The Effects of Hurricane Mitch on a Community in Northern Honduras

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Abstract

Introduction: Hurricane Mitch was an event described as one of the most damaging recent natural disasters in our hemisphere. This study examined its effects on a community of 5,000 residents in northern Honduras.

Methods: Survey responses of 110 attendants at an ambulatory clinic 4 months after the event were analyzed. Correlates were established between demographic and housing characteristics and morbidity and mortality.

Results: The availability of food, water, and medical care decreased significantly immediately after the hurricane, but by four months afterward returned to baseline values. Residents reported emotional distress correlated with the loss of a house or intrafamilial illness or mortality. Diarrheal illnesses more commonly were found in households with poor. chronic access to medical care. The use of cement block housing correlated with availability of food or running water, with access to medical care and vaccinations, and with a reduced frequency of diarrhea or headaches in the immediate post-hurricane phase.

Conclusions: Improvements in housing construction appear to be the most effective preventive measure for withstanding the effects of future hurricanes in tropical regions similar to northern Honduras.

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Introduction

In the autumn of 1998, Hurricane Mitch swept over Central America and left hundreds of thousands with limited means of survival. Honduras and Nicaragua were the most impacted with combined death tolls approaching 10,000 people. (Table 1) About one-third the population of Honduras were required to evacuate, and over 12,000 were forced to live in shelters. The poorest populations were the most severely affected because their frail housing and limited food supplies offered minimal protection.[1]

Hurricanes frequently destroy the property and lives of Caribbean and adjacent territory residents. The destructive effect of hurricanes is magnified in developing countries where inadequate housing and shortage of foodstuffs exacerbate the effects of a natural disaster. For these reasons, rapid and appropriate relief efforts are required to avert further catastrophes. In order to supply suitable relief to the areas most in need, information regarding nutrition, immunizations, epidemic diseases, as well as knowledge about the age distribution of a population and risk factors for individual morbidity are needed.[2] Studies of previous hurricanes and the effects on the population may aid in relief efforts, although current data are not always available.

Fatalities are frequent in the wake of hurricanes. Population profiles

allow relief organizations to better discern areas of highest mortality and destruction. Unfortunately, reports are not complete until months later at which time the results are less useful in prevention activities. Reports were produced in Puerto Rico for Hurricane Hugo in 1989,[3] in the Virgin Islands and Puerto Rico for Hurricanes Marilyn and Opal in 1995,[4] and in multiple areas of the Caribbean for Hurricane Georges in 1998.[5]

Data describing the effects of Hurricane Georges in 1998 on the Dominican Republic[6] were gathered by a modified cluster-sampling method[7] to select persons in greatest need of relief two months following the hurricane. Health needs assessments were also carried out on St. Thomas, U.S. Virgin Islands, and other small Caribbean islands one week after Hurricane Marilyn in 1995.[8] These studies reported the effects on food supply, health care, and water/sanitation for those living in worker settlements, shelters, and housing and helped focus relief efforts for future tropical hurricanes.

Only a few studies[6-8] are reported that analyze the effects of a hurricane on a given area or suggest methods for avoiding similar destruction in the future. These late-term consequences are even less often reported, although in one report, they included even a surge in infectious diseases.[9] In this paper, we review the effects of Hurricane Mitch on one community in northern Honduras based on survey results obtained four months after the advent of the hurricane.

Honduras

Honduras is a Central American republic with a population of 5.8 million (1997) that is predominantly young (42% are under age 15 years) and rural (56% reside in agricultural communities).[10] Its infant mortality rate of 47 per 1,000 live births is the highest in Central America, and the natural increase of the population is at 2.9%, the highest for this region. With a per capita GNP of $740 per year, Honduras remains one of the poorest countries in the Western Hemisphere.[11]

With an economy dependent on export of bananas, coffee, sugar, and shrimp, agriculture accounts for over 20% of the Honduran gross domestic product and employs over half the workforce. The poor status of Honduran health is reflected in a child malnutrition rate of 18% between 1992 and 1997 and an estimated 47% of deaths being attributable to infectious diseases.[12]

Methods

Adult participants (n = 110) were chosen randomly from a church-administered ambulatory relief clinic in San Juan Pueblo, Atlantida Province, on the northern coast of Honduras and were interviewed four months after the advent of Hurricane Mitch. This sample represented 14% of the clinic attendants. The interviews assessed demographic information and health and socioeconomic status before, immediately after, and four months following the arrival of the hurricane in the fall of 1998.

