

## Research paper

# Suicide ideation and a post-disaster assessment of risk and protective factors among Hurricane Harvey survivors

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## ABSTRACT

**Background:** Previous studies have documented evidence of increased suicidality after natural disasters. While there is some disagreement about when and how long mental health consequences are sustained in the post-disaster setting, it is nevertheless an important outcome requiring further examination.

**Method:** In the present study, a sample of Hurricane Harvey survivors (n = 316) were interviewed over a three-month period beginning in October 2017, two months after a Category 4 hurricane devastated the Texas Gulf Coast. Using logistic regression, the analysis examines sociodemographic vulnerabilities, as well as individual risks that potentially exacerbate and protections that mitigate the odds of suicide ideation among survivors.

**Results:** Approximately 10 percent of the sampled survivors reported suicide ideation post-Hurricane Harvey. Females, persons with elevated symptoms of post-traumatic stress symptoms, persons reporting moderate to high levels of food insecurity, and those with previous mental health issues were related to higher odds in reported suicide ideation. We examined a number of protective factors and religious social capital and optimism were both negative and statistically significant ( $p < 0.05$ ) and related to lower odds of suicide ideation.

**Conclusions:** To our knowledge, these findings are the first to come out of the Hurricane Harvey disaster zone, specifically focusing on suicide ideation. Mental health professionals need to continue to be sensitive to the nuance of disaster impact on the psychological functioning of survivors, with potential negative mental health symptoms persisting 6 to 12 months after a natural disaster event.

## 1. Introduction

A disaster is a “potentially traumatic event that is collectively experienced, has an acute onset, and is time delimited,” (p. 4) (MacFarlane and Norris, 2006). Disasters include natural hazards, such as hurricanes, tornadoes, and wildfires, as well as mass violence like terrorist attacks and mass shootings. Beyond physical destruction and economic disruption, disasters can result in a range of challenging mental health consequences including depression, posttraumatic stress disorder (PTSD), anxiety, psychosomatic complaints, and suicide ideation (Bonanno et al., 2010). Although slightly less than a third of disaster-affected populations tend to experience severe or frequent symptoms that would qualify for clinical PTSD or depression diagnoses, it is still possible that disaster survivors may experience challenging mental health reactions that complicate the disaster recovery process for individuals, families, and communities (Neria et al., 2008). Thus, it

is important for public health officials, mental health services, and emergency management to understand who is at heightened risk for developing mental health symptomatology, and what protective factors might help to mitigate the challenging mental health reactions that often emerge in the weeks and months following a disaster.

For the purposes of this study, we are interested in disaster survivors' suicide ideation, which refers to both an individual's desire to die and/or plan to commit suicide. Whereas attempted and completed suicides are behavioral concepts, suicide ideation is psychological (Beck et al., 1979). According to the Centers for Disease Control and Prevention (CDC), suicide was the tenth leading cause of death that claimed nearly 50,000 lives in 2017 (Centers for Disease Control 2017). Data estimates from a national survey during that same year, reported approximately 4 percent of adults 18 years of age and older had thoughts about killing themselves. (Substance Abuse Mental Health Services Administration 2017) While suicidality is often higher among

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certain subpopulations (e.g., youth, veterans, American Indians) disproportionately, a growing body of research has underscored the importance of identifying and managing suicidality (ideation, plans, attempts) during and after natural disasters, with empirical evidence of elevated rates of both suicide ideation and in a few instances, completion among disaster victims. (Fergusson et al., 2014; Goldman and Galea, 2014; Kolves et al., 2013; Alfonso, 2018) While there appears to be some disagreement on these mental health effects over time, the majority of studies seem to agree that mental health risks are typically elevated after a natural disaster and mental health professionals need to be acutely aware of this “after-the-disaster effect.” (Goldman and Galea, 2014; Alfonso, 2018; Kessler et al., 2008; Kessler et al., 2015)

The current study seeks to examine how risk and protective factors associated with Hurricane Harvey survivors potentially shape post-disaster mental health outcomes like suicide ideation. As such, we propose examining sets of risk and protective factors that underscore the importance of the relationships among factors that negatively impact health, and factors that often can shield one against those negative risks (Fitzpatrick and LaGory, 2011). Risks help to explain why some groups are more vulnerable to negative health consequences. In contrast, protections often mitigate or shield persons against the negative impact of such risks on their mental health. Understanding these relationships can help mental health professionals in the development and implementation of programming efforts that target particularly vulnerable, high-risk groups in post-disaster settings.

