

In Texas, natural disasters increase domestic violence risks

After Hurricane Harvey and Winter Storm Uri, domestic violence calls dropped immediately because of outages but in the days that followed, they rose.

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HOUSTON – When a deadly winter storm struck in February 2021, tens of thousands of Texans were stuck inside with no power and, often, no water. Michelle J. Abdelnoor was trapped with her abusive boyfriend.


She tried to leave on the first day of the five-day storm, when he blamed her for the time he spent in jail after he was convicted of assaulting her in 2020. But he convinced her to stay, arguing the snow-and-ice storm was even worse at her parents' home north of Houston than in his downtown house.

He quickly became abusive, she said, pushing her, lightly slapping her face, holding her down and pulling her hair. He tried to disguise his threats as jokes.

"I could see in his face and eyes that he just wanted to hurt me physically, but he would stop himself," the 39-year-old Abdelnoor said in an interview. She suggested he was trying to avoid doing anything that would leave physical evidence on her body. "It was almost worse mentally, because I didn't know at what point he was going to explode."

When she tried to escape, he blocked her path, she said. The storm intensified her sense of danger. "The level of toxicity and abuse was condensed," Abdelnoor said. "The accusations or outbursts of anger that would have taken three weeks were condensed to five days."

The winter storm, called "Uri," [killed 246 Texans](#).

While Abdelnoor survived, her experience illustrates the heightened risk of intimate partner violence prompted or exacerbated by natural disasters. Research shows that in the United States, [domestic violence](#) is a leading cause of death for women aged 15 to 44. 

States, such violence [starts or worsens](#) during and after natural disasters, like the one that befell Texas three years ago.

"Often, abusers will point to the environment and the circumstances and say, 'Well, that's what made me snap. We're stuck at home. We're cold. We have no power. We can't eat,'" said Christina Allen at FamilyTime Crisis and Counseling Center in Humble, Texas.

The National Academies of Sciences, Engineering, and Medicine [reported in January](#) that natural disasters "worsen the frequency and severity of (intimate partner violence)" and make access to care and support "even more critical."

Storms, floods, wildfires and other natural disasters make it difficult for victims to access help, leaving them even more vulnerable to abuse.

Meanwhile, disasters like these are becoming more frequent and extreme as climate change worsens. A study published in the journal Atmospheric Environment projects that [wildfires alone will grow by up to 170%](#) in the western part of the country during the next three decades. [Floods, hurricanes and other storms](#) also are projected to increase 25% to 50% during that period.

The latest [National Climate Assessment](#), published in November, found the U.S. experienced 18 weather-related disasters that did more than \$1 billion in damages in 2022. Nevertheless, the National Academies report said "scant evidence exists" that federal disaster response teams or volunteer organizations are prepared to respond to intimate partner violence during emergencies.

A complete understanding of the impact of natural disasters on intimate partner violence isn't possible in the U.S. because there is no comprehensive national database or even standardized emergency call data detailed enough to quantify it. Only a fraction of police departments publish their [911 call data online](#).

Surveys and studies are hard to compare because researchers often use varying terms and questions when asking about intimate partner violence, the National Academies report found.

The same is true for police departments, which sometimes record intimate partner violence under the umbrella of family violence.

Sue Curry, who chaired the National Academies committee that authored the report, said the lack of awareness and training put women, who are most often the victims of intimate partner violence, at greater risk.

Following Hurricane Katrina in 2005, Mississippi women who were either married or living with their partners were nearly twice as likely to report severe physical abuse than during the six months before the hurricane, according to a study for the journal *Violence and Victims*. After the hurricane, 8.3% of women reported abuse compared to 4.2% beforehand. Men reported no increase in physical violence, but both men and women said they were more likely to experience psychological abuse by a partner after the storm.

A separate survey of people forced to relocate to Federal Emergency Management Agency trailer parks in Louisiana and Mississippi after Hurricane Katrina found that, 274 days after they were displaced, the rate of intimate partner violence was nearly three times higher than the U.S. baseline rates, the *Annals of Emergency Medicine* reported.

Researchers studying the effects of Hurricane Harvey in 2017 in Texas found a significant increase in psychological intimate partner violence, climbing to 47% from 36% among study participants, they reported in *Social Work Research*.

After Uri hit Texas in 2021, a national advocacy organization that provides cash grants to victims of intimate partner violence surveyed those applying for help. The organization, FreeFrom, found that one in four applicants reported that the abuse began or got worse during the storm.

As climate change advances, "women are definitely more at risk," Jennifer First, lead author of the Hurricane Harvey study, said in an interview.

Disasters can isolate women

Sybil Winters-Little at Bay Area Turning Point, a Webster, Texas, provider of services to domestic violence victims, said it can be hard for victims to find a private moment to call a hotline in the midst of a disaster because workplaces and schools close and they often are living with their abusers.

"When it's all about power and control, if you can isolate your victim from all of their resources, their family, their support system, it's easier to prey upon them," said Heather Bellino, CEO of the Texas Advocacy Project, which provides free legal services to survivors of violence. "And there's less opportunity for them to call for help and get out."

A Fuller Project analysis of family violence calls to police departments shows they dropped during hurricanes Harvey and Ida and lagged in the aftermath.

Hurricane Harvey caused at least \$125 billion worth of damage and killed 88 people in Texas. The hurricane hit Houston on August 26. In just a few days, 20 trillion gallons of water fell on the city. The day after, only 14 calls related to family violence reached the Houston Police Department, the Fuller Project analysis showed. In the three weeks following the hurricane, police received an average of 61 calls per day, significantly less than the 80 average daily calls during the same period in the ensuing five years.

