

BEHAVIORAL RESPONSE TO HURRICANE WARNINGS -- A SURVEY

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by

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Introduction

Severe tropical cyclones through the ages have brought widespread death and destruction to many tropical areas of the world, most graphically illustrated by the tragedy in Bangladesh in 1970, when over 200,000 persons were killed. The World Meteorological Organization (WMO), through its Tropical Cyclone Programme, seeks to mitigate the effects of these storms through participation of these nations at risk in developing effective tropical cyclone warning systems.

At its third session held in April 1980 in Mexico City, the WMO RA-IV Hurricane Committee expressed particular concern on that part of the tropical cyclone warning system that deals with human response. It recognized that the most accurate and timely warning disseminated quickly and efficiently to the population at risk was ineffective if that population failed to respond in a meaningful way. Recognizing that much work had been done in recent years on behavioral response to natural hazard warnings, the Committee invited the author to prepare this report for consideration by Committee at its fourth session scheduled for March 23-30, 1981, in Santo Domingo, Dominican Republic.

This report constitutes a survey of the literature on behavioral response and a summarization of the most important aspects of human response germane to the hurricane threat in the Atlantic Basin. The author does not claim credit for the research findings in this document nor that this survey is complete in every aspect. In researching the literature on social response, it became clear that human response to disaster and threats was extremely complex. A myriad of factors come into play as determinants of behavior, and social scientists have made significant strides in understanding them. This report will examine many of these factors to understand how they influence human response.

Understanding Hurricane Structure

What is the perception of the public at risk about the characteristics of a tropical cyclone? There is evidence that notwithstanding the wording in official messages about the structure of the storm, many persons identify the hurricane with a point of latitude and longitude, which if not headed directly for them, is not viewed as a threat (Windham, et. al., 1977). In a study to determine what types of information are most conducive to timely response, Ruch and Christensen developed two series of television presentations on a developing hurricane. These presentations were identical, except the simulated hurricane was depicted as a point in one presentation and the other a saw-like

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satellite representation. They found that the saw-type video representation led to a more positive response pattern than the point or dot type because it indicated the magnitude of a hurricane more effectively. This important finding should be taken into account in preparing graphic materials depicting hurricane locations for use on television and public education programs.

Public reaction to Hurricane Allen (landfall on the lower Texas coast, north of Brownsville, on August 10, 1980) may have been influenced by this effect. While no formal sociological studies were made on the storm, a government survey team toured the damaged area a few days after the storm struck. They noted that many persons left Texas coastal areas 1 or 2 days before the storm made landfall, prior to any evacuation orders, hurricane watches, or warnings. There is no hard data on which to base firm conclusions, but one factor which may have played a significant role in convincing the population of personal risk was the widespread use of television to portray storm position. Allen had at one time during its life cycle been classified as the second most intense Atlantic hurricane in modern records, and this made the hurricane a "media event." The public had ample opportunity to see satellite imagery of Allen on television -- an extremely impressive storm with a well-developed eye and a cloud circulation that virtually covered the Gulf of Mexico. It seems logical that such high visibility of the hurricane coupled with official warning messages made a significant impression on coastal residents.

Another public misconception that is related to storm dimensions is the apparent belief by many people that they have experienced a hurricane when in reality, they only went through the fringes of the storm. Again, in the study of Eloise (Windham, et. al., 1977), Camille (Wilkinson, et. al., 1970) and other notable hurricanes, perception of the danger was distorted by this "false" hurricane experience. In a recent survey in Sarasota, Florida, Levy and Smith found that 85 percent of the residents who claimed to have experienced a hurricane first-hand actually have not. It isn't surprising, therefore, that those respondents who only experienced the gale winds of a hurricane seem to be less accurate in their assessment of hurricane intensity and less aware of necessary preparations in the event of a major storm (Levy, Smith). This effect was noted also in a study in predisaster planning in the Bahamas (Lewis, 1975). Respondents described a hurricane as any event involving strong winds and rain which produced some damage. Hurricanes do not visit the Bahamas very often, and yet a large percentage of the respondents indicated that they had hurricane experience. However, Bowden, et. al., reports that residents of the U.S. Virgin Islands only identify with the strong tropical cyclones that cause significant damage. These are considered "true hurricanes," and the residents relate their hurricane experience in terms of these more intense storms.

