"El documento original contiene páginas en mal estado."

THE EPIDEMIOLOGY OF NATURAL AND MAN-MADE DISASTERS

-- THE PRESENT STATE OF THE ART --

by

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I. INTRODUCTION

Disasters are extremely common events which will become ıcre frequent as the population density on earth increases. :alamities requiring international assistance occur at an av- ırage of once a week (Tripp, 1970). Many times that number ɔf disasters are dealt with internally by the affected coun- ıry. The United States of America, as an example, usually ex- ɔeriences five serious floods and over 500 tornadoes in a ıingle year (Lemons, 1957).

These repeated opportunities to study disasters have not esulted in a large body of organized information on the ef- ects of disasters on communities and how damage can be min- mized or prevented in the future. I think there are three ıain reasons why this should be so.

A. Important information is not always collected. Disaster elief efforts are almost entirely operational. Following a lisaster, the survivors are too disorganized and relief work- rs too busy in rescue operations to collect data for evalu- ıtion. As a result, opportunities to document the needs of he population and assess the effectiveness of relief oper- ıtions are lost.

B. Scientists have studied disasters in a limited fashion long specialty lines. Teams of scientists representing a ariety of disciplines with experience in a broad range of lisaster situations do not exist. Most scientists become

involved with disasters only when their region or country is affected. When we do become involved there is a danger of taking a narrow, specialist approach. The meteorologist is concerned solely with weather conditions, the clinician with ill patients, and the nutritionist with food kitchens.

C. Each disaster is different (League of Red Cross Societies, 1959). This aphorism was developed as a warning against a stereotyped response to disasters. Unfortunately, some of the people I have met in disaster relief work have concluded that disasters are so different that it is impossible to make any meaningful inductive conclusions.

I think that general statements can be made about disasters by applying the epidemiologic method to information already available. Epidemiology is the study of populations (both the sick and the well), their environment, and their relationships to each other (Langmuir, 1965). The epidemiologic method depends upon accurate field observations, orderly arraying of the evidence, and incisive inductive reasoning. The application of epidemiological knowledge consists in the control and prevention of the condition being studied.

Epidemiology developed during the mid-nineteenth century through the analysis of disastrous epidemics of communicable diseases like cholera (Snow, 1855) and measles (Panum, 1846). Although epidemic diseases still cause major disasters, the epidemiologic method has been extended gradually to acute and

chronic diseases of all descriptions (MacMahon et al, 1960).

Despite the origins of epidemiology in biologic disasters, only two articles (Saylor and Gordon, 1957; Parrish et al, 1964) consciously applied the epidemiologic method to other disaster situations until quite recently. Since the Nigerian Civil War (Aall, 1970; Western, 1970), however, epidemiologists have begun to participate in disaster relief operations. Increasingly sophisticated analyses are now available on communicable diseases in famine (Foege, 1971), the earthquakes in Peru (Blake, 1970; Rennie, 1970), the cyclones in the Bay of Bengal (Sommer and Mosley, 1972) and conditions in refugee camps (Gardner et al, 1972).

I look on this dissertation as an opportunity to assimilate the material I have located which contains epidemiological data on disasters. I am certain that the files of governments and agencies contain additional raw data and reports. I also recognize that I may have overlooked important publications not written in English or appearing in journals excluded from the medical indexing and abstracting services.

The dissertation is divided into four major sections. I begin with my definition of "disaster" and list the important natural and man-made disasters. I then consider the historical and contemporary sources of information on the epidemiology of disasters. The largest portion of the disser-

tation deals with the epidemiologic patterns which disasters follow.

In these first three sections I will indicate the areas where our knowledge of the epidemiology of disasters is most deficient. The fourth section will discuss the areas in which the epidemiologic method should be applied most vigorously in disaster research.

II. DEFINITIONS OF DISASTERS

The word "disaster" is often used loosely in ordinary language. The Oxford English Dictionary (1933), for example, defines a disaster as "anything that befalls of ruinous or distressing nature; a sudden or great mishap, misfortune or misadventure." This definition is far too broad for this dissertation. Such a definition would include most events reported in the morning newspaper, the loss of a head of family or the collapse of a stock portfolio.

I shall use the definition advanced by Beach (1967). Beach defined disasters as...

> "...the relatively sudden and widespread disturbance of the social system and life of a community or of a large part of a community by some agent or event over which those involved have little or no control."

