The Historical Development of Public Health Responses to Disasters

Eric K. Noji  
Centers for Disease Control

Michael J. Toole  
Macfarlane Burnet Centre for Medical Research

Introduction

With both disasters and the number of people affected by such events on the increase, the importance of disasters as a public health problem is now widely recognised. This is reflected by the growing number of manuscripts submitted to peer-reviewed journals on topics such as disaster epidemiology and disaster medicine. Since the journal Disasters was first published in 1976, a score or so of important publications on public health aspects of disasters have added substantially to the body of knowledge on the public health consequences of disasters and have either influenced or changed disaster relief practices. We review some of them here in order to highlight the historical development of the 'state of the art' of public health in disaster situations.

Natural disasters

In the early 1970s, major natural disasters in Peru, Nicaragua and Bangladesh (at that time, East Pakistan) heightened awareness of disasters as a major public health problem. Western, in one of the earliest reviews on the role of epidemiology during natural disasters, observed 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,
In November 1970, a tropical cyclone struck the coast of Bangladesh resulting in over 250,000 deaths. A paper published about a year later in *The Lancet* by Sommer and Mosley summarising the health surveys conducted following the cyclone’s passage vividly demonstrated the numerous complex problems faced by epidemiologists in disaster situations and the value of early on-the-spot assessments in getting an accurate picture of requirements in disaster areas (Sommer and Mosley, 1972). This was an important paper that emphasised for the first time the need for valid and timely data collection and analysis as the basis of rapid and effective problem solving during natural disasters.

In February 1976, a major earthquake struck Guatemala leaving an estimated 23,000 dead. This earthquake served as a landmark event in the history of studies of the medical and public health impact of disasters. Important epidemiologic studies conducted following the 1976 earthquake in Guatemala pinpointed significant logistical deficiencies in the international disaster relief system (Spencer et al., 1977; de Ville de Goyet et al., 1976). In particular, authors from the then recently established Centre for Research on the Epidemiology of Disasters (CRED) in Belgium provided new insights that proved most useful in preparing for disasters and increasing the effectiveness and acceptance of relief operations (Lechat, 1976). For example, Lechat and de Ville de Goyet identified many myths and erroneous beliefs that are widely associated with the public health impact of disasters. These include the following:

- **Myth Number 1:** Foreign medical volunteers with any kind of medical background are needed. **Reality:** The local population almost always covers immediate life-saving needs. Only medical personnel with skills that are unavailable in the affected country may be needed.
- **Myth Number 2:** Any kind of international assistance is needed, and it is needed now! **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. As a matter of fact, most needs are met by the victims themselves and their local government and agencies, not by foreign intervenors.
- **Myth Number 3:** 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.

Furthermore, Lechat and de Ville de Goyet described how in the absence of an adequate field assessment, disaster scenes were often cluttered by unnecessary/useless/outdated/unlabelled drugs, vaccines for cholera and typhoid fever that were not needed or effectively used, medical and surgical teams without proper support and relief programmes that did not address immediate local needs. Since these relief operations were often conducted under the watchful eye of the media, medical relief efforts were pejoratively termed by the authors as ‘the second disaster’.

These early series of papers were very influential in sensitising governmental and non-governmental organisations to the importance of disasters as a public health problem. It was during this period of time in the mid-1970s that specialised emergency units were established by the World Health Organization and the PanAmerican Health Organization (PAHO).

The Guatemala earthquake was also important from the perspective of public health prevention and disaster research methodology. A major ground-breaking paper in the
journal Science by Roger Glass and colleagues described the first application of analytic epidemiology to the investigation of health effects of a disaster (Glass et al., 1977). It was the first attempt to identify risk factors for specific outcomes such as death and injury in order to develop effective strategies to prevent future disaster-related morbidity and mortality. The article described a case study of the relationship between death or injuries and the type of traditional housing structures and concluded by providing recommendations on simple construction measures to reduce deaths and injuries in earthquakes. The Glass study of the Guatemala earthquake yielded new information that altered traditional thinking about the prevention of disaster-related mortality and set the stage for all disaster epidemiology research over the following twenty years.

