ARE RADIATION EMERGENCIES LIKE OTHER EMERGENCIES?

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The nuclear reactor explosion at Chernobyl sent waves of anxiety and concern throughout industralized countries on an unparalleled scale. Does this public response reflect fundamental differences between emergencies related to nuclear energy and those resulting from other types of disasters? Are radiation emergencies like other emergencies? This paper compares technological emergencies, such as that at Chernobyl, to natural disasters, such as earthquakes and mudslides caused by volcanic eruption.

DEFINING AND CLASSIFYING DISASTERS

Attempting to define a disaster precisely invites disagreement among scientists, relief officials, and other experts. A working definition that has been adopted by the Pan American Health Organization (PAHO) is: a life-threatening ecological disruption occurring on a scale sufficient to exceed capacity of the affected community to respond.

In recent years, the extent of mass media coverage appears to be a key determining factor in the definition of a disaster: An emergency that makes the front page of newspapers or appears on prime-time television seems to be a disaster. This publicity influences the extent of official and public response and the level of resources mobilized.

Disasters are classified according to suddenness of onset and causal factors. Sudden-onset disasters would include earthquakes, hurricanes, and explosions; drought and famine would be examples of slow-onset disasters. Causal factors may be natural and involve climatic, seismologic, or volcanic hazards, or they may be technological--illustrating hidden costs of industralization and development--for instance, radiation or chemical releases, explosions, and modes of transportation. Conflicts and civil disturbances also lead to disasters of various kinds. In this paper, discussion is limited to sudden natural or technological disasters.

EMERGENCY PREPAREDNESS AND CONTINGENCY PLANNING

As in medicine, the best cure for disasters is prevention. Because prevention falls outside the direct responsibility of the health sector and, in the case of natural disasters, often outside the reach of society, it will not be discussed extensively. Preparedness, however, is within reach. Accepting the inevitability of catastrophic events in the foreseeable future, we should institute measures to help organize an effective and rapid response to disasters, and thus minimize public health consequences.

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The same principles, strategies, and approaches used to prepare for natural disasters also apply to technological disasters involving radiation or chemicals and include conducting vulnerability analyses, maintaining up-to-date inventories of resources, and developing response procedures.

An important first step is to assess potential hazards by carrying out a vulnerability analysis for each geographical area based on climatic, seismologic, geologic, or engineering studies. Worst-case scenarios are then formulated according to the location of communities or at-risk population centers. However, it is easier to map flood-prone or seismic areas than it is to predict the shift of radioactive atmospheric contamination following radiation emergencies. Worst-case earthquake scenarios tend to be unrealistically severe and beyond the capacity of the existing resources to meet adequately, while those developed for radiation emergencies are often mild and assume full containment with existing procedures.

Keeping an accurate inventory of resources that can be mobilized in an emergency is crucial regardless of the etiology of a disaster. The complexity of this inventory is directly proportional to the level of development of the country. The more skills, equipment, and institutional resources available, the more formidable this task becomes. Radiation emergencies, for the most part, remain the dubious privilege of countries that can afford nuclear technology. It is no wonder that authorities' familiarity with resources available for emergency response in wealthier countries will be less comprehensive than the more intimate knowledge of authorities in small, poorer nations with scarce human and material resources.

The success of contingency planning or formulating response mechanisms and procedures depends on a sound vulnerability analysis. Radiation contingency planning remains limited to experts in industry and lacks significant participation of the medical community and public. As noted in a JAMA editorial in 1986, no physician was listed among the 3,500 employees of the Nuclear Regulatory Commission.[1] In most countries, participation by communities and those in the health professions in planning for natural disasters is generally widespread and effective. A decade of promotion and technical cooperation by the PAHO in the field of emergency preparedness has fostered active participation of the medical community in Latin America in preparing for natural disasters.

PUBLIC AWARENESS AND WARNING

Preparedness cannot be complete without the participation of an informed public. Awareness of risks and available protective measures is proportional to education and, therefore, the socioeconomic level of the population. There is little scientific or social controversy about whether seismic or volcanic risks are significant in a given community, although individuals may chose to ignore it. The extent of

the risk posed by the nuclear power industry remains hotly debated. The Chernobyl and Three Mile Island emergencies suggest that the contention of a 100% safe industry is unsustainable. In brief, informed awareness about the two categories of risk differs appreciably.

A warning phase, "the last minute chance for awareness" before the actual impact of a disaster, plays a decisive role in getting a community organized. Warning signs act as yellow traffic lights, triggering emergency response mechanisms and inspiring the at-risk population to take protective measures. Premonitory signs of a volcanic eruption or a hurricane permit resources to be mobilized and individuals to adopt protective measures.

Reports of nuclear reactor mishaps range from misleadingly reassuring statements from the industry to unsubstantiated alarms from "experts" or private groups. Industry and government sources with direct access to the facts often are distrusted equally by the public. Highly technical information is known only by a few experts, but they may be unwilling or unable to translate it into terms that are understandable by the general public. This conflicting advice results in our traffic lights flashing randomly green, yellow, and red signals. In fact, some experts constantly see green, others red.

EMERGENCY RESPONSE

Emergency response management following any type of disaster is an exercise in decision-making under highly uncertain conditions. Securing and managing timely and reliable information are the keys to a successful response and are the most important differentiating features between natural disasters and radiation emergencies.

