Cover Page:

Imagining Worse than Reality: Comparing Beliefs and Intentions between Disaster Evacuees and Survey Respondents

Gina Yannitell Reinhardt

Imagining Worse than Reality: Comparing Beliefs and Intentions between Disaster Evacuees and Survey Respondents

This work was supported by the National Science Foundation under Grant #0554875.

Abstract
Do beliefs and behaviors change in different ways for people who live through these LPHC critical events, as opposed to people who observe them? This study compares hypothetical hurricanes with actual hurricane effects in a survey quasi-experiment. Findings indicate that hypothetical disasters induce stronger reactions than those experienced in the natural world, as Hurricane Katrina bystanders imagine themselves incurring much higher damages, and being much less likely to return to live in their hurricane-damaged homes, than actual Hurricane Katrina evacuees. Ultimately, respondents considering a hypothetical low-probability, high-consequence event exhibit exaggerated beliefs and opposite decisions of those who actually lived through one of these events. Results underline the importance of examining the differences between public perceptions and experiential reality.We often credit disasters, and their coverage in the media, with changes in the public perception of risk associated with low-probability, high-consequence events (LPHCs). With a change in perceptions, we also expect changes in beliefs, preferences, and behaviors.

Keywords:
Low-probability high-consequence events, disaster, survey experiment, risk perception, risk amplification

The internet and 24-hour news cycles have brought world attention to catastrophes like the Indian Ocean Tsunami (2004), Hurricane Katrina (2005), and the Fukushima Tsunami and Dai-ichi Nuclear Accident (2011). Scholars credit disasters and their coverage in the media with an increase in the public perception of risk associated with low-probability, high-consequence events (LPHCs). With this change in perceptions, we anticipate subsequent changes in beliefs, preferences, and behaviors (Lupia and Menning 2009). As people's experiences and perceptions change during and after these critical events, we expect their preferences and beliefs to continually update (Druckman and Lupia 2000). We also expect one's emotions associated with LPHCs to drive the tendency to take future risks (Druckman and McDermott 2008).

Many claim that the public always exaggerates the risks of LPHCs, particularly due to media influence. Yet this assertion has not been settled in the literature. Wahlberg and Sjoberg (2000) find that among heavy media users, media are not a likely causal factor in personal risk perception, and that risk perception's link to behavior is uncertain. They also find no support for the argument that a disproportionate focus (in the media) is given to LPHCs. Leschine (2002) elaborates on how media reports of critical events can both amplify and attenuate the social perception of risk associated with those events.

To date, however, little is understood about the effect of varying LPHC experience on risk estimation or risk behavior.[1] Do bystanders of low-probability, high-consequence events have systematically different beliefs and intentions from those who directly experience that event? My work contributes to the LPHC discussion by arguing that risk perceptions can be inflated among some groups of people, and that these groups are delineated by personal experience. I investigate results of a survey administered in experimental style among residents of hurricane-threatened areas of the United States one year after Hurricane Katrina. Those who experienced and evacuated for a hurricane were asked

[1] Li et al (2010) do gauge differences in perceptions, but not by varying disaster intensity.

about damages to their property and their likelihood of permanently living in their pre-disaster residence after displacement. Their answers were compared to those of respondents who were not directly affected by a hurricane, but were posed a hypothetical hurricane. These non-evacuees were randomly assigned a hurricane of varying intensity, and asked questions regarding their expected damages and likelihood of living in pre-disaster residences after hypothetical displacement.

Those in the hypothetical group exhibit exaggerated beliefs and opposite decisions of those who actually lived through either Hurricane Katrina or a disaster of lesser catastrophic import. Those assigned to low-intensity hurricane groups estimate a likelihood of sustaining hurricane damage at probabilities approaching those of Hurricane Katrina victims, rather than comparable to the likelihood of damages typically caused by low-intensity storms. Those in medium and high intensity groups estimate the likelihood of sustaining damages at levels extraordinarily higher than the average high-intensity hurricane inflicts. And while increasing damages make Katrina evacuees *more* resolved to return to and commit to living in their pre-disaster place of residence, the opposite effect is exhibited in the hypothetical group, who are *less* resolved to return to their evacuated residence as damages increase. Despite the passage of one year and several storms between Katrina and the survey, non-evacuees generally believed any hurricane that hit them would cause a Katrina-level catastrophe.

This paper is unique in its power to demonstrate important belief, behavior, and intended behavior differences between people who directly experience a disaster and people who observe it filtered through other sources of information. My contribution lies in showing that the perception of disaster is causing a distortion between beliefs and plans, on the hypothetical side, and actual decisions, in reality. This distinction is important for three key reasons.

First, most studies of risk amplification compare respondent beliefs about risk to expert estimates. Yet expert consensus on estimates of risk levels can be difficult to find (Camerer and Kunreuther 1989). And we are limited in our ability to experiment regarding LPHCs because the drastic nature of critical events prohibits the creation of painful and potentially traumatic stimuli to study subjects. By taking advantage of a quasi-experimental design, I am able to compare observation to experience. It is only in comparing the perceptions and intentions of observers to those of actual survivors that we learn the type and level of distortion taking place between hypothesis and reality.

Second, we know that emotions affect one's propensity to take risks (Druckman and McDermott 2008), and that risk assessments can be manipulated by policymakers (Lupia and Menning 2009). Debate exists over the economic and political prudence of rebuilding disaster-threatened areas (Joyce 2013; Rozario 2010). The heightened resolve of Katrina and Rita evacuees to return home, even a year after the storm, is *un*-desirable among some policy makers and disaster managers who would rather citizens live in places less susceptible to catastrophic events (Birkland et al 2003; *Public Broadcasting Service* 2012; Glaeser 2005). As observers constitute the majority of voters and taxpayers, it is important to be able to evaluate their beliefs and intentions regarding hypothetical threats, and based on second-hand information. If they differ radically from those built on the first-hand experiences of disaster evacuees, genuine conflicts of political interest may result.

Ultimately, this distortion challenges our ability to make policy and predictions about political behavior, an important challenge to recognize in any situation for which government leaders hope to plan, but cannot wholly simulate. Learning about individuals' risk perceptions is important to planning recovery, which can in turn reduce the risk of subsequent disasters (Comfort et al 2010). May and Birkland (1994) find that local government willingness and ability to undertake risk-reduction programs have less to do with previous hazard experience and more to do with local political demands. If these demands are in any way a result of bystander observation, we must know how drastically those bystander reactions to critical events diverge from the reactions of actual experience. The information presented here can help policymakers, journalists, government officials, and the general public draw more accurate inferences about the human impact of disasters. If not, we run the risk of letting socially amplified beliefs, rather than personal realities, drive public policy.

DISASTERS, PERSONAL EXPERIENCE, AND THE MEDIA

Disasters are unplanned disruptions in social and political systems (based on Quarantelli, Lagadec, and Boin 2006; also Perry 2006). Both man-made disasters, such as nuclear accidents, and natural disasters, such as hurricanes, are what scholars term 'low-probability, high-consequence events,' or LPHCs. They join other LPHCs that happen rarely but often carry high death tolls, such as genocides, terrorist attacks, and airplane hijackings, to form a group of events with profound impacts on human and political behavior that we do not completely understand.

Experts derive estimates of risks associated with LPHCs at the same time as citizens create their own estimates, which can be on par with the experts, but are often found to be divergent. Kasperson and Kasperson (1996) term the deviations *social amplification*, meaning the exaggeration of risk, and *attenuation*, or the dampening of risk, compared to generally accepted estimates. Both phenomena occur as information is processed via a combination of personal experiences and second-hand information sources, such as the media (Leschine 2002). The change in beliefs about risk then has the potential to affect preferences (Druckman and Lupia 2000).

The 'personal impact hypothesis' surmises that one's personal experience with a particular hazard predisposes the individual to disregard information coming from other sources as unreliable or overblown. In reaction to this information, the individual dampens her risk perception, downplaying risk because she has experienced similar events before and lived through them (see Wahlberg and Sjoberg 2000). Personal experiences are then likely to dominate potential countervailing secondary sources of information to become the driving force in preference formation (Lupia and Menning 2009; Kasperson and Kasperson 1996).

