Quick Response Report #122 NATURAL DISASTER EPISODE: IMPACTS, EMERGENCY RESPONSE, AND HEALTH EFFECTS OF HURRICANE GEORGES IN THE GULF COAST

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SUMMARY

In September, 1998, Hurricane Georges impacted the Gulf Coast of Florida, Louisiana, Mississippi, and Alabama respectively. Several communities, especially in Mississippi and Louisiana coastal regions were directly hit, and numerous others suffered indirect impacts. Through a quick response survey, data were collected in selected communities along the Gulf Coast. The communities studied were either hit directly by Hurricane Georges or severely affected by the associated tidal surges and floods. In a sample of 300 victims, data were collected on the extent of damage, emergency responses, equity of relief, and physical, health, and psychological problems reported by respondents. The results of this study indicate that people do come together to respond to a natural disaster, with race/ethnicity being of less importance, at least during the impact phase of the hurricane. Few specific health problems were reported to be associated with the hurricane episode. Even though certain communities are more vulnerable to hurricanes or other types of natural disasters than others, whether race and ethnicity are significant in explaining natural disaster impacts remains unclear. Practical/applied policy recommendations are suggested based on current findings.

INTRODUCTION

Hurricanes are among the most destructive natural disasters, affecting millions of people worldwide and thousands of people along the Gulf Coast of the United States annually (Malilay, 1997; National Environmental Satellite, Data, and Information Service, 1993; Baker and Patton, 1974; Cross, 1990). Hurricane episodes are responsible for billions of dollars lost in property damage, death, and debilitating health problems. For instance, in the United States this century, hurricane episodes have resulted in more than 14,600 deaths and have caused property damage in excess of $94 billion in constant 1990 U.S. dollars (National Research Council, 1994). The stress of these disasters often result in immediate and long-term health, emotional, and psycho- social problems among the victims.

Unfortunately, besides adequate warnings and evacuations, there are currently little or no practical means to curb the intense effects of hurricanes. Early attempts at weather modification in the U.S. included the first experimental cloud seeding of a hurricane event in 1947 and the cloud seeding of Hurricane Debbie in 1969. As Smith (1996, p.227) indicates, most currently available weather modification techniques or hurricane mitigation methods are limited in terms of scientific and statistical feasibility, and have economic, environmental, legal, and socio-cultural constraints (see Malilay, 1997).

Fundamentally, hurricane episodes are naturally occurring meteorological depressions that evolve over open water in the tropics, usually between the latitudes of 30o N and 30o S; a rotating disturbance forms around a center of calm atmosphere, usually 30 to 50 kilometers in diameter, with air circulating counterclockwise in the northern hemisphere and clockwise in the southern hemisphere. Through oceanic evaporation, hurricanes have the potential to move at speeds ranging from 74 to 155 miles per hour (see Figure 1 for Hurricane Georges).1 Hurricanes' motions are mostly determined by the winds that surround them. Hurricane intensity is reckoned on the Saffir-Simpson scale

ranging from category one (minimal with 74 - 95 m.p.h. winds and 4 - 5 ft. surge) to category five (catastrophic, with over 155 m.p.h. winds and over 18 ft. surge) respectively (see Malilay, 1997, p. 209).2

Hurricanes are very devastating to human and nonhuman habitats along the coastal regions of the Atlantic and the Gulf of Mexico in the United States. The development of El Nino suggests that major hurricane/flood episodes along the Gulf Coast and Atlantic Coasts of the United States can be expected during the coming years. This study was a quick response to Hurricane Georges and a peremptory collection of data on the distribution of impact, associated health problems, variation in emergency relief efforts, community resource mobilization, and coping in affected communities in the Gulf Coast regions of Louisiana and Mississippi. Specifically, data were collected from selected communities affected by Hurricane Georges along the Gulf Coast of Mississippi and Louisiana.

Generally, natural disasters are conceptualized as uncontrollable (non-routine), systemic events in which societies, regions, and communities are disrupted and damaged economically, socially, physically, and psychologically. Disasters represent a disruption of the normal social and economic structures and functions of a community (Aguire International, 1996). The resources of impacted communities are mostly overtaxed or ruined (Green et. al, 1988). Because they are viewed as uncontrollable events, viable targets to blame by the victims are often rare (see Drabek, 1986; Kreps, 1989; Blocker et al., 1991). While a considerable amount of research has been devoted to the study of immediate and long-term impacts of natural disasters, people's perception of hazards, coping and adaptation to natural disaster events, there is still a serious lack of adequate attention to the distribution of impacts of systemic environmental disasters such as hurricanes, floods, and other natural calamities, in communities by race, ethnicity, and socioeconomic status (see Blocker et al., 1991; Baumann and Sims, 1974; Cross, 1990; Laska, 1990; Wolensky, 1983; and Bolin, 1986; Peacock and Girard, 1997 for exception). Also, very little research exists on the latent health consequences of such events. The research questions originally raised by this study include:

1 Are the impacts of a hurricane/flood episode randomly dispersed or are certain communities more vulnerable than others?
2 What significant disparities exist in emergency relief to victims following an hurricane event - by race, class, gender or other relevant community characteristics?
3 Do people come together and share resources during a period of crisis brought on by natural disasters? Or are there significant race or socioeconomic factors in society's response to natural disasters?
4 How do the victims of natural hazards such as hurricanes/floods define their predicament - an act of God, society, misfortune, or what?
5 Are there racial and socioeconomic differences in the victims' perception of fairness, equity, and appreciation of emergency response efforts at the local, state, and national level?
6 What are the major health problems self-reported by the victims in the aftermath of a hurricane/flood?

Following this introduction, this report proceeds by stating the aims/objectives of the present research. Next, the nature of hurricanes and the specific episode of Hurricane Georges and associated impacts on the Gulf Coast of Louisiana and Mississippi are discussed. Subsequently, the research methods, analyses and findings are presented, followed by some closing remarks.