Table 1 illustrates the nature of information available to the public following natural disasters and radiation emergencies. The general public, the medical community, and the mass media comprehend the magnitude or nature of the risks of natural disasters. These are tangible: the earth shakes, hurricane winds blow, the house is under water. But the scientific and technical information available following radiation emergencies is difficult for the general public to grasp. There usually is no tangible indicator of risk. Combined with the potentially global nature of the threat, this lack of a personal yardstick with which to measure the risk leads to unsubstantiated fears on the part of the public and overreaction by the authorities.

Both types of emergency situations evolve in a highly emotional and political setting. On the one hand, public distrust is heightened after radiation emergencies by the perceived aura of secrecy and the vested interest in the technology. Nuclear energy and therefore radiation emergencies are a divisive social issue with well-entrenched opposing sides. On the other hand, after natural disasters, scientific information is freely available. Earthquakes, cyclones, and floods are not controversial. Blame need not be assigned because

TABLE 1

INFORMATION ON IMPACT AND HEALTH RISK

Natural Disasters	Radiation Emergencies
Risk is tangible, based on common sense, and understood by laymen	Risk is intangible, insidious, based on highly technical concepts, and scarcely understood by laymen
Risk is well defined and localized	Risk is diffuse, shifting with the winds, and potentially global

they are perceived to result from acts of nature rather than from human error. The fact that society may have played a contributing role, or that government may have lacked preventive foresight in terms of land zoning or building codes often can be overlooked in the aftermath of natural disasters (Table 2).

Few health personnel have lived and worked in disaster situations or have critically reflected upon them. As a result, myths based on unsubstantiated assumptions are common. For instance, after sudden-impact disasters, the following myths are often accepted unquestioningly by the public and some in the medical profession.

> The affected population and local authorities are unable to assume responsibility for their own survival. This becomes a self-fulfilling misconception when outsiders decide what is best for the affected country and undermine that country's resilience and creativity.
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> Foreign medical teams and volunteers are urgently needed to provide emergency medical care to victims. On the contrary, local health services often are better prepared than the international community to respond quickly to mass casualties. Most Latin American countries, for example, have a large number of well-trained physicians. Indeed, some even suffer from severe medical unemployment. International medical teams, volunteers, or field hospitals have caused logistic nightmares in past disasters. Usually they arrive too late to be of use in the emergency phase of sudden-impact disasters.[2]
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> Dead bodies constitute a serious health hazard, making mass burial a public health emergency measure. This myth is one of the most tenacious and is due, possibly, to stories about the great plagues of the Middle Ages. Corpses buried beneath a landslide or the debris of an earthquake are not a source of communicable diseases.
>
> Catastrophic outbreaks of communicable diseases inevitably occur within a few days, making mass immunization campaigns the most important public health priority. On the contrary, surveys have failed to detect severe epidemics of diarrheal diseases, typhoid fever, or other water- or food-borne diseases following earthquakes or volcanic eruptions in Latin America.[3-7] Postdisaster, improvised mass immunization campaigns, especially against typhoid fever and cholera, have been discouraged by the World Health Organization (WHO), PAHO, and Latin American governments. Similar misconceptions exist regarding immediate needs for blood supplies and food.

Undoubtedly, a situation as threatening and complex as a radiation emergency has its own myths. Therefore, the regional office of WHO in Europe convened a meeting of experts 10 days after the Chernobyl

TABLE 2

SOCIAL CONTEXT OF EMERGENCY RESPONSE

Natural Disasters	Radiation Emergencies
Information freely available	Aura of secrecy
Limited vested interest	Vested economic interest in technology
Nondivisive issue	Highly conflictive social issue
Act of nature	Result of human "error" or decision

explosion to review the findings of the monitoring network developed after the emergency and to sum up the most effective preventive measures.[9] Their report helped alleviate public fears concerning breastfeeding, outdoor activities, and the need for massive use of iodine tablets, and it prevented, for example, an unjustified ban on travel. More research is required to identify counterproductive myths and medical cliches concerning low-dose public exposures after radiation releases.

LONG-TERM CONSEQUENCES

A few weeks after the impact of a natural disaster, public life rapidly returns to normal. Although economic and social sequelae persist, the delivery of health services may even benefit from the crisis as responsible persons turn their attention to long neglected areas or replace inefficient or poorly located facilities. Following radiation emergencies, there is little opportunity or incentive to improve the health care system, which usually remains in place. Life, however, does not return to normal.

Morbidity and mortality caused by natural disasters quickly are past history. However, the cost in human lives and genetic abnormalities after radiation emergencies remains to be determined. Experts' opinions vary greatly on the magnitude of the excess mortality to be expected in the coming decades. All agree, however, that long-term epidemiologic follow-up is essential and must transcend national boundaries.[10]

CONCLUSIONS

The principles and mechanisms for managing emergencies at the national or international level are well known and apply to all types of disasters. However, radiation emergencies pose special problems, and balanced response based on technical criteria seems to be more elusive. Regardless of their positions on the issue of medical care following nuclear war or their opinions on the ecological merit of nuclear energy, health care personnel should become more knowledgeable and more involved in planning and implementing responses to radiation emergencies.

More dispassionate research is required to identify the myths and realities of emergency responses to radiation disasters and to formulate guidelines on the rational use of protective or curative measures. A well-informed and active medical profession is the essential ingredient for effective emergency preparedness and response.

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