

March 15, 1995

TO: Dr. Marie Andree Diouf  
Country Representative  
Pan American Health Organization  
Port-au-Prince, Haiti

FROM: Josephine Malilay, Ph.D.

VIA: Dana Van Alphen, M.D.

SUBJECT: Mortality associated with Tropical Storm Gordon in  
Haiti: a summary of preliminary findings

The following summarizes preliminary results of a field investigation on February 26-March 15, 1995 concerning mortality related to Tropical Storm Gordon in Haiti during November 13-14, 1994.

As you know, the Republic of Haiti experienced the effects of Tropical Storm Gordon, a complex weather system that passed across the western Caribbean Sea, Jamaica, Cuba, Florida, and the southwestern Atlantic. Initial reports by PAHO estimated that 1.5 million people were affected by the storm, with over 8,000 homeless families in inaccessible areas. Mortality was estimated at 1,122 persons, primarily among inhabitants of the Departments of the West and Southeast. The impact of Gordon in Haiti was especially noteworthy: 1) deaths occurred in spite of current forecasting, warning, evacuation, and sheltering measures for hurricanes; 2) deaths occurred in a country located in the periphery of the storm; and 3) deaths may have been due to environmental degradation, resulting from deforestation and erosion that facilitate water runoff, a major problem in recent years.

Accordingly, we conducted a community survey in conjunction with the National Red Cross Society of Haiti (HCR). The specific objectives were 1) to describe the causes of mortality related to the tropical storm and 2) to recommend prevention strategies at the community level for future disasters.

Initial activities consisted of meetings with officials from the HCR, regional government officials in selected disaster zones, and disaster-affected residents. Site visits were also made to four severely affected areas--Cite Soleil, Leogane, Kenscoff, and Jacmel. Under the auspices of the HCR, we conducted a community survey in three selected communes: 1) Jacmel, Department of the Southeast; 2) Leogane, Department of the West; and 3) Kenscoff, Department of the West. Selection of these communes was based on results of initial surveys of deaths counts and needs assessments conducted by the International Federation of the Red Cross (IFRC), the Haiti/Gordon/Comite d'Urgence, and topographical features of these areas.

We interviewed families of decedents from the selected communes and compared their responses to those of an estimated 300 households that were randomly selected from the same communes. Issues addressed circumstances of storm-related mortality, demographics, evaluation of warning, evacuation, sheltering systems, and risk factors including structural and geological determinants that may have contributed to death.

We obtained information of 83 case fatalities in Jacmel, 21 in Leogane, and 41 in Kenscoff. These figures represent 22 percent, 8.6 percent, and 55 percent, respectively, of storm-related deaths identified by the IFRC and the Tropical Storm Gordon Commission. However, it is interesting to note that in Kenscoff, the remaining 33 deaths identified by the Commission could not be verified by the volunteers.

The major cause of mortality in Jacmel and Leogane was drowning from inundating water. Almost all deaths in these areas, primarily among residents of river plains, were attributed to drowning and being swept away by flooding water. In Kenscoff, the principal cause of mortality was trauma and asphyxiation from mudslides. Again, nearly all deaths were attributed to these causes. Among 80 cases identified in Jacmel for which information about age and sex were known, mortality appeared to be equal among men and women and uniformly distributed throughout all age groups.

The pattern of deaths in this disaster could be explained in part by the lack of advanced warning in the community before heavy rains occurred. In all 3 communes, an overwhelming majority (99%) of respondents from the household survey described the lack of communication to their community about the heavy rains associated with Tropical Storm Gordon and the hazards that the rains presented. In almost all instances, the awareness of a disaster by household members was based on atmospheric conditions at the time, i.e., the rising level of water, the sound of rushing water and debris, and in other cases, the sudden roar of mudslides. In many instances, there was no time to react.

Deaths from most tropical storms, especially in the West Indies, are usually attributed to drowning from storm surge in low-lying coastal areas. The experience of Haiti in Tropical Storm Gordon, however, indicated that fatalities occurred from drowning from flooding water in riverbeds, trauma and asphyxiation from mudslides. Understandably, it may be difficult to generalize this pattern of death to that of other communes that experienced storm-related fatalities.

Clearly, warning and communications were the major issues in this disaster. According to the U.S. National Hurricane Center in Miami, a tropical storm warning had been issued for the southwestern peninsula of Haiti on November 13 at 0900 hours and

discontinued on the same day at 1500 hours. Given that a number of deaths occurred on November 12, perhaps a warning system for heavy rains should be instituted to allow for earlier lead time to implement appropriate safety measures. The gravity of the disaster may also have been minimized by the direct route taken by Tropical Storm Gordon. One resident in La Fond, Jacmel recalled a radio broadcast that described the storm's path through Jamaica and Cuba, but did not mention the hazards of heavy rains in Haïti.