### 1.1. Risk factors

In this study, we identify mental health problems prior to Hurricane Harvey, posttraumatic stress symptoms (PTSS), and food insecurity as potential risk factors for suicide ideation in the months following Hurricane Harvey. Prior mental health problems have been noted in previous research as an important risk factor in determining post-disaster health consequences. (Goldman and Galea, 2014; Fussell and Lowe, 2014; Morris and Deterding, 2016; Norris et al., 1999) In particular, previous studies have found that pre-disaster depression was directly predictive of the likelihood that one would report post-disaster suicide ideation. (Warheit et al., 1996) Pre-disaster post-traumatic stress disorder served as a moderating variable between pre- and post-disaster suicide ideation by intensifying post-disaster suicide ideation among individuals with PTSD before the disaster. (Brown et al., 2018) Taken together, these studies illustrate that pre-existing mental health challenges along with post-traumatic stress symptoms (PTSS) may serve as risk factors for suicide ideation in the aftermath of a disaster.

The final risk factor we consider is food insecurity. Generally, a loss of both material and social resources has been associated with increased post-disaster psychological distress. (Zwiebach et al., 2010) One material resource that may be lacking during and after a disaster is food. While individuals may be food insecure prior to a disaster, it is also possible that the economic disruptions brought about by disasters, such as job loss or displacement, may propel a whole new group of individuals into food insecurity. In the disaster context, there is a noted positive association between challenging mental health reactions and food insecurity. (Clay and Ross, 2020; Clay et al., 2018) Given the association between challenging mental health reactions and post-disaster suicide ideation, we posit that the relationship between food insecurity and post-disaster psychological distress may extend to suicide ideation as well. Therefore, we include food insecurity as a risk factor in the current study.

### 1.2. Protective factors

We posit that optimism, community connectedness, and religious social capital serve as protective factors against suicide ideation. Optimism encompasses individuals' expectations that their future will be favorable and positive; (Carver et al., 2010) if someone holds a

favorable view of their future, we would expect that their odds of suicide ideation would be lower. In general, optimism has shown to mitigate the effects of stress. (Scheier and Carver, 1985; Aspinwall and Brunhart, 1996) In the disaster context, individuals with higher levels of dispositional optimism reported significantly lower levels of depression, anxiety, and PTSS. (Carbone and Echols, 2017) Although these findings do not establish a direct causal relationship between optimism and suicide ideation, the results suggest that optimism may protect individuals against other risk factors (such as PTSS and prior mental health problems) when examining health outcomes; therefore, we include optimism in the model.

The second protective factor we consider is social connectedness, which refers to perceived closeness, interdependency, and sharing of resources with other individuals. (Centers for Disease Control and Prevention, 2008) Social connectedness spans ecological levels across individuals, families, community organizations, and broader social institutions. In this study, we focus on community connectedness, which includes fellow residents, organizations, and places within the community one resides. Studies have found that social connections serve as protective factors against suicide ideation particularly in adolescent, military service members, and senior populations, (Arango et al., 2019; Langinrichsen-Rohling et al., 2011; McLaren et al., 2007) which has led the CDC to incorporate strengthening community bonds as a strategy in their national suicide prevention initiative.

The final protective factor included in the model is religious social capital. More religious involvement and connections to faith-based organizations have been associated with less suicide ideation (Rezaeian, 2008) and stronger feelings that a community would make positive transformations post-disaster. (Spialek et al., 2016) Specific aspects of religious social capital have also been positively correlated with positive psychological trajectory after major disasters. Specifically, practicing good deeds by participating in various post-disaster relief ministries was associated with less psychological distress. Additionally, attending church services and seeking support from faith leaders was associated with a stronger spiritual life in the months following a disaster, (Smith et al., 2000) which serves as a form of positive psychological functioning known as posttraumatic growth. (Tedeschi and Calhoun, 1996) Although these aspects of religious social capital do not directly predict suicide ideation, their association with posttraumatic growth and less psychological stress, provide evidence for religious social capital to serve as a protective factor against post-disaster suicide ideation.

