Differential social vulnerability and response to Hurricane Dolly across the US-Mexico border

Isabelle Ruin (NCAR), Cedar League (UCCS), Mary Hayden (NCAR), Barry Goldsmith (NWS), and Jeral Estupiñán (NWS)

Introduction

Loss reduction of life and property from flooding in the aftermath of hurricanes is dependent not only on adequate preparation and lead time, but also on effective warning dissemination and, more importantly, public response to the warning. Previous research notes that warnings are geared toward the cultural majority and are less likely to reach those who are most vulnerable – the poor, the elderly, and cultural minorities (Burton et al. 1978, Mileti 1999; Perry and Mushkatel, 1986; Lindell and Perry, 2004, Hayden et al. 2007).

Mileti et al. (1975) found that appropriate response to warnings was more likely to occur if the warning could be confirmed by a variety of sources including various agencies, government entities, media, family or friends, thereby assuring those in the warning area of the accuracy of the message. Other factors that may influence an individual's response to warnings include age, education, gender, previous experience with a hazard, environmental cues, perceived risk, source credibility, and message specificity within the warning (Gruntfest 1987; Tobin and Montz 1997; Lindell and Perry 1992). Hayden et al. (2007) found most people continue to receive warning information from home via television, while the internet also plays a small role.

Successful warnings are those that are taken seriously and responded to in a timely and effective manner. Recent studies show that public reliance on "official" warnings from traditional sources may be shifting to more private and informal sources such as The Weather Channel and the internet (Baker, l995; Dow and Cutter, 1998; Drabek, 2001). Dow and Cutter (1998) suggest there is a perceived belief in the lack of reliability of official warnings among coastal residents, leading people to find other sources of warning information which are more personally relevant to influence their decisions about whether, how, and when to react to hazardous conditions.

Lindell and Perry (1992) use the protective action decision model to explain how people's risk perceptions are influenced by the certainty, severity, immediacy, and duration of their personal consequences. Furthermore, the propensity for individuals to take protective actions is influenced by cost, time and effort, knowledge and skill, amount of cooperation with others, and capacity to protect life and property. Additionally, environmental cues, the behavior of others, and messages from the news media, authorities and peers influence one's propensity to take protective action. These factors lead to a decision-making process beginning with risk probability and identification, consideration of possible actions, evaluation of consequences, and concluding with protective action implementation (Lindell and Perry 2004; Burton et al. 1993).

The main purpose of this study was to examine hurricane preparedness of the Lower Rio Grande Valley community when Hurricane Dolly hit the region July 23, 2008. This study posed the following questions: 1) How do the temporal aspects of hurricanes (warning lead time, duration,

and frequency) influence community hurricane preparedness? 2) Are there any differences in hurricane preparedness between English-speaking communities and Spanish-speaking communities? 3) Are there geographical differences in hurricane preparedness across the Lower Rio Grande Valley? And 4) Which aspects of the hurricane forecast lead people to take storm preparations more seriously?

To answer these questions, a questionnaire (Appendix A) was administered in English or Spanish to 67 participants from 10 separate locations in the Lower Rio Grande Valley on both sides of the United States and Mexico border between August 3-6, 2008. The questionnaire was used to examine the sources of warning information received by respondents for Hurricane Dolly, when the information was received, what action respondents took after learning of the hurricane warning, and when they took action. Respondents' perceptions of personal safety were examined and how that might or might not relate to their proximity to the coast, length of time in the area and prior hurricane experience.

Data Collection and Study Area

The study area included locations affected by Hurricane Dolly including Cameron, Hidalgo and Willacy Counties, along the Lower Rio Grande Valley (LRGV) in the state of Texas, and Matamoros, Mexico located in the State of Tamaulipas (Figure 1). Semi-structured intercept interviews were conducted in either English or Spanish in 10 separate locations in the LRGV (Figure 2). Participants were interviewed if they lived in the LRGV and were affected by Dolly. Sixty-seven participants were interviewed in 4 days either at their home (mostly in Matamoros, Los Fresnos, and Laguna Vista), on the beach at South Padre Island, and in shopping centers (Matamoros and Harlingen). For door-to-door interviews, we chose neighborhoods reflecting a broad variety of incomes, from trailer parks to wealthier neighborhoods.

Our study area is home to 1,020,228 people, with the city of Brownsville being the largest metro area in the US side of the border with a population of 165,223 (City of Brownsville, TX 2005). The US part of the study area has a Hispanic or Latino population of 87 percent (of any race), and 81.5 percent of the population speak a language other than English at home (US Census Bureau 2008). The median household income is $25,347 and 34 percent of individuals live below the poverty level. Brownsville has three border crossings to its closest neighboring city, Matamoros, Mexico. Matamoros has estimated population of 422,711 with a median household income of $10,570 (Mexico Census 2005).

Our study revealed the following demographics (Table 1). Compared to the census for both study areas, including Cameron, Willacy and Hidalgo counties in Texas, and for the city of Matamoros in Mexico, respectively, an overrepresentation of females exists for both areas. For the US, Spanish spoken as a first language is underrepresented, as well as those who did not finish high school and those who make less than $100/week. Those obtaining a high school diploma or equivalent and those who have had some college or a Bachelor's degree as the highest level of education completed are overrepresented. In Mexico, those who did not complete high school are underrepresented.

Characteristics	**US respondents** (% of total US)	**MX respondents** (% of total MX)	**Total survey**	**US Census** (study area)	**MX Census** (study area)
Gender					
Male	**16** (43.2%)	**7** (26%)	**24** (35%)	**48.5%**	**49.3%**
Female	**21** (56.8%)	**20** (74%)	**44** (65%)	**51.5%**	**50.7%**
Language spoken at home					
English	**26** (70%)	**3** (11%)	**33** (48.5%)	**18.5%**	-
Spanish	**11** (30%)	**24** (89%)	**35** (51.5%)	**81.5%**	-
Education					
Did not complete high school	**4** (11.4%)	**13** (50%)	**17** (26.2%)	**39%**	**66.3%**
High school diploma or equivalent	**15** (42.9%)	**4** (15.4%)	**20** (30.8%)	**25.5%**	**33.7%** (H.S. Grad/ College/ or further)
Some College/ Bachelors Degree	**14** (40%)	**7** (26.9%)	**23** (35.4%)	**30.9%**	
Graduate School or further	**2** (5.7%)	**2** (7.7%)	**5** (7.7%)	**4.6%**	
*** Household Income (weekly)**					
Less than 450 pesos or $100	**0** (0%)	**6** (26.1%)	**6** (10.3%)	**19%**	-
450-2250 pesos or $100-$400	**9** (28.1%)	**10** (43.5%)	**20** (34.5%)	**30%**	-
More than 2250 pesos or $400	**23** (71.9%)	**7** (30.4%)	**32** (55.2%)	**51%**	-
Total Population	**37** (58%)	**27** (42%)	**67**	**1,020,228**	**422,711**