Not surprisingly, the next major paper on reducing health effects of a natural disaster was also written by Glass in 1979 when he turned his attention from earthquakes to the problem of preventing deaths and injuries from tornadoes (Glass et al., 1980). Despite widespread dissemination of tornado citizen-safety recommendations and guidelines in the United States, the effectiveness of these recommendations in reducing the toll of deaths and injuries had never been tested. Glass and colleagues examined the circumstances of death and severe injury among victims of a tornado disaster in Wichita Falls, Texas, and the protective measures taken by a representative sample of community residents who suffered no major injury, a practice that was found useful in identifying new prevention strategies. People in mobile homes or in motor vehicles were found to be at greatest risk. Information presented in the Glass earthquake and tornado articles have provided the scientific basis for increasingly effective prevention and targeted intervention strategies to decrease mortality in several different disaster situations. For example, results of the tornado study just described and those of others who have followed Glass's lead have changed local land-use regulations regarding the level of danger represented by mobile homes and safety guidelines for topics like fleeing in cars.

Before Mt St Helens in 1980, little information was available in the literature on the health effects of volcanic eruptions. The Mt St Helens blast generated more studies and investigations regarding health effects than any other single volcanic eruption. In 1986, an entire supplemental issue of American Journal of Public Health summarised key findings of many of these investigations (Buist and Bernstein, 1986). The historical importance of this particular issue of AJPH lay in its comprehensive overview of virtually all existing knowledge (and most of what is still known today) about the health effects of explosive volcanism and appropriate control measures.

During the past 15 years, the uses of epidemiology in disaster situations has been reviewed in a number of reports with periodic updates on the 'state of the art' appearing every few years. As a result, a considerable body of knowledge and experience has been regularly documented (PAHO, 1981; Logue et al., 1981; Western, 1982; Seaman, 1984; Gregg, 1989; Lechat, 1990; Noji, 1997). These updates and reviews have provided readers with substantial technical descriptions of each type of natural disaster, pertinent summaries of previous disasters and copious data on findings from past epidemiologic investigations and their public health consequences. In particular, the paper by Logue and colleagues provides an excellent summary of the great variety of research designs, methods, study groups and data-collection instruments that have been used over the years to study post-disaster health effects. A common theme that runs through every single report is that although all natural disasters are unique, there are some similarities...
in their health effects which, if recognised, can ensure that health and emergency medical relief and limited resources are well managed.

With regard to disaster relief efforts, since the 1970s, as already noted, it has been recognised that international disaster assistance has been plagued by inappropriate donations, non-essential pharmaceuticals and a diversity of medications. After several years of study (based on epidemiological data, population profiles, disease patterns and certain assumptions borne out by emergency experience), field-testing and modifications, standard lists of essential drugs, medical supplies and equipment for use in an emergency were first published in 1984 by the World Health Organization (WHO) with the assistance of UN High Commissioner for Refugees (UNHCR) and the London School of Hygiene and Tropical Medicine. It was called an ‘Emergency Health Kit’ and updated in 1990 with additional contributions by others such as UNICEF, Médecins Sans Frontières (MSF), International Federation of the Red Cross and Red Crescent Societies and International Committee of the Red Cross (now called “The New Emergency Health Kit”) (World Health Organization, 1984, 1990). The WHO Emergency Health Kit has now been adopted by most relief organisations and national authorities as a reliable, standardised, inexpensive, appropriate and quickly available source of the essential drugs and health equipment urgently needed in a disaster situation. In addition to the development of the WHO Emergency Health Kit in the early 1980s (e.g., medications for 10,000 people for three months), another major innovation during the past 10–15 years has been the introduction by MSF of pre-packaged specialty kits (e.g., emergency surgery, cholera, immunisation, sanitation, etc.).