Despite the fact that suicidality has long been an interest in both clinical and epidemiological literatures, there continues to be significant gaps in our understanding of precisely what risk and protective factors are associated with these specific behaviors. While a number of studies have documented factors associated with suicidality in disaster zones, (Goldman and Galea, 2014; Kolves et al., 2013; Ozdemir et al., 2015) the current study, to the best of our knowledge, is the first to examine the correlates of suicide ideation among Hurricane Harvey survivors.

## 2. Method

### 2.1. Participants and procedure

A cross-sectional study of Hurricane Harvey adult survivors was conducted from October to December 2017. For the face-to-face portion of the study, trained personnel conducted interviews (n = 92) in the highest impact disaster counties designated by Federal Emergency Management Agency (FEMA). Interviews were all pre-arranged and times were set up for private interviews at general locations like hotels, shelters, service provider locations, or in some instances, individuals' homes or apartments. While interviewers were obtaining face-to-face interviews in the disaster zone, Qualtrics Inc. had recruited residents living in these same high-impact disaster counties to participate in an

identical online survey ( $n = 224$ ).

The sampling of both groups was randomly obtained, with quotas meeting representational minimums for gender, race, ethnicity, and location/specific geography. Our approach to sampling the disaster zone of the Texas Gulf Coast was complicated by the fact that individuals were dispersed and not living in their homes, and even if they were doing face-to-face interviews, those were not going to take place simply by knocking on resident's door. Thus, we had to improvise and strategically approach the interview acquisition a little differently than we might under some other non-disaster circumstance. Our first step was to examine the counties that were impacted the most, based on FEMA's damage estimates, the size of those counties, their racial and ethnic diversity, and the size and diversity characteristics of the largest cities found in each of those counties. As such, primary targets for interviews were in counties with the largest populations including Brazoria, Galveston, Harris, Jefferson, and Nueces Counties. Of course, there were many other counties impacted by the hurricane, yet, these were the counties that had the largest population concentrations with sizable cities (over 20,000). Using these counties as primary sampling targets, and using total population estimates from these counties, a series of decisions were made regarding how to secure somewhere between 300 and 350 interviews. Part of that decision was based on the realistic expectation of how many interviews could be secured given the funds that were allocated, as well as in the short period of time we had to complete the interviews with eight trained interviewers on the ground.

To clarify the sampling process, we provide an example of how decisions were made about interview locations and respondents. So, for example, we looked at Brazoria County and with its total city populations of approximately 167,000, that represented about 5 percent of the total number of persons based on the 3.5-million-person FEMA estimate of persons that had been directly or indirectly impacted by the storm. Representing 5 percent of the total interviews, we estimated at least 14 interviews would need to be secured from this county if we were keeping with the 300–350 targeted interviews. Alvin, Lake Jackson, and Pearland were the specific city targets within Brazoria County, though interviews could come from persons living elsewhere in the county and outside of those city limits. In addition, we added other requirements with regards to exactly which persons would be selected for interviews. We had to ensure a reasonable gender distribution (preferably 50/50), as well as a distribution that reflected the racial and ethnic composition of the counties that we were sampling in. To simplify matters, we focused on obtaining white vs. nonwhite interviews, and then once we determined the concentration of Hispanics in each one of the targeted cities, we included that into our final computations of how many nonwhite interviews we would need to obtain. Again, in the Brazoria County example where 88 percent of the county was white, the targets were for 9 white respondents to be interviewed, leaving the remaining 5 interviews to be NonWhite and 30 percent (Brazoria County estimate of Hispanics) of those 5 (2) interviews would need to be Hispanic.

Here is how things actually worked when it came to interviewee selection. The data that was collected for Brazoria County included 25 total interviews (our original target was a minimum of 14). The percentage of women was 60 percent (the original target was 50 percent). The racial and ethnic targets were pretty precise; 88 percent of interviews were white which was the current percentage of white residents in Brazoria County. We needed at least a third of Nonwhite respondents to be Hispanic and we managed to get 21 percent Hispanic interviews. Finally, interviews were divided into groups: those not having to move from their residence (58 percent), and the remaining respondents who were displaced (42 percent), divided across the other displacement options. Keep in mind that these represented targeted estimates, and in some cases, we were successful in reaching the targets, in other cases, we were not. A similar strategy was used for the collection of the online survey responses. We invoked strict parameters for participation and if persons fit into the pre-determined quotas they were allowed to

participate in the survey.