During the nine days of Hurricane Ida, which made landfall in Louisiana in late August of 2021, family violence calls for help to the New Orleans Police Department dropped to their lowest levels of 2021. The police received about 35 calls per day, down from an average of about 44 calls per day during the same period in the previous five years.

Joseph Fernandez, an expert in disaster preparedness and emergency response at Florida International University, explained that those affected by a natural disaster are generally asked not to call emergency services unless they absolutely have to. "We can't come out. Calls get parked," he said. "Then, as (the storm) lightens up, (911) calls go through the roof."

Sometimes victims want to seek help but they can't. Disasters can destroy infrastructure. The New Orleans 911 call center crashed, for instance, when Hurricane Ida hit in 2021, leaving calls for help unanswered. "It is a very common issue," Fernandez said.

In the five days when the winter storm trapped Texans in their homes and cut off electricity, not a single victim tried to get to the FamilyTime shelter, CEO Christina Allen said. But when the power came back, "hotlines were ringing off the hook" and the call volume remained higher than usual for the following two months, she added.

Chelcee Thomas, executive director of Live Violence Free, said after evacuation orders for the 2021 Caldor Fire in California were lifted, the number of calls to her organization's crisis line rose. "The fire added another layer of stress," she said. "We heard [from clients] that the abuse was more intense, it was more frequent."

In Kentucky, staff members noticed that calls for help were more urgent after disasters like a 2021 tornado or historic flash flooding in 2023 in the western part of the state, said Mary Foley, executive director at Merryman House Domestic Crisis Center in Paducah. "We noticed that the types of physical abuse that would threaten their lives with choking, stabbing, guns held to the head — anecdotally, those went up."

In some cases, the abuse turned deadly.

Aaron Richard Nanni and his wife were estranged and planning to divorce, but were forced back into the same house in Conroe, Texas, during the 2021 winter storm.

On Feb. 20, just days after the storm passed, Nanni told his wife that he was leaving the house. When she arrived at the home later that day with Jeremy Entriiken, her new partner, Nanni returned. He fatally [shot and killed Entriiken](#), then fatally shot himself.

The Texas Council on Family Violence found that intimate partner homicides occurred [twice as often](#) in the four weeks after the winter storm compared to the first six weeks of the year. From Jan. 1 to Feb. 12, the organization tallied 13 homicides. In the following four weeks, 26 people were killed.

Storms disrupt protections

Protective orders can help keep victims safe, but data from Houston's Harris County shows Hurricane Harvey disrupted that system. Only two criminal protective orders, which are initiated by the court, were filed on August 27 while the hurricane raged, down from an average of 43 daily filings over the last six years.

"Harvey knocked out our criminal justice center. It literally knocked out the whole building. There were no courts," said Amy Smith, senior director of operations and communications at the Harris County Domestic Violence Coordinating Council. That caused a backlog in cases, and defendants out on bond continued to torment their victims, she said.

"Most victims just gave up, failed to cooperate, or requested for the cases to be dismissed, so they could get on with their lives," Smith said. Some are still waiting for their day in court, six years later, she said.

Courts closed again during Winter Storm Uri in 2021. For five full days, not a single person filed for a civil protective order. "There was a freezing of time," Bellino said. The storm trapped people in abusive relationships without access to any outside support systems. Even a short disruption of services can have dire consequences. "That can be lethal," she said.

Michelle Abdelnoor survived five days with her abuser during the winter storm in Texas. Four years later, she is building a new life for herself, with a job in compliance that she likes and two dogs. "I remember telling him at one point: No matter how much you try to break me down, I will always rise in a better situation than you left me."

This story was produced in collaboration with [The Fuller Project](#), a journalism nonprofit that reports on global issues affecting women, and the Howard Center for Investigative Journalism at the University of Maryland. Woelfl and Morton reported for the Howard Center; Klein reported for The Fuller Project.

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The Impact of Natural Disasters on Domestic Violence: An Analysis of Reports of Simple Assault in Florida (1999–2007)

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Abstract

Natural disasters are increasing in frequency and severity worldwide. Associations between individual-level vulnerability to natural disasters and social stratification have been widely demonstrated in the published literature, with excess negative impacts disproportionately affecting women, ethnic and racial minorities, and the elderly. Specifically, several studies have demonstrated a positive relationship between exposure to natural disasters or other extreme events and rates of interpersonal violence (IPV). People experiencing IPV in the postdisaster period may face unique barriers, including loss of access to safe housing and a need to remain with family to qualify for or obtain financial assistance and other types of disaster aid. To assess the potential association between exposure to natural disasters and reports of IPV, the authors used data compiled by the Federal Emergency Management Agency and the Florida Department of Law Enforcement. The Difference in Differences analysis included 819,684 reported assaults in 67 Florida counties over a 9-year period (1999–2007). Longer-lasting exposure to natural disaster (>199 days of major declared disaster) was associated with an increase in reports of simple assault in Florida counties. Longer-lasting exposure to disaster among Florida residents increased the expected number of assaults at the county level by approximately 78 per year. Domestic violence in the disaster recovery context carries potentially unique implications due to limited safe housing and loss of community networks. As the frequency and severity of disasters increase globally, disaster relief programs should provide support within this context of increased IPV.