Unfortunately, despite these admirable attempts at defining essential drug lists and providing some degree of standardisation, on-the-ground problems persisted with unsorted shipments, unintelligible labelling, perishable goods, out-dated products, late arrival and customs restrictions. For example, after the 1988 Armenian earthquake, the international relief community sent no less than 5,000 tons of drugs and consumable medical supplies to the country. According to a simple, yet elegant analysis by Autier and colleagues from MSF, because of difficulties with identification and sorting, only 30 per cent of the drugs were immediately usable by the health workers in Armenia; 11 per cent were useless and 8 per cent had already expired (Autier et al., 1990). Ultimately, 20 per cent of all the drugs provided by international aid had to be destroyed. Furthermore, it took 50 people six months merely to inventory the drugs sent to Armenia in the first few weeks after the earthquake. More positively, articles such as this one and earlier ones by Lechat and de Ville de Goyet, were followed by a major initiative of PAHO to develop a computer system called SUMA (Supply Management) which is designed to sort, classify and make an inventory of relief supplies at the port(s) of entry in a disaster-affected country in order to assure appropriate distribution.

Another important reason why the usefulness of international disaster assistance has been diminished by inappropriate donations and non-essential pharmaceuticals and other supplies (in addition to unrealistic requests by disaster-affected communities) has been the lack of assessment of real needs by potential donors and other relief organisations. Several articles over the years have been published that describe efforts to develop rapid and valid epidemiologic assessment techniques. Guha-Sapir and Lechat, for example, have developed useful needs-assessment indicators for use following natural disasters (‘quick and dirty’ surveys) (Guha-Sapir,
The former's article described an organised approach to data collection in disaster situations that provided much useful guidance to disaster managers when they need to make crucial decisions based on sound information.

Lechat and Guha-Sapir also point out the great difficulty in applying well-known or standardised epidemiologic techniques in the context of great destruction, public fear, communal disruption and the breakdown of the usual infrastructure for collecting and assembling data. As a result, in their discussion of assessment methods, they highlight the importance of simplicity, speed of use and operational feasibility. Articles such as this clearly served as the inspiration to WHO in the 1990s to sponsor the development of a series of written protocols on rapid needs assessment in several different disaster situations (e.g., natural disasters, sudden population displacements, famine, communicable disease outbreaks and chemical accidents).

During the late 1980s and early 1990s, interest in the epidemiology of natural disasters clearly accelerated. Several university research centres now concentrate on the health and medical effects of disasters, including collaborating centres under the sponsorship of WHO. Some of these institutions have also developed curricula that include basic epidemiology and information systems for disasters. In addition, new professional societies and scientific forums for the presentation of original work in this field have appeared.

One such scientific forum was held in July 1989 at Johns Hopkins University in Baltimore. This symposium, entitled 'The International Workshop on Earthquake Injury Epidemiology for Mitigation and Response', brought together a group of interested professionals, all directly or peripherally interested in the research, planning, mitigation and response aspects associated with earthquake-induced injuries and deaths. It aimed to build on the foundations laid by Glass in the mid-1970s: identifying critical knowledge gaps and developing a research agenda for the study of earthquake health effects. Practical preventive interventions which could be based on research findings were discussed during the workshop, and some agreement on data-collection needs and methodologies was reached. But the truly unique contribution of this workshop was its emphasis on the absolute requirement of a multi-disciplinary scientific approach to the successful study of earthquake-related injury. 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. Working alone, neither structural engineers nor epidemiologists can provide a complete description of the health effects of such disasters.

Over the years, the lessons drawn from this symposium on earthquakes have proven very useful to the prevention of deaths and injuries in other natural (and technological) disasters. The widely disseminated proceedings of the Johns Hopkins University Workshop have been used by other scientists, planners in urban and rural development and, perhaps most importantly, by government agencies charged with maximising the safety of citizens in earthquake-prone parts of the world (Jones et al., 1989).