Table 1. US and Mexico Demographics

**Household weekly income data unavailable for Matamoros. The average daily income for all households in Matamoros is 143.64 pesos. Source: INEGI Censo de Población 2000.*

Hurricane Dolly: Forecasts, Warnings, Impacts and Social Response

Historically, the Lower Rio Grande Valley is affected by tropical cyclones less frequently than most locations along the Gulf of Mexico; about once every five years the region experiences a tropical storm, and about once every 11 years, a hurricane (NWS 2008). Before Dolly, the most recent named storms to hit this area included Beulah (1967), Amelia (1978), Allen (1980), Barry (1983), Bret (1999) and Erika (2003).

Dolly first appeared as a tropical storm on July 20, 2008, and made landfall on July 21 in the northern Yucatan Peninsula before gaining hurricane strength (Figure 3). Moving quickly through the Gulf of Mexico, the eye of Dolly made landfall on South Padre Island, Texas, along the Cameron and Willacy County line, as a Category 2 hurricane on July 23 at approximately 12:15 pm CDT with instantaneous peak wind gust speeds exceeding 100 mph and sustained winds at Category 1 strength (NWS 2008). Average peak 3-second wind gusts reached 74 mph in the coastal town of Port Isabel, 77 mph in Bayview, 71 mph in Brownsville, and 74 mph moving inland into Harlingen. Dolly gradually weakened through the afternoon and evening, and was downgraded to a tropical storm as it moved inland across the Lower Rio Grande Valley in southern Texas and northern Mexico. By 9 pm CT on July 23, Dolly's sustained winds had decreased to an estimated 70 mph. A Category 1 hurricane has winds of at least 75 mph.

Dolly's torrential rains caused widespread flooding primarily of low lying and poor drainage locations, as well as filling local *resacas*, some *arroyos*, and causing rises on larger area creeks and rivers (NWS 2008). While it was feared the levees of the Rio Grande River, Arroyo Colorado River and Los Olmos Creek would not hold, the rivers did not reach flood stage. Minor instances of coastal flooding occurred, both on the front and backside of Dolly. The storm surge was measured up to 3 feet, but was estimated near 4 feet in some areas.

Forecast Warnings and Watches Issued by the National Weather Service

The National Weather Service first issued a public information statement on July 20 at 9:52pm CDT indicating that tropical storm Dolly had formed over the northwest Caribbean Sea. Dolly was forecasted to continue moving northwest and make landfall south of Brownsville and northeast Mexico as a category one hurricane on July 23 and 24. The public information statement included the following emergency preparation information for the public:

- Build an emergency supply kit (food and water - with a three to seven day supply of non perishable food and one gallon of bottled water per person per day). Remember to include food and any other items for babies, the elderly and pets.
- Prepare your home to decrease the chances for damage. Reinforce your garage door, and cover windows with plywood. Be sure to move patio furniture (outdoor grills, trash cans and lawn ornaments) to an inside area as these items may become flying missiles in strong winds.
- Know where to go. Evacuations have not been requested or ordered by emergency management or other county officials at this time. However, in the event of evacuations

make sure your automobile is fully fueled and in good working condition before leaving. Know the evacuation route that you will use and expect traffic congestion and delays. Keep in regular contact with family and friends to let them know that you are safe.

The first hurricane watch was issued July 21 at 12:21pm CDT for the Texas coast from Brownsville northward to Port O'Connor, Texas. A hurricane warning was later issued July 21 at 10:45pm for the mouth of the Rio Grande to Port O'Connor.

A flood watch was subsequently issued July 22 at 3:07pm CDT as the outer rain bands of tropical storm Dolly approached the lower Texas coast. The flood watch became a flood warning July 23 at 7:43am for small streams and arroyos in southeastern Kenedy and eastern Willacy County. A flood warning was then issued at 8:24 am for Cameron County including Olmito, Port Isabel and Brownsville.

The National Weather Service headquartered in Brownsville, Texas continually issued public statements to media, emergency management, NOAA Weather Radio, and on their "Top News" web page, to help people stay safe during the aftermath of Hurricane Dolly.

As of 11:17pm CDT July 23, a tropical storm warning remained in effect from Brownsville to Port Aransas, Texas. Tropical storm warnings were cancelled for most areas by 10:40am CDT July 24.

Impact

In Texas, according to the National Weather Service (2008), Hurricane Dolly resulted in minor to moderate damage across much of the area. Heavy rains and strong winds caused severe flooding which resulted in damage to homes and buildings, and produced widespread power outages in Cameron, Hidalgo, and Willacy Counties. Initial estimates were that 250 thousand customers lost power across the more populated regions of the Lower Rio Grande Valley, including most of Cameron County at one point (NWS 2008). In those same counties, hundreds of thoroughfares had standing water of three feet or more during and immediately after the heaviest rains. A number of flooded structures required water rescues in the Laguna Vista area, where an estimated 16 inches or more of rain fell; however, no flood-related injuries or deaths were reported (NWS 2008).

Much of the hurricane damage occurred on South Padre Island as roadways and yards were strewn with trees, fences, power line poles and fallen streetlights (Time 2008). Much of the significant damage on the Island was to buildings of modest construction and larger, warehouse style facilities, all with a direct exposure to the strongest winds, which came from the west (NWS 2008). Significant damage also occurred just prior to and for several hours after landfall, when an intense rain band developed in the southwest portion of the inner eye wall, which pounded an area from the City of South Padre Island northwest through Port Isabel, Laguna Vista, Bayview, San Benito, and Harlingen (NWS 2008). Inland wind damage was also reported in the city of Harlingen where the southwest eyewall went through. According to Federal Emergency Management Agency (FEMA 2008) Cameron, Hidalgo, Willacy and Starr county residents received about $44 million in aid from the FEMA for temporary housing, housing repairs, business repairs and other needs. The NWS (2008) reports the following insured dollar damages have been received for Texas residents affected by Dolly; Texas Windstorm Insurance Association, $280 million. According to the

NWS (2008), “A fair estimate of insured and uninsured property damages is normally increased by a factor of two, so the latest estimate due to wind alone is $560 million.” For insured flooding, only $171 thousand has been reported thus far through the National Flood Insurance Program; however, these numbers are likely to be well underestimated given the ultimate number of properties not insured for inundation (NWS 2008).