Health and emergency management officials should realize that a tropical storm or hurricane is actually not the hazard, but that heavy rains in general present a high risk of death in both river plains and in mountainous areas. Accordingly, the sites where deaths occurred should be explored for soil, slope, and rainfall characteristics. These parameters could further be explored for their relationship to deforestation, which has led to changes in rainfall patterns.

Although the country is situated in the hurricane belt and is subject to severe storms from June to October, a lack of preparedness for Tropical Storm Gordon was observed in all three communes. The pervasive lack of preparedness is perhaps further exacerbated by the infrequent occurrence of major hurricanes in the area. Although located in an area prone to hurricanes, three hurricanes resulting mortality struck the country in the past 15 years: Hurricane Gilbert with 54 deaths in 1988; Hurricane Allen with 300 deaths in 1980; and Hurricane David with 8 deaths in 1979. It is conceivable that disaster preparedness may not be perceived to be important, as the last major storm occurred eight years ago.

## Recommendations

The major preventive strategy from this investigation is the institution of **community warning systems** by the HCR in zones that are subject to flooding and mudslides from heavy rains. Special attention should be given to address small, isolated communities within communes, particularly those in mountainous zones and in river plains.

Specific recommendations for preventive strategies address the warning and preparedness phases of the disaster continuum as follows. If you agree, please forward them to Dr. Claude Jean-Francois.

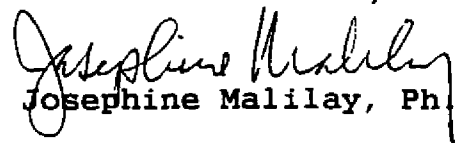
1. **Warning system.** A timely and effective alert system for communities subject to heavy rain is clearly needed in Haïti. HCR volunteers, presently approximately 2,000 should expand their base with outreach and training for additional volunteers from all communes.

2. Radio communications. A radio-based communications system is highly recommended for the affected communities, as radios are presently in use in the area. A specific channel could be dedicated for communicating warning messages to volunteers, who in turn could alert communities at risk. The system could be established and operated by the HCR.
3. Hazards-vulnerability analysis. The HCR can initiate a community hazards-vulnerability assessment in order to determine the areas at risk for death or injury from heavy rains. The sites where deaths occurred should be identified by geologists for soil, slope, and rainfall characteristics. A census of communities in these areas should also be obtained in order to determine populations-at-risk. This activity can be performed in conjunction with the Ministry of Environment, which oversees issues related to deforestation, soil erosion, water runoff and deforestation.
4. Emergency plan. Because of its organized structure in a country with fledgling government institutions, the HCR can initiate the drafting of community emergency plans in communes that are subject to flooding or mudslides from heavy rain. It is recommended that communities, particularly those which are situated on river plains, draft emergency plans within their respective neighborhoods as well. For example, in addition to a general emergency plan for the zone of Jacmel, a specific plan for the community of La Fond in Jacmel, should be drawn to incorporate evacuation, sheltering, and its components such as identification of safe shelters and mass care.
5. Training and exercises. Clearly, appropriate training of volunteers in communications and warning is a priority at present. As the HCR expands its cadre of community volunteers, it can also broaden its disaster preparedness activities to include training in evacuation, sheltering, and mass care. Drills and exercises are also recommended as part of any training regimen.
6. Training materials. In line with training, the HCR has requested copies (French version) of the World Health Organization's 1989 publication, "Coping with natural disasters: the role of local health personnel and the community". It is recommended that these publications serve as a basis for briefing officials at the national sector, followed by training at regional and local levels. The HCR has also requested disaster training materials, many of which have been produced by PAHO in recent years. These could easily be made available to the HCR.
7. Exchange of expertise. As a result of the 1970 cyclone, the Bangladesh Red Crescent Society has developed and maintained

a warning system for cyclone-prone areas in a country prone to the seasonal onslaught of cyclones and floods. Using local volunteers and radio announcements, the system is based on the maritime alert system, with warnings that increase in severity from 1 to 11. Past studies have shown that the system is successful in warning residents, although changes in shelter-seeking behavior have yet to be effected. It is recommended that the HCR collaborate with the Bangladesh Red Crescent Society to determine how a similar system may be modified and instituted in Haiti.

I trust that the recommendations are sufficient to be realistically implemented by the HCR for the disaster-affected communities in Haiti. If there are any questions, I can be contacted at telephone (404) 488-7350, via facsimile (404) 488-7335, or via Internet at [jym7@cehdehl.em.cdc.gov](mailto:jym7@cehdehl.em.cdc.gov). Following analysis of the data, a report will be sent to Dr. Claude de Ville de Goyet and to yourself with specific information from the community surveys.

Finally, I highly appreciate the outstanding collaboration from Dr. Claude Jean-Francois, Dr. Camille Archange, and the HCR volunteers, and the cooperation from Dr. Dana Van Alphen and your staff for this effort.

  
Josephine Malilay, Ph.D.

cc: Dr. C. de Ville de Goyet