Aims and Significance of the Study

This study focuses on objective and subjective assessment of similarities and differences in the distribution of the impacts of a hurricane/flood event (i.e., Hurricane Georges) among communities/neighborhoods in the Gulf Coast regions of Louisiana and Mississippi. Information on perceived equity or inequity in emergency response by the Federal Emergency Management Agency (FEMA), other local and state organizations, community resource allocation, and relief measures were collected and analyzed. Also, social solidarity among groups and coping strategies of the victims were explored. Hurricane and flood episodes are usually accompanied by mortality and morbidity, including trauma,

dermal problems, gastrointestinal illnesses, neura-tube defects (i.e., spina bifida cystica and encephalocele), megaloblastic changes in sickle-cell patients, emotional and physical distress, nonpsychotic psychosocial dysfunctions, and post-traumatic stress disorders (WHO, 1992; Duff and Cooper, 1991). Information on variation in immediate and short-term health consequences along race, age, gender, and other relevant sociodemographic characteristics were collected and evaluated.

Even though natural disasters such as hurricanes and floods ravage communities without bias, the severity of impacts, emergency responses and relief, communities' resource mobilization capacity, and coping mechanisms may be disproportionate by race, age, socioeconomic status and household characteristics. For instance, Quarantelli (1988) notes that despite the myth that natural disasters are random killers, the elderly and poor segments of communities are most likely to suffer disproportionate impact. The literature on environmental justice suggests that minority, elderly, and poor people are unjustly burdened with environmental hazards (Adeola, 1994, 1995; Bullard, 1990; Peacock and Girard, 1997). Since they are most likely to occupy older, substandard dwellings in disenfranchised communities, and less likely to afford flood/natural hazards insurance, and less likely to implement flood and hurricane mitigation measures, these groups are more likely to be victims of hurricanes/floods than any other groups in society.

HURRICANES AND THE STUDY AREAS

When it comes to systemic atmospheric changes, the law of Murphy seems to apply to most communities near the seashore, especially along the coast of the Gulf of Mexico or the coast of the Atlantic.[3] The communities in close proximity to the Gulf of Mexico and other coastal regions have witnessed numerous hurricanes. Most residents can name quite a few - from Hurricane Andrew (Florida and Louisiana), Audrey (Southwest Louisiana), Betsy (Southeast Louisiana), Camille (Mississippi and Louisiana), Hugo (S. Carolina), Opal (Florida and

Alabama), to the most recent episodes of Georges (that swept through Alabama, Florida, Louisiana, Mississippi), and Ivan, Jeanne, Karl, and Nicole. Overall, 1998 witnessed ten Atlantic hurricanes and four tropical storms.

The Episode of Hurricane Georges, September 1998

On September 28, 1998, Hurricane Georges ravaged several communities and areas along the Gulf Coast, from the Florida Keys to Louisiana, and from Biloxi, Mississippi, to Mobile, Alabama. Figure 2 depicts the path of this hurricane from September 19 to September 28, 1998.

On September 28, 1998, the Mississippi Gulf Coast took a direct hit by Hurricane Georges that left approximately 230,000 people without electricity and about 15,000 residents in public shelters. In Biloxi, Mississippi, flooding and hurricane-force winds (over 95 miles per hour) damaged several homes and businesses, necessitating curfew and a state of emergency.

While Hurricane Georges' impact was less than anticipated in New Orleans, Louisiana, there were several communities outside the New Orleans metropolitan area impacted, especially by tidal surges, flooding, and the trauma of evacuation of the residents. Even in the New Orleans metropolitan area, close to ten thousand residents fled to the neighboring states and other perceived safe areas in the northern and western parts of the state to escape the wrath of the hurricane. At least one death was reported as a latent consequence associated with Hurricane Georges by the *Times Picayune* newspaper. Slidell, Louisiana, had severe flooding due to tidal surges, and at least 82 homes were severely damaged, especially in the Palm Lake subdivision. In Biloxi and Gulf Port, Mississippi, and Slidell, Louisiana, tree limbs, debris, scattered vegetation, and muck impacted all the streets posing significant danger and creating health and other hazards for the residents. As one respondent remarked:

Cleanup is the slowest I have ever seen. It's been over a month and we still have piles of debris in front of houses. Since the piles are steadily

accumulating, a breeding and nesting place for snakes and rodents is very favorable. We have already found a couple of snakes.

Another residents expressed similar concern that:

A number of dangers and accidents were due to debris lingering on sidewalks and streets. As of October 25, 1998, the city has yet to begin cleanup. A friend of our daughter was hit by a car on an adjacent street due to the driver's inability to see the child because tree limbs were stacked on the street.

The respondents for this study were residents of Biloxi, Mississippi and Slidell, Louisiana, respectively. Brief background information about those areas is in order.

The city of Biloxi is located on the sandy shores of the Gulf of Mexico. Due to its close proximity to the Gulf of Mexico, the city is prone to hurricanes and other systemic hydro-meteorological disturbances. Most residents are aware of the risks associated with living too close to the seashore. Available census data indicate that the city has over 53,000 residents, with median income of $26,426, and racial composition of 72.6% white, 19.1% black, and 8.3% other (U.S. Bureau of Census, 1995).

Similar to Biloxi, the city of Slidell, Louisiana, is susceptible to periodic flooding and hurricanes because it is located at the juncture of a floodplain and coastal zone. The greater Slidell area hosts a population of about 53,000. Both Slidell and St. Tammany Parish (county) are among the fastest growing areas in Louisiana in recent years, with the latter experiencing a positive net migration rate of 15.6% between 1980 and 1990 and an increasing population density (DBER, 1997). As Laska (1986) notes, Slidell is a good example of the increasing number of communities that are prone to flooding because housing development is spreading to marginal areas - i.e., floodplains in proximity to bayous and other riverine environments - thus resulting in more communities being faced with the risks of flooding.