At least two persons were injured on South Padre Island as a result of Dolly. A 17-year-old boy fell from a seventh-story balcony in Port Mansfield, Willacy County and sustained head injuries, a broken leg and a broken hip (CNN 2008). Two injuries occurred near Port Mansfield, when a media reporter was struck by flying debris and sustained minor head injuries, and an elderly man lost part of a finger from flying debris (NWS 2008b). In Mexico, one fatality due to electrocution occurred as a result of Dolly in Matamoros (El Universal 2008).

Social response

No mandatory evacuation orders were issued in Texas. Texas Governor Rick Perry issued disaster declarations in 14 counties across the southern portion of the state, and hundreds of National Guard troops and other emergency crews were deployed in advance of the storm.

At Gladys Porter High School in Brownsville, Texas, nearly 300 evacuees flowed inside even as Dolly's winds dismantled a school sign (Time.com 2008). On South Padre Island, many of the 2,400 residents began bracing for the storm Tuesday night as strong winds forced the closure of South Padre Island's causeway to the mainland. The causeway is closed any time winds reach 39 mph (CNN.com 2008).

In Mexico, state of Tamaulipas officials were planning to evacuate 23,000 people to government shelters, and Governor Eugenio Hernandez requested that the federal government to declare a state of emergency in his jurisdiction (Yahoo News 2008). Soldiers were rescuing people at the mouth of the Rio Grande River up until the last-minute before Dolly hit. At least one family trapped in their home was rescued when the soldiers battled storm-charged waves in an inflatable raft, while other people further inland were still refusing to go to government shelters (Time 2008).

Major Findings

Public Perception about Hurricane Dolly’s Warnings and Safety Information

According to the information they received about Dolly, a little more than half of the survey respondents (51.5%) believed they were at risk. The people who didn’t believe themselves to be at risk either didn’t trust the information they received (35.5%), believed that they lived in a safe location or house (32%) or believed the forecasted weather events were not bad enough for them to be concerned (29%). Additionally, there was no apparent relationship between a respondent’s risk perception and the day when he/she first realized there was a threat, no relationship between risk perception and taking protective actions, or risk perception and the sources of weather information. In other words, those who believed themselves to be at risk reported taking the same protective actions as those who felt they were not at risk. Nonetheless, it is noteworthy that

people who didn't believe they were at risk tended to be the ones who perceived they suffered more damage from Dolly.

Generally, interviewees were more concerned about strong winds (41%) than flooding (29%), but 28% of the participants considered both to be equally important. In terms of consequences, people were primarily concerned about their families' safety (43.5%), property damage (27%), their own safety (13%) and finally, business and/or job interruption (8%).

During the event, local TV appears to have been the main source of information about Dolly as 44% of participants obtained storm information from the local TV channels (Figure 4). Twenty-three percent listened to the radio and 15% watched satellite or cable TV. Internet was more important as a source of information (8%) than family and friends (7%). Many of the interviewees (43%) used two sources of information, but nearly 40% only used only one. Finally, 17% used three sources of information. Eighty-eight percent of our participants found the information they received helpful to assure their family's safety, but the percentage drops down to 73% when we asked the same question about damage to property. The main complaints concerned the lack of information about potential power outages and when power would be restored. Very few people expressed concern about being able to understand the information or about the inaccuracy of the forecasts. When asked about hurricane false alarms, only 25% believed that there had been too many of them in the past 5 years.

Warning Lead Time and Individual Responses

One of our main research questions concerned temporal aspects of hurricanes and their influence on community hurricane preparedness. To answer that question we asked interviewees when they first realized there was a threat to their area and when they started to take protective actions, in order to compare the timing of their reaction to the posting of the National Weather Service's (NWS) public information statement (Figure 5). More than half of the participants stated that they recognized a potential threat the same day as the first public information statement was issued on July 20th. At that time, NWS forecasters were only talking about a tropical storm that had formed over the northwest Caribbean Sea and was expected to make landfall south of Brownsville and northeast Mexico as a Category 1 hurricane. Even though people started to worry about a possible storm in this area, only 9% of the interviewees actually started taking protective actions that day. Then as the storm track narrowed and we got closer to the expected day of landfall, more people started to take protective actions, with a peak of 42% the day before landfall. This peak seemed to coincide with the time the hurricane warning was issued the night of July 21st. Cumulative percentage indicates that 88% of the participants took the hurricane warnings seriously and initiated protective action one day before the forecasted date of landfall. Looking more closely at the timing of protective actions taken, 6% (4 persons) realized the threat less than 6 hours before they were hit, and 12% of the interviewees actually took action during the 6 hours before landfall. Regardless, none of the interviewees complained about a lack of preparation time.

The public information statement issued by NWS included emergency preparation information such as advice about emergency supply kit preparedness and tips to avoid or reduce material damage. One of our questions asked participants to assess what the inhabitants of the Lower Rio Grande Valley community actually did to protect themselves or their property. Many people (34%)

stored food and water, and 30% also protected their windows, but fewer people (9%) thought about protecting their doors. Fifteen percent also put some kind of a safety kit together and a smaller proportion of people put sand bags in front of their doors or secured loose items outdoors. Two respondents from Matamoros told us that they didn't do anything to cope with Dolly. These results indicate that there is still some work to be done to encourage the public to undertake basic hurricane preparation. Finally, we looked at how inhabitants protected their windows. Although the NWS explicitly recommends using plywood to protect windows and doors, a little more than half of the respondents used plywood or hurricane shutters. Indeed, a fairly large number (21%) intended to protect their windows by taping them, an action not recommended by the NWS.

Differences in Hurricane Risk Perception, Preparedness and Protective Actions Across the Border

This last section focuses on the main differences in terms of risk perception, preparedness and action that were observed across the US-Mexico border.