When personal experience is lacking, observation of LPHCs through the media can intensify risk perceptions. Media coverage focuses on dramatic and rare events, such as nuclear accidents and natural disasters, to the exclusion of more common risks like smoking. Evidence shows that both the amount and the nature of media coverage are powerful predictors of public knowledge of events that amplify beliefs (Barabas and Jerit 2009; Nyhan and Reifler 2010), including risk assessments (Gore et al 2005; Frewer, Miles, and Marsh 2002). In other words, coverage amplifies observer risk assessments the more shocking and evocative it is, and the more plentiful it is. One mechanism at play seems to be that for observers who lack personal experience with LPHCs, fear and uncertainty combine with media coverage to intensify risk assessments to levels far beyond those projected by experts (Wahlberg and Sjoberg 2000; Camerer and Kunreuther 1989; Leschine 2002).

In sum, observers may glean a distorted perception of events based on selective journalism, reporter error, and the anxiety and trauma depicted in disaster coverage (Izard and Perkins 2011; Jha and Izard 2011; Sommers et al 2006, Atkeson and Maestas 2012), and when not tempered by personal experience, this perception can inflate one's perception of risk. These new beliefs then affect future actions by causing people to avoid (or plan to avoid) situations they believe are risky (Gigerenzer 2006). As LPHCs are often surrounded by intense emotions and volatile reactions, studying their effects can be a delicate proposition. After formulating hypotheses based on this discussion, I explore experiments associated with disastrous events and the challenges and benefits they can offer.

HYPOTHESES

Based on the preceding discussion, we should expect a few things to be true regarding beliefs and intentions, when comparing observers to survivors:

Amplification of Beliefs:

1) Observers of a LPHC that received media coverage either in large amounts or in a shocking/evocative nature are likely to have their risk assessments of similar LPHCs amplified compared to actual survivor experiences.

2) The more extreme the LPHC considered, the more amplified the observer's risk assessment should be.

Intentions:

3) Observers should be more likely to plan to avoid risky situations than survivors.

4) Observers' intentions to avoid risky situations should increase as perceived risks increase.

EXPERIMENTS AND DISASTERS

Experiments on risk amplification and attenuation regarding disasters are rare, with methodological complications inherent in probing the questions outlined above. Research on beliefs, intentions, and disasters is difficult to conduct for at least four reasons. The first two deal with research design. First, the unpredictability of most LPHC events makes it challenging to carry out studies, and unethical to conduct most experiments, designed to explore amplification and numbing stimuli (Frewer, Miles, and Marsh 2002; Schlenger and Cohen Sliver 2006). Scholars cannot knowingly assign participants to treatments of disastrous conditions. Disaster studies can therefore suffer from problems with selection (Grievink et al 2006; Hussain, Weisaeth, and Heir 2009) and population validity (Arceneaux and Stein 2006 are a notable exception; but see Mortensen, Wilson, and Ho 2009; Brodie et al. 2006; Jenkins et al. 2009; Kessler et al. 2007; Beaudoin 2007).

The second problem is a result of the first. To preserve random assignment, experiments on disaster-motivated beliefs and intentions often pose hypothetical disasters to randomly-assigned respondents, typically academic convenience samples who know little about disasters as a phenomenon (North and Norris 2006). Though internally valid, this situation threatens setting validity because 'the estimate of impact is based on one subset of the population that experiences forced exposure in an experimental setting,' but would never come in contact with the treatment in actuality (Mutz 2011, p. 152).[2] Treatment validity is also at risk because the subject is detached from 'real' responsibility, offered choices that bear no concrete consequences (Bracht and Glass 1968, p. 453-454). Such removal can lead subjects to say they will take actions different from those they actually take when presented with the situation itself (see Lusk and Fox 2003; also List 2001).

The third and fourth problems relate to treatment effects. Recall that LPHCs can inflate risk perceptions, which in turn affect choices and behavior regarding risky situations (discussed above). Similarly, in LPHC-related experiments a subject's estimation of her behavior may be exaggerated due to pretreatment by mass communications. *Pretreatment* occurs when 'contamination from real-world experience' affects experimental outcomes (Gaines, Kuklinski, and Quirk 2007, p. 12). Druckman and Leeper (2012) find that pretreatment effects can be just as influential as treatment effects, sometimes more so. This means that when media attention to a particular LPHC is high, subjects' beliefs and intentions are likely to change prior to receiving the experimental stimulus. We already know that people are constantly updating their preferences based on new experiences and perceptions, and cannot always distinguish which events or stimuli lead to specific sentiments or beliefs (Druckman and Lupia 2000). With the possibility of contamination by media pretreatment, it becomes difficult to know whether experimental treatment stimuli can lead to belief updates.

Finally, public perceptions of the risks and impacts of these types of events are typically compared to expert risk estimates in order to determine whether an amplification or attenuation is taking place. Unfortunately, even experts do not always agree on the precise estimate of a particular risk

[2] Rick Wilson and others (Whitt and Wilson 2007; Eckel, Wilson, and El-Gamal 2009) work with evacuation shelter residents in Houston and randomly assign disaster evacuees into treatment and control groups. Although unable to generalize to all disaster victims, their work speaks to the behavior of disaster evacuees of a particular demographic. Baker et al. (2009) also engage a disaster-savvy sample of 77 evacuees in the Houston area, though their sample is restricted by access to advertising and transportation.

(Camerer and Kunreuther 1989). The inability to find expert consensus increases the difficulty in estimating the degree of individual or collective subject divergence.

Given these complications, laboratory experiments are ill-suited to examine most results of disaster stimuli. Survey experiments, however, have been on the rise as a research tool (Druckman et al 2006) due to their high internal validity and external validity (Barabas and Jerit 2010). Below I explain how my experiment-style survey was designed to capitalize on these features while accommodating disaster-related idiosyncrasies and investigating the hypotheses outlined above.

THE STUDY

The 2005 hurricane season unleashed two of the largest, strongest, and most damaging hurricanes on record: Katrina and Rita. On August 29, Hurricane Katrina made landfall in eastern Louisiana, Mississippi, and Alabama as a Category 3 storm with winds above 125 mph and a storm surge exceeding 30 feet. With 1833 lives declared lost due to the storm, it was the deadliest in modern history (Lott et al 2013). On September 24, Hurricane Rita hit western Louisiana and eastern Texas as a Category 3 storm, having been noted the most intense Atlantic Basin hurricane on record (Kurth and Burckel 2006). Rita caused 118 deaths (ibid.), and displaced 1.5 million people from the Houston area alone (250,000 of which were evacuees of Hurricane Katrina; Stein et al 2011).

Katrina and Rita also spurred a media event closely followed around the world. In both an Associated Press poll of U.S. news editors, and the Pew Research Center U.S. News Interest Index, Hurricane Katrina was the top world story of 2005 (Kohut, Allen, and Keeter 2005). In a random Gallup poll of U.S. adults in September 2005, 96% of respondents reported they were following reports of Katrina and its aftermath either very closely or somewhat closely (Gallup 2005). Atkeson and Maestas (2012) document the evocative nature of the coverage and its effectiveness in focusing national attention on particular geographic areas and topics, such as the City of New Orleans and blame attribution. As a result, the situation allows us to examine the actual behavior of citizens in response to catastrophic events (Katrina and Rita evacuees), in comparison to the intentions of people who lived in an environment where the events were closely covered by the news media.

Issues 1 and 2 (below) examine data collected for purposes of this study by a survey firm, Survey Sampling International, which administered an opinion survey to residents of hurricane-threatened areas along the US Gulf and Southeast Atlantic coastlines in September 2006.[3] The study features an Internet-based comparison among non-evacuees of the 2004-2006 hurricane seasons, as well as comparisons to evacuees from hurricanes that took place during those seasons. I provide a detailed discussion of the research design below.

The study focused only on hurricanes, to reduce the possibility of competing frames that might occur with questions regarding other natural or manmade disasters. The sample was restricted to areas regularly threatened by hurricanes so setting validity would be maintained, and so the situation would represent a decision the respondent could have to make in the future, and might have made in the past.

The study was conducted a year after the events of Hurricanes Katrina and Rita. The lag between natural event and survey experiment is important because it allows for the short-term effects of the catastrophe to wane. We know that extreme emotional and visceral reactions are likely to abate over time (Chong and Druckman; Bracht and Glass 1968, p. 464). Investigations into public health and post-traumatic stress find similar results (Bourque, Siegel, and Shoaf 2002), and that surveying disaster survivors is less likely to cause stress when questions are asked 12 months or more after the event (Newman and Kaloupek 2004; Galea et al 2005). Fielding this study a year after the hurricanes means it is less likely to measure fleeting or ephemeral phenomena, and more likely to capture enduring effects of the disaster experience on beliefs and decision-making.