RESEARCH METHODS

As Wolenski (1983) indicates, communities affected by natural disasters represent important natural laboratories for conducting social research. Southern coastal Louisiana, with communities of different racial and socioeconomic mix, and with a higher frequency of devastating natural disasters - hurricanes, floods, tornadoes, etc. - represents a unique setting for studying these natural calamities and the health consequences of such events. To ensure currency, observations and information collection were made within one to three months following the event. In southern Louisiana and Mississippi, where residential segregation endures, it is easy to locate predominately white communities and predominately black communities. Most disasters do not impact all communities equally (Fischer, 1998). However, the common assumption is that natural disasters such as hurricanes do not discriminate by race, ethnicity, or any other social characteristics. Nevertheless, recent empirical evidence reveals how social conditions of inequality and housing segregation may confine certain people into low-valued, disaster-prone neighborhoods. For instance, Peacock and Girard (1997, p. 173) indicate that to live in the best housing on the right side of town requires financial resources and the correct of social characteristics. In fact, people of lower socioeconomic status residing in mobile homes and other substandard dwellings are far more prone to the wrath of hurricanes, tornadoes, and floods than any other groups.

The targeted populations for this study consisted of residents of impacted residential building structures in communities affected by Hurricane Georges and the associated floods of September 1998 in Biloxi, Mississippi, and Slidell, Louisiana. Affected dwellings within the communities were identified through media reports and personal visits to the sites. Through a multistage cluster sampling, approximately 300 households were sampled (200 in Biloxi) and (100 in Slidell). Unlike other areas of social research, the nature of natural disasters calls for a specific type of researcd method. As Babbie (1990) indicates, cluster sampling technique is particularly recommended when it is either impractical or impossible to obtain an exhaustive sampling frame of the

target population, as was the case in this study. According to Fischer (1998, p. 7-8), there are five specific stages in the life cycle of a disaster, including the pre- impact period (activation of warnings), the impact period (manifestation of disaster), the immediate post-impact phase (rescue efforts, debris removal, etc.), the recovery period (debris clearance is completed, services are restored, insurance claims are filed), and the reconstruction period (which may last for years). Data collection was initiated during the immediate post-impact phase of Hurricane Georges.

The respondents were contacted within 90 days following the event and administered a questionnaire incorporating the research questions. A 57-item, 10-page questionnaire with close-ended and a few open-ended items was constructed, pre-tested, and hand-delivered directly to the respondents in the cluster of households selected. In severely impacted households, questionnaires were delivered to the front door with instructions and self-addressed return envelopes. Also, most respondents contacted chose to complete the questionnaires and return them later in self-addressed stamped envelopes. In other instances, respondents completed the questionnaires in the presence of the interviewers within approximately 30 minutes. Five advanced undergraduate students trained in survey research techniques participated in the distribution of the questionnaires, especially for the Slidell sample. Most of the field work in the Mississippi Gulf Coast area was carried out by the principal investigator in the evenings and on weekends when most people were likely to be at home.

As mentioned, in several cases where face-to-face, person-to-person, administration of the questionnaire was impossible or inconvenient, respondents were provided stamped, self-addressed envelopes for returning the questionnaires upon completion. In Biloxi and adjacent impacted communities, 200 questionnaires were distributed. However, only 91 completed questionnaires were achieved, which represents a 45.5% completion rate. Due to budget constraint, there were no follow-ups or reminders. Issues concerning the characteristics of non-respondents is beyond the scope of the present study.

The sample from Slidell, Louisiana, was obtained from the Palm Lake

subdivision, the community impacted the most in the area. Following the identification of the streets where more than 80 homes were flooded, trained interviewers supervised by the principal investigator administered the 10-page questionnaire. A total of 100 questionnaires were distributed to the Slidell sample. Similar to the strategy used in the Mississippi Gulf Coast, Slidell respondents were provided the option to complete the questionnaires on the spot and return them to student interviewers or to use stamped, self-addressed envelopes to return them at their convenience. This flexibility was allowed to maximize the return and completion rates. A total of 64 respondents completed the questionnaires out of the 100 delivered. This implies that approximately 64 out of the 84 houses inundated due to Hurricane Georges were surveyed.

Information was collected on the damage, impacts, perceptions about equitable or inequitable emergency responses, relief, resource mobilization, and other coping strategies, as well as on health, economic, social, and psychological problems associated with Hurricane Georges. To maximize sample size, a replacement sampling procedure was used for vacated or completely destroyed buildings. Information was also collected on background characteristics of respondents, including race, age, sex, level of education, household income, neighborhood and household composition (see Table 1). The results of the survey are summarized in the next section.

RESULTS

The results of the survey are summarized in Tables 1 to 6. In Table 1, the social and demographic characteristics of the respondents are presented with racial composition of 84.6% white relative to 15.4% nonwhite in the Biloxi sample, and 93.7% white relative to 6.3% nonwhite in the Slidell sample. Clearly, these samples do not reflect the official racial composition of the cities from which they were drawn. The breakdown by gender is similar for both the Slidell and Biloxi

samples, with a ratio of 47% male and 53% female respondents. The distribution by age is also presented in the table, with the majority falling into the 31 to 50 years age bracket in Biloxi, and 51 to 70 years age bracket in Slidell's Palm Lake subdivision. About 37.5% of respondents in the Palm Lake community in Slidell, are retired, relative to 25.3% in Biloxi. The majority, however, hold full-time employment and are home owners (80.2% in Biloxi) and (96.9% in Palm Lake, Slidell). The distribution by level of education is also shown, with the majority indicating they have completed high school and some college. The income distribution for the samples indicates that most respondents in Biloxi are in the $30,000 to $50,000 income bracket, while most respondents from Slidell registered income of $70,000 or above. Other background characteristics shown in Table 1 include the respondents' marital status, number of children living in the household during the hurricane, and political ideological orientation.

In addition to percentages of the raw score distributions, chi-square was used to identify which of the background characteristics are significantly related to hurricane effects. The result shows that home ownership ($p < .01$), job status ($p < .10$), household income ($p < .01$), number of children in household ($p < .05$), and neighborhood racial population composition are significantly associated with hurricane vulnerability.