Keywords: intimate partner violence, natural disasters, hurricanes, difference in differences, Florida

Introduction

NATURAL DISASTERS ARE increasing in frequency and severity worldwide (Leaning and Guha-Sapir 2013). Although definitions of disaster vary, most research describes a disaster as an acute incident that disrupts normal behaviors in a negative way, which may include extreme social failure and loss of life (Perry 2007). However, the negative impacts of natural disasters are not limited to physical and economic losses. Numerous psychological consequences, including increased levels of depression and anxiety, have been reported not only for immediate victims of disasters (Briere and Elliott 2000) but also for public health and public safety workers aiding in disaster relief (Benedek et al. 2007). Past research has also linked exposure to natural disasters with increased suicide risk (Petro-

vich et al. 2001) and posttraumatic stress disorder (Norris et al. 2002). As natural disasters are associated with a breakdown in normal functioning social relationships, these adverse mental health effects may be exacerbated by a loss of preexisting social support (Kanaisty and Norris 1995).

While increases in the incidence of negative physical and mental health impacts from natural disasters may, in part, be attributed to better and more accurate forecasting and reporting, recent hazards and disasters research provides evidence that the prevalence and severity of natural hazards such as flooding and severe storms is increasing (Loftis 2015; Wisner et al. 2004). Between 1994 and 2013, natural disasters claimed an average of nearly 68,000 lives per year, affecting nearly 218 million people over the entire period (Centre for Research on the Epidemiology of Disasters 2015). In 2016, natural disasters caused more than \$175

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billion in overall economic loss, while only a fraction of those losses were insured (Riley 2017). The economic costs and other impacts of natural disasters will continue to grow over time as populations and economic development in vulnerable areas continue to increase (Riebeek 2005).

At the individual level, vulnerability to the impacts of natural disasters has been shown to be strongly associated with various aspects of social stratification. Therefore, vulnerability to the impacts of natural disasters is not only a function of biophysical hazard exposure but also the social and community vulnerability context (Cutter et al. 2000; Peacock et al. 1997; Wisner et al. 2004). Overall, women, children, the elderly, members of racial and ethnic minority group, and persons living in poverty are differentially and negatively impacted by natural disasters (Bourque et al. 2007). For example, one study of flooding in Pakistan found that the adverse effects of flooding more heavily impacted poorer and more disenfranchised segments of the population (Mustafa 1998). Case study data have also been supported by larger studies. In a review of the impacts of natural disasters, Striessnig and Loichinger (2015) found that higher levels of education were inversely associated with disaster-related fatalities. Disasters appear to exacerbate preexisting social inequalities, disproportionately victimizing women, especially in developing nations (Enarson and Fordham 2001; Enarson et al. 2007; Hines 2007; Neumayer and Plümper 2007; Wiest et al. 1994;) and racial and ethnic minorities (Bolin 2007).

Multiple studies have found a relationship between natural disasters and increased rates of interpersonal violence (IPV) (Chew and Ramdas 2005; Lewin 2001; Parkinson and Zara 2013;), which in some cases persists well beyond the immediate aftermath of an event (Fisher 2010). IPV is generally understood as violent behavior within the home, especially involving spousal or romantic relationships. According to the National Institute of Justice, IPV occurs more frequently in disadvantaged neighborhoods, especially among households that experience significant financial strain (Benson and Fox 2004). More than half of all homicides with female victims have been found to be related in some way to a current or past intimate partner (Petrosky 2017).

The natural disaster context may compound preexisting risk factors for domestic violence by increasing feelings of helplessness and giving prominence to feelings of loss of control over the well-being and protection of one's family (Coontz 1992). For example, following the 2009 "Black Saturday" bushfires in Australia, qualitative interviews and anecdotal evidence revealed an increase in IPV among those families that were affected (Parkinson and Zara 2013). Research after Hurricane Andrew, a Category 5 hurricane that made landfall in South Florida in 1992, found that spousal abuse calls to Miami's helpline increased by 50 percent postdisaster. More than one-third of calls reporting abuse stated that someone living in the home had recently been stressed to the point of losing physical or verbal control (Morrow 1997).

People experiencing IPV during the postdisaster recovery period may face unique barriers to receiving assistance or escaping their situation. While research and best practices from disaster recovery aim to provide insights that will improve the pace and quality of disaster recovery and mitigate future losses through resilience building, there is fre-

quently an emphasis on the importance of the family unit in times of great duress. For example, to reduce the risk of mental health sequelae, service providers advise keeping kinship networks and family units intact to the extent possible (Norris et al. 2002). However, the safety of the family unit itself is an issue that has largely not been addressed by relief organizations, which are often working under very difficult conditions to meet the immediate physical and mental health needs of a large number of people. For example, interviews with service providers following Hurricane Andrew indicated that it was often the first family member to submit an application for each home address who would ultimately receive direct aid, with the expectation that this aid would be shared equitably within a family unit (Enarson and Morrow 1997). In providing aid, crisis workers may also rely on traditional gender roles, limiting the autonomy of women within the family (Enarson and Morrow 1997). Qualitative research after Hurricane Andrew highlighted the inability of agencies to provide adequate aid to families that deviated from the traditional nuclear family structure, with some women citing judgmental and accusatory attitudes of caseworkers (Morrow 1997). Domestic violence shelter facilities, already limited during nondisaster periods, are themselves as likely to be damaged as any other building in a community impacted by a disaster, which may reduce capacity. Postdisaster living arrangements, such as shelters and temporary housing for evacuees, may exacerbate preexisting barriers to seeking help. After Hurricane Katrina, a shelter system that was designed to provide safe housing in the very short term was stressed by the displacement of Gulf Coast residents across the United States for a period of many months (Meth 2001). The inadequacies of the shelter system meant that IPV victims impacted by Hurricane Katrina were more likely to remain with an abusive partner, or even return to an abusive partner out of desperation (Jenkins and Phillips 2008).