Overview of Research Design

[3] Hurricane-threatened areas were defined as containing respondents with registered addresses in a county or parish that either borders the coast, or is separated from the coast by no more than one other county/parish. Displaced residents were included based on original home addresses before displacement. Ultimately we received responses from 38 states and Puerto Rico.

From September 13 to 27, 2006, researchers at Survey Sampling International[4] solicited survey participation via email. We chose an internet sampling frame to be able to reach as many displaced evacuees as possible, during a time when postal and telephone services had still not been completely restored to the hurricane-affected areas. Internet services were the first communication lines available after Katrina and Rita, however, and email addresses were functional regardless of physical location. Contacting approximately 75,000 people randomly within our geographic restriction, we cut off the survey upon receipt of 7,024 responses. Since a non-response could indicate either ineligibility or unavailability, and the hurricanes and displacement precluded us from knowing the reason for nonresponse, we elected to treat all nonresponses as 'unknown eligibility,' the most restrictive eligibility estimate possible (Smith 2009). This gives an AAPOR-1 response rate of 9.4%. Online appendix has further details on sample collection and characteristics.

We randomly assigned each of the 7024 respondents a hypothetical hurricane. These hurricanes varied on two dimensions: *category of intensity*, and *probability of making landfall* at or near the respondent's residence. Each dimension contained three options: category of intensity could be Category 1, Category 3, or Category 5; probability of making landfall could be 20%, 50%, or 80%.[5] As a respondent's hypothetical hurricane had one of three intensities, and one of three probabilities, there were nine groups (3 x 3 = 9). The variations were created to represent the most pertinent hurricane-related dimensions that would be available as information to residents in a typical hurricane situation, while allowing for a sizeable portion of respondents in each group.

Respondents were also sectioned into two analytical sets as follows. Those who had evacuated for a hurricane during the 2004-2006 seasons were considered 'Disaster Evacuees,' and were asked

[4] Survey Sampling International (SSI) is a respected survey firm similar to Knowledge Networks. The agency has over 1800 clients across more than 80 countries, and maintains extensive databases from which to sample respondents (2.5-3 million) willing to participate in internet surveys.
[5] Respondents were given a full definition of all five hurricane categories on the Saffir-Simpson Hurricane Intensity Scale (NOAA 2013) when assigned to a group (Appendix A gives treatment and questions).

questions about their actual experiences and behavior regarding their most recent evacuation. To allow for as many respondents in this category (and as many Hurricane Katrina and Hurricane Rita evacuees) as possible given the random sample of hurricane-threatened counties/parishes, 7024 responses were collected.[6] Of these, 2329 (33.16%) were present in an area physically affected by a hurricane in 2004-2005. In this *Disaster Evacuee Set*, 893 evacuated for Katrina and 994 for Rita (an overlapping 311 evacuated for both).[7] At the time of the survey, 904 respondents were still displaced from the homes they had evacuated. For the analyses conducted in this article, only the respondents directly affected by Hurricanes Katrina and Rita will be considered. These survivors will be referred to as 'evacuees'[8]; their random assignment is no longer pertinent, other than to assess the randomness of the survey distribution itself. Survivors of other hurricanes during the 2004-2005 seasons are dropped from the sample.

The remaining 4695 (66.84%) are considered 'Disaster Bystanders.' These respondents were asked questions about their expected experiences and behavior with respect to a hypothetical hurricane of the intensity category and landfall probability corresponding to the group into which they were randomly assigned. Because the term 'observer' carries the connotation of active observation of events, I use the term 'bystander' to refer to this group in the sample, without assuming explicit observation. As there were nine of these groups, each member of the *Disaster Bystander Set* had a roughly 1 in 9 chance of being in each category, although the final group totals differ slightly due to the rate at which responses were received. Table 1 gives the distribution of respondents as portions of the sample.

< Table 1>

[6] This number was just above the budget for the study, which allotted for 7000 responses. Because the entire state of Florida fits within the hurricane-threatened definition, responses from Florida were restricted to 2500. At the time of the study, SSI had not sampled the Katrina-affected area and was interested to see how the survey would fare, though there was no idea how many Katrina/Rita evacuees would actually respond.

[7] Another 771 reported evacuating for other major hurricanes of those seasons: Hurricanes Charley (254), Frances (211), Ivan (309), Jeanne (154), Wilma (115), Dennis (112), or some combination thereof. Evacuees for all hurricanes do not equal 2329 because several respondents evacuated for more than one hurricane.

[8] I choose the term 'evacuee' instead of 'survivor' because of the possibly-negative or damaging connotations conveyed by the term 'survivor.' Please see Rodriguez, Quarantelli and Dynes (2006).

Bystanders were asked about the damages they expect their home to sustain (in monetary terms), given the hypothetical hurricane they faced. First, Bystanders are compared to Evacuees, using information on actual damages Katrina and Rita evacuees report their homes sustaining. It was assumed that respondents in the Evacuee Set knew the severity of the hurricane for which they had evacuated, as well as the proximity of landfall. Then the bystanders are compared to each other, allowing experimental conditions to vary within the Bystander Set. OLS regression allows assessment of the effects of intensity, probability, and their interaction.

Bystanders' damage estimates are then utilized to analyze the second issue, the prediction of the likelihood of living in a hurricane-threatened area after the hurricane occurs. Bystanders' hypothetical hurricanes are varied, and their self-predicted damage estimates are noted. Bystanders predict the likelihood of living in their homes after the hypothetical hurricane passes, given the level of damage they believe their home would sustain. Bystanders' decisions are then compared to responses of the Evacuee Set, based on the damages their homes actually incurred.

It is important to note that the assignment into the 'Evacuee' set does not happen by chance, as it would in a true experiment. Although weather events may appear to occur randomly, a person's vulnerability to them is not. Previous research has shown that those experiencing critical events suffer housing and property damages, employment effects, and loss of life and livelihood in disproportionate amounts according to group characteristics such as race, age, and income level (Groen and Polivka 2008; Fussell, Sastry, and VanLandingham 2010; Paxson and Rouse 2008).

The decision to evacuate is similarly non-random, and not entirely dependent on the critical event itself. Rather, evacuation depends on group characteristics and other factors. Previous disaster experience, risk of disaster, and reliability of public services dictate evacuation decisions by conditioning one's perceptions of whether or not evacuating is worthwhile (Perry 1983; Grothmann and Reusswig 2004). Sources of information such as television, radio, newspapers, or friends lend different levels of credibility to the decision to evacuate (Lindell, Lu, and Prater 2005). Proximity to the coast or other geographically exposed areas such as lakes and rivers (Wu, Lindell, and Prater 2012) shape the decision by affecting perceptions of vulnerability. These factors combine with group attributes to dictate access to information and means of evacuation, and thus the decision to evacuate (ibid.).

In light of these non-random vulnerabilities and decisions, we must take care below when interpreting differences between Evacuees and Bystanders. *Bystanders* are respondents who were not in the path of any hurricane. *Evacuees* are respondents who were in the path of Katrina or Rita, and evacuated. Simple difference-of-means comparisons on key variables are presented initially, then group characteristics are controlled for subsequently. Though I focus on the differences between sets due to disaster evacuation experience as a key explanatory variable, I do so with the caveat that disaster vulnerability and resulting evacuation experience are themselves driven by non-random factors of risk perception and information source not captured here.

ISSUE 1: DAMAGES

Personal damage from a disaster can include physical injury, loss of work, the death of loved ones, and psychological or traumatic stress (see Galea et al 2005; Versporten et al 2009; Plyer, Warren, and Bonaguro 2007). Overall damages to private and public property have been estimated by the National Oceanic and Atmospheric Administration at a total of $125 billion for Hurricane Katrina and $16.0 billion for Hurricane Rita (2012 US$ dollars; Lott et al 2013), not including damages to the fishing, gas, tourism, or farming industries. In the *2009 American Housing Survey for the New Orleans Metropolitan Area*, 74% of New Orleans homeowners reported damage to their homes by Hurricane Katrina. Just over 40% of these reported 'major' damage, defined by the Census Bureau as requiring repairs of $15,000 or more (US Census Bureau 2011).

It is important to note the difference between the damages caused by Katrina versus Rita. Katrina was remarkable in terms of damages because it caused more than four times the damages of any hurricane in contemporary history.[9] Table 2 shows the 8 major hurricanes of the 2004-2006 hurricane seasons, as well as their total monetary damage estimates, and how they compare to those caused by Hurricane Katrina. While several hurricanes of that period caused over $10 billion in damages, none caused even one-sixth of the monetary damages of Hurricane Katrina.

