elements are not great, even after disasters in temperate climates. As long as the population is dry, reasonably well clothed, and able to find windbreaks, death from exposure does not appear to be a major risk in Latin America and the Caribbean. The need to provide emergency shelter therefore varies greatly with local conditions.

Food and Nutrition

Food shortages in the immediate aftermath may arise in two ways. Food stock destruction within the disaster area may reduce the absolute amount of food available, or disruption of distribution systems may curtail access to food, even if there is no absolute shortage. Generalized food shortages severe enough to cause nutritional problems do not occur after earthquakes.

Flooding and sea surges often damage household food stocks and crops, disrupt distribution, and cause major local shortages. Food distribution, at least in the short term, is often a major and urgent need, but large-scale importation/donation of food is not usually necessary.

In extended droughts, such as those occurring in Africa, or in complex disasters, the homeless and refugees may be completely dependent on outside sources for food supplies for varying periods of time. Depending on the nutritional condition of these populations, especially of more vulnerable groups such as pregnant or lactating women, children, and the elderly, it may be necessary to institute emergency feeding programs.

Water Supply and Sanitation

Drinking water supply and sewerage systems are particularly vulnerable to natural hazards, and the disruptions that occur in them pose a serious health risk. The systems are extensive, often in disrepair, and are exposed to a variety of hazards. Deficiencies in established amounts and quality of potable water and difficulties in

the disposal of excreta and other wastes result in the deterioration of sanitation, contributing to conditions favorable to the spread of enteric and other diseases.

Mental Health

Anxiety, neuroses, and depression are not major, acute public health problems immediately following disasters, and family and neighbors in rural or traditional societies can deal with them temporarily. A group at high risk, however, seems to be the humanitarian volunteers or workers themselves. Wherever possible, efforts should be made to preserve family and community social structures. The indiscriminate use of sedatives and tranquilizers during the emergency relief phase is strongly discouraged. In industrialized or metropolitan areas in developing countries, mental health problems are reported to be significant during long-term rehabilitation and reconstruction and need to be dealt with during that phase.

Damage to the Health Infrastructure

Natural disasters can cause serious damage to health facilities and water supply and sewage systems, having a direct impact on the health of the population dependent on these services. In the case of structurally unsafe hospitals and health centers, natural disasters jeopardize the lives of occupants of the buildings, and limit the capacity to provide health services to disaster victims. The earthquake that struck Mexico City in 1985 resulted in the collapse of 13 hospitals. In just three of those buildings, 866 people died, 100 of whom were health personnel. Nearly 6,000 hospital beds were lost in the metropolitan facilities. As a result of Hurricane Mitch in 1998, the water supply systems of 23 hospitals in Honduras were damaged or destroyed, and 123 health centers were affected. Peru reported that nearly 10% of the country's health facilities suffered damage as a result of El Niño events in 1997–1998.

IMMEDIATE HEALTH PROBLEMS RELATED TO THE TYPE OF DISASTER

Earthquakes

Usually because of dwelling destruction, earthquakes may cause many deaths and injure large numbers of people. The toll depends mostly on three factors.

The first factor is housing type. Houses built of adobe, dry stone, or unreinforced masonry, even if only a single story high, are highly unstable and their collapse causes many deaths and injuries. Lighter forms of construction, especially woodframe, have proved much less dangerous. After the 1976 earthquake in Guatemala, for example, a survey showed that in one village with a population of 1,577, all of those killed (78) and severely injured had been in adobe buildings, whereas all residents of woodframe buildings survived. In the earthquake affecting the villages of Aiquile and Totora in Bolivia in 1998, 90% of deaths resulted from the collapse of adobe housing.

The second factor is the time of day at which the earthquake occurs. Night occurrence was particularly lethal in the earthquakes in Guatemala (1976) and Bolivia (1998), where most damage occurred in adobe houses. In urban areas with well-

constructed housing but weak school or office structures, earthquakes occurring during the day result in higher death rates. This was the case in the 1997 earthquake that struck the towns of Cumaná and Cariaco, Venezuela. In Cumaná an office building collapsed, and in Cariaco two schools collapsed, accounting for most of the dead and injured.

