THE ROLE OF THE WORLD HEALTH ORGANIZATION IN DISASTER EPIDEMIOLOGY

OPERATIONS, RESEARCH AND TRAINING

CENTERS FOR DISEASE CONTROL

ATLANTA, GEORGIA, USA

THE DEVELOPMENT OF DISASTER EPIDEMIOLOGY
Role of the World Health Organization

A. EXECUTIVE SUMMARY

Natural disasters have claimed 3 million lives during the past two decades, and adversely affected the lives of at least 800 million more people. Better epidemiologic knowledge of the causes of death and types of injuries and illnesses caused by disasters is clearly essential to determine appropriate relief supplies, equipment and personnel needed to effectively respond to such situations. Improving postdisaster health assessment should be a major goal of the World Health Organization. WHO should support research conducted to improve postdisaster assessment information systems, define the information that should be collected, including the methodology of assessment, and techniques of data collection. WHO is in an excellent position to play a leading international role in strengthening the institutional capacity of the health sector of its Member States in disaster epidemiology, particularly in highly disaster-prone countries. This goal of building local and national infrastructure can be accomplished by facilitating the exchange of information, experience and expertise between developing countries (TCDC). Improving national capacity in disaster epidemiology will also assist disaster-prone countries to become more self-reliant in disaster preparedness and response. In summary, disaster epidemiology provides the tools for acute problem solving in public health emergencies and is instrumental in having a direct impact in relieving human suffering.

B. INTRODUCTION

Epidemiology, as classically defined, is the quantitative study of the distributions and determinants of health-related events in human populations. Disaster epidemiology, however, can be viewed in a broader perspective which links data collection and analysis to an acute decision-making process. The overall objective of disaster epidemiology is to

scientifically measure and describe the health effects of disasters and contributing factors to these effects, with the goals of assessing the needs of disaster-affected populations. efficient matching of resources to needs, further prevention of adverse health effects, evaluation of program effectiveness, and for contingency planning. In addition, the epidemiologist has an important role to play in providing informed advice about the probable health effects which may arise in the future, in establishing priorities for action and in emphasizing the need for accurate information as the basis for relief decisions. The low mortality rates observed in such recent disasters as Hurricanes Gilbert (1988) and Hugo (1989), the San Francisco earthquake (1989) and tornadoes in North America may have been a result of excellent community preparedness programs, improved public awareness, and advances in antiseismic housing design, in the case of the earthquake. Some of these improvements have resulted from knowledge obtained from both descriptive and analytic epidemiologic studies conducted during and after disasters (see Annexes).

Disaster epidemiology was born from the increasing realization that the effects of disasters on the health of populations are amenable to study by epidemiological methods. Such studies can include the following: description of the public health impact of a disaster; description of the natural history of the acute health effects; analytic studies of risk factors for adverse health effects; clinical investigations of the impact of diagnostic and treatment approaches; population-based studies of long-term health effects; studies of psychosocial impact of the disaster; evaluation of the effectiveness of various types of assistance and the long-term effects of aid on the restoration of predisaster conditions; and surveillance. Results of such studies have assisted in the design of appropriate warning systems and have provided guidelines for preparedness training. Despite the advances in disaster epidemiology over the past 20 years, there is currently a need for a more integrated approach to this subject using the large body of knowledge that has been accumulating through case studies, analytic investigations and exercises in the

aluation of disaster response.