Complex humanitarian disasters

Two decades ago, the term 'complex humanitarian disasters' was not commonly used. The focus of attention was usually the plight of refugees fleeing conflicts related to the
tensions between the two superpowers, the Soviet Union and the United States. Much has changed in the intervening years. First, the geopolitical context has altered dramatically with an initial increase in the intensity and scope of Cold War-related conflicts in the 1980s followed by the collapse of the Soviet Union and the subsequent epidemic of ethnic and religious conflicts. Second, the public health impact of armed conflicts on civilian populations has significantly worsened, especially during the five years since the end of the Cold War. Third, on a more positive note, there has been a steady increase in technical publications in the form of journal articles, books and manuals documenting public health outcomes and proposing more effective responses to conflict-associated population emergencies. The term ‘complex humanitarian disaster’ reflects the multi-causal nature and complicated response mechanisms of recent emergencies. In terms of their public health impact, complex humanitarian disasters may be defined as ‘relatively acute situations affecting large populations, caused by a combination of factors, generally including civil strife or war, often exacerbated by food shortages and population displacement, and resulting in significant excess mortality’ (Burkholder and Toole, 1995).

Although several articles appeared in medical journals during and after the Biafran and Bangladesh conflicts (Mayer, 1969; Seaman, 1972), there was a marked increase in the number of published papers relating to the health problems of refugees during the late 1970s and early 1980s. This coincided with the exodus of millions of refugees from Indo-China and Afghanistan into neighbouring countries, such as Thailand and Pakistan. Articles began to appear describing public health assessment and surveillance methods and accurately documenting the major health problems of refugees in south-east Asia. Once again, Roger Glass was at the forefront of this trend (Glass et al., 1980). Subsequently, the CDC published a comprehensive monograph which documented the context, health services organisation, disease control programmes, public health surveillance and other aspects of the refugee crisis in eastern Thailand between 1979 and 1982 (Allegra et al., 1983). During the same period, Disasters published an entire issue devoted to refugees (1981) and the first textbook on refugee health was published (Simmonds et al., 1983).

During the early 1980s, international public health was heavily influenced by the Alma Ata Declaration by UNICEF and WHO which promoted primary health-care (PHC) as the most effective approach to addressing the developing world’s health problems. Stephanie Simmonds and Bruce Dick, from the London School of Hygiene and Tropical Medicine, were particularly active in suggesting that refugee health programmes should be based on the PHC model and should give refugee communities a greater role in planning and implementation (Dick and Simmonds, 1985). Perhaps the most successful attempt to apply PHC principles to a large-scale refugee health programme took place in Somalia in the early 1980s. An estimated 700,000 ethnic Somali refugees fled armed conflict in Ethiopia and were dispersed in 35 camps. With the support of UNHCR, international NGOs and CDC, the Somali Ministry of Health’s Refugee Health Unit (RHU) developed a programme that stressed disease prevention, health education, standard treatment protocols and essential drugs and the training of more than 2,000 refugee community health workers and traditional birth attendants. The programme was outlined in a manual that was among the first of its kind (Somali Ministry of Health, Refugee Health Unit, 1982).

Throughout the 1980s, CDC published regular bulletins through its widely disseminated Morbidity and Mortality Weekly Report (MMWR). These articles
comprise the most comprehensive summary of the public health impact of refugee emergencies during that decade and include reports from refugee populations in Thailand, Somalia, Pakistan, Sudan, Malawi and Ethiopia as well as famine situations in Mauritania, Mozambique, Niger and Burkina Faso. One effect of these reports was an increased emphasis on the use of epidemiological assessments to develop programme priorities.