In Table 2, respondents' attitudes, opinions, and perceptions of Hurricane Georges and associated impacts are presented. In the questionnaire, respondents were asked to rate the quality of their community before and after the hurricane. They were also asked to indicate the extent to which hurricane Georges has affected their health and whether their communities were declared a federal disaster area, whether they carried a hurricane hazard insurance policy, and what specific impacts they suffered due to Hurricane Georges. Respondents were also asked to identify the major obstacles to mitigating hurricane and flood-related problems in their communities. The responses to these items are tallied and presented in Table 2. As expected, the area that suffered the most impact registered about 10% reduction in post-hurricane ratings of the quality of their community as a place to live. In Biloxi, Mississippi, 14.3% of respondents reported their health had been

negatively affected a fair amount to a great deal, while 30.8% indicated they were not affected very much, and 54.9% indicated it was too early to tell or that they were not affected at all. About 69% of Biloxi respondents said that their communities were declared a federal disaster area, with the deployment of National Guards in some cases.

Despite the intensity of the hurricane, over 70% of respondents from Biloxi indicated they stayed home. In Slidell, only 39% of respondents stayed home, about 22% evacuated, and over 34% traveled out. Most respondents suffered minimal to moderate damage. Both in Biloxi and Slidell, only about 5% to 11% of respondents indicated they suffered severe damage or total destruction to their homes, automobiles, and personal property; another 16% to 38.5% indicated they suffered slight damage to moderate damage to their homes [$p < .05$].

Respondents were asked to give an estimate (in dollars) of their losses due to Hurricane Georges. Both in Biloxi and Slidell, an overwhelming majority reported their losses to be under $5,000. Only about 3.3% and 12.5% from the two areas respectively reported losses in excess of $30,000. Also noteworthy is the fact that 67% to 94% of respondents in Biloxi and Slidell respectively carried hurricane hazard insurance prior to Georges. Over 80% of respondents from both areas reported they did not receive any emergency relief. But the few that did receive emergency relief indicated FEMA, Red Cross, and local civic associations as the major sources. Most of the respondents confirmed that shelters were provided for residents' evacuation in their respective communities. The majority of respondents reported extensive power outage problem during the hurricane. Other impacts reported by respondents are presented in the table. When asked about the major obstacle to solving hurricane and flood problems, the majority identified poor drainage as a major problem. Thus, improving the drainage system would help to mitigate flooding problems along the Gulf Coast.

The media play a vital role during these events by broadcasting weather advisories during the pre-impact, impact, and post-impact phases of hurricane or other disaster episodes. Hurricane Georges received substantial coverage by the media. Our respondents were asked to rate how useful the various media were as sources of information during

Hurricane Georges. The rating categories included "most useful," "adequate," "inadequate," and "not useful" as shown in Table 3. Local television stations and radios were found to be the most useful ($p < .10$), followed by neighbors and friends. To some extent, a few respondents found local newspapers to be adequate (33%) as an important source of information during the hurricane episode.

Table 4 presents the results of survey items asking respondents to rate the quality of life since Hurricane Gorges, present health as compared to a few months prior to the episode, how often the respondents think about the hurricane, and the likelihood of staying in the same neighborhood in the next five years. Generally, the majority of the respondents did not see much diminution in the quality of life due to the hurricane. However, most respondents said they always or sometimes think about Hurricane Georges ($p < .01$). About 11% to 13% of the samples reported their health to be worse off than prior to the hurricane. When asked how likely it is the respondents would be staying in the same neighborhood in the next five years, about 41% in Biloxi and 70% in Slidell indicated they will definitely stay in their neighborhood, and 42% in Biloxi and 27% in Slidell indicated they will probably stay in the same neighborhood. Only about 8% indicated they will probably or definitely not stay in their present neighborhood ($p < .01$). Thus, the community breakdown often associated with natural disasters seems not to be in effect in these two areas.

In Table 5, the attitudes and opinions concerning various aspects of Hurricane Georges were obtained using Likert-type items asking respondents to strongly agree, agree, disagree or strongly disagree to a series of statements displayed in the table. Most respondents strongly agreed that disasters such as hurricanes are the work of nature. The majority also agreed that people came together to help one another during the hurricane/flood episode and that neighbors developed a sense of closeness more than ever before. About 31% to 48% of the respondents agreed or strongly agreed that emergency relief was fairly and equitably distributed to all needy victims. However, a few respondents expressed their dissatisfaction in open-ended items of the survey. For instance one respondent in Biloxi expressed that:

There are some who had no damages or losses who were first in line for handouts which were needed by others who lost everything.
Quite a few respondents complained about the response of insurance companies. A respondent in the Mississippi Gulf Coast area remarked that:

The insurance companies did much more psychological damage than the hurricane.
Another indicated having a very negative experience with the insurance companies' lack of adequate response and provision of coverage stated in the insurance policy.
Most respondents from the two samples agreed or strongly agreed that emergency responses were prompt and that emergency preparedness and hurricane warning systems were promptly activated. Two other items in the table involve respondents' opinion as to whether humans are partly to blame for some of the damage caused by natural hazards such as hurricanes, and whether the power of science and technology will enable humans to control the paths of hurricanes and other natural hazards. For the former, only about 36.3% of respondents from Biloxi agreed or strongly agreed that humans have some blame for the damage caused by hurricanes, while over 56% of Slidell respondents agreed or strongly agreed that humans are definitely partly to blame for most damage caused by disasters. People build houses in floodplains, hurricane paths, and other disaster prone environments due to a variety of reasons, including urbanization, population density, desires and preferences to live on the coastal shores. For the latter item concerning the power of science and technology, the majority of respondents disagreed or strongly disagreed that mankind would someday control the paths of hurricanes.
A list of possible adverse health conditions linked to hurricanes and floods were included in the survey. On a 1 to 5 frequency of experience scale, respondents were asked to indicate whether they have experienced or never experienced each of the health conditions listed in Table 6 as a result of the hurricane and floods of September 1998. The results for

both the Biloxi and Slidell samples are presented in the table. Using chi-square, only five health problems are statistically significant, including attention span disorder ($p < .10$), sleeping problem or insomnia ($p < .10$), skin irritation ($p < .10$), insect bites ($p < .05$), and depression and moodswings ($p < .05$). Because of the differences in the degree of impacts, the respondents from Biloxi reported more adverse health problems than their counterparts in Slidell. For instance, in addition to problems identified above, a large percentage of Biloxi respondents indicated they have frequently experienced or experienced fatigue (45.1%), aches and pains (51.6%), fear or anxiety of future health problems (31.9%), and 28.6% complained about diarrhea and respiratory problems respectively.