The first significant difference is related to risk perception. Nearly half of the Texans and Mexicans didn't believe themselves to be at risk, but it appears not to be for the same reasons. While US residents had little confidence in or were downplaying the forecast of a Category 2 hurricane, most of the Matamoros inhabitants felt safe in their homes. This relationship between country of residence and risk perception is fairly strong (Cramer's V=0.757).

The country of residence also plays a significant role in terms of consequences that people worry about. Mexicans clearly cared more about their personal and families' safety than about the worry of economic losses that preoccupied more Texans. This tendency is confirmed by their responses concerning property damage. Sixty-eight percent of the US residents versus 15% of the Mexicans considered that they suffered property damage. We question whether this result reflects a matter of perception or an actual spatial disparity related to the distance from the hurricane's path. This second hypothesis is fairly plausible (but not really verifiable with a non-spatially representative sample), as the US interviewees happen to live closer to Dolly's path than the Matamoros residents.

In examining information sources, it seems that the country of residence is also related to the type and amount of information sources mobilized during the event. More than half of the Americans tended to use two distinct sources of information while Mexicans only used one source (Figure 6). Preferences also vary across the border as 89% of the Matamoros residents tended to rely mostly on local TV while Texans used satellite and/or cable TV and internet more frequently. Again, this may be an artifact of availability.

Finally, we noticed significant differences across the border regarding the amount and choice of protective actions. Sixty-seven percent of Texas residents interviewed undertook at least three types of protection measures versus only 30% of Mexican households (Figure 7). The main difference lies in the preparation of a safety kit that was rarely mentioned by Matamoros residents. Looking also at the type of window protection used, we observed that a fairly high proportion (41%) of Mexicans taped their windows instead of using plywood (30%). On the other side of the border, tape was used in only 8% of the US properties. A few residents of Matamoros indicated that they were too poor to take or afford protective actions; however, we found no

evidence of a relationship between family income and the type and variety of protection used. Instead we observed that the use of tape tended to be specific to some neighborhoods, as in location 2 in Matamoros.

Conclusion

The main purpose of this study was to examine hurricane preparedness of the Lower Rio Grande Valley community when Hurricane Dolly hit the region. Overall, Hurricane and Tropical Storm Dolly resulted in relatively minor damages, injuries, loss of property and life. However, results from this study show that despite timely and accurate warnings from the NWS in the US, respondents could have overall taken more steps in a timelier fashion to prepare for and protect themselves from potential negative impacts from Dolly. While all but two respondents took at least one protective action, most did not meet the suggested protective actions recommended in the Public Information Statement by the NWS, showing there is still some work to be done to encourage the public to undertake basic hurricane preparation.

When comparing results between the US and Mexico, it is important to point out that people living in Matamoros, Mexico do not necessarily receive the same warnings that are issued in the US by the NWS. Mexico's *Servicio Meteorológico Nacional* handles weather warnings in that country. While this study shows respondents in Matamoros took fewer protective actions when preparing for Dolly than those in the US, this could perhaps be a result of different warning information received in the two countries, or perhaps the geographical distance from the projected path of Dolly. Matamoros lies to the south of Dolly's path; thus, perhaps people felt they would not get hit as hard. Regardless, a better effort should be made to encourage people to take more protective actions prior to a forecasted hurricane. Also, a concerted effort should be made to advise the public against the use of tape as a protective measure against property damage.

While over half of all respondents recognized the threat of Dolly three days before the hurricane hit, only 9% took at least one protective action that day. As the storm drew closer, most people (42%) took protective action(s) the day before Dolly hit, showing a delay between when information is received and when action is taken. Perhaps people prefer to "wait and see what happens" before making the effort to protect themselves. However, the public should be encouraged to make preparations as soon as possible when a hurricane is forecasted.

While 51.5 % of respondents believed they were at risk, the 29% of respondents who believed the forecasted weather events were not bad enough for them to be concerned and the 35.5% of respondents who didn't trust the information they received is of concern. Several respondents mentioned the forecasted storm was *just* a Category 1, or a *just* a Category 2, and that they had seen worse, and were therefore not too concerned. This presents a challenge to weather forecasters to come up with ways to communicate risk to the public. Hurricane categories are not always indicative of potential damage. For example, Tropical Storm Fay which made landfall in the US on August 18, 2008, shortly after Hurricane Dolly, resulted in heavy damage and 36 deaths despite being *just* a tropical storm.

More research is needed to compare the protective actions taken by respondents prior to a Category 1 or 2 hurricane compared with that taken by those in the path of a Category 3 or higher

hurricane. Additionally, a better understanding of the barriers to undertaking protective action could inform emergency response and preparation.