C. **MANDATE**

WHO's responsibility in disaster preparedness and response is an integral part of its mandate which requires the Organization to provide health assistance in emergencies. This mandate in emergencies comes from its Constitution: Chapter II (Functions), Article 2, Item (d) states that, among its functions, the Organization is to furnish appropriate technical assistance and, in emergencies, necessary aid upon the request or acceptance of Governments. In addition, many other official functions relate to emergencies as well as to general health development. Functions pertaining to prevention, education, providing standards of care, and cooperating with other specialized agencies, for example, apply to ERO's work as well as to the work of other technical units. In the past ten years, the scope of this important mission has been further defined by the World Health Assembly in numerous resolutions:

- Resolution WHA 34.26 (1981) which emphasizes the importance of preventive measures and emergency preparedness, and reaffirms WHO's role as the lead UN agency in health aspects of disaster preparedness.
- Resolution WHA 38.29 (1985) which recognizes the need for an integrated response linking emergency health measures with long-term development. It also charges WHO with the technical responsibility for strengthening the health preparedness and response capacity of its Member States.
- Resolution WHA 42.16 (1989) which calls upon the Director General to support the International Decade for Natural Disaster Reduction and to develop a WHO program for the Decade.

These resolutions have strengthened and confirmed WHO's role in specific disaster situations as well as helping to shape WHO's approach toward emergency preparedness and response.

STATE OF THE ART

Over the past 20 years, the epidemiology of disasters has emerged as an area of special interest. The uses of epidemiology in disaster situations has been reviewed in a number of reports (see References below) with periodic updates on the "state of the art" appearing every few years (Western, 1972; Logue et al, 1981; Seaman, 1984; Centers for Disease Control, 1989; Lechat, 1990). The role of epidemiology in such situations has included a broad framework of activities:

1. Rapid assessment of health needs
2. Surveillance and action-oriented information systems
3. Disease control strategies for well-defined problems
4. Assessment of the use and distribution of health services
5. Etiologic research on the causes of morbidity and mortality due to disasters
6. Efforts for the long-term development of epidemiologic activities for the affected populations (e.g., continuous monitoring and surveillance of the health problems faced by the affected population).

Saylor and Gordon (1957), in one of the earliest reviews on the role of epidemiology during natural disasters, considered disasters as epidemics and suggested using well-defined epidemiologic parameters such as time, place and persons to describe disasters. However, the practical application of epidemiology to disasters really began during the massive international relief operation mounted during the civil war in Nigeria in the late 1960s. Through the involvement of epidemiologists from the US Centers for Disease Control, techniques were developed for the rapid assessment of nutritional status, and surveys were conducted to identify the population in need. For the first time, it was realized that the effects of disasters on the health of populations were amenable to study by epidemiological methods and that certain common patterns of morbidity and mortality following certain disasters could be identified (Western, 1972). There have been many studies made on the causes and effects of food shortage on populations in the developing

rld and techniques of surveillance and assessment developed during the crises in the West African Sahel, Ethiopia, Bangladesh and Uganda have become a routine part of relief work in famine areas and in refugee populations.

Investigations of major disasters involving acute events such as earthquakes and cyclones have employed a great variety of data collection methods and strategies to study post-disaster health effects. There have been extensive collections of epidemiologic data through case studies of new and previous disasters involving primarily descriptive ?idemiology (Sommer A et al, 1972; de Ville de Goyet C et al, 1976). Examples of some of the few analytic epidemiologic studies conducted include studies of risk factors for morbidity and mortality in Guatemala (Glass, et al, 1977), Italy (de Bruycker et al, 1985) and Armenia (Noji, 1990).

There is now sufficient practical experience to show that, after disasters involving nutritional needs and displaced populations, it should be possible to accurately determine the relief needs. The techniques employed- essentially the use of sample and systematic surveys and the establishment of simple reporting systems- are methodologically straightforward, and there is every reason to suppose that, given suitable personnel and transport, reasonably accurate estimates of relief needs could be obtained very quickly. Problems may arise, however, with the interpretation of data, particularly in developing countries, where predisaster "baseline" health and nutritional levels are unknown, and with the interpretation of incomplete data.