The last factor is population density: the total number of deaths and injuries is likely to be much higher in densely populated areas.

There are large variations within disaster-affected areas. Mortality of up to 85% occasionally may occur close to the epicenter of the earthquake. The ratio of dead to injured decreases as the distance from the epicenter increases.

Some age groups are more affected than others; fit adults are spared more than small children and the elderly, who are less able to protect themselves. However, 72% of the deaths resulting from collapsed buildings in the 1985 Mexico earthquake were among persons between the ages of 15 and 64 (see Table 1.2).

Secondary disasters may occur after earthquakes and increase the number of casualties requiring medical attention. Historically, the greatest risk is from fire, although in recent decades, post-earthquake fires causing mass casualties have been uncommon. However, in the aftermath of the earthquake that hit Kobe, Japan, in 1995, over 150 fires occurred. Some 500 deaths were attributed to fires, and approximately 6,900 structures were damaged. Fire-fighting efforts were hindered because streets were blocked by collapsed buildings and debris, and the water system was severely damaged.

Little information is available about the kinds of injuries resulting from earthquakes, but regardless of the number of casualties, the broad pattern of injury is likely to be a mass of injured with minor cuts and bruises, a smaller group suffering from simple fractures, and a minority with serious multiple fractures or internal injuries requiring surgery and other intensive treatment. For example, after the 1985 earthquake in Mexico, 1,879 (14.9%) of the 12,605 patients treated by the emergency medical services (including certain routine cases) needed hospitalization, most of them for a 24-hour period.

Most of the demand for health services occurs within the first 24 hours of an event. Injured persons may continue to show up at medical facilities only during the first three to five days, after which presentation patterns return almost to nor-

TABLE 1.2. Distribution of deaths by age group resulting from the September 1985 earthquake in Mexico City.[a]

Age group (years)	Deaths	Percent of deaths
Under 1 year old	173	4.8
1 – 4	143	4.0
5 – 14	287	8.0
15 – 24	770	21.5
25 – 44	1,293	36.1
45 – 64	519	14.5
65 and older	226	6.3
Not defined	168	4.7
Total	3,579	100

[a]Bodies recovered from collapsed buildings between 19 September and 29 October 1985.
Source: General Directorate of Investigation, Attorney General, Department of Justice, Mexico, D.F.

mal. A good example of the crucial importance of the timing of emergency care is seen in the number of admissions to a field hospital after the 1976 earthquake in Guatemala, as shown in Figure 1.1. From day six onward, admissions fell dramatically, despite intensive case-finding in remote rural areas.

Patients may appear in two waves, the first consisting of casualties from the immediate area around the medical facility and the second of referrals as humanitarian operations in more distant areas become organized.