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List of Figures

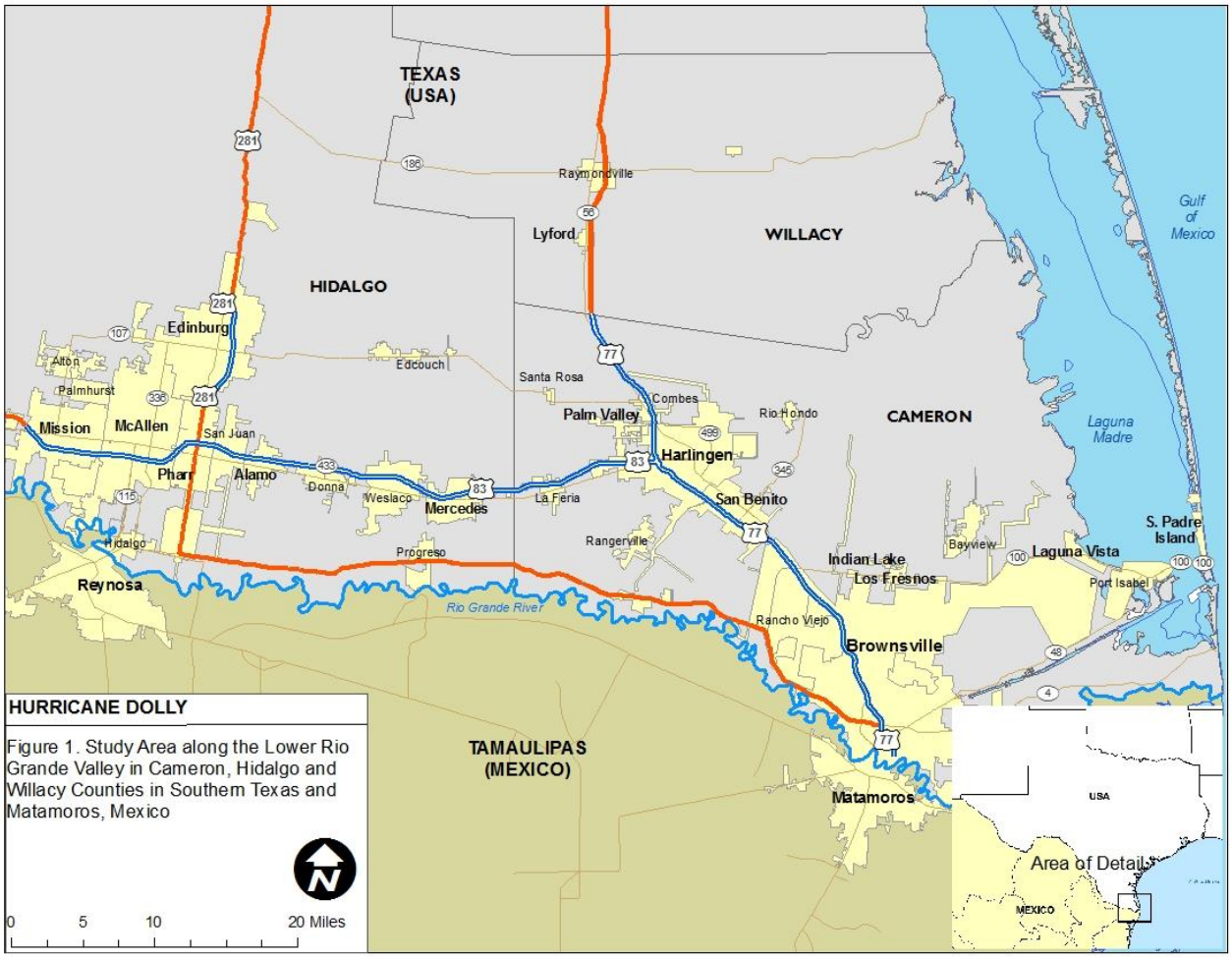

Figure 1. Study Area

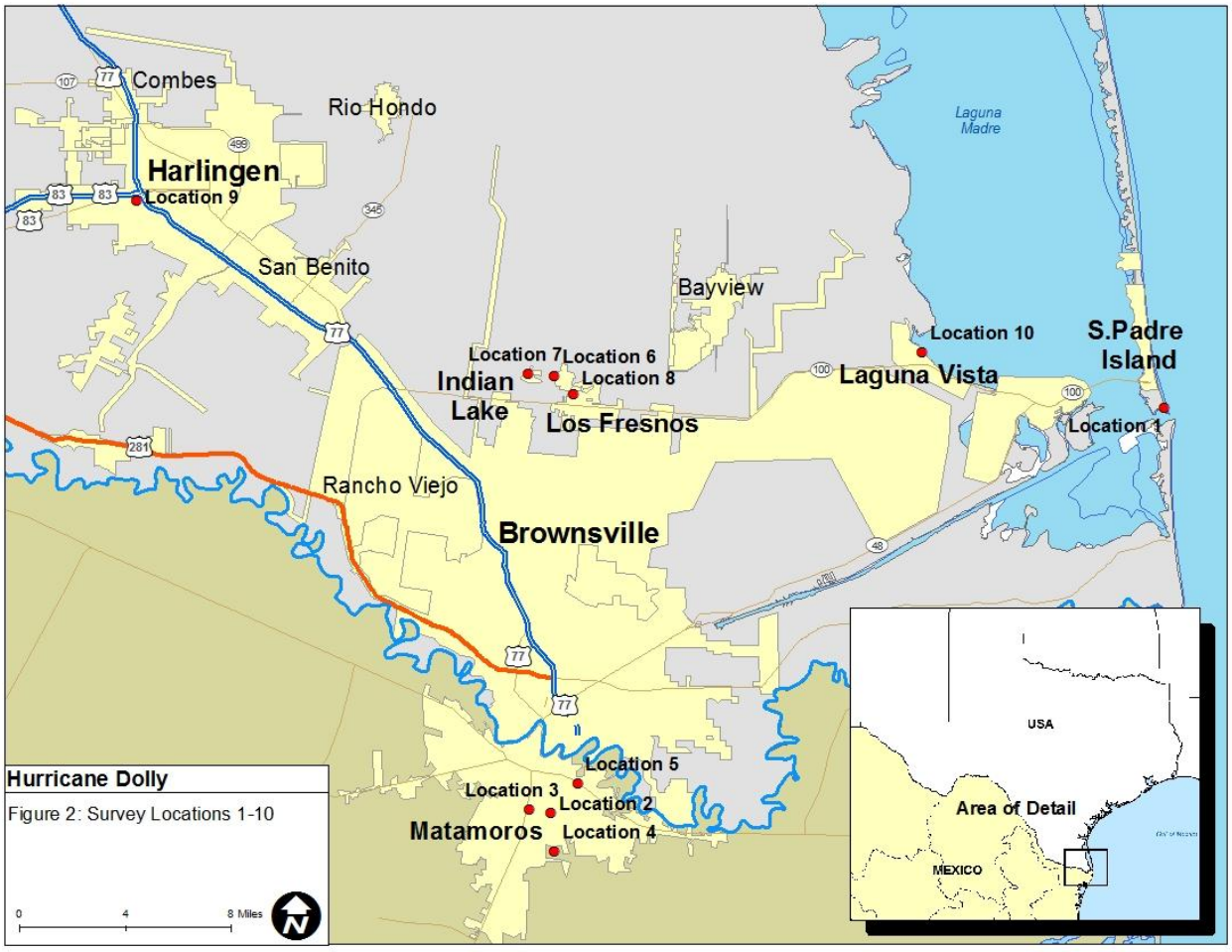

Figure 2. Survey Locations 1-10

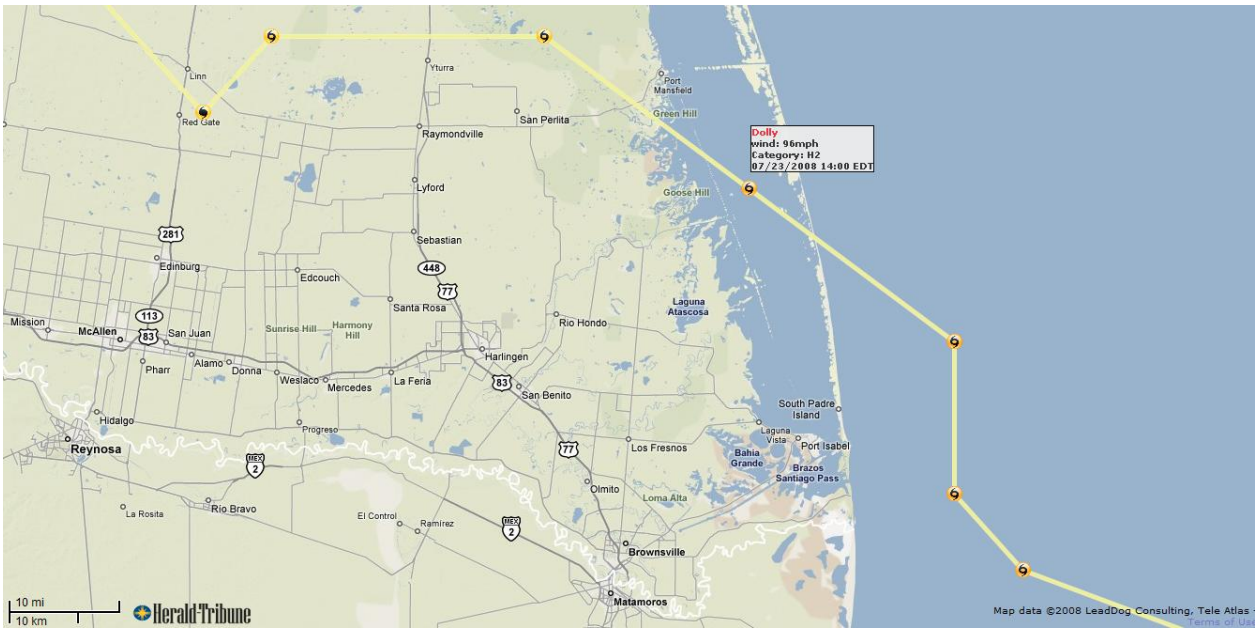