DISCUSSION

Natural disasters are generally inevitable; but in the United States, advanced warning systems and evacuation plans are generally employed to mitigate the impacts of hurricanes and related disturbances. In September 1998, Hurricane Georges packed a devastating punch, affecting many residents in Gulf Coast communities. The city of Biloxi and adjacent communities in Mississippi, as well as the city of Slidell in St. Tammany Parish, Louisiana, were among the several communities impacted by Hurricane Georges. Within a quick response framework, specific research questions were put together in anticipation of a possible hurricane episode of the magnitude of Hurricane Georges. Shortly after Georges, permission to enter the field and carry out the necessary field work, including data collection and observation, was obtained.

The original intent of this project was to assess the issue of racial/ethnic and socioeconomic inequity associated with a natural disaster such as a hurricane. Unfortunately, the skewed or unrepresentative distribution by race/ethnicity of the present sample does not allow any meaningful analysis along racial/ethnic line. However, neighborhood racial/ethnic

mix as reported by the respondents was found to be significant in explaining hurricane impact vulnerability. Are certain communities more vulnerable than others? Most definitely yes, as those communities located in proximity to the Gulf Coast and at lower elevation or in proximity to the bayous and reiverine plains are more vulnerable to hurricane and flooding. The respondents who indicated they live within half a mile or less of the seashore or bayous suffered more damage than those who live farther away from such areas. One practical or policy implication of this finding is that people who prefer to live in close proximity to the seashores and other low elevation environments must be able to afford building structures engineered to withstand high velocity winds, hurricanes, and other hydro-meteorological disturbances. Thus, there is a need to develop more stringent building codes for residential building structures in lower elevation coastal/riverine environments.

In terms of emergency relief, only a very few respondents indicated a slight problem of inequity. An overwhelming majority reported a fair and equitable distribution of relief to victims. The results of the present study suggest that people do come together to help each other and share resources during the period of crisis or impact phase of a disaster. This is consistent with expectation. However, recent empirical studies have noted a significant deterioration of social support during the post-impact period of a disaster (Kaniaski and Norris, 1993). Most respondents agreed that natural hazards such as hurricanes are an act of nature and that there is little science and technology can do about these phenomena. However, a significant percentage of the respondents agreed or strongly agreed that humans (society) share a substantial blame for the damage caused by natural hazards such as hurricanes.

The health effects of the floods and hurricanes represent an important area of research previously underinvestigated. A broad list of self-reported health problems associated with Hurricane Georges is offered in this report. The percentage breakdown of respondents who experienced and did not experience specific health problems by region is presented in Table 6. As expected, insect bites, attention span disorder, depression, skin irritation, and sleeping problems were among the

physiological and psychological impacts of Hurricane Georges. Other conditions including fear/anxiety, aches and pains, fatigue, gastroenteritis, and a recent outbreak of encephalitis (brain inflammation) in Louisiana are among critical health problems associated with hydro-meteorological disturbances, especially among coastal and riverine areas. While no direct "cause" and "effect" is currently established, previous research suggests several factors associated with a natural disaster episode that may negatively affect the health of victims. Clayer, Bookless-Pratz, and Harris (1985) suggest that health problems among the victims of natural disasters may not be formally recognized 12 months after the incident. Thus, the findings reported here are preliminary as further analyses of the data are required. The major shortcoming of this endeavor, however, involves the lack of sample representativeness by race and ethnicity. This was inevitable for Slidell's Palm Lake sample. For Biloxi, the only way to ensure representativeness would have involved the use of a purposeful (snowball) sampling strategy, and this was not practically feasible at the time of field-work. Therefore, future studies using samples that reflect the racial and demographic composition of impacted communities are encouraged. For this study, we cannot fully address the role of race/ethnicity in the differential impacts of Hurricane Georges. Future studies can and should shed more light on this issue.

TABLES

Table 1

Background Characteristics of Respondents to Hurricane Georges Survey

	Mississippi Gulf-Coast	Slidell, Louisiana

	Biloxi, Mississippi			
Basic Characteristics	(N = 91)	%	(N = 64)	%
	x^2			
Race:	7.5			
White	77	84.6	60	93.7
Non-White	14	15.4	4	6.3
Home ownership status:	12.8***			
Own home	73	80.2	62	96.9
Renting or leasing	18	19.8	2	3.1
Sex:	0.0			
Male	43	47.3	30	46.9
Female	48	52.7	34	53.1
Age:	68.7			
19-30	9	9.9	2	3.1
31-40	17	18.7	7	10.9
41-50	18	19.8	8	12.5
51-60	16	7.6	17	26.6

61-70	15	16.5	19	29.7
71-80	9	9.9	7	10.9
81 and above	3	3.3	4	6.3
N/A	4	4.4	--	--

Level of education:
8.6

8th grade or less	4	4.4	--	--
Some high school	5	5.5	2	3.1
High school or GED	22	24.2	14	21.9
Some college/voc. school	36	39.6	25	39.1
Completed college	13	14.3	17	26.6
Some graduate program	3	3.3	2	3.1
Completed graduate degree	8	8.8	3	4.7
N/A	--	--	1	1.6

Job status:
9.3*

Employed full-time	48	52.7	31	48.4
Employed part-time	5	5.5	4	6.3
Home-maker or retired	23	25.3	24	37.5
Unemployed/on disability	15	16.5	4	6.3
N/A	--	--	1	1.5

Total household income: 38.7***				
Less than $10,000	14	15.4	--	--
$10,000-$19,999	8	8.8	7	10.9
$20,000-$29,999	16	17.6	2	3.1
$30,000-$49,999	28	30.8	9	14.1
$50,000-$69,999	10	11.0	12	18.7
$70,000 or more	11	12.1	25	39.1
N/A	4	4.4	9	14.1
Marital status: 7.4				
Married	55	60.4	48	75.0
Divorced	10	11.0	6	9.4
Widowed	9	10.0	7	10.9
Separated	3	3.3	--	--
Living together	4	4.4	1	1.6
Single, never married	10	11.0	2	3.1
Number of children living in household: 14.9**				
None	51	56.0	34	53.1
One child	16	17.6	12	18.8