The impact of natural disasters on rates of IPV remains quantitatively elusive for several reasons. IPV remains largely underreported, and data collection in areas devastated by natural disaster is understandably methodologically challenging. The disaster context may exacerbate existing barriers to reporting, and even contribute to community-wide indifference toward the issue, as victims are encouraged to forgive their abusers, or are accused of being inconsiderate or overreacting (Parkinson and Zara 2013). The goal of this analysis is to provide a foundation for defining the impact of natural disasters on rates of IPV to inform future interventions and policy.

Materials and Methods

Data sources

The President of the United States can declare a major disaster under the authority provided by the Stafford Act in response to a request from the Governor of an affected state (Federal Emergency Management Agency [FEMA] 2016). County-level data on major disasters declared in the State of Florida between 1999 and 2007 were compiled from FEMA (FEMA 2014). County-level data on police reports of simple assault during the same time period were obtained from the Florida Department of Law Enforcement (Florida Department of Law Enforcement,

TABLE 1. NUMBER AND TYPE OF ASSAULTS BY YEAR, FLORIDA, 1999–2007 (N=819,684)

Year	Number
1999	94,369
2000	93,296
2001	92,893
2002	91,299
2003	90,781
2004	90,079
2005	90,455
2006	88,110
2007	88,402
Total	819,684

n.d.). County-level unemployment statistics were obtained from the Bureau of Labor Statistics (United States Department of Labor, Bureau of Labor Statistics, n.d.). The three datasets were merged using County and State Federal Information Processing Standards codes.

Data analysis

Difference-in-differences (DID) models can be used to highlight changes between treated and untreated groups in longitudinal studies where potential confounders are time invariant. To apply the DID method, the authors dichotomized the number of days in which a major disaster was declared in each county in the State of Florida, with counties with more than 199 days of major disaster declaration per year designated as treated and counties with 199 days or less of major disaster declaration per year designated as untreated. One hundred and ninety-nine days were selected as

the treatment cut point because many Florida counties experienced at least 150 days of major disaster declaration in 2004. Only counties impacted by all four hurricanes—Charley, Frances, Ivan, and Jeanne, as well as tropical storm Bonnie—had more than 199 days of major disaster declaration. The authors assessed this variable and found it to be highly correlated with other measures of disaster exposure, such as the total amount of individual assistance and housing assistance dollars approved per capita.

Using natural disaster treatment as defined above, the authors attempted to quantify the association between exposure to more than 199 days of major disaster declaration during the severe hurricane season of 2004 and reports of simple assault, defined as an attempt to cause physical harm to someone and including fear of battery or reasonable apprehension that a crime is imminent if no physical harm occurs. Based on the review of literature and subject matter expertise, they hypothesized that more days of major disaster declaration would be positively associated with reports of simple assault at the county level. The authors controlled for changes in the unemployment rate over this period, a factor that has been shown to affect rates of IPV, as well as for county population characteristics and time-specific effects (Equation 1).

Equation 1. Difference-in-Differences Model

$$Y = B_0 + B_1X + B_2Z + C_1 + C_2 + C_3 + \dots C_{67} + T_1 + T_2 + T_3 + \dots T_9$$

Y is the number of simple assaults reported in a county in a single year, B_0 is the y-intercept of the model, and B_1 is the coefficient of interest on X—an interactive variable capturing possible differences between the treatment and control