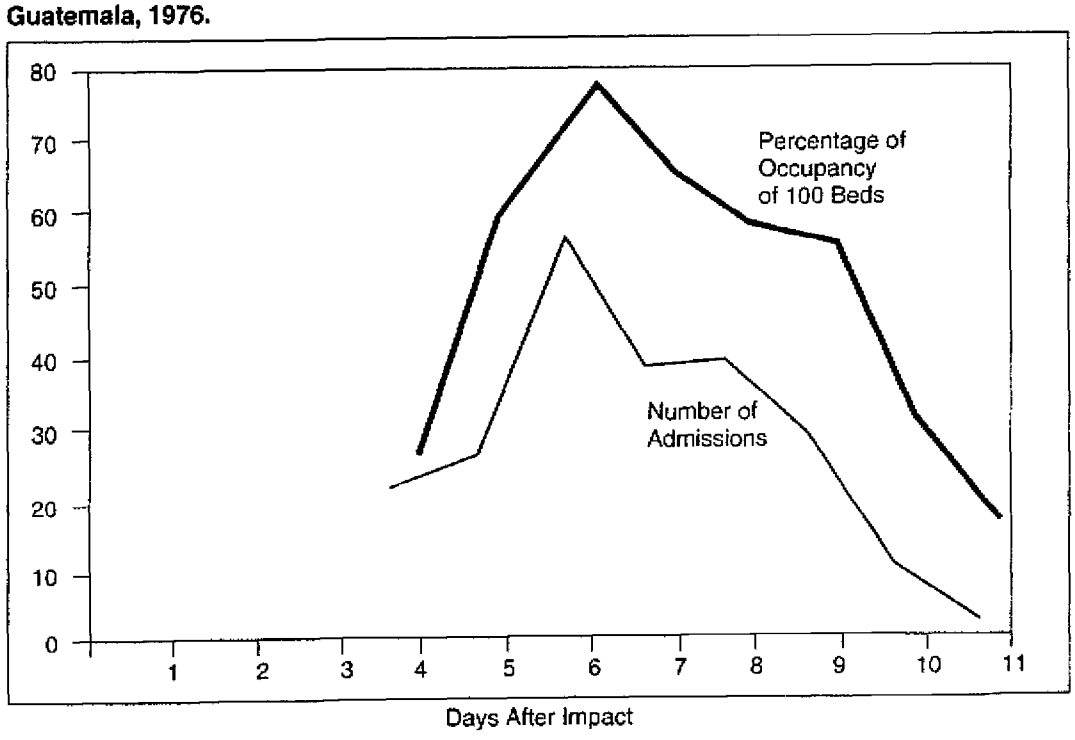
Destructive Winds

Unless they are complicated by secondary disasters such as the floods or sea surges often associated with them, destructive winds cause relatively few deaths and injuries. Effective warning before such windstorms will limit morbidity and mortality, and most injuries will be relatively minor. Most of the public health consequences from hurricanes and tropical storms result from torrential rains and floods, rather than wind damage. The catastrophic death toll—an estimated 10,000—in Central American countries after Hurricane Mitch in 1998 was primarily caused by flooding and mudslides.

Flash Floods, Sea Surges, and Tsunamis

These phenomena may cause many deaths, but leave relatively few severely injured in their wake. Deaths result mainly from drowning and are most common among the weakest members of the population. More than 50% of the deaths in

FIGURE 1.1. Admissions and occupancy rates at the field hospital in Chimaltenango, Guatemala, 1976.



Nicaragua following Hurricane Mitch in 1998 were due to flash floods and mudslides on the slopes of the Casitas Volcano.

Volcanoes

Volcanoes are found worldwide and significant numbers of people often live in close proximity to them. The fertile volcanic soil is good for agriculture and is attractive for the establishment of towns and villages. In addition, volcanoes have long periods of inactivity, and some generations have no experience with volcanic eruptions, thereby encouraging the population to feel some degree of security in spite of the danger in living close to a volcano. The difficulty in predicting a volcanic eruption compounds the situation.

Volcanic eruptions affect the population and infrastructure in many ways. Immediate trauma injuries may be caused if there is contact with volcanic material. The super-heated ash, gases, rocks, and magma can cause burns severe enough to kill immediately. Falling rocks and boulders also can result in broken bones and other crush-type injuries. Breathing the gases and fumes can cause respiratory distress.

Health facilities and other infrastructure can be destroyed in minutes if they lie in the path of pyroclastic flows and lahars (mudflows containing volcanic debris). Accumulated ash on roofs can greatly increase the risk of collapse. Contamination of the environment (e.g., water and food) with volcanic ash also can disrupt environmental health conditions; this effect is compounded when the population must be evacuated and housed in temporary shelters.

If the eruptive phase is prolonged, as in the case on the Caribbean island of Montserrat where the Soufriere Hills volcano began erupting in July 1995 and continued for several years, other health effects, such as increased stress and anxiety in the remaining population, become important. Long-term inhalation of silica-rich ash also can result in pulmonary silicosis years later.

One of the most devastating events to occur in Latin America was the November 1985 eruption of the Nevado del Ruiz volcano in Colombia. The heat and seismic forces melted a portion of the icecap on the volcano, resulting in an extensive lahar that buried the city of Armero, killing 23,000 people and injuring 1,224. Some 1,000 km^2 of prime agricultural land at the base of the volcano were affected.