By "community" he means a collection of people who occupy a common geographical area and who are bound together in a relatively permanent and interdependent service and social relationship.

Disasters are often divided into two groups--natural disasters and man-made disasters. Natural disasters are caused by one or more destructive forces of nature. Man-made disasters, on the other hand, are the direct result of the destructive activities of man.

Table 1.

ETIOLOGIC CLASSIFICATION OF NATURAL AND MAN-MADE DISASTERS

A) NATURAL DISASTERS

1. Caused by natural phenomena occurring beneath the surface of the earth.
   a. Earthquakes
   b. Tsunamis (Seismic Sea Waves)
   c. Volcanic Eruptions

2. Caused by natural phenomena of complex physical origin occurring at the surface of the earth.
   a. Landslides
   b. Avalanches

3. Caused by meteorological and/or hydrological phenomena.
   a. Wind Storms (Cyclones, Typhoons, and Hurricanes)
   b. Tornadoes
   c. Hailstorms and Snowstorms
   d. Sea Surges
   e. Floods
   f. Droughts

4. Caused by biologic phenomena.
   a. Locust Swarms
   b. Epidemics of Communicable Disease

B) MAN-MADE DISASTERS

1. Caused by warfare.
   a. Conventional Warfare (Including Siege and Blockade)
   b. Nonconventional Warfare (Including Nuclear, Biological, and Chemical Warfare)

2. Caused by accidents.
   a. Vehicular (Including Airplanes, Trains, Ships, and Automobiles)
   b. Drowning
   c. Collapse of Buildings and Other Structures
   d. Explosions
   e. Fires
   f. Biological
   g. Chemical (Including Poisonings by Pesticides and Environmental Pollution)

After: Gil (1963) and Fournier d'Albe (1969).

The major types of natural and man-made disasters are given in Table 1. The list is not intended to be complete. Freak disasters such as a large meteorite falling in a densely populated area are not included. In other circumstances the etiological classification of the disaster has been arbitrary in the interests of simplicity. Fire, for example, is usually an accidental, man-made disaster. Fires may also result in nature from lightning or spontaneous combustion; they may arise as well from an intentional criminal action (i.e. arson).

I do not find the separation of disasters into natural or man-made events very productive. At one level a disaster becomes a disaster only when man and the environment he has created are affected. An avalanche into an uninhabited valley or an earthquake in the Arctic are geophysical events--not disasters.

Disasters may also have multiple causes or occur as a series of linked events. Wind storms striking coastal areas often produce considerable damage from flooding as well as wind (Reichelderfer, 1957). The association of warfare with epidemics of communicable diseases is well known (Lerche, 1967). The Peruvian Earthquake (United States Agency for International Development, 1970) is a good example of the sequential linking of disasters. The earthquake (primary natural disaster) resulted in the collapse of buildings (secondary man-made disaster). Fires broke out in some of the destroyed

structures (another secondary man-made disaster). The earthquake also triggered massive landslides (a second natural disaster) which engulfed whole towns.

Finally, as mankind increases in numbers, more geophysical events will affect man. The opportunity for accidents will increase with population density and the proliferation of vehicles and new chemicals of unknown toxicity. Although uncommon now, the point will be reached when man's alteration of his environment will produce what have been regarded as natural disasters. Earth tremors following the creation of large artificial lakes are an early manifestation of this danger (Latter, 1968).

II. SOURCES OF INFORMATION ON THE EPIDEMIOLOGY OF DISASTERS

Information concerning the epidemiology of disasters is rived from historical and contemporary sources. I consider s contemporary disasters those which have occurred since 945. This recent a cut-off point is due to developments in everal areas which make it hazardous to generalize from a omparison of pre-World War II with post-War disasters. The ive most important of these areas are:

1. Increased Interest. Before World War II, the International League of Red Cross Societies and her national societies had little assistance in the field of disaster relief. he concern with human suffering and food shortages in Europe fter the War has persisted and gathered strength. The entire United Nations complex of international agencies, governmental, and voluntary agencies have come into existence n the past thirty years.

2. Communications. The development and proliferation of he transister radio and television have made it possible to arn the remote or poor areas about disaster conditions. Miniturization and improvements of field equipment has also shortned the periods of isolation after a disaster.