Figure 3. Detailed Path of Dolly

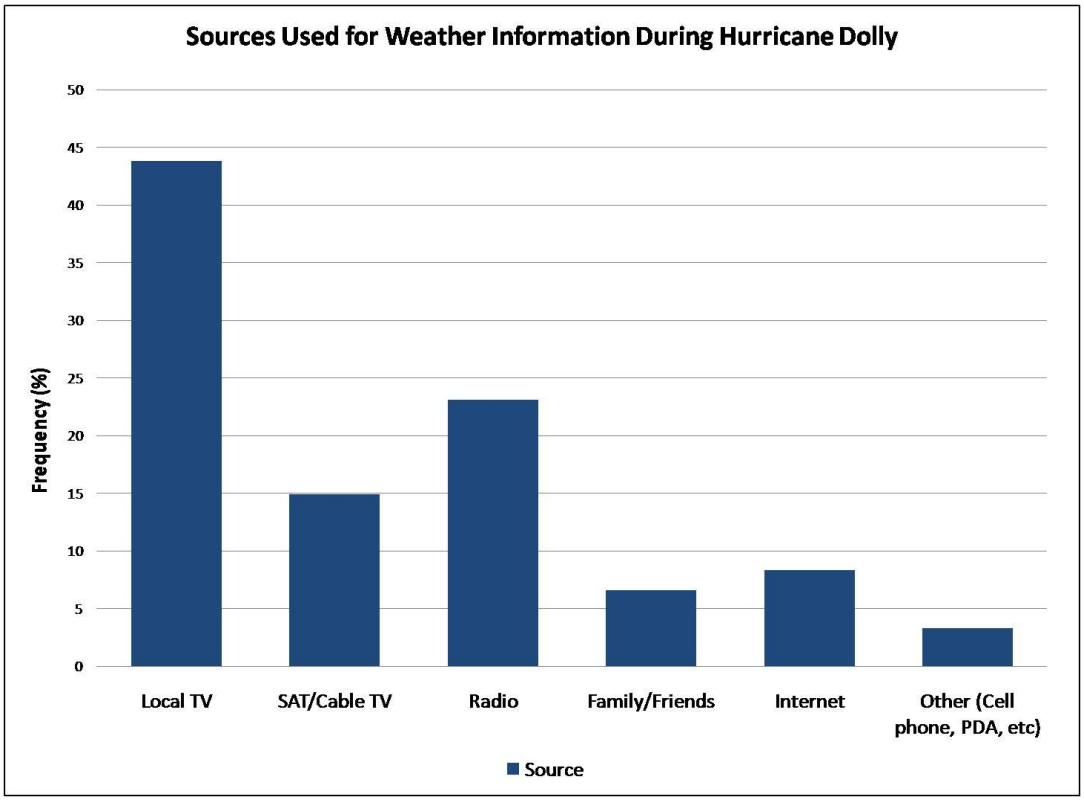

Figure 4. Sources of Weather Information

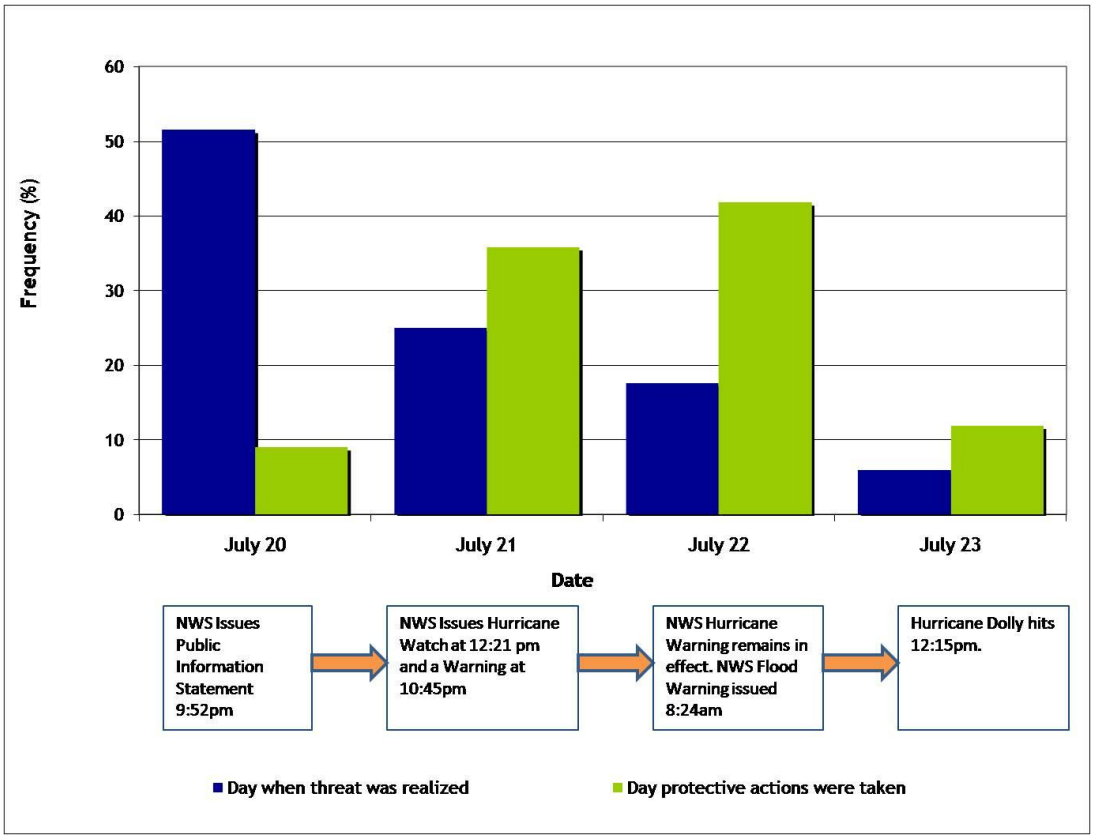

Figure 5. Comparison between individual's reaction and the timing of NWS public information statements