< Table 2>

Measuring Knowledge and Beliefs

The empirical analysis focuses on one main outcome measure of damages. First, a respondent was asked to call to mind the market value of her home pre-hurricane. Subsequently, she was asked to estimate the value post-hurricane. Questions were worded to reflect whether the hurricane and damages were hypothetical (for Bystanders) or real (for Evacuees), and to remind the Bystanders of the intensity of their hypothetical hurricane. The damages measure captures the simple likelihood of one's home sustaining damages, and is measured by dichotomizing the respondent's damages indicator (0 if the respondent indicated 'no damages' and 1 if the respondent indicated any other level of damages).

Empirical Results

Table 3 gives results of basic difference-of-proportions tests between Bystanders and Evacuees on the dichotomous damages measure. The value displayed for Bystanders indicates the proportion of Bystanders who believe their property will sustain any damages at all, given the particular intensity and probability of their hypothetical hurricane passing over their home. The Evacuees' values indicate the proportion of evacuees who indicate their property was damaged.

<Insert Table 3>

The top panel shows Bystanders three times as likely to believe they will incur damages from a hurricane as Evacuees actually are to incur them (.30/.10 = 3). This difference is statistically significant

[9] At the time, Hurricane Andrew (1992) was the second costliest hurricane on record, causing $27 billion in damages. Between Hurricane Andrew and 2004, no single hurricane caused more than $6 billion in damages (compiled by the author from Lott et al 2013).

($|z|$=15.21; $p < .01$) and large. The next panels show that Hurricane Katrina is driving this difference. The second panel compares Bystanders to Katrina Evacuees; the means are statistically different but much closer in size. Meanwhile, Bystanders are more than four times as likely to believe they will sustain property damages as Rita evacuees actually are to sustain them (.30/.07=4.29; $|z|$=15.18; $p < .01$).

We begin to see a pattern emerge. Bystander estimates regarding their own hypothetical situation is somewhat comparable to that which was experienced by Hurricane Katrina Evacuees, but quite exaggerated compared to that which was experienced by Hurricane Rita Evacuees. As Hurricane Katrina was such a drastic departure from other hurricanes in terms of damages, to exceed even Katrina's damage probabilities shows a heightened belief of damages, and a heightened perception of risk, compared to evidence seen in the natural world.

Table 4 reports regression results for the two measures of damages (MLE logit for the dichotomous outcome, OLS for the level of damages). Model (1) examines the effects of Evacuee experience on the likelihood of sustaining damages. Results conform to the difference-of-means test results: Katrina and Rita Evacuees are less likely to experience damages than Bystanders believe they themselves would, if in a hurricane (both $p < .01$). The effect of any Evacuee experience is captured in the coefficient for 'Joint Significance of Experience,' testing the hypothesis that Katrina and Rita are simultaneously zero, and indicates that Evacuees of both hurricanes *taken together* are significantly less likely to experience damages than Bystanders forecast (coefficient: -2.51; $p < .01$).[10]

<Insert Table 4 about Here>

Models (2) – (4) are robust to these effects of Katrina and Rita experience, as well as their joint significance, on the dichotomous damages measure. These models also include fixed effects for each hurricane group, using the Category-1 intensity group, and the 20% probability group, as baselines. In all three models, the hurricane category variables are positive and significant ($p < .01$), while the hurricane

[10] Joint significance tests are computed using Stata's 'test' and 'lincom' commands (Stata 13).

probability variables are not significant. This means that within the Bystanders, the belief that damages will occur increases as hurricane intensity increases.

Model (3) includes interactions of hurricane intensity and probability, to see whether intensity affects beliefs differently when the chances of the hurricane making landfall change (Model (4) adds controls for race, sex, age, education, and work status).[11] There is no evidence of an interactive effect. The results for Models (3) and (4) also list tests for joint significance of each hurricane intensity and each hurricane probability. Both intensity levels are positive and significant ($p < .01$), and neither probability level is significant, in any model.

Interpreting the interaction terms and joint effects in Models (3) – (4) will be as follows. In Model (4), the coefficient on *Hurricane Category – 5* indicates that Bystanders in the 'Category – 5, 20% probability' hypothetical group are significantly more likely than Bystanders in the 'Category – 1, 20%' group to believe they will sustain damages (1.77, $p < .01$). 'Joint Significance of Category 5' indicates that *all* Bystanders assigned a Category – 5 hurricane are significantly more likely than *all* Bystanders assigned a Category – 1 hurricane to believe they will sustain damages (1.50, $p < .01$). The same interpretation can be applied to Category – 3 coefficients. Similarly, the coefficients on Katrina and Rita experience indicate that Katrina Evacuees (-.86, $p < .01$) and Rita Evacuees (-1.94, $p < .01$) are each significantly less likely to sustain damages than Bystanders expect themselves to be, while the coefficient on Joint Significance of Experience signifies that *all* Evacuees are significantly less likely (-2.80, $p < .01$) to sustain damages than Bystanders expect themselves to be.

[11] Although a pure experiment would not need to account for the effects of intervening or mitigating variables (Mutz 2011, pp. 123-126), respondents were non-randomly assigned into sets based on where they were at the time of the hurricanes. This fourth model therefore includes basic socio-demographic measures to ensure that differences between the samples will not confound analysis of the treatment effects. In particular, these controls help avoid the 'White Male Effect,' a pattern noticed among white males, who uniquely down-weight risk and vulnerability (Flynn 1994; Finucane et al 2000; Palmer 2003), as well as some of the non-random drivers of vulnerability and evacuation decision making mentioned above.

Relationships among intensity, probability, and experience are perhaps best understood by examining marginal effects. Figure 1 depicts marginal effects of hurricane intensity on expectations of sustaining damages, using Model (4). The top (solid green) line represents the predicted probabilities of Bystanders in the Category-5 group, for the landfall probabilities of 20%, 50%, and 80%. The middle (dotted red) and bottom (dashed blue) lines represent the same increase in probabilities for the Hurricane Category-3 and Category-1 groups. Two short vertical lines depict the likelihood of Katrina Evacuees (14%; 95% CI .11, .17) and Rita Evacuees (6%; 95% CI .05, .08)[12] sustaining damages.

<Insert Figure 1>

Bystanders believe higher intensity hurricanes are more likely to cause damages, consistent with Hypothesis 2. Further, Evacuees are significantly less likely to experience damages than Bystanders predict for themselves. Katrina evacuees had a 14% chance of experiencing damages, compared to the 28% chance of damages expected by Bystanders given a Category-3 hurricane. Hurricane Rita respondents had a 6% chance of experiencing damages, less than even the 10.6% chance expected by Bystanders imagining a Category-1 hurricane, which is two categories less severe than Hurricane Rita.

These findings are remarkable considering the extent of damage Katrina inflicted. For Bystanders to believe they are *more likely* to experience damages than Katrina victims, they believe themselves in a situation more risky than a hurricane four times more costly, and ten times more deadly, than any hurricane since prior to WWII. Damages similar to those from Rita are more typical according to previous history, despite the fact that Rita approached record-breaking barometric pressure and overall size while in the Gulf of Mexico. Yet the likelihood of experiencing damages as a Rita Evacuee in the sample is almost uniformly less than the likelihood supposed by Bystanders imagining a much weaker Category-1 hurricane. And the likelihood of damages imagined by those in a

[12] For these two predictions the x-axis is meaningless; their placement is to facilitate visual comparison.

hypothetical group the same strength as Rita (Category-3) were the likes of which only the costliest hurricane in history had ever inflicted.

In sum, hypothetical hurricanes elicit statistically significant and substantively large effects. As the scenarios become more severe, subjects respond with more extreme beliefs about damages, as predicted. Additionally, Bystander beliefs about damages are more dramatic than damages experienced as a consequence of actual events, even when the hypothetical event matches the severity of the actual event, even when the hypothetical event is *less* severe than the actual event.

ISSUE 2: LOCATION

The second issue is location, referring to the decision about whether to return (or continue) to live in one's place of residence after a disaster. Return-migration patterns of displaced evacuees are never certain, and have been studied after events such as civil and internal conflict and natural disasters. Scholars speculate that migration is based on attraction to population centers (Warin and Svaton 2008; Helliwell 1997; Lewer and Van den Berg 2008; Plane 1984), diaspora contacts (Moore and Shellman 2007), socio-economic status (Smith et al 2006), housing damage (Fussell, Sastry, and VanLandingham 2010), and network ties (Landry et al 2007; Groen and Polivka 2008).