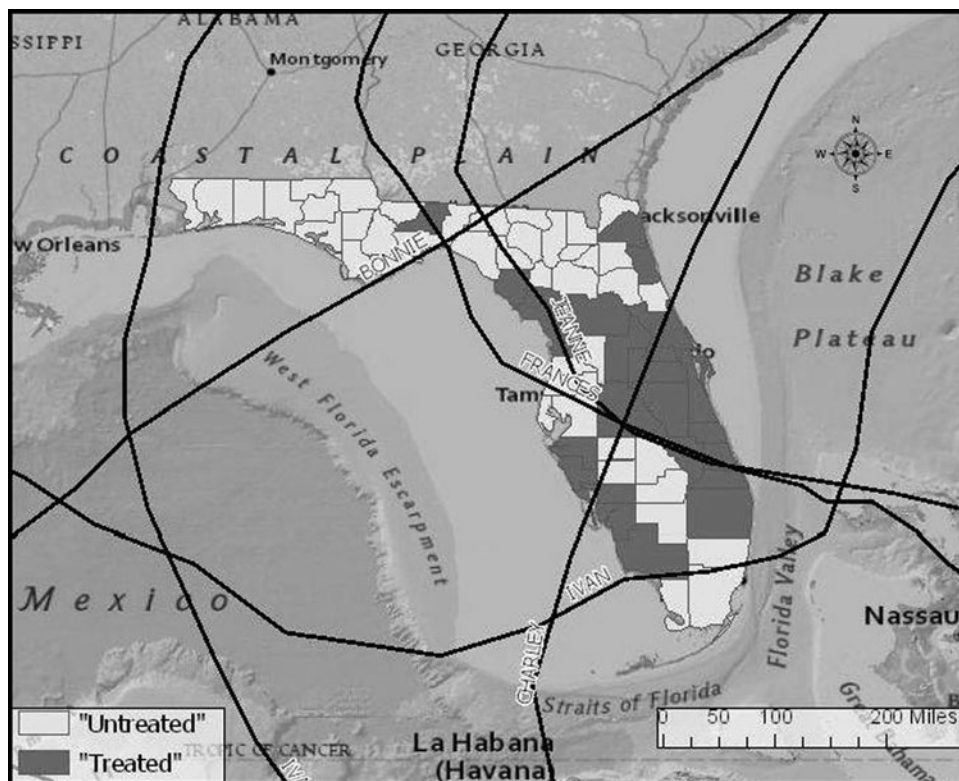
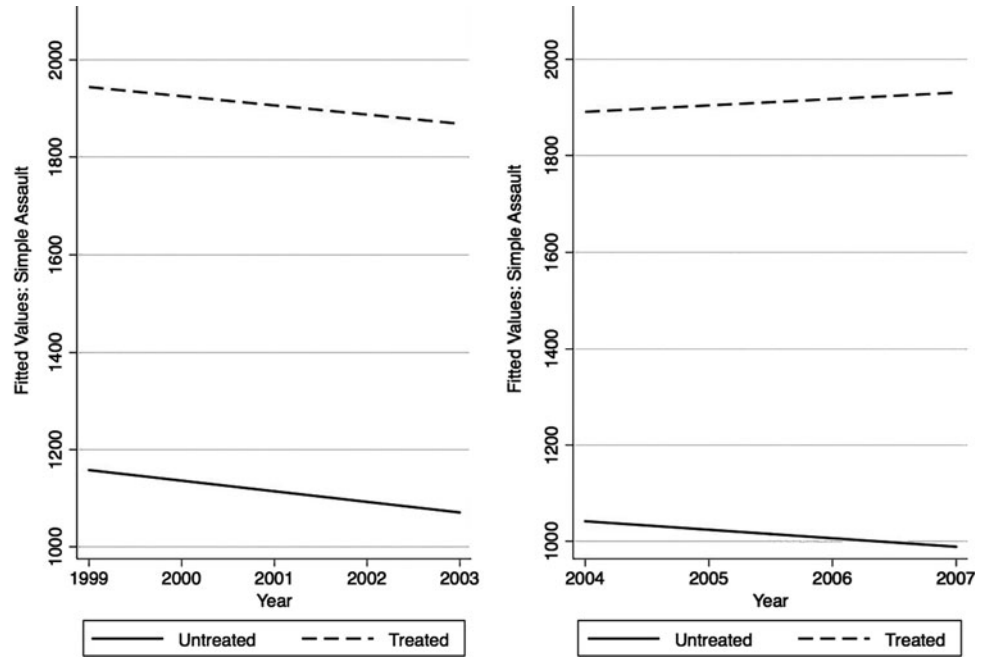


FIG. 1. Tracks of Hurricanes Charley, Frances, Ivan, and Jeanne and Tropical Storm Bonnie and County-Level Exposure to >199 days of Major Disaster Declaration, Florida, 2004.

FIG. 2. Treated and Untreated Groups, Florida, (1999–2007).



groups—equaling one for those counties that qualified as treated in the years following 2004, inclusive. B_2 is the coefficient of interest on Z , a variable controlling for changes in the unemployment rate in counties across the time period studied. $C_1 + C_2 + C_3 + \dots + C_{67}$ are controls for county-level characteristics of the 67 Florida counties, and $T_1 + T_2 + T_3 + \dots + T_9$ are controls for year-specific characteristics where T_1 is 1999 and T_9 is 2007.

All analyses were conducted using Stata v. 14 (College Station, TX). This research was reviewed by the Texas A&M Institutional Review Board and determined to be exempt (IRB 2017–0526).

Results

Simple assaults

Between 1999 and 2007, there were a total of 819,684 reports of simple assault in 67 Florida Counties (Table 1).

Disaster declarations

Major disaster declarations were in place for at least 200 days in 24 of 67 Florida counties (36%) during 2004, when four separate hurricanes, Charley, Frances, Ivan, and Jeanne, and one severe tropical storm, Bonnie, impacted the State of Florida between August 12 and September 26 (Fig. 1).

DID model

Beyond the typical assumptions underlying statistical models, the validity of a DID model requires additional assumptions related to parallel trends in county attributes. Trends within both treated (>199 days of major disaster declaration) and untreated (≤ 199 days of major disaster declaration) counties must be comparable within the first time period for valid inferences to be drawn about the second time period without residual confounding by factors that change differently over time. In this case, trends in the treated and untreated groups (shown in solid and dashed lines, respectively) are parallel for the initial time period (1999–2003), but diverge during the postdisaster period (2004–2007) when fitted values of simple assault are plotted against time (Fig. 2). Counties in both the treated and untreated groups experienced comparable decreases in reports of simple assault in the years leading up to 2004. However, following a year of intense hurricanes and tropical storms in 2004, there was an increase in simple assault in the treated group over the subsequent 4 years. The change in the number of simple assaults during the postdisaster period captures the hurricane effect.