Demographic information acquired included number of persons (stratified by gender) living in a household, ages of children, number of pregnant women, locale of community, and type of housing construction. Inquiries assessing adequacy of food stores, running water, access to medical care and vaccinations, and access to prenatal care were determined for time points before, immediately after, and four months following the hurricane. Inquiries assessing availability of information via radio or television and method of transportation were determined for time points both before and immediately after the hurricane. The number of sick family members, number of missing or dead family members, status of housing, and the number of family members with diarrhea, headaches, upper respiratory infections, or significant emotional distress were determined for only the period immediately after the hurricane. The status of housing four months following the hurricane was determined for those whose house was destroyed due to the hurricane. Parameters such as adequacy of food and emotional distress were categorized by respondents' perception.

Interview data were assessed with STATA version 6.0, which is a statistics/ data analysis software program.[13] The availability of food, water, and medical care were compared for three time periods. Characteristics of housing construction were assessed using a binomial probability test. Characteristics of households whose members developed diarrhea or significant emotional distress were assessed using chi-square or Fisher's exact tests. Regression analyses were performed using independent and sufficiently common variables that were found to be significant in a preliminary dichotomous analysis.

Results

Surveyed Households

Four months after Hurricane Mitch struck the northern coast of Honduras during the fall of 1998, 110 individuals, each representing a single household (among approximately 800 families treated during a week-long ambulatory care clinic) in the northern affected province of Atlantida, were interviewed. The number of people living in a household ranged from 2 to 25, with a average of seven persons. Average food reserves per household before the hurricane were three days. In the month following the hurricane, most households reported an average of interval of about four weeks without food stores and running water.

Food, Water, and Medical Care

The number and percentage of households reporting adequate food supplies fell from 55% to 23% immediately after the hurricane. Four months following the hurricane, however, the food supplies had recovered to levels actually higher than those before the hurricane, with 64% reporting adequate supplies. The same trends were reported for availability of running water, medical care, and prenatal care. The immediate post-disaster values were compared to those before and four months following the hurricane using a binomial probability test ($p < 0.001$) (Table 2).

Housing Construction

The percentage of surveyed individuals who lived in block versus other (wood, adobe) housing was 60.8% (n = 45) and 39.2% (n = 29), respectively. In almost all instances, residents

Type of Disaster	Hurricane Mitch, Category 4
Location	Northern coast of Central America, with most impacted nations in descending order: Honduras, Nicaragua, Guatemala, Belize
Date	Late October 1999
Mortality	Estimated at 5,000 to 10,000
Morbidity	Homelessness immediately following the event estimated at 1,000,000

Table 1—Characteristics of the disaster

Characteristic	Before hurricane[a]		Month after hurricane[b]		Four months after hurricane[c]	
	n/total	(%)	n/total	(%)	n/total	(%)
Adequate food supply	57/104	(55)	22/94	(23)	61/95	(64)
Available running water	95/110	(86)	11/101	(11)	80/98	(82)
Adequate medical care	49/96	(51)	10/83	(12)	52/94	(55)
Access to prenatal care	39/81	(48)	2/65	(3)	27/60	(45)

p <0.001, binomial probability test comparing values in columns "a" and "b" or "c" p not significant when comparing values in columns "a" and "c"

Table 2—Availability of food, water, and medical care

Reported Characteristics	Total	Block houses		Nonblock houses	
	n	n	(%)	n	(%)
Inadequate food stores in the home					
Before the hurricane	47	9	(19)	38	(81)
In the month following the hurricane	72	28	(39)	44	(61)
Four months following the hurricane	34	7	(21)	27	(79)
No running water in the home					
Before the hurricane	15	2	(13)	13	(87)
In the month following the hurricane	90	39	(43)	51	(83)
Four months following the hurricane	18	3	(17)	15	(83)
Inadequate medical care					
Before the hurricane	47	8	(17)	39	(83
In the month following the hurricane	73	27	(37)	46	(67)
Four months following the hurricane	42	310	(24)	32	(76)
No access to vaccinations					
Before the hurricane	31	27	(23)	24	(77)
In the month following the hurricane	77	29	(38)	48	(62)
Illness in the month following the hurricane					
Diarrhea	47	11	(23)	36	(77)
Headaches	58	15	(26)	43	(74)
Deaths in the household due to the hurricane	9	2	(22)	7	(78)

p <0.001, using binomial probability test comparing values for houses made from block versus other substances

Table 3—Characteristics of respondents living in houses made from block versus other substances (adobe, soil, wood, etc.)