Coastal residents who only experienced the fringe effects of major hurricanes or experienced the core winds of weak hurricanes may feel they are prepared and are not at risk. Certainly, in the case of Hurricane Camille which struck the northern Gulf coast, August 1969, no one had previous experience with a storm of such extreme intensity. Wilkinson and Ross found in their study of Camille that there was a serious underestimation, particularly by the stayers of the potential destructiveness of the storm. While residents were aware of the warnings, they apparently did not translate this awareness into a conception of personal danger.

Several studies have shown the public has a poor understanding concerning the interaction of winds and storm surge. In both the Camille and Eloise studies, there was a lack of understanding about the extreme danger posed by the storm surge. In Eloise, most people who evacuated did so because of fear of strong winds. There appeared to be no realization that the storm surge was a much more serious threat to life and property (90 percent of all hurricane-related deaths are attributable to storm surge). In the simulated hurricane scenario, Ruch and Christensen divided 32 residents into control and experimental groups. All were asked to respond to recorded information on a developing storm. After the experimental group had viewed the most destructive scenes from several hurricane films, all were again asked to respond to messages relating to a developing hurricane. These responses were compared with the original ones. More than three times the number of positive responses were recorded amongst the group exposed to the hurricane film.

Effect of National Culture on Disaster Attitudes

Southern has described a broad spectrum of attitudes based on cultural backgrounds. An extract from his paper on the "Psychological Aspects of Disaster" is pertinent and is included here.

"Psychological aspects of disasters must be interpreted in terms of each nation's own culture and stage of economic development; these factors condition the whole program of community preparedness.

Significant differences exist between the cultures and basic attitudes or life philosophies of people living in so-called western and eastern societies, apart from more obvious contrasts which may be drawn between urban and rural communities.

Communities brought up in the shelter of an ever-advancing technology probably tend to be more optimistic of the triumph of man's initiative over nature's hazards and thus respond to the latest developments of science and engineering for their protection. In rural communities of developing countries a more fatalistic attitude is more likely, conditioned by absence of technological resources to cope with major disasters. Basic differences also exist between nations which are decidedly materialistic in outlook and those which adopt traditional beliefs which place less emphasis on individual survival.

Western and many urban societies may generally be regarded as impatient in that lives are highly organized in terms of personal schedules which must be maintained. This life style leads to increased risk-taking and lack of judgment when natural weather hazards compete with personal time-tables.

Developed societies are decidedly more mobile than developing societies and better transport facilities and systems enables more opportunities for evacuation or preventive measures. On the other hand increased leisure time often take the affluent citizen, the tourist, and boat owner into areas in which he does not understand local weather and water hazards.

In some societies in which life is centered very much around the family unit and concern for the authority of senior members, a family may decide to "stick together" in familiar surroundings come what may. To many people "home," be it land or property so constitutes a part of themselves that its abandonment cannot be contemplated.

Furthermore, the lives of many families in rural communities are entirely associated with the safety of stock, farming implements, or fishing gear which receive first priority when natural hazards threaten, at the expense of attention to personal safety. In such communities there is a natural reluctance to evacuate in order to attend to safety of animals or to take advantage of the beneficial rainfall which often accompanies severe weather.

The extent of the development and authority of local government is also important. Some communities are reluctant to initiate action on their own behalf either through laxity or even fear of offending officialdom. Other communities have an effective local government emergency service well integrated with other safety agencies."