Two or more children	22	24.2	8	12.5
N/A	2	2.2	10	15.6

Duration of residency in neighborhood:
4.1

Less than 6 months	1	1.1	1	1.6
6 months to 1 year	8	8.8	1	1.6
Over 1 year to 5 years	17	18.7	10	15.6
6 or more years	65	71.4	52	81.2

Neighborhood racial population composition:
26.4***

Mostly black/minority	3	3.3	1	1.6
Mostly mixed	34	37.4	2	3.1
Mostly white	54	59.3	61	95.3

Political views:
3.8

Very liberal	5	5.5	2	3.1
Somewhat liberal	9	9.9	6	9.4
Moderate or middle	29	31.9	24	37.5
Somewhat conservative	30	33.0	14	21.9
Very conservative	12	13.2	11	17.2
Don't know	3	3.3	4	6.3

N/A	3	3.3	3	4.7

Note: *P < .10, **P < .05, ***P < .01 significance.

Table 2

Respondents' Attitudes and Perception of the Impact of Hurricane Georges

Survey Item(s)	Response by Place				
	Mississippi Gulf Coast (Biloxi)		Louisiana Gulf Coast (Slidell-Palm Lake)		
	N	%	N	%	x^2
How do you rate your community as a place to live prior to Hurricane Georges?					8.2**
Good to excellent	83	91.2	63	98.4	
Fair	7	7.7	1	1.6	

Poor	1	1.1	0
	0.0		

How do you rate your community as a place to live after Hurricane Georges?
14.9***

Good to excellent	73	80.2	62
	96.9		
Fair	11	12.1	2
	3.1		
Poor	6	6.6	--
	--		
DK/NA	1	1.1	--
	--		

How much has Hurricane Georges affected your health?
11.2**

A fair amount to a great deal	13	14.3	11
	17.2		
Not very much	28	30.8	7
	10.9		
Too early to tell or not at all	50	54.9	46
	71.9		

Was your community declared a Federal

disaster area after Hurricane Georges?
27.4***

Yes	63	69.2	17
	26.6		
No	17	18.7	29
	45.3		
DK/NA	11	12.1	18
	28.1		

Did you and your family stay at home, travel

out, or evacuate during the hurricane?
16.3***

Stayed home	64	70.3	25
	39.1		
Evacuated	7	7.7	14
	21.9		
Traveled out	16	17.6	22
	34.3		
Other arrangement	4	4.4	3
	4.7		

How would you describe the damage

caused by the hurricane on your home?
20.9***

Severe damage to total destruction	5	5.5	7
			10.9
Slight damage to moderate damage	35	38.5	10
			15.6
Very minimal damage	34	37.4	17
			26.6
No damage	17	18.6	30
			46.9

How would you describe the impact of

Hurricane Georges on your personal

belongings?
10.9*

Severe damage to total destruction	3	3.3	6
			9.4
Slight damage to moderate damage	15	16.5	6
			9.4
Very minimal damage	6	6.6	7
			10.9
No damage	66	73.0	45
			70.3
DK/NA	1	1.1	--
			--

How would you describe the damage caused

to your automobile by the Hurricane?
13.8**

Severe damage to total destruction	4	4.4	--
			--
Slight damage to moderate damage	4	4.4	1
			1.5
Very minimal damage	9	9.9	62
			96.9
No damage	74	81.3	1
			1.5
DK/NA			--
			1

What do you estimate your dollar losses due

to the hurricane and associated flood to be?
36.8***

Under $5,000	75	82.4	49
			76.6
$5,000 to $9,999	9	9.9	1
			1.5
$10,000 to $19,999	2	2.2	--
			--
$20,000 to $29,999	2	2.2	4
			6.3
Over $30,000	3	3.3	8
			12.5
DK/NA	--	--	2
			3.1

Did you have hurricane hazard insurance

coverage on your property prior to Georges?
16.9***

Yes		61	67.0	60
	93.8			
No		29	31.9	3
	4.7			
NA		1	1.1	1
	1.5			

Did you receive any emergency relief?
2.2

Yes		10	11.0	10
	15.5			
No		81	89.0	53
	83.0			
NA		--	--	1
	1.5			

Primary source of emergency relief?
2.12

FEMA		14	15.4	12
	18.8			
Red Cross		4	4.4	2
	3.1			

City government	2	2.2	2	3.1
Civic group	64	70.3	43	67.2
Others: friends & relatives	7	7.7	4	6.3
DK/NA	--	--	1	1.5

How soon were you able to get help after the Hurricane?
13.0***

Few hours to 1 day	12	13.2	4	6.3
2 to 3 days	9	9.9	1	1.5
4 to 6 days	5	5.5	6	9.4
Over 1 week	21	23.0	8	12.5
Never	44	48.4	44	68.8
DK	--	--	1	1.5

About how much relief did your family receive?
2.26

None		79	86.8	54
	84.4			
Under $1,000		5	5.5	3
	4.7			
$1,000 to $4,999		5	5.5	4
	6.2			
Over $5,000		2	2.2	3
	4.7			

Did your household suffer power outage during the hurricane?
8.3**

Yes		80	87.9	64
	100			
No		10	11.0	
DK/NA		1	1.1	--

If yes, for how long?
22.0***

Few hours		23	25.3	2
	3.1			
Half day		9	9.9	21
	32.8			
Over 2 days		55	60.4	39
	60.9			
DK/NA		4	4.4	2

3.1

Trouble getting food and water?
3.6

Yes	8	8.8	1
			1.6
No	82	90.1	62
			96.8
DK/NA	1	1.1	1
			1.6

At any time during the hurricane did you think you or any member of your family might die?
0.8

Yes	10	11.0	6
			8.4
No	80	87.9	58
			90.6
DK/NA	1	1.1	--
			--

Has it been hard to see your friends since the hurricane because they've moved or you've moved?
1.9

Yes	3	3.3	1
			1.6

No		88	96.7	62
	96.9			
DK/NA		--		1
	1.6			

Family lived apart for more than

one week?