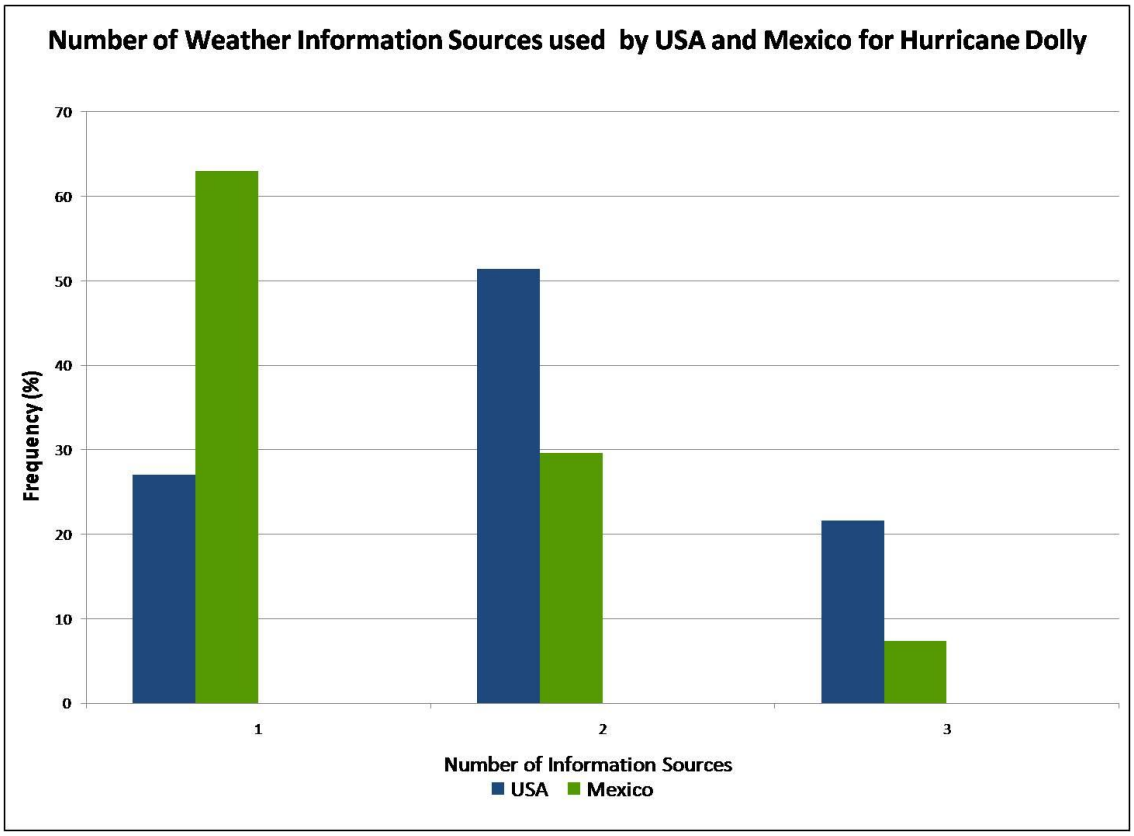

Figure 6. The number of information sources used by US and Mexico respondents

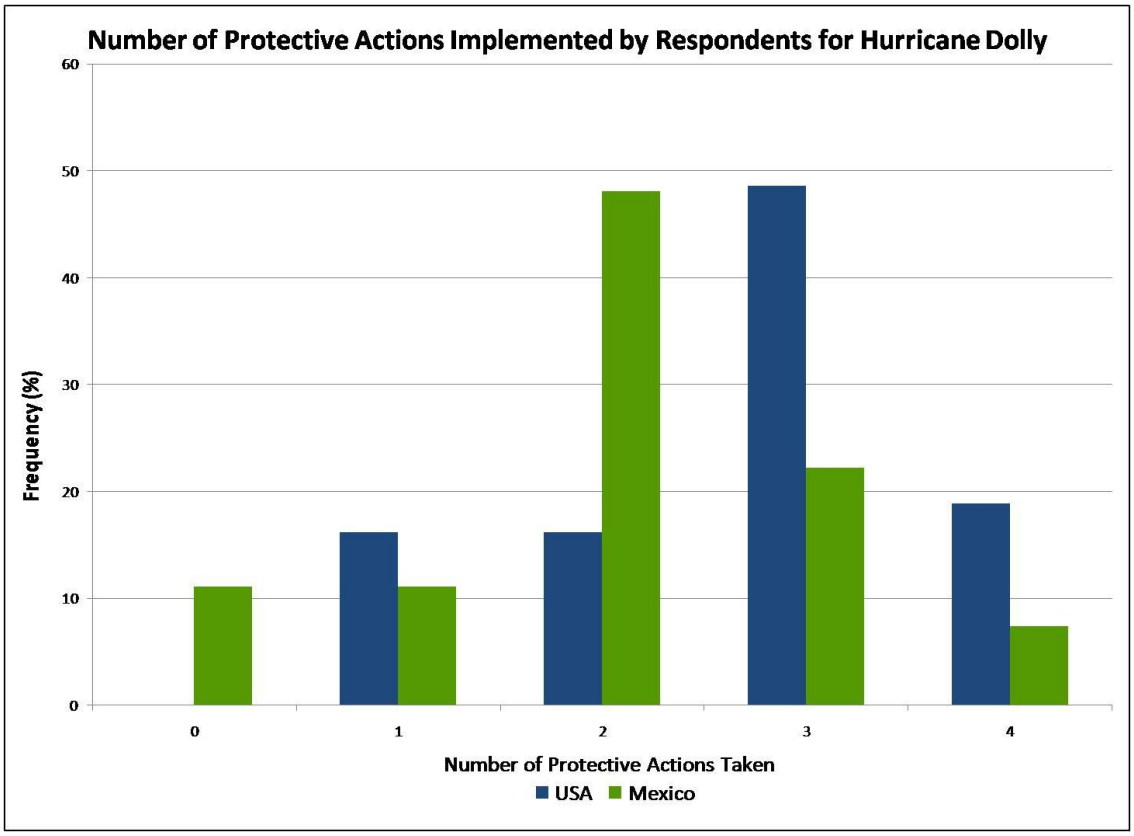

Figure 7. The number of protection actions taken by US and Mexico respondents

Appendix A – Survey Questionnaire in English

Section 1: Perception of risk

1. When did you first realize there was a threat of hurricane in your area? (Dolly made landfall Wednesday July 23 at 1pm on S. Padre Island).
Day: _____ Hour:_____

2. From the information you received, did you believe you and your family might be at risk?
1. [ ] yes **2.** [ ] No 3. [ ] I don't know
Why:_____

3. What hurricane related threat were you more concerned about?
1. [ ] Strong winds
2. [ ] Flooding
3. [ ] Levee break
4. [ ] Storm surge
5. [ ] Other(s)_____
6. [ ] I don't know

4. What consequences were you worried about with the hurricane?
1. [ ] Threat to your life
2. [ ] Property damage
3. [ ] Business/Job interruption
4. [ ] Your family's safety
5. [ ] Other(s)_____
6. [ ] I don't know

Section 2: Information and warnings

5. Which sources did you use to find information throughout this event?
1. [ ] Local TV
2. [ ] Satellite TV / cable
3. [ ] Radio
4. [ ] Family/friends
5. [ ] Internet
6. [ ] Cell phone / PDA
7. [ ] Other(s): _____
8. [ ] Don't know

6. Did you find this information helpful to…

a.	to assure your family's safety	1. [ ] yes	2. [ ] No	3. [ ] Don't know
b.	to lower damage to property	1. [ ] yes	2. [ ] No	3. [ ] Don't know

7. Was there information you needed, but didn't get?
1. [ ] yes 2. [ ] No
What information was missing: _____

8. Do you think there have been too many hurricane false alarms in the past 5 years?
1. [ ] yes 2. [ ] No 3. [ ] I don't know

Section 3: Decision-making and protective actions

9. When did you first start taking protective actions for Hurricane Dolly?
Day: _____ Time: _____

10. What action did you take?
1. [ ] Store water and food

2. [ ] Protect your windows
3. [ ] Protect your doors
4. [ ] put together a safety kit (batteries, radio, flash light, medicine…)
5. [ ] Other(s)_____

11. How did you protect your windows?

1. [ ] Board
2. [ ] Tape
3. [ ] Hurricane shutters
4. [ ] Nothing
5. [ ] Others_____