Floods

Slow-onset flooding causes limited immediate morbidity and mortality. A slight increase in deaths from venomous snakebites has been reported, but not fully substantiated. Traumatic injuries caused by flooding are few and require only limited medical attention. While flooding may not result in an increased frequency of disease, it does have the potential to spark communicable disease outbreaks because of the interruption of basic public health services and the overall deterioration of living conditions. This is of concern particularly when flooding is prolonged, as in the case of events caused by the El Niño phenomenon in 1997 and 1998.

Landslides

Landslides have become an increasingly common disaster in Latin America and the Caribbean; intense deforestation, soil erosion, and construction of human settlements in landslide-prone areas have resulted in catastrophic events in recent years. This has been the case in both urban and rural areas. Rain brought by Tropical Storm Bret triggered landslides in poor neighborhoods on the outskirts of Caracas, Venezuela, in August 1993. At least 100 people died, and 5,000 were left homeless. High death tolls occurred in the gold mining town of Llipi, Bolivia, in 1992, where a landslide buried the entire village, killing 49. Deforestation contributed significantly to the disaster, and mining tunnels collapsed. A similar disaster occurred in the gold mining region of Nambija, Ecuador, in 1993, claiming 140 lives.

In general, this phenomenon causes high mortality, although injuries are few. If there are health structures (hospitals, health centers, water systems) in the path of the landslide, they can be severely damaged or destroyed.

MYTHS AND REALITIES OF NATURAL DISASTERS

Many mistaken assumptions are associated with the impact of disasters on public health. Disaster planners and managers should be familiar with the following myths and realities:

Myth: Foreign medical volunteers with any kind of medical background are needed.

Reality: The local population almost always covers immediate lifesaving needs. Only medical personnel with skills that are not available in the affected country may be needed.

Myth: Any kind of international assistance is needed, and it's needed immediately!

Reality: A hasty response that is not based on an impartial evaluation only contributes to the chaos. It is better to wait until genuine needs have been assessed. In fact, most needs are met by the victims themselves and their local government and agencies, not by foreign intervenors.

Myth: Epidemics and plagues are inevitable after every disaster.

Reality: Epidemics do not spontaneously occur after a disaster and dead bodies will not lead to catastrophic outbreaks of exotic diseases. The key to preventing disease is to improve sanitary conditions and educate the public.

Myth: Disasters bring out the worst in human behavior (e.g., looting, rioting).

Reality: Although isolated cases of antisocial behavior exist, most people respond spontaneously and generously.

Myth: The affected population is too shocked and helpless to take responsibility for their own survival.

Reality: On the contrary, many find new strength during an emergency, as evidenced by the thousands of volunteers who spontaneously

united to sift through the rubble in search of victims after the 1985 Mexico City earthquake.

Myth: Disasters are random killers.

Reality: Disasters strike hardest at the most vulnerable groups—the poor, especially women, children, and the elderly.

Myth: Locating disaster victims in temporary settlements is the best alternative.

Reality: It should be the last alternative. Many agencies use funds normally spent for tents to purchase building materials, tools, and other construction-related support in the affected country.

Myth: Things are back to normal within a few weeks.

Reality: The effects of a disaster last a long time. Disaster-affected countries deplete much of their financial and material resources in the immediate post-impact phase. Successful relief programs gear their operations to the fact that international interest wanes as needs and shortages become more pressing.

CHAPTER 2.
STRUCTURING HEALTH DISASTER MANAGEMENT

The role of disaster professionals in Latin America and the Caribbean has changed considerably over the last 30 years. Up to the 1970s, their actions were mostly limited to the disaster aftermath, or disaster response. However, the ministries of health and other governmental and nongovernmental organizations of the Region, recognizing that a number of relief operations were poorly coordinated, started to work on disaster preparedness to provide better humanitarian assistance to their populations.

Following the devastation caused by the 1985 earthquake in Mexico City, and with particular concern for the losses suffered in hospitals, regional authorities acknowledged that not only did the population need assistance in the disaster aftermath, but they deserved to have a less vulnerable health system. With existing technology it is possible, at a reasonable cost, to greatly reduce the susceptibility of a system to the effects of a hazard. This approach was strongly reinforced by the U.N. General Assembly's designation of the 1990s as the "International Decade of Natural Disaster Reduction," and spurred concerted efforts in the Region to implement disaster mitigation programs.