For some areas of the country, disasters spurred by natural hazards are likely to recur. Annually, the Gulf Coast is exposed to hurricanes, Southern California experiences wildfires, and the southern plains states expect tornados. The choice to live in these areas has implications for resource allocation and public health efforts. The decision of where to live after a catastrophic event is thus important to political scientists, economists, demographers, sociologists, and policymakers.

Measuring Beliefs and Intentions

Respondents were asked their intentions to live in their original place of residence after a catastrophic event. Each Bystander was placed into one of three categories of damages, based on the level of damages they indicated they believed their home would sustain as a result of their hypothetical hurricane. Evacuees were placed into the same three categories, based on the level of damages their homes did sustain. Damage levels were chosen based on FEMA guidelines in the Road Home Recovery Plan: cosmetic = $0-$4,999; structural = $5,000-$30,000; and severe = $30,000 and over.[13]

Bystanders were then asked to imagine the hypothetical hurricane inflicting damages according to the level their own estimate indicated. That is, if the Bystander estimated their home would sustain damages in the range of $15,000, they were told the hypothetical hurricane inflicted 'structural' damages to their home. They were also told they would be able to fix the damage with insurance funds, and then asked whether they would continue to live in the area where their home was damaged.

Evacuees were asked their intentions of living (or continuing to live) in the area they had evacuated. This allowed the evacuee the possibility of moving, even upon an initial return to the evacuated area, if she found herself unwilling to stay.[14] The measure for *probability of living in disaster area* measures (0,1). All subjects were assigned a 1 if they indicated they were sure they would return to live (or continue living) in the area where the real (or hypothetical) hurricane passed, 0 otherwise.

Empirical Results

How well do the estimates of the Bystander Set correspond to Evacuees' experience? Table 5 reports t-tests for the Location Issue. Bystanders are 26% less likely to see themselves living in the disaster area than Evacuees (1-(.56/.76)=.26; p < .01), 20% less likely than Katrina Evacuees (1-(.56/.70)=.20; p < .01), and 29% less likely than Rita Evacuees (1-(.56/.79)=.29; p < .01).

Table 6 compares proportions between Bystanders and Evacuees according to damages. At all levels, Bystanders are less likely to live in the disaster area than actual disaster Evacuees. The difference

[13] Classifications based on 2005 categories, though they have changed slightly (US Department of Housing and Urban Development 2006; Road Home Program 2012).

[14] Measured this way, *probability of living in disaster area* merges people who have and have not returned; I do so in order to not seriously undermine the analysis with selection bias. Additional analysis yields the same results when either omitting the 902 displaced evacuees, or evaluating only the 902 displaced evacuees, instead of analyzing all evacuees together. These findings indicate that analyses are robust and give valid inferences about the mechanisms of interest while relieving selection concerns.

is smallest, 12%, when damages are cosmetic (1-(.66/.75)=.12; $p < .01$). Bystanders are also 16% less likely than Evacuees to see themselves living in the disaster location after suffering structural damages (1-(.66/.79)=.16; $p < .01$), and a full 68% less likely after suffering severe damages (1-(.25/.79)=.68; $p < .01$).

<Insert Tables 5 and 6>

Table 7 displays Logit MLE estimates of intentions to live in the pre-disaster area. Since Bystanders were told the hypothetical hurricane had indeed passed over their area, 'probability of making landfall' and 'category of intensity' are no longer covariates. Instead, that information is incorporated into each Bystander's damages forecast. Covariates for Models (5)-(8) thus include the Katrina/Rita experience, adding damage levels in Model (6), then the interaction between Katrina/Rita experience and damages in Model (7), and socio-demographic controls in Model (8).

A word about interpretation for Models (7)-(8) might be helpful. Due to the interaction terms, the coefficient for each level of damages represents the effect of that level of damages on the likelihood of living in the disaster area, as compared to the base level (cosmetic), for Bystanders only. The coefficient for Katrina experience represents the difference in the likelihood of living in the disaster area for Katrina experiencers as opposed to Bystanders, for those at the cosmetic level of damages. The coefficient on an interaction term, such as *Katrina*structural*, represents the difference between Katrina Evacuees and Bystanders in the likelihood of living in the disaster area when damages are structural. The overall effect of any one attribute, such as Katrina experience, is found by summing the coefficient of the Katrina fixed effect, plus the coefficients of the interactions between Katrina and each level of damages. Results for these joint effects are given in Table 7. I discuss Model (8) below.

<Insert Table 7>

As might be expected among Bystanders, the higher one's level of self-predicted damages, the less likely one is to plan on living in the disaster area. Structural damages (-1.15, $p < .01$) and severe damages (-1.19, $p < .01$) both make Bystanders less likely to imagine returning or staying. Notably, this is not true for Evacuees, for whom the likelihood of living in the disaster area *increases* with damages. Katrina Evacuees experiencing structural damage are significantly more likely to plan on living in the area than Bystanders (1.45; $p < .01$), and the difference only widens as damages grow (2.20; $p < .01$). Rita Evacuees with cosmetic damages are more likely to plan on living in the disaster area than Bystanders with cosmetic damages (.78; $p < .01$), and the move to severe damages only increases this difference (1.99; $p < .01$).

Those who lived through Katrina and Rita are more determined to live in the disaster area than those imagining a hypothetical hurricane. Katrina Evacuees are significantly more likely to live in the disaster area (3.81; $p < .01$) than Bystanders, as are Rita Evacuees (4.22; $p < .01$).

Interactive effects are perhaps most easily seen in Figure 2, which depicts the marginal effects of the varying levels of damages, separated into groups for Bystanders, Katrina Evacuees, and Rita Evacuees. Katrina and Rita Evacuees (the dotted and dashed lines, top and middle) are not exactly parallel, but do follow the same general path, beginning with a probability over 70% (72% for Katrina, 81% for Rita), increasing in that probability to 79% and 86%, respectively (although not statistically significant increases for either) as damages move from cosmetic to structural, and then leveling off at 79% and 83% as damages move from structural to severe. Bystanders, on the other hand (the lowest, solid line), begin at 67% for cosmetic damage, and then move steadily down in probability to 40% ($p < .01$), and finally 24% ($p < .01$), as damage levels increase.

<Insert Figure 2>

Bystanders are not simply exaggerating the effects of the disaster experience when they imagine it. They are imagining the effects to be more dramatic, and their reactions to be in the opposite direction, of those experienced and exhibited by people who actually live through a disaster of similar proportions, *even a disaster inflicting similar levels of damage*. Bystanders' imagined effects are so horrible that the Bystanders' self-imagined likelihood of behaving differently from actual Evacuees widens as the effects of the disaster are believed more and more drastic.

DISCUSSION

In a controlled experiment, decisions can appear reasonable and predictably motivated by treatments. Those in the Bystander Set predicted a greater likelihood of damages as their hypothetical hurricane grew in intensity, and decreased their predicted likelihood of returning to the disaster-stricken place of residence as the damage to their home increased. On the surface these seem like sound and appropriate beliefs and intentions. And yet the responses do not mirror the experiences and intentions of actual evacuees who lived through hurricanes of similar intensity, or even greater intensity, than the hypothetical hurricanes. Bystanders demonstrate amplified beliefs, and intend to make decisions contrary to those exhibited in the behavior and intended behavior of actual evacuees.

Some caveats with the study must be acknowledged. First, the intention to return home after evacuation is an *intended* behavior, rather than a behavior. For the 904 displaced evacuees, and the set of bystanders, the self-assessed intention of returning is similar to an attitude, and we are unable to assess whether that intention lines up with actual behavior for any particular respondent. Fishbein and Ajzen's Theory of Reasoned Action (1975) explains how one's attitude toward an act is more able to predict actual behavior than one's attitude toward an object. This suggests that at the least, assessments of the likelihood of living in an area will be more reliable predictors of that action than assessments of risk would be of true hurricane risk (also Lindell and Prater 2002; Terpstra and Lindell 2012). Still, it would be unwise to use the stated resettlement intentions as concrete resettlement predictors. We can, however, compare the intended behaviors of the two groups (evacuee and bystander) to each other. The results do not change if including evacuees who have definitively decided whether to return (see "Measuring Beliefs and Intentions," p. 20), and since the intended behavior regards something of great import, and each respondent has the capacity to make her own decisions regarding return, we have less cause to worry about the difference between evacuees' intentions versus behaviors than we might with other types of decisions (Morwitz 2001).