Again, in the case of both online and face-to-face data collection strategies, targets and sample quotas were determined by disaster impact, population size of major cities, and subpopulation percentages in those locations. Responses between the two forms of data collection were compared across all variables and there were no statistically significant differences across those two groups. Consent was obtained in person and electronically with the University of XX IRB approving the human subjects' protocol and consent forms.

## 2.2. Measurement

The dependent variable, *suicide ideation* was measured based upon Yes = 1/No = 0 responses to the question: "Since Hurricane Harvey, have you thought about killing yourself?" While the intent was to ask a more detailed set of questions concerning both intent and action, we were constrained by both context and time. The sociodemographic control variables included in the analysis were *gender* and *age* coded in years. While respondents were asked in person and online how they self-identified (male, female, or other), no one responded affirmative to the "other" category and thus gender was coded as a dummy variable (1 = male). There are of course a number of other social and demographic characteristics that were collected from the interviewees that are not presented here, but available upon request from the authors.

### 2.2.1. Risks

We considered three risk variables for the analysis. The first risk variable assessed *prior mental health problems*. To measure pre-disaster mental health, respondents were asked: "Have you ever had problems with mental illness or nerves?" (1 = yes). The second risk variable was the *Impact of Event Scale-Revised* (IES-R); ( $\alpha = .97$ ), a 22-item self-report measurement that assesses subjective levels of stress from traumatic events. (Weiss, 2007) The IES-R allows participants to rate how distressed they feel toward a series of difficulties that may have occurred within the last few weeks from the time that they are interviewed. The IES-R can measure either probable PTSD through a cumulative cutoff score of 33 on a 0 (*Not at All*) to 4 (*Extremely*) scale (Creamer et al., 2003) or level of distress due to posttraumatic symptoms through an overall summation score. (Spialek et al., 2019) Sample items include: "I felt watchful and on-guard;" "I tried not to talk about it;" "I had waves of strong feelings about it;" and "I had trouble staying asleep." We re-coded the variable into a dummy variable with persons scoring less (non-clinical symptom cutoff) than 33 = 0 and persons scoring more (clinical symptom cutoff) than 33 = 1.

*Food insecurity* ( $\alpha = .92$ ) was measured using items selected from the USDA Food Security Survey Module used to assess food insecurity in the United States. (Coleman-Jensen et al., 2019) Given the significant time constraints of administering the survey in a disaster setting, food insecurity was measured using an abbreviated 4-question module. Respondents were given three choices 0 (*Never*); 1 (*Sometimes*); and 2 (*A Lot*) to respond to four questions. Items included: "I worried that my food would run out before I got money to buy more"; "The food that I bought just didn't last, and I didn't have money to get more"; "I couldn't afford to feed myself or my family a balanced meal because I couldn't afford it"; and "I relied on only a few kinds of low-cost food to feed myself or my family because I was running out of money to buy food."

### 2.2.2. Protections

Additionally, we considered three protective factors in the analysis. We measured optimism using the *Life Orientation Test-Revised* (LOT-R); ( $\alpha = .76$ ) ten-item scale. (Scheier and Carver, 1985) This scale has been examined extensively both in clinical and non-clinical settings (Carver et al., 2010), but has not been examined, to our knowledge, in a post-disaster setting. Response options ranged from 1 (*Strongly Agree*) to 4 (*Strongly Disagree*) with higher scores indicating higher levels of optimism. Items included: "In uncertain times, I usually expect the best;"

“It’s easy for me to relax;” “If something can go wrong for me it will;” “I’m always optimistic about my future;” “I enjoy my friends a lot;” “It’s important for me to keep busy;” “I hardly ever expect things to go my way;” “I don’t get upset too easily;” “I rarely count on good things happening to me;” and “I expect more good things to happen to me than bad things.”