3. Transportation. Aerial reconnaissance (including satllites), the jet-propulsion airliner, and the helicopter were n their infancies or not in production in 1945. During the

same interval, there has been a considerable increase in the construction of airports, harbor facilities, roads, and bridges in even the most underdeveloped areas of the world.

4. Living Conditions. The population explosion and urbanization have changed the social structure of many countries. North America and Europe are enjoying sustained economic prosperity and are developing new technologies to meet these two challenges. In the developing world, however, resources for irrigation, flood control, and structures designed to withstand wind and seismic tremors are in short supply.

5. Medical Knowledge. The past thirty years has witnessed improved sanitary facilities, more and better immunizing agents, and an explosion in the number of effective antibiotics and other drugs available to the physician. Nutritionists are rapidly changing their concepts of the causes of protein-calorie malnutrition and its prevention (Hegsted, 1972). As a result, the mortality of young children has fallen steadily in developing countries such as Burma (Kywe, 1972) as well as the developed world. Scourges which frequently followed disasters in the past (typhus, relapsing fever, and plague) are now restricted to isolated epicenters (Center for Disease Control, 1972) and pose no threat in most calamities.

With this background material in mind, I shall discuss first the value of historical information concerning disasters. I will follow with a more detailed analysis of contemporary data.

A. HISTORICAL SOURCES OF INFORMATION CONCERNING DISASTERS

The historical approach to disasters depends heavily upon oral tradition, literary allusions, and scraps of records which have survived. In most circumstances, the only data that has survived have been the nature of the disaster, the date, the general geographic area affected, and an estimate of the number of fatalities. It is scarcely surprising, then, that the pioneering historical chronicles of Short (1749) on natural disasters and Walford (1879) on famines concentrated on comparatively well-documented English and European sources.

Following these early efforts, later writers have added nominations for the list of the world's leading disasters. The most formidable of these lists (Keys, 1950) chronicles 294 "notable" famines outside of India from 1,708 B.C. until 1,933 A.D. Eighty famines occurring in India from 503 B.C. to 1,907 A.D. were considered separately. Milne (1911), Daly (1926), F. Montandon (1959b), and Gil (1963) have approached disasters in a similar fashion. The popular press has also printed this sort of information in feature articles (New York Times, 1970; Die Welt, 1970). Of particular interest have been articles summarizing the experiences of a particular country or region with disaster (Der Spiegel, 1970; People's View, 1970).

None of these listings, however, is complete. Most exclude one or more important types of disaster. Keys (1950),

for example, considers only the disasters which have produced famine. The other authors exclude epidemics, war, and mass accidents. A further problem is that all the lists contain major omissions which undermine their claims to being comprehensive. Frédéric Montandon (1959b) cites an earthquake in China in 1850 which caused about 300,000 casualties. Gil (1963) does not mention the event.

Kröger (1971) has made a heroic attempt to consolidate the "serious" disasters in history. In order to keep the list down to reasonable size, he defined a "serious" disaster as one involving 10,000 deaths or more.

Kröger's (1971) approach has limited value for the epidemiologist. First, relatively few kinds of disasters (earthquakes, wind storms, floods, and volcanic eruptions) have caused more than 10,000 deaths until the present time. Second, disaster deaths are more a function of the population density of the affected area than the severity of the disaster itself. Third, Ambraseys (1972) has argued persuasively that the number of disaster deaths may bear little relationship to the long-term social, medical, and economic effects of the disaster. Fourth, and of most importance to the epidemiologist, the accounts of the earlier disasters are barren of the detail needed to analyze the natural history of the disaster and its effects upon the affected community (Keys, 1950).

Latter (1969) has taken a different historical approach owards disasters. Latter takes the geographic distribution f natural disasters into account and estimates the maximal umbers of deaths if a severe disaster were to strike a heavly populated region. Because Latter is a seismologist, this nalysis is limited to geophysical events. Drought, epidemics, nsect swarms, and the spectrum of man-made disasters are excluded.

Detailed studies of the disaster history of a country have een published only for the United States of America (Lemons, 957; Smith, 1957). Summaries dating from the early twentieth entury are available for floods (Sturgis, 1957), wind storms Reichelderfer, 1957) and earthquakes (Leet, 1957). Inforation for the rest of the world is limited to fragmentary eports on specific types of disaster such as dust storms Montandon, F., 1942), earthquakes and volcanic eruptions Rothé, 1946, 1961), and wind storms (Poisson, 1938; Montanon, F., 1961).

