Natural Hazards and the Elderly

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FINAL FIELD REPORT

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INTRODUCTION

In December and January 1991/92, the Trinity River inundated large tracts of Liberty County, Texas. The Trinity River has a long history of flooding with references in the scientific literature and media accounts to events occurring in 1843, 1853, 1869, 1870, and 1889, and many others during the 20th Century. With the installation of river level gauges at Romayor and the City of Liberty, data have shown that the return period for damaging floods is less than ten years (Tables 1 and 2). Indeed, communities along the Trinity have been flooded four times in the last three years.

TABLE 1: GAUGING STATIONS - LIBERTY COUNTY, TEXAS

	ROMAYOR (1908-1961)	LIBERTY (1903-1961)
DRAINAGE AREA $(MILES)^2$	17,192	17,539
MEAN ANNUAL FLOW (cfs)	44,000	44,000
GAUGE HEIGHT BKFL (ft)	28	24
GAUGE HEIGHT MAX (ft)	45.8	29.4
DISCHARGE MAX (cfs)	111,000	114,000
RETURN PERIOD (yr)	25	31
REORD FLOOD	MAY 1942	MAY 1942

AVERAGE FLOW AT LIBERTY = 7,155 cfs.

TABLE 2: MAJOR FLOOD EVENTS AT LIBERTY, TEXAS

	GAUGE HEIGHT (ft)	DISCHARGE (cfs)
MAY 1942	29.38	114,000
MAY 1990	30.03	107,000
JAN 1992	29.72	N/A
APR 1945	28.8	104,000
MAY 1957	29.26	88,100
MAY 1944	27.81	64,000
MAY 1958	28.35	58,000
MAY 1953	28.02	53,200

JAN 1961	28.28	52,400
JUN 1965	28.32	46,700
MAY 1922	28.6	N/A
FEB 1920	28.4	N/A
MAY 1914	28.3	N/A
JUN 1929	28.3	N/A
JUN 1908	28.1	N/A

NOTE: Data collected from various sources but based on USGS statistics. Return periods not calculated because of incomplete data. Figures based on annual maximum series.

Since 1968, flooding has been linked in part to the operation of Lake Livingston Dam that stores water for the City of Houston. Many claim that flooding is particularly severe when large releases are required to preserve the integrity of the dam. Typically, management of such facilities is predicated on one of two strategies: release of water in anticipation of extreme precipitation upstream, or release of water during and following such precipitation events. Since the former is dependent on the certainty of occurrence of needed precipitation, the latter management technique is often used. Thus flooding of low-lying areas is to be expected. However, hydrologists at the Trinity River Authority argue that the operation of the dam merely transmits the flood wave downstream. Further work is necessary to determine the effects of the dam on water levels in Liberty County.

Sixteen subdivisions along the Trinity were directly affected by flooding in December and January. Over 270 dwellings were under water and thousands more had flood water on the property or were inaccessible for several weeks because of high flood levels and damaged roads. Many houses have recently been raised on stilts because of the high frequency of flooding and this undoubtedly reduced losses for a number of residents. Nevertheless, the incidence of flooding in Liberty County is typically of long duration with floods lasting for many weeks. When the subdivisions were visited in January 1992, three weeks after the onstart of flooding, some subdivisions were still only accessible by boat and official damage estimates had still not been made. County officials were even uncertain as to how many people were flooded and how many had evacuated their houses. Several emergency services were still operating in the county, including the Federal Emergency Management Agency, the Red Cross, as well as local church and community groups. Some people were still residing in shelters and many meals were being supplied both at the shelters and to people who had refused to move out of their properties. Locals with boats were used to distribute some of these supplies.

Given the high probability of flooding, Liberty County provides an ideal case study for examining the effects of the flood hazard on older adults. The field work provided the initial background data and it is planned to follow this up with additional studies during 1993.

The goal of the research is to produce an explanatory model of how older adults cope with hazardous events through an analysis of behavior patterns and attitudes. Of particular concern are changes in the mental and physical health of older adults, responses and attitudes towards hazard warning systems, and propensities to utilize support services such as federal relief programs.