The final adjusted DID model suggested a statistically significant association between exposure to 200 or more days of major disaster declaration and the number of simple assaults reported in Florida counties over the 9-year period from 1999 to 2007. Exposure to a disaster declaration for 200 or more days was associated with an increase of

TABLE 2. SUMMARY RESULTS FROM DIFFERENCE IN DIFFERENCES MODEL

	Model coefficients	Standard error	$P > t $	95% Confidence interval
Duration interaction	78.49	35.75	0.03	8.26–148.72
Constant	1260.26	84.10	0.00	1095.05–1425.48
Unemployment rate	8.79	12.12	0.47	–15.02 to 32.60

approximately 78 simple assaults annually, controlling for unemployment ($p=0.03$) (Table 2).

Discussion

The differential impacts of the severe 2004 hurricane season across Florida counties present a unique opportunity to quantify the impacts of disaster on IPV. Using DID methods, this analysis demonstrated that the disruption of normal community function by natural disasters that result in long-term major disaster declarations can have a significant, positive effect on reports of simple assault, controlling for changes in employment status, and county- and time-specific trends. Although existing research has provided qualitative evidence of psychological malaise and the negative impacts such stressors have on families following natural disasters, this analysis provides a first step toward quantifying the magnitude of this issue.

This study has several limitations. First, data are available only on the county level, and thus descriptive power is limited for exploration of the associations between disasters and IPV across classifications of race, ethnicity, class, and type of relationship. However, the usefulness of DID methods in controlling for confounding in ecological analyses has been demonstrated in the disaster literature (Grabich et al. 2015). Second, analysis is limited to the state of Florida, where data on IPV were available, and may not be representative of the impact of natural disasters on IPV across the rest of the United States or globally. Third, 2004 was adverse for all counties in Florida, not only for those that were classified as treated because they were impacted by all four hurricanes and a major tropical storm. It follows that the total difference in reporting may not be fully captured in the analysis provided in this study, as reporting in untreated counties may also have been inflated since some had up to 150 days of exposure to a major disaster declaration. However, this would result in the analysis underestimating the impact of natural disasters on IPV. Although studies exploring the validity of varying classifications of hurricane treatment have found roughly equivalent outcomes across a wide range of classification methods, such as mapping and wind speed analysis (Grabich et al. 2015), the method of assigning counties within a binary of “treated” or “untreated” cannot account for within-county differences in disaster impact. IPV is chronically underreported. It follows that the breakdown in effective communication following natural disasters would further exacerbate this fact, leading to significant underreporting during the timeframe of the event, another potential reason why these results could underestimate the impact of natural disasters on IPV.

Future research should address the above limitations by seeking to perform analyses with enriched individual-level information. Extending the timeframe examined post-disaster, as well as focusing on changes from 1 year to the next post-disaster may offer useful insight as to when interventions are most likely to be effective. In addition, researchers should investigate the differential impact of natural disasters on different types of relationships, as research has found that non-heterosexuals are more likely than heterosexuals to be victims of IPV (Walters et al. 2013).

Conclusion

Domestic violence in the disaster recovery context carries potentially unique implications due to limited safe housing and loss of community networks. This analysis aims to provide quantitative evidence to policymakers that natural disasters have a significant positive impact on reports of IPV. Disaster relief programs should make an effort to provide adequate support within this context of increased IPV, perhaps through cultivating awareness and acceptability of alternative living arrangements, or improving training of relief workers to provide more nuanced responses to the diverse needs of disaster-impacted communities. As the frequency and severity of disasters increase, and their impacts affect a growing population in disaster-prone areas, the physical and mental health consequences of natural disasters will become more widespread. There is a need to expand the collective understanding of IPV to include the postdisaster setting, to better meet the needs of impacted individuals and communities.

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The association between natural disasters and violence: A systematic review of the literature and a call for more epidemiological studies

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The links between disasters and violence either self-directed or interpersonal are now more recognized. Nevertheless, the amount of research is limited. This article discusses the underlying association of disasters and violence and it also outlines a systematic review of the literature from 1976 to 2011. Finally, it concludes and recommends particular approaches for further epidemiological research.

Key words: Epidemiological studies, natural disasters, interpersonal violence, self-directed violence

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INTRODUCTION

The World Health Organization (WHO) defines violence as: "The intentional use of physical force or power, threatened or actual, against oneself, another person or against a group or community, which either results in or has a high likelihood of resulting in, injury, death, psychological harm, maldevelopment or deprivation."^[1]

Based on this definition WHO splits violence into three broad categories, i.e., self-directed violence; interpersonal violence; and collective violence. Self-directed violence includes suicidal behavior (i.e., suicidal ideation, plans, attempted suicide, and suicide). Interpersonal violence by itself divides into two categories, i.e., family and intimate partner violence (e.g., child abuse, violence by an intimate partner and abuse of the elderly) and community violence (e.g., youth violence, rape or sexual assault by strangers and violence in institutional settings). Collective violence includes wars and armed conflicts within or between states, genocide, and terrorism.^[2]

Collective violence as like as other types of violence is related to human distress and is disastrous, which is dealt with elsewhere.^[3-7] Nonetheless, the results of a few recent studies^[8-16] suggest that both self-directed violence and interpersonal violence might increase after natural disasters, e.g., earthquake, flood, tropical cyclones etc.

In the present article therefore, I am going to focus on the relation between violence and natural disasters by looking at the literature, and recommend more well-planned epidemiological studies. I begin with the underlying associations between natural disasters and violence.