Even these detailed studies do not provide a predictive attern which can be put to practical use. Having defined he Circum-Pacific Earthquake Belt, for example, the hisorically minded seismologist can not tell us when Califoria will experience her next severe seismic shock or whether n urban area will be affected. The meteorologist can tell s that hurricanes form during the summer months and threaten

the Caribbean Gulf and South Atlantic areas of the United States an average of four times a year (Reichelderfer, 1957). But until the hurricane forms, builds up wind velocity, and begins its path, the meteorologist will not be able to predict its force, course or danger to populated, low-lying areas.

B. CONTEMPORARY SOURCES OF INFORMATION CONCERNING DISASTERS

The general public derives its information about disasters from press reports and popularized non-fictional accounts. The epidemiologist, however, relies more heavily on reports from within the affected country, reports from international agencies, and technical or scientific papers. The most accessible and useful of the epidemiologic sources are listed and annotated in Table 2.

1. Press Reports

Press reports may originate at the local, regional, and national levels or be distributed by the international news services. The influence of the press in disseminating useful information and molding public opinion should not be discounted. The facts and figures quoted in press reports, however, have serious limitations for the epidemiologist. Certain segments of the press, for example, may co-operate with government policy of minimizing a disaster to prevent panic in a population or for political reasons. Other segments may exaggerate the extent of a disaster in order to embarrass the authorities or to obtain a sensational story (Western et al, 1971)

Table 2.

SOURCES OF CONTEMPORARY INFORMATION ABOUT THE EPIDEMIOLOGY OF NATURAL AND MAN-MADE DISASTERS, 1945-1972

I. PRESS REPORTS
   A. Local
   B. Regional
   C. National
   D. International

II. NON-FICTIONAL ACCOUNTS

III. NATIONAL REPORTS
   A. Government Sources
      1. United States of America
         a. Office of Disaster Preparedness, Executive Office of the President, Washington, D.C.
         b. Division of Emergency Health Services, U.S. Public Health Service, Rockville, Md.
         c. Office of Civil Defense, Department of Defense, Washington, D.C.
      2. Canada
         a. Department of National Health and Welfare, Ottawa.
      3. Japan
         a. National Research Center for Disaster Prevention, Chuo-ku, Tokyo.
   B. Non-Government Sources
      1. The National Red Cross, Crescent or Lion Society located in the capital city of the affected country.
         a. Summary reports on individual disasters
         b. Annual reports of the Society
      2. Disaster Research Group, Division of Anthropology, National Academy of Sciences/National Research Council, Washington, D.C. (1951-1963). Now the Disaster Research Center, Ohio State University, Columbus, Ohio.
      3. Department of Geography, University of Toronto, Toronto, Canada.
      4. Office of Information, North Atlantic Treaty Organization, Brussels, Belgium.

IV. INTERNATIONAL AGENCY REPORTS
   A. United Nations Technical and Assistance Agencies.
      1. United Nations Relief and Rehabilitation Administration (UNRRA), 1943-1948. Relief of war victims.
      2. Food and Agricultural Organization (FAO). Drought and agricultural assistance.

(Continued)

Table 2 (Continued).

3. United Nations Educational, Scientific and Cultural Organization (UNESCO). Geophysical investigations of natural disasters.
4. United Nations Childrens Emergency Fund (UNICEF). Technical assistance to mothers and young children.
5. United Nations High Commissioner for Refugees (UNHCR). Assistance to refugees produced by social disruption or natural disasters.
6. World Health Organization (WHO). Technical assistance in sanitation, communicable diseases, and nutrition
7. International Telecommunications Union (ITU). Disaster warning systems.
8. United Nations Development Program (UNDP). Rehabilitation following disasters.
9. United Nations Co-ordinator for Natural Disasters. Established February, 1972.

B. International Relief Agencies
   1. League of Red Cross Societies (LRCS).
      a. Relief Bureau Circulars--published immediately after and at intervals following a disaster. Limited circulation.
      b. Panorama--LRCS newsheet. Available by subscription
      c. Final Reports--published after termination of LRCS activities in individual disasters.
      d. Annual Reports.
   2. International Committee of the Red Cross (ICRC). Deals with relief and medical assistance projects in special situations such as civil wars and disturbances.
   3. International Committee of Voluntary Agencies (ICVA). Clearing house for information concerning the major international voluntary agencies.
      a. World Council of Churches (WCC).
      b. Caritas Internationalis.
      c. Oxford Committee for Famine Relief (OXPAM).
      d. Many other agencies.