Literature Review: A number of studies have focused on natural hazards and the elderly. Results suggest that the elderly experience declining health, and have greater social disruption and higher levels of depression than members of the community at large. Research has also discriminated between elderly groups, finding differences in behavior based on economic status, race and gender. Others have indicated that kinship relationships, socio-psychological characteristics and familiarity with stressors are significant variables in influencing post-hazard behavior. Age structure of the community may also play a role in perceived long-term support.

Hypotheses: The proposed theoretical framework to explain stress from hazards on older adults is based on three factors described in the literature: environmental conditions, mental health status, and physical health. The model predicts that older adults living in age homogeneous environments will experience less long-term stress and will react more favorably to subsequent hazard warnings than older adults in age heterogeneous environments. Furthermore, family networks, gender, race, and socioeconomic status will influence the emotional, physical and psychological responses of older adults towards hazards.

METHODOLOGY

During the site visit to Liberty County in January 1992, we obtained many large-scale maps of the subdivisions that were under water. These maps provided information on individual properties and details on the layout of each community. In addition, we collected telephone directories for each of the subdivisions. Based on these sources, we drew a random sample of households from the flooded areas and were able to match addresses with locations. Census data provided additional background information (Table 3).

TABLE 3: DEMOGRAPHICS - LIBERTY COUNTY, TEXAS

POPULATION:	54,700	1984
	47,088	1980
	5,900	Births
	3,100	Deaths
	4,900	Immigration

RACE:	86% White 11% Black 2% Hispanic
HOUSEHOLDS:	18,600 2.9 Persons/household 18.8% Households with one person
INCOME:	$8,404/CAP 1985 $9,895/CAP 1979 (1985 dollars) 13.6% persons below poverty line 10.7% families below poverty line
AGE:	41.4% UP TO 24 YEARS 29.5% 25 TO 44 YEARS 9.5% 45 TO 54 YEARS 19.7% 55 YEARS AND OVER

A total of 300 households were included in the sample. We then conducted a telephone interview survey. Since some of the individuals were still unable to get back into their homes by the time we were calling, we extended the period of interviewing into March. In the end, we completed interviews with 127 respondents who lived in the flooded areas. Of these, 85 had been directly affected by the flood by either having their home or land flooded or were unable to gain access to their property because of the flooding.

RESULTS

Sample Characteristics: Of the 127 respondents, 47.2% (n=60) were male and 52.8% (n=67) were female. Their ages ranged from 15 to 98. The median age was 56 and 64.3% of the sample were 50 years of age or older. The vast majority (93.7%) were white with only 7 respondents indicating they were either African American/Black or American Indian. Most of the respondents (74.9%) lived with at least one other person in the household and ten respondents indicated they lived with five or more people in the household.

Thirty-seven (29.1%) of the respondents were employed full-time, 33.1% (n=42) were retired and 11.8% (n=15) indicated they were homemakers. Only 4.7% (n=6) were unemployed and 8.7% (n=11) were employed part-time. The remaining individuals were students (n=3) or farmers (n=1).

Housing Characteristics: The majority of respondents (71.7%, n=92) lived in houses and 16% (n=33) lived in mobile homes. The remaining three respondents lived either in apartments or townhouses. Only 19.6% of the respondents who lived in houses had multiple stories in the home. However, 72.8% (n=67) indicated that their houses were built on stilts. The vast majority (91.2%, n=114) indicated they owned their home, and of these, only 23.7% n=27), were still making payments on their home.

Flooding Consequences: Forty-eight (37.8%) of the respondents indicated that their home had been flooded. Seventy-five (59.1%) indicated that their land had been flooded and seventy-four (58.3%) indicated that they

had problems getting to and from their property because of the flood. A total of eighty respondents had experienced at least one of the three aforementioned flooding problems. Estimates of damage repair costs ranged from a low of zero to a high of $30,000. The following table (Table 4) indicates the cost estimates to repair property. Of those who experienced flooding, only 36.4% (n=20) were insured for losses.