Reported characteristics	Total	Developed diarrhea		Did not develop diarrhea		*p-value*
	n	n	(%)	n	(%)	
Adequacy of food stores						
Inadequate food stores before the hurricane	37	27	(0.72)	10	(0.27)	0.007
Inadequate food stores in the month following	59	35	(0.59)	24	(0.41)	0.08
Adequacy of medical care						
Inadequate medical care before the hurricane	37	29	(0.78)	8	(0.22)	0.001
Access to vaccinations						
No access to vaccinations before the hurricane	27	22	(0.81)	5	(0.19)	0.001

p values defined with chi square or Fischer's exact analysis

Table 4—Characteristics of households with members who developed diarrhea in the month after the hurricane

of block housing fared better before, immediately after, and four months after the hurricane with respect to availability of food stores, potable water, and access to medical care. For example, in the month following the hurricane, among those with inadequate food stores, the percentages by housing type were almost reversed from the above percentages, with 39% living in block housing and 61% in non-block housing. In addition, acute illnesses, in particular headaches and diarrhea, were more common among the residents of non-block housing. For example, 77% of those with diarrhea and 74% of those with headaches lived in non-block housing. Block housing did not significantly correlate with other variables relating to socioeconomic status, such as possession of a television, car, and radio. The specific percentages and p values are shown in Table 5. All p-values were significant at $p < 0.001$.

Diarrhea Following the Hurricane

Diarrhea in the month following the hurricane was more apt to develop among those with inadequate food stores, those with inadequate medical care, and those who reported incomplete vaccination histories, with 72%, 78%, and 81% of patients in these three categories reporting diarrhea (Table 4). By regression analysis, impaired access to medical care and vaccinations before the hurricane were the two variables which independently predicted the development of diarrhea (Table 3).

Emotional Distress Following the Hurricane

Emotional distresses were more apt to develop among families who reported illnesses or the loss of a family member in the month following the hurricane as well as those who did not have adequate access to medical care following the hurricane. Maintaining one's home was a significant predictor of being spared emotional distress, with 91% of those with a standing home reporting no emotional distress (Table 6). By regression analysis of significant parameters, in dichotomous assays, both loss of the house and reported illness or mortality among family members immediately following the hurricane were independent predictors of emotional distress (Table 7).

Discussion

A hurricane can manifest the poverty, inequality, and structural disintegration of a society.[14-15] Although the primary event itself is not preventable, it is the secondary effects and their management that determine the availability of water and food, the integrity of buildings, the access to modalities of transportation and communication, and, above all, the preservation of community and individual health. The secondary effects include a recognized increase in late-term infectious diseases, an effect that may transpire years after an event. In this publication our discussion of the effects both immediately, and four months after Hurricane Mitch include aspects related to housing, food availability, and emotional distress as well as traditional medical illnesses.

Morbidity and mortality admittedly are higher in communities with limited resources and compromised economic indices,[16] less developed housing, water supplies, food storage, and communication links. One major risk factor in most disasters is population density. Density in many developing countries is high and may account for the larger numbers affected within a given area or contribute to difficulties associated with the availability of rescue and relief efforts. The secondary prevention that characterizes the post-disaster phase requires coordinated measures that address the issues associated with high population densities.

A particular parameter noted in many natural disasters is housing construction. Inappropriately constructed housing is less able to withstand the harsh conditions of a hurricane. The poor often can afford only fragile wooden houses built on steep hillsides inappropriate for construction. With Hurricane Mitch, for example, houses were swept down hills into rivers within minutes.[17] The long-term impact was devastating and one year after the event, 10,000 Hondurans remained living in temporary shelters.[18]

The actual substance used for housing construction is also important. During a Guatemalan earthquake, for example, it was shown that houses made from cement blocks were less likely to collapse than were those made from adobe or other substances.[13,19,20] It was theorized that aged adobe in particular, was structurally unstable, because it was often composed of excess sand (making it more brittle) and adobe houses often lacked internal reinforcements, solid frames, or support cables.[20] Other work from the Dominican Republic in the wake of Hurricane Davis emphasized the importance of housing materials in withstanding natural disasters.[21]

Sturdier housing construction affords high-risk populations a greater chance to survive a disaster. Hence, prevention efforts should include urging citizens to build houses out of appropriate materials, such as cement, and also helping them to do this through loans or grants. A Central American development officer tersely described the issues, "Do we simply rebuild what we had before? What we had before was widespread injustice and corruption. If we don't change things, then Mitch will be a double disaster."[17]

This study showed that the individuals who lived in houses made from cement block were more likely to have food, potable water, access to medical care and vaccinations after the hurricane. In addition, they were less likely to report illness and deaths as a result of the hurricane. These results may, in part, be related to the socioeconomic status of the families. Nonetheless, a family's ability to fare better in health and availability of resources after a hurricane is significantly related to the type of housing construction.