V. SCIENTIFIC AND TECHNICAL REPORTS
   A. Natural Science Journals
      1. Geographical Reviews (New York City).
      2. International Relief Union
         a. Matériaux pour l'étudè des calamités (1924-1937).
         b. Revue pour l'étude des calamités (1938-1962).
         c. Revue de l'Union internationale de Secours (1963--)
   B. Medical Science Journals
      1. The Lancet. In recent years has published a number of articles by physicians involved in disasters.

Furthermore, most journalists who gather about the site of a disaster do not have the scientific or epidemiologic background to evaluate conflicting "official" reports and unconfirmed rumors. This deficiency has become apparent in circumstances where epdemiologists have checked press reports. The population of Biafra, for example, was thought to be about nine million people by the popular press (Atlanta Journal., 1969) Crude demographic surveys using the smallpox vaccination scar as a population marker indicated that the total number of civilians was slightly above three million (Western, 1970). Epidemics of typhoid fever rumored in the press after the Peruvian Earthquake of 1970 were not detected in intensive case detection efforts in the field (Blake, 1970; Rennie, 1970).

2. Non-fictional Accounts

Disasters draw journalists; they also stimulate more serious literary figures. While some accounts such as Daniel Defoe's (1722) journal of the epidemics of bubonic plague in London are largely fiction, there have been a number of valuable works written by non-scientists. The authors conduct careful background searches and often draw intensively from medical and scientific sources. Nevertheless, it is clear that the authors write with a general audience in mind. The flavor is anecdotal and the data to support observations is frequently not included in the text or references.

This literary treatment of real disasters has reached its most sophisticated form in the works of Berton Roueché (1967). Roueché writes regularly for The New Yorker magazine and carefully interviews medical epidemiologists and patients before presenting epidemics of communicable diseases and toxic hazards along the same lines as a Conan Doyle detective story. Downey (1938) has popularized the emergency relief services in the United States in a book entitled Disaster Fighters. Famines in India (Merewether, 1898) and Russia (Fisher, 1927; Salisbury, 1969) have also been described in graphic fashion. Other disasters treated in a similar fashion are the volcanic destruction of Krakatoa (Furneaux, 1964), the atomic explosion over Hiroshima (Hersey, 1946), and fires in general (Masters, 1950).

3. National Reports

The separation of national reports into official government and non-government sources is not as clear-cut as indicated in Table 2. All national Red Cross societies, for example, work closely with government in disaster situations. In highly centralized states it may be difficult to separate activities of the national government from those of the Red Cross. This is true in Italy where disaster relief is centralized and the military play a prominent role in relief operations (Anderson, 1969b). Despite the need to consider each country's social structure and disaster relief organization on an individual

basis, some general comments can be made about the value of official government and non-government sources of epidemiological information on disasters (Roth, 1970).

a. Government Sources

At the start of my readings for this dissertation I rather naively felt that I would be able to locate a number of government reports on disasters. Exactly the opposite has been the case. There are three major reasons for this situation.

1. The central government is not informed about the disaster. Disasters are embarrassing to many local officials. The event may take place in a remote and unimportant area of the country which the central government would not be able to assist in any event. In other situations communications may be so poor that the disaster may have occurred weeks or months before it is reported to the capital. Rich, decentralized societies like the United States have a similar reporting problem. In the United States disasters are the concern of the state (McGill, 1957), not the Federal government. The Federal government may involve itself only when invited by the governor of the stricken state. As a result, only the larger disasters are brought to the attention of Washington authorities.

2. Disasters are internal problems of the affected country. The central government has no obligation to report the occurrence of a disaster to the United Nations or any other country.

:-:eed, there are often strong political reasons not to publi-
::ze that the country is disaster-prone. National pride, tour-
:sm, overseas investment, the confidence of the electorate,
:-d the results of the next election might be affected by ex-
:essive emphasis on disasters--particularly if coupled with
:harges that the relief efforts were inefficient. The raw
:ata and internal reports of a government, then, are rarely
:irculated outside the affected country.