As stated earlier by Southern, rural communities of developing countries tend to have a more fatalistic attitude and this is borne out in studies in Bangladesh (Islam, 1979) and noted by Amadore in the Philippines. The study revealed no understanding of the scientific causes of cyclones, and extreme events are widely regarded as manifestations of the wrath of God falling upon persons or communities which have sinned. They are accordingly controlled by external forces. Fatalistic attitudes were also noted by Lewis in his studies in the Bahamas. According to Bowden, those who pray to God in church on "Supplication Day" (the official and traditional beginning -- July 25 -- of the hurricane season in the Virgin Islands) have a greater fear of, and a much more accurate knowledge of the hurricanes that have affected and will affect the Virgin Islands. Many of these church-goers on July 25 are over 50 years of age and owners of houses, therefore, with more material goods to lose in a severe hurricane. Those who do nothing on Supplication Day are somewhat younger and have less material wealth, therefore, less to lose in a severe hurricane.

Effects of Demographic Factors on Response

In assessing the effectiveness of the warning system in Darwin, Australia, Irwin looked at the variation in message interpretation based on a hypothetical tropical cyclone. She found that understanding was influenced by sex, age, nationality, and educational level. Women have more difficulty than men in understanding the technical aspects of the message, as do the elderly and migrant groups. Higher education levels, as well as past cyclone experiences, gave a higher message perception but did not improve response or preparedness. The inexperienced responded more promptly because of their fear of the unknown. Message perception would be enhanced with visual presentations. Those with little idea of the local geography or little understanding of the English

language would be helped by the use of visual aids. Film clips of damage as a backdrop to warning information in the press on television would emphasize the potential effects of the cyclone hazard.

Several studies such as Southern's look at the Port Hedland community in Australia indicate that message comprehension is greatest in the age group between 20 and 40. Port Hedland may be taken as representative of an intelligent industrialized population with physical resources and vocational skills to protect themselves from the constant threat of cyclones.

Both Southern and Irwin's studies underline the vast array of possible responses ranging from no reaction to overreaction. For those segments of the population inclined to accept high risk, it would seem appropriate to use blunt, forceful language to emphasize the critical nature of the threat. Some coastal communities, such as Port Hedland, Australia, exhibit a good knowledge of the cyclone's characteristics and potential, and they desire more complete and technical warning messages. Other communities, particularly those in predominantly rural areas in developing countries, may respond more effectively to simple, straightforward messages delivered in a personal way by local community leaders (Rajagopal, 1980).

Warning/Evacuation Response

Ultimately, the purpose of emergency hurricane warning messages is to spur the population at risk toward a rational response that will result in the saving of lives and, to the extent possible, property. While not always the case, the action required most often is evacuation from coastal areas.

* Clark, et. al., have shown that the individual at risk must be convinced of personal danger before prompt action is likely. In their comprehensive review of the warning and response relationships, they found that general warning messages broadcast through the mass media motivate the public to seek additional information, but apparently do not motivate them to take immediate action. In their household studies, receipt of warning information prompted household heads to seek confirmation of the warning information through discussions with their family, friends, and neighbors, and by turning to their radios and televisions for more information. General warning messages tended to provide an opportunity for the individual to exclude himself from the "at risk" category, unless there were already prior notions of being at risk to the hazard. Once the family defines itself "at risk," then evacuation is likely, particularly if they had prior plans for what they would do if a threat like the present one occurred. From these studies the researcher found the majority of the public at risk to natural hazards does not take extreme forms of defensive behavior (i.e., evacuation and seeking safe shelter) in response to hazard warnings.

Leik, et. al., designed a laboratory experiment to register the response of volunteers to controlled conditions in which they were subjected to warning messages of differing quality and frequency. While the experiment was based on a hypothetical tornado scenario, the findings seem to apply as well to hurricane

situations. They concluded from these experiments that inexperienced individuals take defensive action sooner when warnings are more frequent and more detailed. As individuals gain experience in responding, they delay response longer regardless of characteristics of the warning messages. In contrast to the behavior of the inexperienced responder, more frequent and more detailed messages produce even longer delays among experienced individuals than do infrequent or incomplete messages. Recommendations for action accompanying warnings will produce quicker response, but the effect is greatest for inexperienced responders.