All of these past studies have addressed the problem from the point of view of a single discipline, either by social scientists, engineers or by health researchers. This lack of active collaboration between workers from different disciplines has been a major shortcoming of past research into health effects of disasters. For example, understanding the mechanisms of building failure in earthquakes requires structural engineering competence while medical expertise is necessary to understand the process of human injury in earthquake-induced building failure. During the last 10 years, considerable attention

s been devoted to the topic of earthquake loss estimation, particularly the development of specific estimations of earthquake casualties. Development of valid casualty estimation models for preparedness and rapid needs assessment will require close interdisciplinary collaboration between structural engineers and disaster epidemiologists (Jones NP et al, 1990). Likewise, collaborative studies of the impact of famine by epidemiologists, agronomists and anthropologists would be desirable.

Over the past several years, various efforts have been made to develop rapid and valid epidemiological assessment techniques. Guha-Sapir and Lechat have developed useful attributes for indicators for needs assessment in earthquakes ("quick and dirty" surveys). These have highlighted simplicity, speed of use and operational feasibility (Guha-Sapir D et al, 1985).

It is important to distinguish between natural and man-made disasters since each type of disaster may be associated with different health problems or may require the use of different techniques to determine disaster-related morbidity (Bertazzi PA, 1988). While natural disasters, such as floods and earthquakes, have been extensively studied, man-made disasters are more difficult to conceptualize because they may include such diverse events as wars, concentration camp internment, population displacement, and technological accidents which threaten the ecologic balance of a community.

The importance of disasters as a public health problem is now widely recognized by both governments and academic institutions (Lancet, 1990). There now exist disaster research centers at universities concentrating on health and medical effects of disasters, among them collaborative centers under the sponsorship of WHO. Some of these institutions also have curricula which include basic disaster epidemiology and information systems for disasters.

Decreases in mortality in several disaster situations can be attributed to contributions from disaster epidemiology over the past twenty years. These include decreased deaths from tornadoes in the United States in recent years and the marked

ecrease in the frequency and magnitude of measles outbreaks in refugee camps since 1985. Other examples can be seen in the Annexes to this report. In the coming decade, wider acceptance of the role of epidemiology in disasters may lessen the crisis management approach and should help to reduce morbidity and mortality.

E. CRITICAL ISSUES ANALYSIS

There are a number of problems faced by epidemiologists involved in disaster situations. These include problems related to the political environment, and the rapidly changing social and demographic perspective. Data must be collected rapidly under highly adverse environmental conditions. Critical information (e.g., building damage, location of entrapment, details of the victim location and extrication process and on-site medical care) are "perishable," and are usually irretrievable unless collected very early.

It is important to link information gathered by epidemiologists in disasters to a management decision process. This information is clearly an essential requirement for determining appropriate relief supplies, equipment and personnel needed to respond effectively to such catastrophic events. Standardized procedures for collecting data in disasters need to be developed that can then be linked to operational decisions and action. An organized approach to data collection in disaster situations assists in improving decision-making and predicting a variety of options that disaster managers need to face.

These decisions vary depending on the different phases of a disaster. Similarly, a variety of epidemiologic methods have been demonstrated to be of value before, during and after disasters. Thus, at the pre-impact phase the decisions are concerned with delineating the at-risk populations, assessing the level of emergency preparedness and the flexibility of the existing surveillance systems, and training of personnel. In the predisaster phase, epidemiologic methods can be used in community vulnerability analyses. Vulnerability analysis involves the collection and assessment of information on

mmunities at risk from hazards, including data on the performance of structures and lifeline systems during past disasters (eg. utilities such as water, electricity and gas, health facilities, etc.). During impact, characteristics of the affected population and the need for emergency services have to be assessed quickly. As stated previously, rapid assessment techniques have recently been developed by WHO with the assistance of several of the collaborating centers. In the post-impact phase, continuous monitoring and surveillance of the health problems faced by the affected population, and information on long-term rehabilitation and health services reconstruction is required. After a disaster, epidemiologic methods can also be used to evaluate the effectiveness of health intervention programs. Glass, et al have emphasized the need for post-disaster epidemiologic follow-up studies to serve as the basis for planning strategies to reduce impact-related morbidity and mortality in future disasters (Glass RI, 1980).