3. Most countries are not capable of preparing quality re-
:orts on disasters. When canvassed two years ago, only 58
of 136 countries were known to have a national disaster re-
:ief plan (League of Red Cross Societies, 1970b). The sit-
:ation was poorest in Africa (nine of 40) and Asia (ten of
31 countries), the most underdeveloped regions of the world.
Furthermore, a country must experience disasters at regular
intervals and have sufficient resources to document what hap-
pens following a disaster in order to prepare meaningful re-
ports.

At the present time only the United States of America,
Canada, Japan, and the Soviet Union qualify as both disaster-
prone and wealthy enough to support independent, sophisti-
cated studies of disaster. Even the published material from
these countries is limited in its scope and content. The
Office of Disaster Preparedness in the United States, for ex-
ample, asks each state for detailed assessments of damages

before authorizing Federal funds for rehabilitation. Portions of this data have been organized and published only after the Alaska Earthquake of 1964 (Office of Emergency Preparedness, 1964), the Los Angeles Earthquake of 1971 (OEP, 1971) and Hurricane Camille (OEP, 1969). Floods are the only major recurring natural disaster in Western Europe. In recent years the North Atlantic Treaty Organization (NATO, 1970) has become involved in flood control.

b. Non-Government Sources

The national Red Cross, Crescent or Lion society is the major non-government source of information regarding disasters in virtually every country. The Red Cross operates through a system of local chapters throughout the country and, on occasion, may have more detailed information than the central authorities. In certain recent disasters such as the Nigerian Civil War and the Bengali refugees in India, the national Red Cross has assumed a major co-ordinating role. Generally, however, the quality of the reports from the Red Cross society correlates with the resources of the country and the national priority given to disaster relief.

The organization of the Red Cross in the United States (Smith, 1957), Canada (Pace, 1967), and Great Britain (Editorial, 1967) has been published relatively recently in a summarized form. Summary and annual reports from these and other well-organized societies may be quite informa-

tive. The deficiencies in the national reports of the Red Cross are similar to those of the international relief agencies and will be considered in the next section.

The Disaster Research Group of the National Academy of Sciences/National Research Council and the University of Toronto are American and Canadian sources of information which will be included in the discussion of technical and scientific reports.

4. International Agency Reports

While the United States, Japan, and the Soviet Union are unlikely to require disaster assistance in peacetime, small or developing countries often find their budgets and resources taxed by what would elsewhere be an internal problem. International assistance comes from three main sources: 1) the technical and assistance agencies of the United Nations; 2) the international relief agencies; and 3) bilateral assistance from one country to another. The first two of these sources have been outlined in Table 2.

a. The United Nations

The activities of the United Nations in the past have been complex and fragmented in dealing with disasters. At some points eight United Nations agencies have been involved in some aspect of disaster investigation or disaster relief (Table 2). The tendency to form special bodies for individual disasters (UN Operations in the Congo; UN East Pakistan Relief Operations) has been particularly confusing. Recently,

the United Nations has summarized its activities and policies regarding disasters (UN Economic and Social Council, 1971). A United Nations Co-ordinator for Disaster Relief Activities was appointed in February, 1972 with offices in Geneva and a liaison in New York City.

b. International Relief Agencies

The League of Red Cross Societies occupies a central position among the international relief agencies. The Relief Bureau Circulars sent to the national agencies as soon as the League is asked for assistance contain considerable epidemiologic data.

In contrast to the League, the International Committee of the Red Cross is a Swiss organization which is best known for its inspection of prisoner of war camps, tracing of missing persons in wartime, and service as a neutral body in situations where civil insurrection prevents the League from functioning. The International Committee was the co-ordinating agency with the Nigerian Red Cross in the Nigerian Civil War and directed medical relief teams during the Jordanian Civil War of 1970 (ICRC, 1970).