We measured *Community Connectedness* using a single-item picture measure that consists of six pairs of overlapping circles. Researchers report excellent convergent and discriminant validity with this measure. In addition, they report moderate test-retest reliability in examining several samples of respondents (Mashek et al., 2007). This measure is an extension and variation of the Inclusion of Others in Self Scale (Aron et al., 1992) and a Psychological Sense of Community. (McMillan and Chavis, 1986) The circles are of equal size and begin with two circles that are not touching one another and move left to right in varying degrees of closeness between the circles. The final set of circles are integrated with one circle essentially being inside the other circle. One circle represents the “self” and the other circle represents “community.” Participants are asked to look at the Venn diagrams and respond with a number, that best describes their relationship to the community at large. With little or no additional explanation provided by interviewers, the majority of respondents had little difficulty responding to the purposely vague construct of “community at large.” If additional explanation was needed, interviewers offered guidance by informing them that they were to think about the community as “all those persons, places, and things that made up the larger community.” No specific group or subgroup is used as a referent and interviewers reported very few problems with obtaining what they believed to be reliable responses. (Fig. 1)

Given the role religious social capital plays in mitigating challenging mental health reactions and emphasizing positive psychological change post-disaster, we introduced as a protective factor, religious social capital (Irwin et al., 2008) ( $\alpha = .60$ ), which used four items that assess religious involvement. Items included in the scale were dichotomous measures of importance of religion in one’s life, church membership, whether or not they engaged in some form of church activity in the last twelve months besides service attendance, and whether or not they routinely turn to other persons in their church when feeling lonely or isolated. (Irwin et al., 2008)

2.3. Data analysis

All analyses were performed using SPSS 25.0. The primary focus of the analysis is a series of logistic regressions that examine the suicide ideation odds among survivors after Hurricane Harvey. In addition to sociodemographic covariates in the first model, risk factors (second model), and protective factors (third model), are added in each successive step.

**Table 1**  
Descriptive statistics for model variables (n = 316).

	%	Mean	S.D.
<i>Dependent Variable</i>			
Suicide Ideation (1 = Yes)	10.2%	–	–
<i>Sociodemographics</i>			
Gender (1 = Male)	47.0%	–	–
Age	–	41.9	14.9
<i>Risks</i>			
Impact of Event Scale-R (1 = 33 +)	21.2%	–	–
Prior Mental Health (1 = Yes)	35.0%	–	–
Food Insecurity	–	2.2	1.2
<i>Protections</i>			
Religious Social Capital	–	3.1	.96
Community Connectedness	–	3.1	1.6
Optimism	–	34.1	6.1

3. Results

Demographic characteristics, suicide ideation, and risk/protective variables are summarized in Table 1. Among the sample of survivors, approximately 10 percent reported thinking about killing themselves after Hurricane Harvey. That ideation percentage is nearly 2.5 times what the average person had reported in a national survey of the general adult population in 2017. (Bonanno et al., 2010) This sample of Hurricane Harvey survivors were approximately 42 years old, 74 percent white, more than two-thirds were working at the time of the natural disaster, and 53 percent of those interviewed were female. Thirty-five percent reported having mental health problems prior to Hurricane Harvey. Twenty-one percent had elevated PTSS and nearly half of the survivors reported food insecurity levels that were moderate or high.

Logistic regression results are presented in Table 2. Odds ratios and 95% confidence intervals are presented along with an overall model goodness of fit test. In model 1, age is significant with younger persons reporting higher suicide ideation odds compared to older respondents; gender is non-significant. In model 2, individual risk variables are added to the equation and both food insecure persons and persons reporting prior mental health problems have higher suicide ideation odds compared to their counterparts; the PTSS categorical difference (non-clinical versus clinical) was not significant. In model 3, we added the protective factors and some important changes are noticeable. Age is no longer significant but gender remains significant with females having higher suicide ideation odds compared to males. All three of the risk variables are positive and significant. Persons reporting higher PTSS, more food insecurity, and prior mental health problems have higher suicide ideation odds than their counterparts. Both optimism and religious social capital are negative and statistically significant protective factors.