NATURAL DISASTERS AND VIOLENCE: THE UNDERLYING ASSOCIATIONS

Natural disasters might increase the rate of violence both in the short and long-term, in a number of ways.^[16] For instance, in the aftermath of a natural disaster mental distress among the affected population will increase. There is evidence, which suggests that between a third and half of all persons exposed to natural disasters will finally develop mental distress, e.g., post-traumatic stress disorder (PTSD), depression, anxiety disorders, etc.^[11]

Personal threats to life, loss of loved ones, property loss, immense destruction, breakdown of social security systems, collapse of social cohesion and harmony and so on, are the most important reasons behind this trend and diverse studies highlight that the effects of catastrophic disasters on mental health are larger than mild ones.^[8-10,12-15]

Furthermore, due to the scarcity of basic provisions, failure of law enforcement, powerlessness, aggravation caused by a fraudulent bureaucracy and forgotten

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governments' promises to help victims, etc. it would be possible that the semental distresses will develop into violence, either self-directed^[13] or interpersonal.^[16]

In the path of relation between being exposed to natural disaster and developing mental distress, which leads to one form of violence, there are also a number of other variables.^[17] For example, it has been shown that women, children, elderly, low-income and those people who have been exposed to a previous traumatic event are more vulnerable to developing mental distress^[18,19] or being a victim of violence in the aftermath of natural disasters.^[16]

It is also vital to realize that being exposed to one natural disaster might amplify the adverse psychological outcomes of being exposed to subsequent natural disasters.^[20] Furthermore, those people who received social^[19] or religious^[21,22] support were less vulnerable to developing such adverse psychological outcomes.

All the above discussions are depicted in Figure 1. The key point in this figure is that how the anger and the stress of those who exposed to natural disasters are expressed inwardly, i.e., self-directed or outwardly, i.e., interpersonal violence.

SEARCH OF THE LITERATURE

I searched the literature using a well-known search engine, i.e., PubMed (<http://www.ncbi.nlm.nih.gov>) from 1/1/1978 to

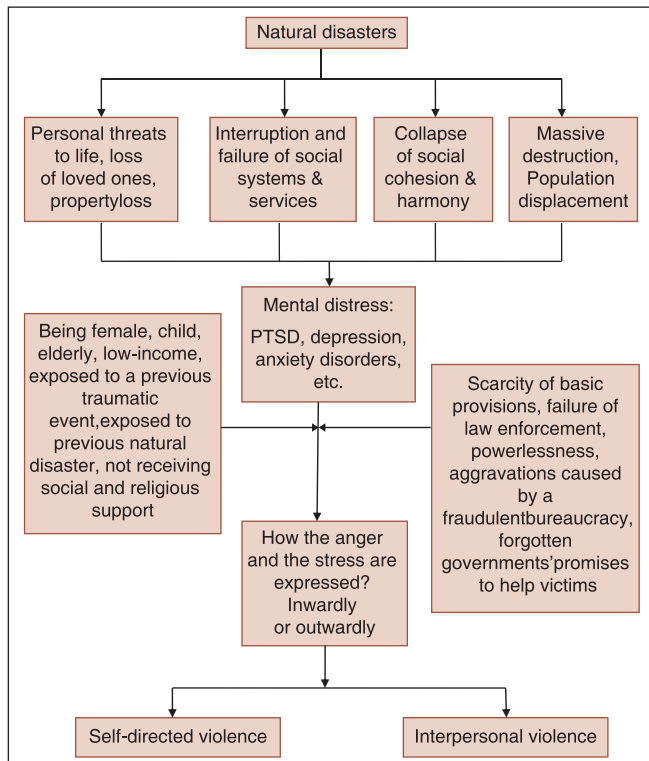


Figure 1: The underlying associations between natural disasters and violence

31/12/2011. Thirteen keywords were selected which included "flood," "hurricane," "drought," "cyclone," "tornado," "volcanic eruption," "earthquake," "blizzard," "tsunami," "avalanche," "famine," "natural disaster," and "violence."

A search strategy was built applying advanced search capability of the search engine. Based on this search strategy, only those articles were retrieved that had one of the first 12 keywords plus the 13 keyword either in the title or the abstract. This strategy retrieved 70 articles.

The inclusion criteria as set out that only original article that explicitly dealt with violence after natural disasters and written in English was included. From 70 numbers of retrieved papers only a handful was original and explicitly dealt with violence after natural disasters.

Therefore, in the next step, I also looked at the reference list of the retrieved papers and searched other search engines such as Scopus. Having carried out that, there was still a shortage of original research regarding these important topics and I have totally retrieved only 21 articles that met the inclusion criteria [Table 1]. Nevertheless, below are the results of these search strategies, which were summarized for self-directed and interpersonal violence, separately.

NATURAL DISASTERS AND SELF-DIRECTED VIOLENCE

Mental disorders are among the strongest risk factors for self-directed violence, i.e., suicidal behavior^[23,24] and as it has been mentioned earlier, being exposed to natural disasters will increase the likelihood of developing mental disorders.^[11] Therefore, a relation between being exposed to natural disasters and developing suicidal behavior would also be possible.^[25]

The literature review highlights that there are only a few studies, which focus on this relationship and report that being exposed to a natural disaster such as hurricane, cyclone and earthquake, might increase the rates of suicide^[26-32] or suicidality.^[33-37] One of these studies^[27] later retracted some of its initial findings due to errors in its analyses.^[38]

The results of one study^[35] have revealed that suicidal behavior might manifest years after a natural disaster, i.e., earthquake has occurred. This seems to be related to "the quarrels among families regarding sharing the financial burden of rebuilding the house, the poor control of mental disease owing to the disorganized health-care systems, the lack of social and financial support during the harsh rebuilding process, the powerlessness, and the frustrations caused by a corrupt bureaucracy,"^[13] and not the shock of the disaster *per se*.