Cement block housing in this study was not significantly related to putative socioeconomic parameters, such as possession of a television, car, or radio before the hurricane. Such housing, however, was related to adequate food, water, and medical care before the hurricane. These parameters may be considered indicators of socioeconomic status in very poor societies. It is difficult to make a firm conclusion regarding socioeconomic status because it is generally low throughout northern Honduras and because the definitions of socioeconomic status are subjective and controversial.

Other important preventive measures in the post-disaster phase include establishing access to medical care

Parameter	Coefficient	(CI)	t	p-value
Food stores before the hurricane	-0.36	(0.16.0.41)	-0.9	0.37
Food stores immediately after the hurricane	-0.16	(-0.44, 0.12)	-1.2	0.250
Access to medical care before the hurricane	-0.31	(-0.59, -0.04)	-2.3	0.027
Access to vaccination before the hurricane	-0.36	(-0.66, 0.06)	-2.4	0.020
(n = 59, adjusted R^2 = 0.25)				

Table 5—Regression analysis assessing parameters associated with report of diarrhea

Reported characteristic	(n)	No emotional distress		Emotional distress		p
Illness (i.e., diarrhea) or mortality in the month after the hurricane						
Reported	(25)	19	(0.76)	6	(0.24)	0.021
None reported	(41)	39	(0.95)	2	(0.05)	0.034
Medical care in the month after hurricane						
Accessible	(34)	32	(0.94)	62	(0.06)	0.050
Not accessible	(7)	0	(0.00)	7	(1.00)	0.021
Status of house immediately after hurricane						
Standing	(58)	53	(0.91)	5	(0.09)	
Destroyed	(8)	5	(0.63)	3	(0.38)	
p values defined with chi-squared or Fischer's exact analysis						

Table 6—Characteristics of families who reported to be spared of significant emotional distress in the month after the hurricane

Parameter	Coefficient	(CI)	t	p value
Status of house immediately after hurricane	-0.26	(-0.49, -0.03)	-2.3	0.027
Illness (i.e. diarrhea) or mortality in the month after hurricane	0.17	(0.02, 0.33)	2.2	0.030
(n = 66, adjusted R^2 = 0.12)				
Medical care variable is not reported in the regression due to the exclusion of >50% of respondents when included in analysis				

Table 7—Regression analysis assessing parameters associated with report of emotional distress

and vaccinations. Both provide benefits that are more long-term rather than acute. Access to such measures—more likely among those with a higher socioeconomic status and those apt to maintain health in the wake of a disaster—is correlated with the general health and well-being of a society. The prevention of overcrowding (in the post-event phase) and the adequate dissemination of information are essential modalities of care, as are the provision of bottled water and the establishment of rapid initial assessments by relief organizations.

Conclusion

The impact of hurricanes and other natural events on communities is unpredictable and a hurricane of sufficient magnitude can wreak damage on even the most sophisticated and technologically advanced society. Appropriate preventive measures, however, do minimize the morbidity and mortality associated with most hurricanes. Such measures are especially important in developing countries where resources are limited and infrastructures compromised. Assessing parameters such as the demographic profile and the agricultural dependency of a given area will allow an equitable distribution of relief measures. Only through coordination of governmental and nongovernmental organizational activities, particularly those efforts aimed at the provision of better housing, can the damage of a catastrophic event such as Hurricane Mitch be mitigated.

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Editorial Comments

Roger Glass, Ian Davis, Nick Jones and others have demonstrated a relationship between housing and health outcome in disasters of various types. Part of the protective dynamic is the direct shielding effects of a sturdy shelter against the forces of the event. However, the relationship between post-disaster health status and housing runs far deeper than the effects of immediate shelter. While the exact causal relationships remain a bit elusive, Guill and Shandera have provided more evidence that adequate housing has a protective effect after an event, not just during it. Respondents with concrete block housing, who did not appear to be socioeconomically different from the rest of the study population, had significantly lower morbidity and mortality rates four months after the onset of Hurricane Mitch.

Guill and Shandera point out that the respondents with concrete block housing typically had lost less than the rest of the population during the hurricane, and hint that this may help account for part of the improved health indices as compared to those with less substantial housing. However, concrete block house inhabitants also had better access to food, medical care, and other necessary resources. This phenomenon is not explained totally by decreased "sense of loss", and points out the need for us all to better understand the relationship between basic variables and successful recovery from disastrous events. To be more effective for the victims of disasters, disaster health service specialists need to integrate their efforts with those who wield the tools of public health and socioeconomic development, not only to find out what works in given environments, but also to see to it that what we learn is implemented.

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