The International Committee of Voluntary Agencies at the present time is serving as a clearing house of information from the voluntary agencies with an interest in disaster relief. As one might expect, the value of the service will depend upon the quality of the individual reports.

c. Bilateral Agency Reports

In major disasters donor countries commonly offer assistance directly to the government of the affected country. The larger donor countries publish reports of their activities at regular intervals. The best known and most complete of these are the annual reports of the Foreign Disaster Emergency Relief Office of the United States Agency for International Development. Although the activities of American agencies are emphasized, the reports attempt to list the contributions of all other countries and agencies.

d. Critique of International Agency Reports

The reports of the international agencies add little to the understanding of the epidemiology of disasters. They tend to be deficient in four major areas:

1. The data and analyses are largely derivative. The international agencies often do not participate in data collection in the field, but rely on information supplied to them by the affected government or a national relief agency. The agencies rarely have the personnel or the interest to check on its validity. Furthermore, interval or final disaster reports are often poorly organized or have omitted the detailed data needed for epidemiologic analysis.

2. The reports are exercises in public relations. I have yet to read a summary report of a relief operation which does

not minimize or ignore the inevitable personal, political, and administrative problems with the affected country and other relief agencies. Political necessity dictates that critical reports or figures at odds with "official" data be filed away at the end of the relief operation.

3. The reports are limited to listing the agency's contributions in cash, goods, and personnel. There are two reasons why most official reports read like a balance sheet. First, the agency has firm control over its donations only until they are shipped. Once the money and goods are sent, the agency usually must rely on second-hand information regarding their deployment and effectiveness. Second, the agency will have to give an annual accounting to its contributors. Line listings of massive donations sent will be more impressive than analyses of spoilage, inappropriate personnel and supplies, and items which were never used.

4. Each agency emphasizes its own importance in a relief operation. More than one hundred agencies will make substantial contributions in a large disaster like the Peruvian Earthquake of 1970 (USAID, 1970). Peruvian sources (Peruvian Red Cross, 1970) and independent observers (Rennie, 1970) were impressed by the indigenous nature of the relief effort. The reports of most international agencies, on the other hand, barely mention the presence of the Peruvian Red Cross and Government. Indeed, the impression conveyed

by some international agencies is that they were the only group in the field.

5. Technical and Scientific Reports

The majority of technical and scientific reports dealing with disasters appear in journals and monographs belonging to three disciplines. The three disciplines are 1) geophysics, 2) sociology, and 3) medicine.

a. Geophysical Reports

The International Relief Union (Geneva) has published a quarterly journal devoted to natural disasters since 1924 (Table 2). Although the name of the journal has changed with time, it continues to be a chronicle of natural disasters. Leading geophysicists also regularly review recent publications on disaster, summarize the pattern of particular disasters during the preceding decade or generation, and discuss methods of reducing the ill-effects of disasters. These reviews and discussions are rewarding sources for data on the descriptive epidemiology of natural disasters in time and place. Unfortunately, the social and medical aspects are usually limited to the number of dead or injured and the number of structures destroyed or damaged.

In recent years UNESCO has sent teams of natural scientists to disasters immediately after their occurrence. The reports to date have been restricted to earthquakes (Ambraseys, 1968; Robson and Canales, 1968; Arsovski, 1970; and UNESCO, 1971),

floods (Pias and Stuckmann, 1970), and typhoons (Mackey et al, 1971). The major purposes of these UNESCO reports are to more fully document the geophysical event and to study its effect upon the physical environment.

The Department of Geography at the University of Toronto has gradually begun to bridge the gap between the physical and social scientists interested in disasters. At present, the Department has printed over twenty working papers (Natural Hazard Research, 1971). The subjects considered include theoretical models of disaster situations (Kates, 1970), disaster surveillance (Sheehan and Hewitt, 1970), human adjustment following disasters (Aminul Islam, 1971; Berry et al, 1971), and the economic effects of disasters upon communities (Mukerjee, 1971).

b. Sociological Reports

The first study of disaster by a sociologist was Prince's (1920) excellent analysis of the explosion of a munitions ship in Halifax Harbor in 1917. During the Second World War, the United States Government asked sociologists to evaluate the effect of bombings on the morale of the civilian populations of Germany and Japan (United States Strategic Bombing Survey, 1947). Government sociologists also carried out retrospective studies of the atomic explosions on Hiroshima and Nagasaki (Oughterson and Warren, 1956).

Indeed, the concern about how American populations might

react during a nuclear attack provided the stimulus for the best sociological studies of disaster. In 1951 the Office of Civil Defense directed the National Academy of Sciences/ National Research Council (NAS/NRC) to form a group to answer this question. With no nuclear disasters to serve as models, the Disaster Research Group undertook a prospective study of similar events which might serve as models. The first of these monographs dealt with explosions in a fireworks factory (Killian, 1953) and the mass evacuation of civilians from the paths of hurricanes (Rayner, 1953). Before the Group disbanded in 1963, 13 major published monographs, even more documents with limited circulation, and a host of related articles had been published (Quarantelli, 1970a).