TABLE 4: COST TO REPAIR DAMAGE TO PROPERTY

Value	Frequency	%
Less than $1,000	7	21.2%
$1,001 - $4,000	15	45.5%
$4,001 - $8,500	6	18.2%
$8,501 - $30,000	5	15.2%
	n=33	

Twenty-eight respondents (25.5%) received some support from federal agencies to help them with the consequences of flooding. Federal assistance was primarily from the Federal Emergency Management Agency. Local agencies provided support for 9 respondents (8.2%) and the Red Cross provided assistance to 42 (38.2%) respondents. Local agencies included a local grocery store, the SOS thrift store and city sandbaggers. In addition, three respondents received assistance from local church groups. Neighbors provided assistance to 25 (22.7%) respondents. Two other groups were also mentioned in providing assistance, these included a local young persons group and a home health service. Only two respondents indicated that a member of their household had suffered an injury because of the flooding.

INDEPENDENT VARIABLES

Age: Eighty of the respondents were 50 years of age or older. Table five indicates the age breakdown of the sample.

TABLE 5: AGE STRUCTURE OF THE REPONDENTS

Age	Frequency	%
Under 30	11	8.9%
31-40	18	14.5%
41-50	18	14.5%
51-60	27	21.8%
61-70	29	23.4%
71 and older	21	16.9%
	n=124	

There existed a significant relationship between age and whether or not the respondent's home had been flooded [X^2=23.62, df=10, p<01] and between age and whether or not the respondents' land had been flooded [X^2=9.89, df=5, p=.07]. Table six indicates the frequency of property and land flooding by age category.

TABLE 6: AGE BY FLOODING CHARACTERISTICS

Age	Home Flooded		Land Flooded		Access Problems	
	N	%	N	%	N	%
Under 30	2	4.4	4	5.6	5	7.0
31-40	2	4.4	6	8.3	8	11.3
41-50	7	15.6	10	13.9	8	11.3
51-60	12	26.7	19	26.4	20	28.2
61-70	13	28.9	19	26.4	19	26.8
71 and older	9	20.0	14	19.4	11	15.5
	N=45		N=72		N=71	

Familiarity with Flooding: In order to assess familiarity with flooding, we asked how frequently respondents had experienced similar types of flooding in the past. Table seven indicates the frequency of past flooding experiences for the respondents.

TABLE 7: FLOOD EXPERIENCE

Number of Past Floods	Frequency	%
0	5	4.1
1	10	8.2
2	20	16.4
3	43	35.2
4	22	18.0
5 or more	22	18.00
	N=122	

As evidenced by the data, our respondents are, for the most part, very familiar with flooding. This is an area which has seen frequent events over the past decade and many of our respondents indicated that flooding along the Trinity River was simply a part of life in that area.

Health Status: General health status of the respondents was ascertained by asking them how their health is, in general: excellent, good, fair or poor. The following table (Table 8) indicates their responses.

TABLE 8: HEALTH STATUS

Health Status	Frequency	%
Excellent	29	22.8
Good	62	48.8
Fair	24	18.9
Poor	12	9.4
	N=127	

Thirty of the respondents (23.6%) indicated that they had had a health problem lasting for more than two months (Over sixty-seven per cent (n=86) of the respondents indicated that they had health insurance. Twenty-four (18.9%) respondents indicated that they had a medical condition which limits their dressing and 17.3% (n=22) indicated that they had a condition which restricts them from moving about. Ten of the respondents (7.9%) require mechanical aids to move about.

Age Homogeneity: Age homogeneity has been shown in the aging literature to be a significant factor in influencing elderly residents' quality of life in the community. Generally, individuals in age homogeneous communities have more access to resources and are less isolated than elderly individuals who live in age heterogeneous communities. In order to assess age homogeneity, we asked whether or not he people who live in the respondent's community are generally of similar age or of various ages. Forty-six indicated that they lived in a community where the majority of residents were of similar ages.