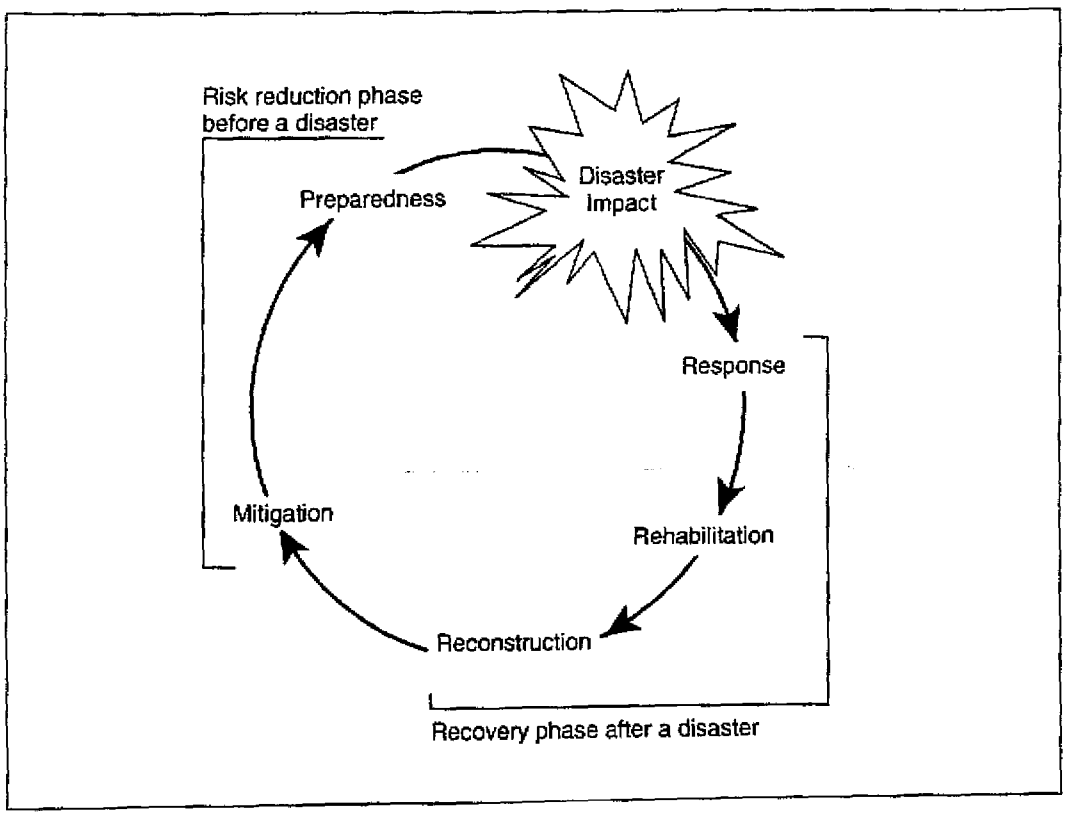
There are three fundamental aspects of disaster management:

- disaster response,
- disaster preparedness, and
- disaster mitigation.

These three aspects of disaster management correspond to phases in the so-called "disaster cycle" (see Figure 2.1).

Activities in the aftermath of disaster include response, rehabilitation, and reconstruction. Chapter 5 of this book concentrates on the coordination of health activities in the emergency period and some aspects of rehabilitation. There will be few references to reconstruction. During the reconstruction phase, the coordination mechanism, project approval, and other decisions are taken in an environment that is much closer to the "normal" situation. Time is no longer the most important factor. The reconstruction period provides an opportunity to implement the health sector's disaster mitigation programs and to initiate or reinforce disaster preparedness programs (see Chapters 3 and 4).

FIGURE 2.1. Management sequence of a sudden-onset disaster.



NATIONAL DISASTER MANAGEMENT AGENCIES

Many Latin American and Caribbean countries have developed national disaster management agencies to coordinate activities involved in disaster preparedness, mitigation, response, and rehabilitation. These organizations are usually assigned to the ministries of defense or interior, or their national equivalent.