	1.9			
Yes		8	8.8	2
	3.1			
No		83	91.2	62
	96.9			

Did any member of your family lose his

his/her job because of the hurricane?

	4.4**			
Yes		6	6.6	--
	--			
No		85	93.4	64
	100			

Did you get hurt during the hurricane?

	5.8*			
Yes		0	0.0	2
	3.1			
No		91	100	60
	93.8			
DK/NA		--		1

1.6

Did anyone in your family get hurt?
1.6

Yes	2	2.2	2
			3.1
No	89	97.8	61
			95.3
DK/NA	--		1
			1.6

Did you have to go outside during the hurricane because the building you were in was badly damaged?
4.4

Yes	6	6.6	0
			0
No	82	90.1	62
			96.9
DK/NA	3	3.3	2
			3.1

Were shelters provided in your community for residents' evacuation?
17.7***

Yes	84	92.3	42
			65.6
No	5	5.5	14

	21.9			
DK/NA		2	2.2	8
	12.5			

The biggest problem/obstacle to solving

hurricane and flood problems in respondents' community
25.5***

LACK OF MONEY		13	14.3	2
	3.1			
LACK OF GOVT. INTEREST		5	5.5	4
	6.3			
LACK OF KNOWLEDGE		6	6.6	1
	1.6			
INADEQUATE LEVEE SYSTEM		1	1.1	5
	7.8			
POOR DRAINAGE		35	38.5	17
	26.6			
INADEQUATE WARNINGS		1	1.1	4
	6.3			
OTHERS		13	14.3	4
	6.3			
DK/NA		17	18.7	29
	45.3			

Note: *p < .10, **p < .05, ***p < .01 significance respectively.

Table 3

Perceived Media and Other Sources of Information Usefulness During Hurricane Georges

Media and Usefulness	Louisiana Gulf-coast (Slidell)		Mississippi Gulf-coast (Biloxi-Gulfport)		T-value
	N	%	N	%	
Local T.V. and radios					-1.8*
MOST USEFUL	86	94.5	51	79.7	
ADEQUATE	4	4.4	6	9.4	
INADEQUATE	0	-	1	1.6	
NOT USEFUL	1	1.1	1	1.6	
DK/NA	0	-	5	7.7	
Local newspapers					-0.2
MOST USEFUL	22	24.2	9	14.1	

ADEQUATE	30	33.0	20	31.3
INADEQUATE	9	9.9	9	14.1
NOT USEFUL	16	17.6	13	20.3
DK/NA	14	15.4	13	20.3

Local Govt. authorities
0.1

MOST USEFUL	18	19.8	11	17.2
ADEQUATE	35	38.5	31	48.4
INADEQUATE	10	11.0	5	7.8
NOT USEFUL	11	12.1	5	7.8
DK/NA	17	18.7	12	18.8

Civic Associations
0.1

MOST USEFUL	12	13.2	9	14.0
ADEQUATE	21	23.1	20	31.3
INADEQUATE	8	8.8	6	9.4
NOT USEFUL	26	28.6	12	18.7
DK/NA	24	26.4	17	26.6

Neighbors
0.1

MOST USEFUL	34	37.4	25	39.1

ADEQUATE	28	30.8	17	26.6
INADEQUATE	5	5.5	3	4.7
NOT USEFUL	7	7.7	6	9.4
DK/NA	17	18.7	13	20.3
	Internet/e-mail 0.7			
MOST USEfUL	5	5.5	2	3.1
ADEQUATE	10	11.0	13	20.3
INADEQUATE	8	8.8	2	3.1
NOT USEFUL	42	46.2	26	40.6
DK/NA	26	28.6	21	32.8

Note: *p < .10 significance.

Table 4

Some Quality of Life Impacts of Hurricane Georges

Item(s)	Mississippi Gulf-Coast	Louisiana Gulf-coast

	N	%	N	%	T-value
General quality of life since Hurricane Georges?					-2.43**
EXCELLENT	17	18.7	26	40.6	
VERY GOOD	42	46.1	22	34.4	
GOOD	29	31.9	14	21.9	
POOR	3	3.3	2	3.1	
DK/NA	--	--			
Present health compared to a few months prior to Hurricane Georges					0.72
BETTER THAN BEFORE	1	1.1	3	4.7	
SAME AS BEFORE	69	75.8	52	81.3	
WORSE THAN BEFORE	12	13.2	7	10.9	
CAN'T TELL	9	9.9	2	3.1	
How often do you think about Hurricane Georges since September?					2.85***
ALWAYS	16	17.6	8	12.5	

SOMETIMES	40	44.0	14	21.9
SELDOM	21	23.1	24	37.5
DON'T THINK ABOUT IT AT ALL	14	15.4	18	28.1
Likelihood of staying in the same neighborhood in the next 5 years -2.69***				
DEFINITELY STAYING	37	40.7	45	70.3
PROBABLY STAYING	38	41.7	17	26.6
PROBABLY NOT STAYING	7	7.7	1	1.6
DEFINITELY NOT STAYING	7	7.7	0	--
DON'T KNOW/NA	2	2.2	1	1.6

Note: *p < .10, **p < .05, ***p << .01 significance.

Table 5

Opinions and Attitudes About Hurricane Georges

Item(s)	Mississippi Gulf-Coast		Louisiana Gulf-Coast	
	N	%	N	%
T-value				

==========

Respondents were asked to strongly agree, agree, disagree or strongly

disagree with each specific statement below.