Second, the sample used here is a convenience sample made up of voluntary participants. Though we took steps to minimize non-responses ($2.50 and entry in a lottery for $5,000), participation was restricted to people who had internet access before the hurricanes. Yet the sample does represent a broad cross-section of people. Moreover, as substantive conclusions about damages and migration are of secondary importance, the sample of this study does not need to be generalizable to the entire US or world populations. Even if these samples are only representative of Gulf Coast residents, we can generalize about beliefs and intentions based on hypothetical versus experienced events.

Third, the political disruption caused by disasters is not an everyday situation, and Hurricane Katrina was not an everyday disaster. But the disaster context is not atypical. The requirement is not to exactly simulate real-life situations, but rather 'to see whether change in the independent variable (by whatever means) produces change in the dependent variable' (Mutz 2011, p. 93). My design is thus useful in that it manipulates independent variables (disaster intensity) and takes advantage of natural variation (disaster experience) to gauge subsequent change in the dependent variables of interest.

Additionally, these models do not explicitly estimate attention to media coverage. A self-reported measure on the attention the respondent paid to events surrounding Hurricane Katrina was included in unreported regressions, and coefficients, signs, and significance of the variables above did not change with their inclusion. The media measure itself behaved as expected. The choice to exclude a self-reported 'attention to media' measure in the final analysis comes from a history of scholarship on the difficulties of reliably measuring the concept (Mutz 1994; Prior 2013; Goldman, Mutz, and Dilliplane 2013; Dilliplane, Goldman, and Mutz 2013), and the desire to avoid muddying our understanding of the relationships analyzed.

Lastly, it is possible that Bystanders were not actually thinking of Katrina/Rita when completing their surveys. We do know that respondents were primed with preliminary questions regarding their knowledge of, concern for, and attention to events surrounding Hurricane Katrina, so we have reason to believe it was not far from their minds. Even if thinking of something else, this should not detract from the results presented here. We *expect* people to continually update their beliefs based on new experiences and perceptions (Druckman and Lupia 2000). Without making claims about the underlying psychological state of bystanders, we can still make conclusions about how they react to the stimulus.

CONCLUSION

This paper has probed an important question about beliefs and intentions. Do observers of low-probability, high-consequence events have systematically different beliefs and intentions from those who experience that event first-hand? On this question, the findings are clear. Bystanders and evacuees exhibit systematically different trends in actual v. predicted damages, and in post-disaster intentions. What appears to make sense to those who have only had the opportunity to *observe* an event is in fact representing an exaggeration of beliefs, in the case of damages, and the reversal of important decisions, in the case of where to live, compared to actual experiences and intentions of those who *experience* the event. This work offers a unique opportunity to compare simulated stimuli with the effects of real-world disruptions. The distinction is important for a few key reasons.

First, we learn that it is only in comparing the Bystanders to the Evacuees that we see the magnitude of Bystander amplification. Sans the ability to compare hypothetical-disaster responses to real-disaster responses, we would run the risk of drawing inferences about beliefs and intentions that only represented the Bystanders' perspective. More importantly, considering many researchers are also bystanders of critical events, rather than survivors or evacuees, we would risk inferring that the amplifications were smaller, or in the same direction, as evacuee responses, even if they were not.

The second reason is relevant to policy. Results find an opposite intended movement of Bystanders, as opposed to Evacuees, based on damages. As hypothetical damages rise for Bystanders, they imagine themselves unwilling to live in the hurricane-prone area. As real damages increase for Evacuees, they are *more* resolved to return home. It could be that the 'rational' or 'desirable' response from a policy standpoint is to move citizens out of disaster-heavy areas, away from places susceptible to catastrophic events. If so, those in the Bystander group have been able to distance themselves from the emotional context of the events of Katrina and Rita and clearly calculate the necessity of moving away. In that case, Evacuees' judgment is clouded by their experience, and their personal attachment to their home areas, so that they cannot make the appropriate decision to leave. Comparing Bystanders to Evacuees in a sample then becomes important precisely because of the difference the *lack* of experience elicits.

The implication is that hypothetical situations in surveys can artificially cue rationality; people will apply risk assessments, costs/benefits, and rational behavior. But when one personally lives through a catastrophic event, even a year afterward different cues appear to be operating. Based on strictly experimental results, we might artificially conclude that respondents are rational because of their response to hypothetical cues, when real cues in ordinary life elicit different responses.

Finally, the difference is notable because in general we expect hypothetical catastrophes in surveys to be moderations of reality, rather than amplifications. To a respondent sitting at a computer, a survey is unlikely to truly simulate a catastrophic experience. Yet the repeated distinction evidenced between Bystanders and Evacuees, across hypothetical damage groups and Evacuee groups, suggests a strong amplifying force counteracting potential moderating effects of the survey instrument. Media reports tend to build stories around visual and visceral examples of damage and disaster. The general public sometimes forgets that the media is not mitigating the actual pain associated with such examples, and that the examples may not be representative of the typical person's experience with the event.

References

Arceneaux, K. and Stein, R. M. (2006). Who is held responsible when disaster strikes? The attribution of responsibility for a natural disaster in an urban election. *Journal of Urban Affairs* 28 (1), 43-53.

Atkeson, L. R. and Maestas, C. D. (2012). *Catastrophe Politics: How Extraordinary Events Redefine Public Perceptions of Government*. Cambridge, UK: Cambridge University Press.

Baker, J., Shaw, W. D., Riddel, M., and Woodward, R. T. (2009). Changes in subjective risks of hurricanes as time passes: analysis of a sample of Katrina evacuees. *Journal of Risk Research* 12 (1), 59-74.

Barabas, J., & Jerit, J. (2009). Estimating the Causal Effects of Media Coverage on Policy-Specific Knowledge. *American Journal of Political Science*, *53*(1), 73-89.

Barabas, J. and Jerit, J. (2010). Are Survey Experiments Externally Valid? *American Political Science Review* 104 (2), 226-242.

Beaudoin, C. E. (2007). Media Effects on Public Safety Following a Natural Disaster: Testing Lagged Dependent Variable Models. *Journalism & Mass Communication Quarterly* 84 (4), 695-712.

Birkland, T. A., Burby, R. J., Conrad, D., Cortner, H., & Michener, W. K. (2003). River ecology and flood hazard mitigation. *Natural Hazards Review*, *4*(1), 46-54.

Bourque, Linda B., Judith M. Siegel and Kimberley I. Shoaf. 2002. 'Psychological Distress Following Urban Earthquakes in California.' *Prehospital and Disaster Medicine* 17 (2): 81–90.

Bracht, G. H., & Glass, G. V. (1968). The external validity of experiments. *American educational research journal*, 437-474.

Brodie, M., Weltzien, E., Altman, D., Blendon, R. J., and Benson, J. M. (2006). Experiences of Hurricane Katrina Evacuees in Houston Shelters: Implications for Future Planning. *American Journal of Public Health* 96 (5), 1402-1408.

Camerer, C. F., & Kunreuther, H. (1989). Decision processes for low probability events: Policy implications. *Journal of Policy Analysis and Management*, *8*(4), 565-592.

Chong, D. and Druckman, J. N. (2010). Dynamic Public Opinion: Communication Effects over Time. *American Political Science Review* 104 (4), 665-680.

Comfort, L. K., Birkland, T. A., Cigler, B. A., & Nance, E. (2010). Retrospectives and prospectives on Hurricane Katrina: Five years and counting. *Public Administration Review*, *70*(5), 669-678.

Dilliplane, S., Goldman, S. K., & Mutz, D. C. (2013). Televised exposure to politics: New measures for a fragmented media environment. *American Journal of Political Science*, *57*(1), 236-248.

Druckman, J. N., Green, D. P., Kuklinski, J. H., and Lupia, A. (2006). The Growth and Development of Experimental Research in Political Science. *American Political Science Review* 100 (4), 627-635.

Druckman, J. N. and Leeper, T. J. (2012). Learning More from Political Communication Experiments: Pretreatment and Its Effects. *American Journal of Political Science* 56 (4), 875-896.

Druckman, J. N., & Lupia, A. (2000). Preference formation. *Annual Review of Political Science*, *3*(1), 1-24.

Druckman, J. N., & McDermott, R. (2008). Emotion and the framing of risky choice. *Political Behavior*, *30*(3), 297-321.

Eckel, C. C., El-Gamal, M. A., and Wilson, R. K. (2009). Risk loving after the storm: A Bayesian-Network study of Hurricane Katrina evacuees. *Journal of Economic Behavior & Organization* 69, 110-124.