Disaster epidemiology, however, needs to go beyond a descriptive concern and address more analytic issues of etiologic relationships. For example, surveys need to collect data that is detailed and specific enough to be useful for interventions. The availability of questionnaires prepared prior to the disaster and that can be adapted and modified quickly will assist in an efficient data collection operation.

During the past 10 years, considerable attention has been devoted to the general area of disaster loss estimation, however, little attention has been devoted to the more specific estimations of disaster casualties. Yet casualties are of prime concern to those who commission loss estimations- public and private sector organizations whose responsibility is life safety. Disaster loss estimation projects should aim to provide a sound basis for development of comprehensive casualty estimation methodologies that combine the most efficient and effective casualty estimation techniques and the most current theories and data. In addition to improving our ability to estimate casualties in future disasters, this research will lead to 1) developing more realistic planning guidelines; 2) developing better response programs; 3) predicting disaster impacts on

specific sub-populations for planning purposes; 4) planning for the allocation of supplies and medical resources in the immediate post-disaster environment; 5) developing more effective medical training, search and rescue and self-help programs and 6) assessing feasibility and designing disaster appropriate warning systems.

It must be remembered, however, that the primary concern of disaster epidemiology is to improve decision-making and public health action.

PROBLEM IDENTIFICATION WITH REGARD TO PROGRAMME DEVELOPMENT

1. The main weakness in present disaster management programs is the absence of a cohesive information collection plan. It important that a framework be established whereby necessary information will become available at the appropriate time.
2. Most relief agencies concerned with disaster- and there are estimates that these now number several hundred worldwide- regard relief as an entirely operational affair. Many of these organizations refuse to acknowledge that useful generalizations may be drawn from past experiences of the effects of disasters and the types of relief rendered which may be useful in future relief operations. Very few of these organizations evaluate the effectiveness of their programs, or allocate resources to operations research. As a result, few agencies have been prepared to accord a high priority to systematic observation and record-keeping and much valuable experience has been lost.
3. Epidemiologic information gathered in past disasters has often not been linked to a management decision process, nor integrated with management training.
4. Lack of validated indicators for rapid assessment of the health effects of natural and man-made disasters and related health needs under highly adverse field conditions.
5. Absence of valid casualty estimation models for planning and response

(predisaster modelling for simulation of disaster impacts). Such health indices should be incorporated into hazard maps, and used in hazard microzonation.

6. The study of disasters has tended to follow narrow specialty lines. Although many aspects of disasters have been intensively studied, and some, such as the geophysics of earthquakes, have led to considerable advances in understanding the causes of natural catastrophes, there have been few successful efforts at integrating knowledge obtained from different disciplines (eg. health/medical with structural engineering or meteorology).

7. Too few people are trained to deal with disaster-related health problems. Most schools of public health, medicine, nursing and other health professions in the world do not offer any courses on disasters, let alone a formal program.

8. The lack of time in which to organize an epidemiologic investigation, the reluctance of relief workers to keep records, the movement of populations from and within disaster areas, and many other factors, work against accurate and complete observation.

9. Disaster-affected countries or regions may lack persons with the epidemiologic expertise as well as trained support staff, and data-handling and communications equipment to conduct rapid assessment surveys.

10. Disasters in many developing countries occur in a setting in which it is inherently difficult to follow people long-term. It is also often impossible to identify appropriate control groups for clinical-epidemiological studies. At the same time, there are deficiencies in personnel, training, equipment, and supplies for large-scale, population-based, long-term surveys of affected individuals.

11. The need for specific supplies and equipment such as blood, plasma,

antibiotics, casting material and kidney dialysis machines is rarely determined on a rational basis resulting in inappropriate delivery of such items (Autier P et al, 1990). Therefore, operational investigations are needed to determine what medical supplies and equipment are:

- Actually needed (based on number and nature of injuries and standard acceptable treatments).
- Most commonly requested at local and national levels.
- Most commonly provided by the national or international community.