Disaster preparedness and mitigation have few immediately visible benefits, and until a major catastrophe occurs, the results are hidden. The establishment of national disaster management agencies is a complex and slow process, requiring consistent political and public support. Legislation is required to ensure the continuity of these agencies and to guarantee their funding. Despite these difficulties, institutionalized disaster management programs are the only long-term solutions to reducing the vulnerability of all sectors of society to disasters.

While the health sector can do a great deal on its own to improve its ability to respond in a disaster situation, it is impossible to reduce the impact of hazards without the involvement of public works, financing, education, housing, and other sectors. The health sector should take the lead in promoting the institutionalization of a national disaster management agency and will benefit from decisions taken to reduce vulnerability in other sectors. For example, a strictly enforced building code will reduce the numbers of homes and other structures damaged by an earthquake, and consequently reduce the number of casualties needing treatment.

NATIONAL HEALTH DISASTER MANAGEMENT PROGRAM

The health sector in Latin America and the Caribbean has been working to reduce its vulnerability to disasters by establishing national health disaster management programs. Responsibilities of such programs encompass the entire health sector, and not only the ministry of health. The program must play the leading role in promoting and coordinating prevention, mitigation, preparedness, response, and early rehabilitation activities related to health. The scope of the program is a multihazard one, including all large-scale emergencies regardless of their origin (natural disasters, chemical or radiation accidents, civil conflicts, violence, etc.).

As part of preparedness activities, the health disaster program should ensure that disaster plans are in place and up-to-date (see Chapter 3). To test these plans, simulation exercises involving the health and other sectors must be conducted on a regular basis.

Activities related to mitigating the effects of disasters (see Chapter 4) require the inclusion of mitigation measures in all ministry of health programs (development of new services, construction or remodeling of facilities, and maintenance programs for hospitals and other health facilities). Vulnerability reduction also must be promoted for services that affect health, especially in water supply and sewerage systems. Finally, mitigation activities require the development of construction standards and norms to ensure that health facilities will resist potential hazards.

Finally, during the disaster response phase, the health disaster management program coordinates all health sector activities to reduce the loss of life and property and protect the integrity of health services (see Chapters 5 through 13).

Regional and Local Responsibilities

This chapter focuses on responsibilities of the health disaster management program at the national or central level, but the same principles apply to the heads of disaster programs at provincial or regional levels as well as in epidemiology and environmental health departments, hospitals, social security institutions, water services, and NGOs.

HEALTH DISASTER COORDINATOR

Establishing a single focal point for coordination of disaster-related health activities ensures the optimal use of health resources available to the ministry of health, social security agency, armed forces, and the private sector. A full-time Health Disaster Coordinator should be designated, and, as in the case of most Latin American and Caribbean countries, assigned to the highest level of the ministry of health (e.g., in the advisory unit of the Minister or Vice-Minister), or to the Director-General of Health, especially when that division has operational responsibilities for emergency health care.

The Health Disaster Coordinator is responsible for the development of the health sector's disaster preparedness, mitigation, and prevention programs. The characteristics of his/her duties have evolved in recent years in Latin America and the Caribbean from those of a low-profile troubleshooter to a multifaceted skilled professional responsible for leading the national health disaster management program.

As can be seen from the functions described in Box 2.1, the responsibilities of the national health disaster management program are complex. Most programs now have one person specialized in response and preparedness and another assigned to disaster mitigation.

Coordination of all components—public and private—of the health sector requires that a standing, advisory committee be established. Coordinated by the Health Disaster Coordinator, the committee includes health sector specialists (epidemiology, environmental health, hospital administration) and representatives of major government agencies providing health services, the Red Cross, NGOs, as well as representatives of the international community involved in health activities. The committee meets on a regular basis to take operational decisions and to coordinate their agencies' activities regarding humanitarian assistance.

ASSESSING RISK

To appropriately orient the activities of the disaster management program, the Health Disaster Coordinator must have an understanding of the risks (hazard and vulnerability) present in the country under his or her responsibility. Hazard probability and vulnerability of systems change constantly, depending on scientific information and development processes of the country (for example, growth of cities, changes in building codes, and installation of new industries). The activities of the preparedness and mitigation subprograms are heavily dependent on risk assessment. The main elements to be taken into account for those subprograms are described in Chapters 3 and 4, respectively.