Persons reporting a higher degree of involvement in the church as a member, or a socially connected participant in church-related activities

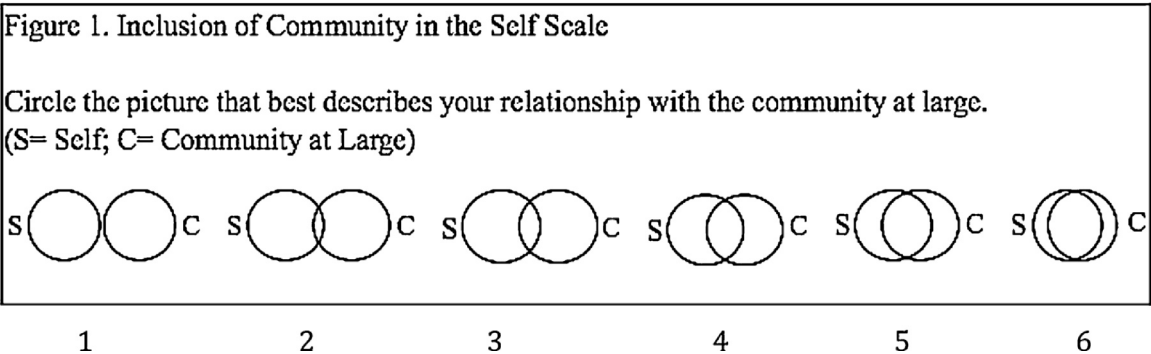


Fig. 1. Inclusion of Community in the Self Scale



**Table 2**  
Logistic regression results for model variables.

Variables	Model 1 OR 95% CI	Model 2 OR 95% CI	Model 3 OR 95% CI
<i>Sociodemographics</i>			
Gender (1 = Male)	.48 .21-1.1	.36* .14-.89	.29* .11-.78
Age	.96* .93-.99	.96* .93-.99	.97 .93-1.0
<i>Risks</i>			
Impact of Event Scale-R (1 = 33+)		2.2 .92-5.3	2.7* 1.1-6.8
Prior Mental Health (1 = Yes)		5.6** 2.1-14.3	5.0** 1.8-13.9
Food Insecurity		1.3** 1.1-1.5	1.2** 1.0-1.5
<i>Protections</i>			
Religious Social Capital			.59* .31-.99
Community Connectedness			1.1 .81-1.5
Optimism			.89** .82-.96
Constant	-.42	-2.54	2.28
X <sup>2</sup>	10.08***	48.79***	60.08***
df	2	5	8
Nagelkerke R <sup>2</sup>	.07	.31	.38

\*  $p < .05$ ;

\*\*  $p < .01$ ;

\*\*\*  $p < .001$

and interactions with others, had lower odds in suicide ideation since Hurricane Harvey. Likewise, persons with a more optimistic outlook on their future had lower odds in suicide ideation since Hurricane Harvey. Our work generally finds a high level of community support and engagement among religious organizations and survivors, compared to survivors and their limited and sometimes negative interactions with state and federal agencies both during and after the hurricane. Clearly, religious organizations, both informal and formal, were playing an important role in the disaster recovery for both individuals and communities. Additionally, it was encouraging to find that the psychological resource of an optimistic outlook was statistically significant and playing a potentially important role in lessening the odds of suicide ideation among the sampled survivors.

#### 4. Discussion

We report here, to our knowledge, the first analysis examining suicide ideation, and the intersection of risk and protective variables among Hurricane Harvey survivors along the Texas Gulf Coast in 2017. Suicide ideation among the sampled survivors was 2.5 times higher than typically reported in the general population. (Substance Abuse Mental Health Services Administration, 2017) These results are certainly noteworthy, and underscore how important it is for mental health professionals and other disaster workers to be sensitive to this elevated risk both immediately and months after a natural disaster strikes.

In both preliminary (not reported here but available upon request), and the current analysis, very few subpopulation ideation vulnerabilities were noted across survivor sociodemographic groups. While both age and gender were correlated with suicide ideation, only gender remained statistically significant in the analysis; women reported higher ideation odds compared to men. Additionally, the prior mental health problem variable was the most significant risk factor among survivors reporting thoughts about killing themselves. This finding is similar to what others report regarding prior symptomatology and mental health problems as significant risk factors in suicidality among disaster survivors. (Brown et al., 2018; Kolves et al., 2013; Norris et al., 1999; Warheit et al., 1996) For reasons related to prior disaster experiences, job loss, personal loss or even the general fear and anxiety related to living on the coast where disaster can strike anytime, the respondents we interviewed clearly had additional mental health struggles prior to Hurricane Harvey and those struggles were

continuing to impact their current mental health. In addition, persons who scored in a clinical diagnostic range of the IES-R (33+), were 2.7 times more likely to have thoughts about killing themselves compared to persons who were not in this high-range clinical diagnostic category. Certainly, another important warning sign that health care professionals need to be constantly wary of in post-disaster settings. This general finding has been supported in a variety of natural disaster settings over the last several decades (Goldman and Galea, 2014; Kolves et al., 2013; Alfonso, 2018).