In the past, these three categories have differed significantly.

G. PROPOSALS FOR STRATEGY AND IMPLEMENTATION

General

1. Convene Colloquium on Disaster Epidemiology (the last International Colloquium on Disaster Epidemiology was held in 1975 organized by the Centre for Research on the Epidemiology of Disasters). The first Colloquium was influential in sensitizing governmental and non-governmental organizations to the importance of disasters as a public health problem. In the 15 years since this last meeting, much new knowledge has been gained in the field of disaster epidemiology, through descriptive and analytic studies as well as simple trial-and-error. As a result, epidemiologic principles have been applied to disaster preparedness and management with increasing frequency. The basic purpose for and objectives of a second Colloquium on Disaster Epidemiology can be summarized as follows:
   - To review the state of the art in the rather diverse field of disaster epidemiology.
   - To define the scope of the problem area and establishment of an action

agenda for WHO.

- To identify relevant expertise. Who are the individuals/organizations who have made, or have the potential for making significant contributions in this area.
- To identify and unify relevant sources of data
- To introduce the problem area to related research communities and begin communication between relevant groups, including epidemiology, architecture, structural engineering, agronomy, emergency medicine, and sociology.
- To enhance communication between the research community and the user or practitioner community concerned with disaster relief.

2. Propose a program of international cooperation in disaster epidemiology focusing on health/medical concerns as a part of the overall endeavors of the International Decade for Natural Disaster Reduction (IDNDR). It is important for WHO to develop permanent linkages with cooperating scientific and technological institutions in other countries, particularly in the developing world. By so doing, WHO can play a decisive role in developing institutions that are devoted to disaster preparedness and response in these countries. As part of an international program in disaster epidemiology, WHO should support/encourage a multidisciplinary approach to assessing health effects of disasters. Engineers, social scientists, psychologists, administrators, economists, agronomists, and geographers, have been or are conducting a number of studies on natural and technological disasters. These studies have provided new insights and have proved most useful in preparing for disasters and increasing the effectiveness and acceptance of relief operations. The epidemiology of disasters needs the contributions of such a wide diversity of fields, since the health component is only one part of the broad disaster

problem and perhaps, not the major one. It also requires the expertise of all branches within the discipline of epidemiology, eg. communicable disease, chronic disease and health care epidemiology, and it needs the contributions of both medical and social epidemiologists.

3. Create an epidemiology expert working or advisory group to assist WHO in developing a sound policy in regards to disaster epidemiology.

Operations

4. Support the development of standardized procedures for collecting data that can then be linked to operational decisions. Improved techniques for the measurement and analysis of disaster-related data need to be developed (e.g., survey sampling methods, data collection strategies, surveillance techniques, etc.).

5. Disaster Information Systems. Greater use should be made of existing information systems and record linkages to established data bases suitable for epidemiologic research (e.g. CRED Disaster Database). WHO should encourage the following: 1) the basic concept of local, national and international disaster-related health information systems; 2) the identification of tools necessary for developing such systems (guidelines, manuals, models); 3) specific recommendations on technical cooperation at national and international levels; 4) developing an appropriate training program for the personnel working in information systems

6. Support efforts to standardize disaster terminology and nomenclature, technologies, methods and procedures, etc. (See paper by Holloway and Dick). These include types of emergency supplies, assessment of needs, vulnerability analysis, etc. Disaster workers and epidemiologists in all parts of the world would benefit from the development of common denominators and a universal

language allowing for better international understanding and easier comparison of data on a worldwide basis.

7. Support the development of a unit for health surveys within ministries of health. Such survey units or epidemiologic teams would be valuable for on-the-spot assessments, and continuous monitoring and surveillance of the health problems faced by the affected population. Such a unit could identify health problems in their early phases and allow timely interventions as well as serve to evaluate the efficiency and effectiveness of delivery of services to the affected population. At the same time, this would advance the potential for more rigorous case studies and longer-term longitudinal studies. Finally, the development of a focus for disaster epidemiology in ministries of health will greatly contribute to the strengthening of public health infrastructure in emergency preparedness and response- which should always be a major priority of WHO.