Mental Health Status: Mental health status was determined by asking two questions related to depression and anxiety. Thirty-seven (29.1%) of the respondents indicated that they had felt depressed prior to the flood and 18.9% (n=24) indicated that they had felt anxious prior to the flood. The mental health variable was created by combining these two issues with a low score of 1 indicating no problem with depression or anxiety and a high score of 3 indicating a history of both depression and anxiety.

Support Networks: Level of kinship and friendship networks were determined by three questions. The first asked how many people live in the respondent's household, the second asked how many close relatives live in the community and the third asks whether or not the respondent has any close friends whom he/she can call if help is needed.

DEPENDENT VARIABLE

Post Hazard Stress: A series of questions were used to assess stress levels following the flooding. We asked whether or not the respondents had had any of the following problems since the flood:

Trouble sleeping
Loss of appetite
Feeling weak all over
Shortness of breath
Hands trembling
Wondering if anything is worthwhile

The responses to these problems were combined to create a single post-hazard stress scale. Responses ranged from a high of 12 (indicating low stress) and a low of 6 (indicating high stress). These scores were then recoded from 1 (low stress) to 7 (high stress).

REGRESSION ANALYSIS

A regression model was used to analyze the influence and significance of the independent variables of friendship networks, kinship networks, age homogeneity, age, familiarity with floods, health status, and mental health status on the dependent variable, stress immediately following the flood. Only those respondents who had actually experienced damage or inconvenience from the flooding were included in the analysis. This included 85 of the 127 respondents.

Predictors of Stress: There were four significant predictors of stress among our respondents, familiarity with floods, health status, mental health status and the number of people living in the household (see Table 9).

Contrary to our hypothesis, individuals who had experienced flooding in the past experienced more symptoms of post hazard stress than those who had experienced fewer or no previous flooding [Beta=.23, T=2.26, p<.03].

TABLE 9: REGRESSION ANALYSIS

Variable	B	Beta	T
Friends to call on	-.37	-.10	-.94
Age Homogeneity	-.33	-.09	-.86
Age	-.01	-.08	-.73
Flooding familiarity	.07	.23	2.26**
Health status	.63	.34	3.09***
Relatives in town	.01	.03	.25
Mental health status	.58	.26	2.42**
No. of people in household	.29	.22	1.83*
(Constant)	.54	.35	

[F=4.734,df=8,p<.001]

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*p<.10
**p<.05
***p<.01

As predicted, individuals who indicated their health was poor or fair, as opposed to excellent or good, were more likely to experience higher levels of stress following the flooding [Beta=.34, T=3.1, p<.003]. Also, individuals who had indicated they had problems with depression or anxiety prior to the flood were more likely to indicate symptoms of stress following the flood than individuals who had no previous history of depression or anxiety [Beta=.26, T=2.4, [<.02].

Also, there existed a significant relationship between the number of people in the household and the levels of post hazard stress with the more people in the household the higher the levels of stress [Beta=.22, T=1.8, p=.07].

Interestingly, age proved not to be a significant predictor of stress and in fact, the nature of the relationship shows that older individuals experienced less stress than younger individuals [Beta=.08, T=.73, ns]. Age homogeneity also proved not to be a significant predictor of post hazard stress however the nature of the relationship illustrated that individuals in age homogeneous communities experienced less stress [Beta=.09,T=.85, ns].

Friendship networks [Beta=.10, T=,94, ns] and kinship networks [Beta=.03,T=.25,ns] also did not significantly predict stress following the flood.

SUMMARY

In conclusion, we found from this pilot survey, partial support for our model concerning age and the likelihood of post hazard stress. However, age did not prove to be a significant factor in this analysis. In fact, older adults were not more prone towards stress than any other age group even though they were significantly more likely to experience negative consequences from the flooding including having their home or land flooded, or to having access problems getting to and from their property. Further studies will now be made to determine stress during the up-coming "flood season" to further test the model.

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