Federal Emergency Management Agency. 2005. 'Hurricane Katrina Response And Recovery Update.' September 4. http://www.fema.gov/news-release/2005/09/04/hurricane-katrina-response-and-recovery-update.

Finucane, M. L., Slovic, P., Mertz, C. K., Flynn, J., & Satterfield, T. A. (2000). Gender, race, and perceived risk: The'white male'effect. *Health, risk & society*, *2*(2), 159-172.

Flynn, J., Slovic, P., & Mertz, C. K. (1994). Gender, race, and perception of environmental health risks. *Risk analysis*, *14*(6), 1101-1108.

Frewer, L. J., Miles, S., & Marsh, R. (2002). The media and genetically modified foods: evidence in support of social amplification of risk. *Risk analysis*, *22*(4), 701-711.

Fussell, E., Sastry, N., & VanLandingham, M. (2010). Race, socioeconomic status, and return migration to New Orleans after Hurricane Katrina. *Population and environment*, *31*(1-3), 20-42.

Gaines, B. J., Kuklinski, J. H., and Quirk, P. J. (2007). The Logic of the Survey Experiment Reexamined. *Political Analysis* 15, 1-20.

Galea, S., Nandi, A., Stuber, J., Gold, J., Acierno, R., Best, C. L., … & Resnick, H. (2005). Participant reactions to survey research in the general population after terrorist attacks. *Journal of traumatic stress*, *18*(5), 461-465.

Gallup. 2005. 'Gallup/CNN/USA Today Poll # 2005-42: Hurricane Katrina and New Orleans/Race.' *The Roper Center for Public Opinion Research*. Accessed 27 June 2012, <http://webapps.ropercenter.uconn.edu.libezproxy.tamu.edu:2048/CFIDE/cf/action/ipoll/Abstract.cfm?keyword=hurricane+Katrina&keywordOptions=4&exclude=&excludeOptions=1&topic=Any&organization=Gallup&fromDate=09%2F01%2F2005&toDate=09%2F15%2F2005&sortBy=ASC&studyId=&label=&start=summary&ArchNo=USAIPOCNUS2005-42&label=&abstract.x=25&abstract.y=9>.

Gigerenzer, G. (2006). Out of the frying pan into the fire: Behavioral reactions to terrorist attacks. *Risk analysis*, *26*(2), 347-351.

Glaeser, E. L. (2005). 'Should the Government Just Rebuild New Orleans, or Just Give the Residents Checks?,' *The Economist's Voice, 2: 4,* 1-6.

Goldman, S. K., Mutz, D. C., & Dilliplane, S. (2013). All virtue is relative: A response to Prior. *Political Communication*, *30*(4), 635-653.

Gore, M. L., Siemer, W. F., Shanahan, J. E., Schuefele, D., & Decker, D. J. (2005). Effects on risk perception of media coverage of a black bear-related human fatality. *Wildlife Society Bulletin*, *33*(2), 507-516.

Grievink, L., van der Velden, P. G., Yzermans, C. J., Roorda, J., and Stellato, R. K. (2006). The Importance of Estimating Selection Bias on Prevalence Estimates Shortly After a Disaster. *Annals of Epidemiology* 16 (10), 782-788.

Groen, J. A., & Polivka, A. E. (2008). Hurricane Katrina evacuees: Who they are, where they are, and how they are faring. *Monthly Lab. Rev.*, *131*, 32.

Grothmann, T., & Reusswig, F. (2006). People at risk of flooding: why some residents take precautionary action while others do not. *Natural hazards*, *38*(1-2), 101-120.

Helliwell, J. F. (1997). National borders, trade and migration. *Pacific Economic Review*, *2*(3), 165-185.

Hussain, A., Weisaeth, L., and Heir, T. (2009). Nonresponse to a Population-Based Postdisaster Postal Questionnaire Study. *Journal of Traumatic Stress* 22 (4), 324–328.

Izard, R. S., and Perkins, J. (2011). In the Wake of Disaster: Lessons Learned. In Izard, R. S., and Perkins, J., (eds.), *Lessons from Ground Zero: Media Response to Terror* (pp. 1-14). New Brunswick, NJ: Transaction Publishers.

Jenkins, J. L., Hsu, E. B., Sauer, L.M., Hsleh, Y. H., and Kirsch, T. D. (2009). Prevalence of Unmet Health Care Needs and Description of Health Care-seeking Behavior Among Displaced People After the 2007 California Wildfires. *Disaster Medicine and Public Health Preparedness* 3 (1), 24-28.

Jha, S., and Izard, R. S. (2011). 'Sources: No Time for the Rolodex.' In Izard, R. S., and Perkins, J., (eds.), *Lessons from Ground Zero: Media Response to Terror* (pp. 79-84). New Brunswick, NJ: Transaction Publishers.

Joyce, Christopher. *National Public Radio*, 18 November 2013. 'How and Where Should We Rebuild After Natural Disasters?' http://www.npr.org/2013/11/18/245949244/how-and-where-should-we-rebuild-after-natural-disasters.

Kasperson, R. E., & Kasperson, J. X. (1996). The social amplification and attenuation of risk. *The Annals of the American Academy of Political and Social Science*, 95-105.

Kessler, R. C., et al. (2007). Methodological Issues in Post-disaster Mental Health. Paper presented at the Conference on Health Survey Research Methods, March 2007, Peachtree City, p.33-44.

Kohut, A., Allen, J. T., and Keeter, S. (2005). What Was and Wasn't on the Public's Mind And How Opinions Changed During 2005. Pew Research Center.

Kurth, M. M., and Burckel, D. V. (2006). The Rita Report: A summary of the social and economic impact and recovery of Southwest Louisiana one year after Hurricane Rita. A report commissioned by the Louisiana Recovery Authority. Accessed: 12 July 2013. *www.nola.com/katrina/pdf/091806_lra_ritareport.pdf*.

Landry, C. E., Bin, O., Hindsley, P., Whitehead, J. C., & Wilson, K. (2007). Going home: Evacuation-migration decisions of Hurricane Katrina survivors. *Southern Economic Journal*, 326-343.

Leschine, T. M. (2002). Oil spills and the social amplification and attenuation of risk. *Spill Science & Technology Bulletin*, *7*(1), 63-73.

Lewer, J. J., & Van den Berg, H. (2008). A gravity model of immigration. *Economics letters*, *99*(1), 164-167.

Lindell, M. K., Lu, J. C., & Prater, C. S. (2005). Household decision making and evacuation in response to Hurricane Lili. *Natural Hazards Review*, *6*(4), 171-179.

Lindell, M. K., & Prater, C. S. (2002). Risk Area Residents' Perceptions and Adoption of Seismic Hazard Adjustments1. *Journal of Applied Social Psychology*, *32*(11), 2377-2392.

List, J. A. (2001). Do Explicit Warnings Eliminate the Hypothetical Bias in Elicitation Procedures? Evidence from Field Auctions for Sportscards. *American Economic Review*, 91 (5), 1498-1507.

Lott, N., Smith, A., Houston, T., Shein, K., and Crouch, J. (2013). Billion Dollar U.S. Weather Disasters, 1980 - 2012. *National Oceanic and Atmospheric Administration*.

Lupia, A., & Menning, J. O. (2009). When can politicians scare citizens into supporting bad policies?. *American Journal of Political Science*, *53*(1), 90-106.

Lusk, J. L., and Fox, J. A. (2003). Value Elicitation in Retail and Laboratory Experiments. *Economics Letters* 79 (1), 27-34.

May, P. J., & Birkland, T. A. (1994). Earthquake risk reduction: An examination of local regulatory efforts. *Environmental Management*, *18*(6), 923-937.

Moore, W. H., & Shellman, S. M. (2007). Whither will they go? A global study of refugees' destinations, 1965–1995. *International Studies Quarterly*, *51*(4), 811-834.

Mortensen, K., Wilson, R. K. and Ho, V. (2009). Physical and Mental Health Status of Hurricane Katrina Evacuees in Houston in 2005 and 2006. *Journal of Health Care for the Poor and Underserved* 20, 524-538.

Morwitz, V. G. (2001). Methods for forecasting from intentions data. In *Principles of forecasting* (pp. 33-56). Springer US.

Mutz, D. C. (1994). Contextualizing personal experience: The role of mass media. *The Journal of Politics*, *56*(03), 689-714.

_____. (2011). *Population-Based Survey Experiments*. Princeton: Princeton University Press.

National Oceanic and Atmospheric Administration. (2013). 'Saffir-Simpson Hurricane Wind Scale.' Accessed 27 June 2013: <http://www.nhc.noaa.gov/aboutsshws.php>.