Training

8. Training in disaster epidemiology. WHO should support the training of public health workers in epidemiologic principles and methodology to assess and evaluate disaster-related morbidity in disaster-prone countries. Technical cooperation with and among different countries (e.g., TCDC) in the area of disaster epidemiology training may be achieved by providing them with information, expert services, and advice, and by stimulating and supporting research and training. Clearly, there is also an important role for the Collaborating Centers in this area. Such an effective instrument of technical cooperation will greatly support the United Nations in its overall effort towards the reduction of the effects of natural disasters during the IDNDR.

Research

9. Provide indirect and/or direct support of an international network of leading investigators and institutions in disaster research throughout the developed and developing worlds to provide high-level scientific and technical guidance. For example, WHO should encourage/support well-designed and carefully conducted studies, carried out by epidemiologists to more comprehensively define and detail many of the risk factors for death and injury related to individual disasters.
10. Provide disaster epidemiologists with assistance in securing advanced approval of disaster-prone countries in order to permit an immediate implementation of epidemiologic studies should a disaster occur.
11. Provide direct technical, material or administrative field support of disaster epidemiology projects according to a pre-established plan of action and protocol. The direct participation of the WHO in carefully selected disaster epidemiology projects will be, in many cases, an essential condition of acceptability by the disaster-prone country and the funding agency, as well as a factor in the success of the studies to be carried out during the actual emergency.

H. SUMMARY

Thorough predisaster risk analysis and postdisaster health assessment should be a goal of the World Health Organization. This requires the systematic and objective measurement of the overall effects of the disaster impact, specific health care needs of the survivors, local resources to cope with the event, and the extent of response to the disaster by local authorities. The epidemiologic data base can have a major impact on public policy provided it is valid, reliable and timely. The development of valid methods for rapid assessment of needs under highly adverse conditions in disaster-stricken

ocieties will require considerable research and additional resources. WHO should support research which will improve postdisaster assessment information systems, define the information that should be collected, including the methodology of assessment, and techniques of data collection. Following a classification of epidemiologic issues in disaster situations, a systematic protocol needs to be developed on the international scene to bring about a stronger scientific base to disaster epidemiology. However, it must be remembered that the primary concern of epidemiology in disasters is public health action and emergency decision-making. The objective should be to develop standardized procedures for collecting data that can then be linked to operational decisions. In summary, disaster epidemiology provides the tools for acute problem solving in public health emergencies and is instrumental in having a direct impact in relieving human suffering.

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CASE STUDY 1

Epidemiologic Assessment of Newly Arrived Kampuchean Refugees in Thailand, 1979

In October, 1979, 35,000 Kampuchean refugees crossed into Thailand and were relocated in refugee camps on the Thai-Cambodian border. This group represented the initial wave of more than 200,000 refugees requiring relief assistance. In the aftermath of this immigration, chaos ensued concerning the health needs of the refugees. Moreover, during the first week so many deaths occurred that the camps were called "death camps" by the press, and the relief efforts were deemed to be ineffective. At the same time, no data was available to assess the refugees' health status or their requirements for specific assistance.

With rapid epidemiologic assessment including surveys for malaria, malnutrition, morbidity in field hospitals, and counting of deaths, information became available within one week that was critical to organizing the relief effort. These interventions included grouping patients with cerebral malaria to receive intense treatment by a group of physicians with special training in the disease, rehabilitation of young children with malnutrition and anemia, prevention of epidemic diseases including meningococcal meningitis, and provision of basic health services. The effect of this effort has been documented in the attached publication. The data provided was key to organizing the relief effort and in making the interventions appropriate to the diseases of the population in need.