12. Did you receive an order to evacuate?

1. [ ] yes
2. [ ] No
3. [ ] I don't know

13. Did you evacuate your home?

1. [ ] yes
2. [ ] No

14. If yes, when did you evacuate?

1. [ ] 2 days before
2. [ ] 1 day before
3. [ ] The day of the hurricane
4. [ ] Others

15. Where were you when the hurricane hit?

1. [ ] At home
2. [ ] At work
3. [ ] At an emergency shelter
4. [ ] Stay with relatives or friends
5. [ ] Driving
6. [ ] On vacation
7. [ ] Other(s): _____

16. Did your property suffer any damage?

1. [ ] Yes
2. [ ] No

If yes, what type of damage?_____
_____

17. Did you or your family require any emergency assistance during or after the hurricane?

1. [ ] Yes
2. [ ] No

18. If yes, what type of assistance?_____

Section 4: Previous experiences of natural hazards

19. How long have you lived in here? _____ Years / Months (please circle one)

20. Have you experienced a hurricane before?

1. [ ] yes
2. [ ] No

21. How many times have you experienced a hurricane?_____

22. Have you ever experienced flooding before?

1. [ ] yes
2. [ ] No

How many times?_____

Section 5: Demographic information

23. Age: _____

24. Gender: 1. [ ] Male 2. [ ] Female

25. Type of home

1. [ ] condo
2. [ ] single-story house
3. [ ] trailer
4. [ ] others_____

26. Do you rent it or own it?

1. [ ] owner
2. [ ] renter

27. Highest level of education completed?

1. [ ] Junior high school
2. [ ] Some high school
3. [ ] High school graduate/GED
4. [ ] Some college
5. [ ] 4-year or baccalaureate degree
6. [ ] Graduate school or further

28. What is your weekly family income?

Mexico

1. [ ] Menos de 450 Pesos por semana
2. [ ] 450 hasta 2250 Pesos por semana
3. [ ] Mas de 2250 Pesos por semana

USA

4. [ ] Less than $100 US dollars/week
5. [ ] $100 – 400 US dollars/week
6. [ ] More than $400 US dollars/week

29. The language spoken most often in my home is: _____

30. Other languages spoken in my home: _____

***31.* How people live in your home? _____**

32. I usually get around the city by *(please choose all that you frequently use)***:**

1. [ ] Car
2. [ ] Sport Utility Vehicle (SUV)
3. [ ] Truck
4. [ ] Motorcycle/Scooter
5. [ ] Bus
6. [ ] Bicycle
7. [ ] Walking
8. [ ] Other _____