Table 1: The details of 21 original articles that met the inclusion criteria

Authors	Published year	Natural disaster	Violence
Lew, and Wetli	1996	Hurricane Andrew	Suicide
Chou, Huang, Lee, Tsai, Tsay, Chen, <i>et al.</i>	2003	Taiwan earthquake	Suicide
Yang, Xirasagar, Chung, Huang, and Lin	2005	Taiwan earthquake	Suicide
Jani, Fierro, Kiser, Ayala-Simms, Darby, Juenker, <i>et al.</i>	2006	Hurricane Isabel	Suicide
Nicholls, Butler, and Hanigan	2006	Rainfall in New South Wales	Suicide
Larrance, Anastario, and Lawry	2007	Gulf Coast hurricane season	Suicide
Warheit, Zimmerman, Khoury, Vega, and Gil	1996	Hurricane Andrew	Suicidal ideation
Vehid, Alyanak, and Eksi	2006	Turkey earthquake	Suicidal ideation
Kessler, Galea, Jones, and Parker	2006	Hurricane Katrina	Suicidality
Chou, Wu, Chou, Su, Tsai, Chao, <i>et al.</i>	2007	Taiwan earthquake	Suicidality
Kar	2010	Supper cyclone	Suicidality
Curtis, Miller, and Berry	2000	Hurricane Hugo, Loma Prieta earthquake, Hurricane Andrew	Interpersonal violence
Keenan, Marshall, Nocera, and Runyan	2004	Hurricane Floyd	Interpersonal violence
Anastario, Shehab, Lawry	2009	Hurricane Katrina	Interpersonal violence
Fisher	2010	Tsunami Sri Lanka	Interpersonal violence
Picardo, Burton, Naponick, and Katrina Reproductive Assessment Team	2010	Hurricane Katrina	Interpersonal violence
Schumacher, Coffey, Norris, Tracy, Clements, Galea	2010	Hurricane Katrina	Interpersonal violence
Kelley, Self-Brown, Le, Bosson, Hernandez, Gordon	2010	Hurricane Katrina	Interpersonal violence
Biswas, Rahman, Mashreky, Rahman, and Dalal	2010	Bangladesh flood	Interpersonal violence
Harville, Taylor, Tesfai, Xu Xiong, and Buekens	2011	Hurricane Katrina	Interpersonal violence
Fagen, Sorensen, and Anderson	2011	Hurricane Katrina	Interpersonal violence

NATURAL DISASTERS AND INTERPERSONAL VIOLENCE

The literature review also highlight that there are only a few studies, which focus on the relation between being exposed to a natural disaster and the rates of interpersonal violence.^[16] The results of these studies reveal that being exposed to natural disasters such as tsunami, hurricane, earthquake, and flood increases the violence against women and girls, e.g., rape and sexual abuse,^[39-41] intimate partner violence,^[32,42-44] child PTSD,^[45] child abuse,^[46,47] and inflicted traumatic brain injury.^[48]

However, it should be noted that there is also one published study, which reported no significant variations in any of the measures of sexual violence toward women in the periods before and after a natural disaster, i.e., hurricane.^[49]

Since in the aftermath of natural disasters women and children may be separated from their family, they are often at greater risk of being subject to interpersonal violence.^[16] Therefore, in such situations proper attention should be paid to the needs of these vulnerable groups.

These include: Swift identification of separated children and reunification of them with their official guardians,^[50] providing secure places for single women and girls^[39] and providing proper health services, counseling, and legal support for the victims of such violence.^[16,51]

CONCLUDING REMARKS

The relation between being exposed to natural disaster and being a victim of violence either self-directed or interpersonal is coming to light with recent studies. Natural disasters might increase the rate of violence both in the short and long-term by developing mental distress and anger. The key point is that how the exposed population reacts to these pressures either inwardly or outwardly.

Although, there is a scarcity of research in this area the potential threats of violence after natural disaster should not be neglected by the scientific community. Therefore, given the alarming increase of natural disasters during recent decades^[52-54] it is time to design and conduct more methodological sound studies.^[55] The chief aims of these studies are to understand how natural disasters form and/or change the pattern of violence within the community and to recommend the most useful structure of support services.

RECOMMENDING PARTICULAR APPROACHES FOR FURTHER EPIDEMIOLOGICAL RESEARCH

The following approaches could be recommended for further epidemiological research in this area:

1. The length of the study should be long enough to allow scientists to determine any possible relation between being exposed to natural disasters and being a victim of violence. However, it should be noted that although

long-term follow-up is important it does not mean that one should overlooked the importance of getting in the field as fast as possible.

2. Further research should also take into account the type and the magnitude of natural disasters plus the effects of any possible moderating or confounding variables, e.g., age, sex, income, family and social supports, the degree of religiosity of the community, etc.
3. For comparison purposes, it is necessary to have access to the baseline data, i.e., the type and extent of violence in the community before the occurrence of natural disaster. This means that gathering information regarding the type and extent of violence should integrate in any surveillance systems around the world.
4. It worth emphasizing that having an efficient surveillance system for reporting violence is vital especially within developing worlds. Since evidence suggest that there is a high likelihood that different types of violence might be under-reported in such countries.

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