Newman, E., & Kaloupek, D. G. (2004). The risks and benefits of participating in trauma-focused research studies. *Journal of traumatic stress*, *17*(5), 383-394.

North, C. S., and Norris, F. H. (2006). Choosing Research Methods to Match Research Goals. In Norris, F. H., Galea, S., Friedman, M. J., and Watson, P., (eds.), *Methods for Disaster Mental Health Research* (pp. 45-61). New York, NY: Guilford Press.

Nyhan, B., & Reifler, J. (2010). When corrections fail: The persistence of political misperceptions. *Political Behavior*, *32*(2), 303-330.

Palmer, C. (2003). Risk perception: Another look at the'white male'effect. *Health, risk & society*, *5*(1), 71-83.

Paxson, Christina, and Cecilia Elena Rouse. "Returning to New Orleans after Hurricane Katrina." *The American economic review* 98, no. 2 (2008): 38.

Perry, R. W. (1983). Population evacuation in volcanic eruptions, floods, and nuclear power plant accidents: Some elementary comparisons. *Journal of Community Psychology*, *11*(1), 36-47.

_____. (2006). What Is a Disaster? In Rodriguez, H., Quarantelli, E.L., and Dynes, R. R., (eds.), *Handbook of Disaster Research* (pp. 1-15). New York, NY: Springer.

Plane, D. A. (1984). Migration space: doubly constrained gravity model mapping of relative interstate separation. *Annals of the Association of American Geographers*, *74*(2), 244-256.

Plyer, A. D., Warren, D., & Bonaguro, J. (2007). FEATURE PAPER: Real-Time Data Dissemination in a Rapidly Changing Environment. *SESSION 1: EMERGENCY PREPAREDNESS AND SURVEILLANCE*, 3.

Prior, M. (2013). The Challenge of Measuring Media Exposure: Reply to Dilliplane, Goldman, and Mutz. *Political Communication*, *30*(4), 620-634.

Public Broadcasting Service, 20 September 2012. ''I'm Carolyn Parker' in Context – Rebuilding the Lower Ninth Ward.' http://www.pbs.org/pov/carolynparker/photo_gallery_background.php?photo=7#gallery-top.

Quarantelli, E.L., Lagadec, P., and Boin, A. (2006). A Heuristic Approach to Future Disasters and Crises: New, Old and In-Between Types. In Rodriguez, H., Quarantelli, E.L., and Dynes, R. R., (eds.), *Handbook of Disaster Research* (pp. 16-41). New York, NY: Springer.

Road Home Program (2012). 'Homeowner Assistance Program Policies.' Accessed 16 July 2013. http://www.road2la.org/Docs/Default/DefaultNewsUpdates/Homeowner%20Assistance%20Program%20Policies_09-06-2011.pdf

Rodriguez, H., Quarantelli, E.L., and Dynes, R. R., (eds.), *Handbook of Disaster Research*. New York, NY: Springer.

Rozario, Ken. *The Wall Street Journal*, 16 January 2010. 'Rising from the Ruins.' http://online.wsj.com/news/articles/SB10001424052748703657604575005211595984220.

Schlenger, W. E., and Cohen Silver, R. (2006). Web-Based Methods in Disaster Research. In Norris, F. H., Galea, S., Friedman, M. J., and Watson, P., (eds.), *Methods for Disaster Mental Health Research* (pp. 129-140). New York, NY: Guilford Press.

Smith, T. W. (2009). A revised review of methods to estimate the status of cases with unknown eligibility. *Chicago: University of Chicago, National Opinion Research Center*.

Smith, V. K., Carbone, J. C., Pope, J. C., Hallstrom, D. G., & Darden, M. E. (2006). Adjusting to natural disasters. *Journal of Risk and Uncertainty*, *33*(1-2), 37-54.

Sommers, S. R., Apfelbaum, E. P., Dukes, K. N., Toosi, N., and Wang, E. J. (2006). Race and Media Coverage of Hurricane Katrina: Analysis, Implications, and Future Research Questions. *Analyses of Social Issues and Public Policy* 6 (1), 39-55.

Stata: Release 13. StataCorp LP, 2013.

Stein, Robert M., Leonardo Duenas-Osorio, Birnur Buzcu-Guven, Devika Subramanian and David Kahle. 2011. 'How Risk Perceptions Influence Evacuations From Hurricanes.' James A. Baker III. Institute for Public Policy, Rice University.

Terpstra, T., & Lindell, M. K. (2013). Citizens' Perceptions of Flood Hazard Adjustments An Application of the Protective Action Decision Model. *Environment and Behavior*, *45*(8), 993-1018.

United States Census Bureau. 2011. Census Bureau Releases First Detailed Data on Katrina Damage to New Orleans Area Housing. Accessed 16 July 2013. <http://www.census.gov/newsroom/releases/archives/housing/cb11-28.html>

United States Department of Housing and Urban Development's Office of Policy Development and Research. 2006. 'Current Housing Unit Damage Estimates: Katrina, Rita, and Wilma.' Accessed 16 July 2013. <http://www.huduser.org/publications/pdf/GulfCoast_Hsngdmgest.pdf>

Versporten, A. P. R., De Soir, E., Zech, E., & Van Oyen, H. (2009). A longitudinal study on the Ghislenghien disaster in Belgium: strengths and weaknesses of the study design and influence on response rate. *Archives of Public Health*, *67*(3), 116.

Wahlberg, A. A., & Sjoberg, L. (2000). Risk perception and the media. *Journal of risk research*, *3*(1), 31-50.

Warin, T., & Svaton, P. (2008). European Migration: Welfare Migration or Economic Migration?. *Global Economy Journal*, *8*(3).

Whitt, S. and Wilson, R. K. (2007). Public Goods in the Field: Katrina Evacuees in Houston. *Southern Economic Journal* 74 (2), 377-387.

Wu, H. C., Lindell, M. K., & Prater, C. S. (2012). Logistics of hurricane evacuation in Hurricanes Katrina and Rita. *Transportation research part F: traffic psychology and behaviour*, *15*(4), 445-461.

Table 1. Assignment of Treatments and Distribution of Respondents

Panel A. Distribution of Survey Experiment Group (Non-Evacuee 'Bystanders')

Hurricane Probability of Landfall	Hurricane Category of Intensity: 1	%	3	%	5	%
20%	510	(0.08)	512	(0.08)	508	(0.08)
50%	485	(0.08)	546	(0.09)	555	(0.09)
80%	549	(0.09)	494	(0.08)	491	(0.08)
	1544	(0.25)	1552	(0.25)	1554	(0.25)

Panel B. Distribution of Natural Experiment Group (Evacuees)

	Gave Answers Regarding: Katrina	Rita	%	Grand Total
Experienced Katrina only	582		(0.09)	
Experienced Rita only		683	(0.11)	
Experienced Katrina and Rita		311	(0.05)	
Total	582	994	(0.25)	6226

Notes: Grand Total is sum of all column totals. Cell values are the number of respondents from the survey study who fall into each category (values in parentheses give the proportion of the whole sample represented by each cell total).

Table 2. Major 2004-2005 Hurricane Damages Compared to Hurricane Katrina		
Hurricane (Year)	Monetary Damages	Fraction of Katrina Damages
Charley (2004)	$15 billion	12%
Frances (2004)	$9 billion	7.2%
Ivan (2004)	$14 billion	11.2%
Jeanne (2004)	$7 billion	5.6%
Dennis (2004)	$2 billion	1.6%
Katrina (2005)	$125 billion	100%
Rita (2005)	$16 billion	12.8%
Wilma (2005)	$16 billion	12.8%

Source: Compiled by the author from Lott et al 2012; Numbers in 2012 US$

Table 3. Survey and Comparison Effects: Damage Probabilities, Difference-of-Proportions

	Probability of Sustaining Damages		
	Mean	s.e.	n
Bystanders	0.30	0.01	4652
Evacuees (all)	0.10	0.01	1438
Difference	-0.20	0.13	6090
| Sig. test value |	15.21	0.10	
p - value	0.00		
Bystanders	0.30	0.01	4669
Katrina Evacuees (only)	0.17	0.02	510
Difference	-0.13	0.02	5179
| Sig. test value |	6.06		
p - value	0.00		
Bystanders	0.30	0.01	4674
Rita Evacuees (all)	0.07	0.01	928
Difference	-0.24	0.02	5602
| Sig. test value |	15.18		
p - value	0.00		