A series of technical manuals was also published providing detailed guidelines for various aspects of refugee and emergency nutrition. The first manual on applied nutrition in emergencies was published in 1978 (de Ville de Goyet et al., 1978). Then, in the mid-1980s, Oxfam published a manual on selective feeding procedures (Lusty and Disket, 1984). During the same period, some progress was made in standardising methods of assessing the nutritional status of populations through anthropometric surveys. Consensus on definitions of acute and chronic malnutrition was greatly assisted by a Working Group convened by WHO which established the NCHS/WHO reference population as the standard comparison group for nutrition surveys (WHO Working Group, 1986). In the second half of the 1980s, UNHCR and UNICEF published emergency guidelines which included extensive sections on health, nutrition, water and sanitation, while one of the first extensive clinical manuals for emergencies was published by MSF (Desenclos, 1988). A second textbook on refugee health was also published focusing on the clinical management of diseases (Sandler and Jones, 1987).

In the late 1980s and early 1990s, the major sources of articles were CDC, MSF and the Paris-based Epicentre. Authors at CDC published a series of articles summarising the major causes of mortality in refugee and displaced populations and proposing strategies to reduce excess mortality. CDC studies clearly documented evidence that mortality rates among refugee populations were sometimes 10 to 20 times higher than death rates in their countries of origin. Several widely cited papers were also published by the Journal of the American Medical Association in its annual Hiroshima commemoration issue (Toole and Waldman, 1990). Meanwhile, several articles in the Bulletin of the World Health Organization provided detailed guidelines for the prevention and control of specific diseases (e.g., vitamin-A deficiency, measles and meningitis). The article on measles control was noteworthy in that it proposed a strategy that deviated from standard measles prevention policies in non-refugee populations (Toole et al., 1989). Thus, a sub-specialty of international health was developing which had its own methods, policies and practices appropriate for refugee settings. This development was given impetus by the first international refugee health conference sponsored by Georgetown University in Washington, DC in 1988.

In the 1990s, emergency surveillance bulletins published in the MMWR included reports from Guinea, Zimbabwe, northern Iraq, Malawi, Somalia, Sudan, Rwanda, Burundi, Zaire, Russia, Armenia and Bosnia and Herzegovina. CDC summarised its accumulated knowledge of the public health consequences of humanitarian emergencies in a special 1992 Recommendations and Reports issue of the MMWR (CDC, 1992). MSF was particularly active in publishing timely reports on cholera, dysentery, meningitis, leishmaniasis, scurvy and pellagra outbreaks in various emergency settings (Moren et al., 1988). These articles played a key role in establishing epidemiology as a routine field tool and in developing a more professional approach to the practice of public health in emergency settings. Reports on scurvy and pellagra epidemics reinforced the notion that public health and nutrition in emergency
settings had its own unique characteristics (Malfait et al., 1993). Other NGOs such as Save the Children, Concern and Oxfam routinely used the letters section of The Lancet to release information and debate refugee health policy issues. Recognition of the unique circumstances of emergencies led several NGOs to develop specific training courses for their public health workers (Health Emergencies in Large Populations, ICRC; Populations en situations précaires, MSF).

The series of publications during the period of 1978 through 1992 clearly documented the major public health priorities in refugee emergencies: malnutrition, diarrhoeal diseases, measles, malaria and acute respiratory infections. Guidelines and manuals ensured a relatively standard approach to public health in emergency settings. Adequate food rations, clean water, sanitation and shelter were recognised as the major relief programme priorities. Consensus was reached on minimum caloric and micronutrient requirements (at least 2,000 kilocalories per person per day), as well as the minimum quantity of clean water (15 litres per person per day). Measles immunisation was identified as the most urgent and cost-effective medical intervention. Reflecting this, while extensive measles outbreaks were the norm in refugee camps in the early 1980s, they were relatively rare 10 years later. Technical guidelines were published on a broad range of public health issues affecting refugees and displaced persons, including reproductive health, HIV/AIDS and STD prevention and control and tuberculosis control. In addition, the concerns of earlier authors such as Simmonds and Dick that refugee health programmes take a PHC approach were accepted and acted upon by many relief organisations.