When two people must respond jointly, as is often the case for families, they appear to take defensive action sooner than do isolated individuals. This is somewhat offset by the need to reach consensus so that while both effects appear in the data, they are inconclusive.

Baker has done extensive research in behavioral response to warnings and other emergency advices. He reviewed the work of other social scientists from surveys conducted on Hurricane Carla, Camille, and Eloise. Their analyses were extended with respect to one dependent variable: whether the respondent evacuated his home to seek safety in response to warnings. One of Baker's most encouraging findings is that people who most need to evacuate appear to be the most likely to leave. Elevation of the respondent's home above mean sea level exhibited one of the strongest association with evacuation. Extent of neighborhood evacuation was also a strong and consistent predictor of whether the respondent evacuated. This supports the recent findings by Clark, et. al., concerning the influence of friends and neighbors on preparedness actions taken by an individual. Baker found that one aspect of hurricane awareness that was related to evacuation was knowledge of one's homesite elevation. Persons who knew their elevation were less likely to evacuate than those who either overestimated or underestimated their elevation. Baker has identified other factors that produce a positive evacuation response. As with the Clark studies, acknowledgment of personal danger is extremely important. While the results are mixed, evacuation orders increased evacuation of coastal areas, prior to Hurricane Carla, but this was not the case with Hurricane Eloise. While the amount of public monitoring didn't seem to increase evacuation, a much better predictor was how bad a person expected the storm to be. Another positive factor, although less significant, was the public confidence in the accuracy of the warnings.

Baker further noted that in both Camille and Eloise, issuance of a warning without explicit advice to begin evacuation prompted very few to leave. After relocation was advised, increased numbers began to leave, but there was a lag of 4 to 8 hours before the peak evacuation rate occurred. He believes that people delay evacuation because they don't wish to leave unnecessarily, and they realize that evacuation of the entire warning area almost surely will be unnecessary. This can be an extremely serious consequence because evacuation routes out of densely populated coastal areas are woefully inadequate. Furthermore, according to organizational studies, conducted by Clark, half of the available warning lead time is used by authorities in the decision-making process before the public is advised to evacuate (Hurricanes David and Frederic, 1979).

Previous hurricane experience whether real or "imagined" is still considered one of the more important determinants of response. Windham in the Eloise study defined an "Experience Adjustment Paradox," whereby new coastal residents (less than 5 years) with no hurricane experience leave more readily than older coastal residents (more than 5 years) who have listened to and adopted a "false" hurricane experience from their neighbors who say "We don't have a hurricane problem." Saarinen says that "People do learn from experience, but they tend to believe they have a better picture of the truth than they really do, especially in dealing with rare events." These rare events often lead to apathy on the part of the population at risk. The so-called "hurricane party" syndrome is an attempt to deny danger and has been observed with tragic consequences.

It is obvious that awareness does not always produce proper response. Sutherland in his recent study of public response to warnings for St. Lucia noted that while there was complete awareness of Hurricane Allen's existence, the response of the public was very slow and poor. The reason seemed to be that (a) not even the oldest generations on the island had ever experienced a hurricane, (b) there was a lack of adequate public education on natural disasters, (c) the St. Lucians had a rather care-free attitude (there was a holiday observed the day Allen struck), and insufficient guidance was available at the time.

Summary

In order for any warning to be truly effective, it must convince the individual of a grave personal risk. The sociological research into this most complex topic of behavioral response has identified significant factors that acting alone or in concert, offer clues to how the population will respond to the threat of disaster. It is incumbent upon those of us in the business of providing vital emergency warning information to the public, to be cognizant of these behavioral factors if we are to more fully meet the challenge to preserve lives and property. Our information must be timely, accessible, credible, and as accurate as the state of the art will allow. WMO sub-project No. 12, "Human Response to Tropical Cyclone Warnings and Their Content," will be published later this year and should provide further insight into these complicated issues.

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