Disasters such as hurricanes are the work

of nature.
1.08

STRONGLY AGREE	72	79.1	44	68.8
AGREE	16	17.6	15	23.4
DISAGREE	2	2.2	3	4.7
STRONGLY DISAGREE	1	1.1	2	3.1
DK/NA		0		0

People in my community came together to help

each other out during the hurricane.
1.31

STRONGLY AGREE	47	51.6	29	45.3
AGREE	34	37.4	25	39.1
DISAGREE	6	6.6	2	3.1
STRONGLY DISAGREE	3	3.3	1	1.6
DK/NA	1	1.1	6	9.4

Emergency reliefs were fairly and equitably

made available to all of the victims.
1.73*

STRONGLY AGREE	24	26.4	18	28.1
AGREE	47	51.6	29	45.3
DISAGREE	15	16.5	4	6.3
STRONGLY DISAGREE	1	1.1	1	1.6
DK/NA	4	4.4	12	18.8

The emergency responses were prompt.
2.58***

STRONGLY AGREE	34	37.4	20	31.3
AGREE	44	48.4	29	45.3
DISAGREE	9	9.9	1	1.6
STRONGLY DISAGREE	2	2.2	1	1.6
DK/NA	2	2.2	13	20.3

Emergency preparedness and hurricane warning

systems were promptly activated.
3.72***

STRONGLY AGREE	61	67.0	25	39.1
AGREE	24	26.4	26	40.6
DISAGREE	3	3.3	2	3.1
STRONGLY DISAGREE	1	1.1	0	--

DK/NA	2	2.2	11	17.2

I felt closer to my neighbors during the hurricane than ever before.
2.50***

STRONGLY AGREE	35	38.5	22	34.3
AGREE	34	37.4	19	29.7
DISAGREE	16	17.6	15	23.4
STRONGLY DISAGREE	4	4.4	1	1.6
DK/NA	2	2.2	7	10.9

Emergency reliefs and necessary assistance were fairly and equitably made available to all the needy victims.
1.83*

STRONGLY AGREE	23	25.3	15	23.4
AGREE	46	50.5	32	50.0
DISAGREE	15	16.5	3	4.7
STRONGLY DISAGREE	3	3.3	0	--
DK/NA	4	4.4	14	21.9

Humans are partly to blame for some of the damages caused by natural hazards such as hurricanes.

		-0.46		
STRONGLY AGREE	11	12.1	11	17.2
AGREE	22	24.2	25	39.1
DISAGREE	32	35.2	17	26.6
STRONGLY DISAGREE	23	25.3	11	17.2
DK/NA	3	3.3	0	
With the power of science and technology, humans will be able to control the paths of hurricanes and other related natural hazards.				
		-0.42		
STRONGLY AGREE	0	--	3	4.7
AGREE	8	8.8	7	10.9
DISAGREE	39	42.9	19	29.7
STRONGLY DISAGREE	42	46.2	31	48.4
DK/NA	2	2.2	4	6.3

Note: *p < .10, **p < .05, ***p < .01 significance.

Table 6

Self-Reported Health Problems Associated with Hurricane Georges and Related Hazards

Item(s)	Louisiana			Mississippi			
	Gulf-Coast			Gulf-Coast			
	Exp.	Not-Exp	NA	Exp.	Not-Exp	NA	x^2
	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	
a. Attention span disorder	25 (27.5)	59 (64.8)	7 (7.7)	7 (10.9)	45 (70.3)	12 (18.8)	10.5*
b. Respiratory problems	26 (28.6)	58 (63.7)	7 (7.7)	15 (23.4)	38 (59.4)	11 (17.2)	5.7
c. Diarrhea	26 (28.6)	58 (63.7)	7 (7.7)	41 (64.1)	14 (21.9)	9 (14.1)	4.9
d. Insect bites	50	36	5	27			

28 9 12.5**

(54.9) (39.6) (5.5) (42.2) (43.8) (14.1)

e. Malaria 2 81 8 52 2 10 3.27

(2.2) (89.0) (8.8) (81.3) (3.1) (15.6)

f. Encephalitis 2 79 10 2 52 10 2.26

(2.2) (86.8) (11.0) (3.1) (81.3) (15.6)

g. Typhoid fever 0 80 11 2 52 10 3.39

(0.0) (87.9) (12.1) (3.1) (81.3) (15.6)

h. Gastroenteritis 21 64 6 8 47 9 4.65

(23.1)(70.3) (6.6) (12.5) (73.4) (14.1)

i. Trauma 17 68 6 6 47 11 8.85

(18.7)(74.7) (6.6) (9.4) (73.4) (17.2)

j. Inability to work 15 70 6 10
45 9 3.50

(16.5)(76.9) (6.6) (15.6)
(70.3) (14.1)

k. Eye irritation 25 58 8 11
44 9 8.27

(27.5)(63.7) (8.8) (17.2)
(68.8) (14.1)

l. Fatigue 39 44 8 21
34 9 3.48

(45.1)(48.4) (8.8) (32.8)
(53.1) (14.1)

m. Aches and pains 47 39 5 24
31 9 7.12

(51.6)(45.1) (5.5) (37.5)
(48.4) (14.1)

n. Hearing impairment 6 75 10 9
45 10 8.04

(6.6)(82.4) (11.0) (14.1)
(70.3) (15.6)

o. Problem sleeping 41 44 6 18
35 11 9.44*

(45.1)(48.4) (6.6) (28.1)
(54.7) (17.2)

p. Skin irritation 21 62 8 11
42 11 9.55*

(23.1)(68.1) (8.8) (17.2)
(65.6) (17.2)

q. Nervous disorder 17 68 6 6
47 11 9.16

(18.7)(74.7) (6.6) (9.4)
(73.4) (17.2)

r. Depression/mood swings 31 55 5 12
41 11 11.74**

(34.1)(60.4) (5.5) (18.8)
(64.1) (17.2)

s. Fear or anxiety of event 29 55 7 14
41 9 5.9

(31.9)(60.4) (7.7) (21.9)
(64.1) (14.1)

t. Fear of future health

problems 20 65 6 11
44 9 4.4

(22.0)(71.4) (6.6) (17.2)
(68.8) (14.1)

Note: Exp. = experienced, Not-Exp. = not experienced, and NA = no answer of don't know;

*p < .10, **p < .05, ***p < .01 significance.

END NOTES

1. See: The United States Department of Commerce, National Technical Information Service, National Hurricane Center, Unpublished Internet Data. Visit: http://www.nhc.noaa.gov
2. Also visit http://www.aoml.noaa.gov/general/nhurr97.html.
3. The law of Murphy stipulates that if there is any way in which a natural disaster can occur, it definitely will occur.

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