While our understanding of the public health problems of refugees and the displaced has steadily improved, the causes of — and response mechanisms to — man-made emergencies have become significantly more complicated. Whereas the focus of assistance programmes in the 1970s and early 1980s was on refugees who had crossed borders to escape armed conflicts; in the 1990s it was often necessary to provide assistance to civilians still in the proximity of the conflict or displaced within their own countries. Civil wars in southern Sudan, Somalia, Liberia, Afghanistan, Georgia, Tajikistan, Chechnya and the former Yugoslavia have had profound effects on the health of local civilian populations. Increasingly, civilians have become the intentional target of violence. Hundreds of thousands of civilians have been trapped in urban enclaves and siege-like situations where public utilities have been destroyed and basic medical services have collapsed. The provision of humanitarian assistance in these settings has proven to be extremely difficult and dangerous.

The public health impact of complex disasters in the 1990s has been extensively documented. The Lancet and JAMA have both published reports on emergencies in northern Iraq, Somalia, Bosnia and Herzegovina, Nepal and Zaire. One useful article that appeared following the Somali emergency documented the different approaches to the collection of public health information among various agencies (Boss et al., 1994). Several years later, however, when one million Rwandan refugees fled into the eastern Zaire province of North Kivu, there was a remarkable degree of co-operation and standardisation of information-gathering methods among the agencies present. This was reflected in a landmark article jointly authored by 24 epidemiologists from the Zaire Ministry of Health, WHO, UNHCR, CDC, MSF, the French Army and the Red Cross (Goma Epidemiology Group, 1995).

The series of complex humanitarian disasters in the early 1990s provoked intense interest in the international community. The inability of the world promptly to
intervene to protect innocent civilians from slaughter in the former Yugoslavia and genocide in Rwanda has highlighted the need for more effective preventive diplomacy and conflict resolution. Several books on complex humanitarian disasters have been published in the past two years (Noji, 1997; Levy and Sidel, 1997; Perrin, 1996). These books have attempted to address both contextual and technical issues.

In addition to publishing numerous technical reports and guidelines, MSF now annually publishes a book which summarises the geopolitical and ethical aspects of current humanitarian crises. The content of these reports is often bleak and brutally honest in its appraisal of the world’s record in protecting populations affected by conflict. The 1996 report questioned the massive provision of humanitarian assistance to the refugee camps of eastern Zaire which had been transformed into bases for the Hutu extremists responsible for the genocide in Rwanda (MSF, 1997). One can only conclude that no amount of technical improvement in the quality of emergency humanitarian assistance can mask the lack of progress achieved by the international community in preventing these same emergencies from occurring. One author of World in Crisis (MSF, 1997) concluded his chapter on the role of medical relief agencies as follows: ‘... many issues remain unresolved and hotly debated ... foremost is the challenge of working in the hostile and threatening environment of armed conflict in a global climate of political indecisiveness and moral inconsistency. While we await a concrete manifestation of the much-heralded new world order, relief agencies and the individuals who make up their field teams will continue to work on the front lines in an ethical limbo.’

Conclusion

Drought in the African Sahel, refugee crises in Zaire and the former Yugoslavia, floods in Bangladesh and earthquakes in Mexico City and Armenia may not have much in common, but in the investigation of all three, the epidemiologic approach has proved powerful. Results of epidemiologic research on disasters have formed the scientific basis for increasingly effective prevention and intervention strategies to decrease mortality in several different types of disaster situations. The influence of the publications reviewed here on the conduct of disaster relief and humanitarian assistance and the methodology of disaster research have been profound, and all continue to serve as important desk references for health professionals responsible for preparing for and responding to public health emergencies.

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Address for correspondence: Eric K. Noji, Chief International Emergency and Refugee Health Program, Mailstop F-48, Centers for Disease Control and Prevention (CDC), 4770 Buford Highway, Atlanta, Georgia 30341, USA.