The identification of risks posed by natural hazards and those caused by human activity requires collaboration of the health sector with the scientific community (seismologists, meteorologists, social scientists); environmental specialists; engineers; urban planners; fire brigades; private industry; and in the case of complex emergencies, political entities.

There are certain rules for estimating risk (see Chapter 4), but the level of risk that is deemed tolerable is less precise and is dependent on factors such as cultural and social patterns, public and political awareness, and financial constraints. The Health Disaster Coordinator must understand what is considered acceptable risk to determine priorities in the disaster management program.

TRAINING

Training in all components of the disaster management program is necessary if activities are to be properly implemented. The failures in disaster mitigation, preparedness, and response are largely due to the gaps that exist between different professions and a lack of specific training for health care and public health personnel. Many health professionals have never received training, experienced a disaster situation, or participated in disaster management activities. Professionals employed in other sectors such as public works, financing (involved in construction of health facilities), foreign affairs, or the national disaster management agency (humanitarian assistance) should be aware of disaster preparedness and mitigation issues as they relate to the health sector.

BOX 2.1. The National Health Disaster Management Program.

The program's areas of responsibility are promotion, establishment of standards, training, and coordination with other institutions and sectors, as outlined below.

Promotion
- Health and social aspects and benefits of disaster management with other sectors, including the private sector;
- Inclusion of disaster reduction into development activities of other programs and divisions of the ministry of health and other health sector institutions; and
- Public education through mass media and health educators.

Establishment of standards
- Building and maintenance standards for health facilities in disaster prone areas, taking into consideration mitigation and preparedness measures;
- Norms for contingency planning, simulation exercises, and other preparedness activities in the health sector;
- Lists of essential drugs and supplies for emergencies; and
- Standardized telecommunication protocols.

Training
- In-service training of health personnel (from disaster prevention to response);
- Promotion of disaster management in the curricula of undergraduate and graduate schools in health sciences (such as schools of medicine, nursing, and environmental health); and
- Inclusion of health related topics in disaster management training for other sectors (e.g., planning and foreign affairs).

Collaboration with other institutions and sectors
- The national disaster management agency or other agency with multisectoral responsibility;
- Disaster focal point or commission in other sectors (e.g., national disaster management agency, legislature, foreign affairs division, public works departments, NGOs);
- Disaster programs in the health sector in and outside the country, particularly in neighboring countries or territories; and
- Relief organizations at the national or international level (bilateral and UN agencies, NGOs).

In the event of disaster, the program is responsible for:
- Mobilization of the health response; and
- Providing advice and coordinating operations on behalf of the head of the health sector (minister of health), and supporting the health response in case of large-scale emergencies resulting from natural, technological, or man-made disasters.

The health disaster management program is responsible for promoting ongoing training in health disaster management. The two main approaches to accomplishing this are: (*a*) continuous training at the institutional level, and (*b*) academic training provided by a large variety of institutions at the undergraduate and graduate levels or through continuing education.

EVALUATION OF THE HEALTH DISASTER MANAGEMENT PROGRAM

Health disaster management programs are evaluated based on the objectives and functions that have been specifically assigned to it.[1] However, the three indicators that follow are useful for evaluation and can be adapted.

Evaluation of the Preparedness Program

- Date of last review of the national and regional disaster plans of the ministry of health and water system authority;
- Annual disaster exercise, test of disaster plan.

Evaluation of Mitigation Measures

- Percentage of health facilities and water supply and sewerage system having undergone vulnerability study;
- Percentage of critical health facilities and water supply and sewerage system that will remain functional after disasters.

Evaluation of the Training Program

- Number of persons with specialized disaster management training;
- Number of hours of disaster management training available at the undergraduate and postgraduate levels.

[1]See Pan American Health Organization, Emergency Preparedness Program, *Guidelines for Assessing Disaster Preparedness in the Health Sector* (Washington, D.C., 1995).