The Disaster Research Center (1972) at the Ohio State University possesses the files and tape recordings of the Disaster Research Group. The Center concentrates on the sociological aspects of disaster and publishes a wide range of material.

c. Medical Reports

Medical interest in disasters reached a peak during and immediately after World War II. The social disruption, food shortages, displaced persons, and frank famines in Western Europe produced a tremendous amount of information on malnutrition and famine. The comprehensive studies organized by Burger et al (1946) in the Western Netherlands and Valaoras

(1946) in Greece remain the definitive source material for the epidemiology of famine. A major reason for their continued importance was the fact that Europe provided pre-War vital statistics as a basis for comparison. The monumental studies directed by Ancel Keys (1950) on the physiology of starvation in previously healthy volunteers are excellent examples of the research scientist applying his knowledge to practical field problems. The War also produced some moving field observations by physicians who dealt with starvation and disease as political or war prisoners (Leyton, 1946; Markowski, 1945).

The American Medical Association has printed two bibliographies concerned with the medical literature on disaster (American Medical Association, 1966, 1967). The majority of the entries reflect the concern with nuclear attack. In addition to limiting their horizons to medical operations following an atomic catastrophe, these authors felt confident that the military experience with triage, evacuation, and emergency care were quite suitable for civilian disasters. The case studies tended to be superficial recountings of the disaster and how well (or poorly) local physicians were able to apply military principles to the situation. Poor performance was generally attributed to inadequate planning or disaster drills rather than questioning the applicability of a military approach to civilian disasters (Churchill, 1953; Davis, 1954; Therapiewoche, 1965; New Eng. J. Med., 1968).

Despite the preoccupation with atomic attack, several excellent case studies of disasters by physcians did appear between 1948 and 1967. In instances such as the Texas City nitrite explosion (Blocker and Blocker, 1949) and the 1962 earthquake in Iran (Saidi, 1963) the report seems to be an individual effort. More commonly, a group of health workers becomes so involved that they publish the equivalent of a monograph on the disaster they lived through. Although the quality varies, the reports of the Agadir earthquake in Morocco (Maroc Med., 1961), the earthquake in Skopje, Yugoslavia (Vojosanit. Pregl., 1964), the Anchorage, Alaska earthquake (Publ.Hlth Rep., 1964), and the Hamburg floods (Munch. Med. Wschr., 1962) provide an integrated view of the medical problems of disaster stricken communities.

Until quite recently, the only major area in which the medical sciences have carried out applied research in disasters has been the physiologic and epidemiologic studies of casualties following shipwreck (Keatinge, 1965; Glennie, 1969). These studies have changed attitudes about the actual cause of deaths, the design of life-jackets, and instructions for survivors in the water.

Disaster epidemiology in developing countries is particularly barren with the exception of a massive literature on famine in India (Passmore, 1951; Bhatia, 1963). A significant change developed during the Nigerian Civil War. The

developed world became emotionally involved with a disaster of long duration in a developing country and a number of well-qualified physicians participated in the relief effort. The reports they published (Brown, 1969; Gans, 1969; Hickman, 1970; Hughes, 1969; Ifekwunigwe, 1971; Miller, 1970; Cilling-Smee, 1969) often tended to be anecdotal accounts of their experiences in field clinics and hospitals. Nevertheless, medical involvement in disaster situations and then writing about the experience had become acceptable once more.

Physicians, however, do not usually participate in more than one relief action. Of the authors cited above, only Hickman (1971) has published on experiences with the refugees from Bangladesh in India. Furthermore, only the more highly motivated clinicians record their observations and publish.

I am liable to the charge of prejudice, but I feel that one of the most encouraging developments in disaster studies has been a commitment by the Center for Disease Control, United States Public Health Service to send trained medical epidemiologists to disasters. The largest contingent (over twenty-five) served during the Nigerian-Biafran Civil War. Since that time, the Center has participated in the relief activities following the Peruvian earthquake of 1970, the Bay of Bengal Cyclone (1970), and surveys of the nutritional status of Bangladesh (1972).