Psychological and social resources have been reported as important mitigating/protective factors in mitigating the negative risks experienced by natural disaster survivors. (Goldman and Galea, 2014; Kolves et al., 2013) Optimism appears to act as an important protective factor in the current analysis though this has not typically been examined as a protective resource in prior natural disaster research. Additionally, there was a significant, negative relationship between suicide ideation and connection to religious organizations and the formal and informal relationships that survivors often report as being important to them during a disaster. Our results suggest that higher religious social capital (membership, interaction with others, and a reliance on the community when feeling lonely or isolated) among Hurricane Harvey survivors made the difference for many. Researchers have noted the important role that religious affiliation and religious connections/capital can play in disrupting the negative impact of natural disaster on psychological outcomes. (Rezaeian, 2008; Spialek et al., 2016) We find that is certainly true here with regards to the link between religious capital and suicide ideation generally, and among Harvey survivors specifically.

Practically, this finding also suggests that religious organizations can augment efforts emanating from public health and mental health/counseling services that may be initially overwhelmed in the immediate days, weeks, and months following a disaster. For instance, faith-based institutions may assist as information resources for or gatekeepers to mental health services. (Lachlan and Spence, 2011; Aten et al., 2010) Faith leaders can refer congregants for mental health services that extend beyond the spiritual counseling that faith-based institutions may provide. Likewise, mental health service providers can emphasize the spiritual and social support opportunities available in faith-based institutions if their clients are people of faith. (Aten et al., 2010) In order for this partnership to be successful, mental health service providers may need to establish relationships with faith-based institutions before disasters strike so that faith leaders will feel comfortable referring clients to specific mental health service providers. Moreover, community disaster task forces or disaster mental health advisory boards should include faith-based leaders in their volunteer organizations. Given past research suggests that survivors may under-utilize services offered through religious organizations following disasters, (Houston et al., 2015) this invitation could both establish trusted relationships before disasters and inform mental health services about ways faith-based institutions serve disaster survivors in the recovery period.

##### 4.1. Study limitations

These findings while important should be interpreted in the context of some limitations. One, this cross-sectional study represents a snapshot of survivors and their mental health status at a single point in time, approximately two months after the disaster. Other studies have found that while ideation and related psychological traumas are heightened after disasters, with a careful more nuanced longitudinal analyses, higher levels of suicidality may be of greater concern 6-12 months after a disaster strikes. Two, given the limitations of this survey strategy and working in a disaster zone, it is likely that a number of important indicators were overlooked, a full battery of some questions were not asked, and by design, there were a limited number of risk and protective factors that could be measured. Specifically, there has been some discussion around the validity of single-item measurement related to

suicide behavior. (Millner et al., 2015) While we acknowledge this important work regarding the desire to improve the comprehensiveness of measuring suicidality, there were significant limitations in terms of the access and time that could be spent with survivors and thus the decision was made to screen for ideation and action which provided important preliminary evidence of the intersection between vulnerability, risk, protection and ideation in this disaster zone. Likewise, more work needs to be done in examining the precise role of religious affiliation, religiosity, and spirituality and their role in mitigating the negative circumstances of disaster experiences. While there is support for the role of religious capital as a mitigator, other studies have not found this to be the case and more careful and comprehensive studies that look at these “effects” should be considered. People experience and express their spirituality and religion in many different ways. The assessment in the current study is only one way to accomplish this and there are a number of different measures and other assessments that could be used that would potentially reveal a different set of findings. Finally, every attempt was made to design and implement a random, representative sample of Hurricane Harvey survivors. While the results are generalizable, they are specifically generalizable to adults who survived Hurricane Harvey in August 2017 along the Texas Gulf Coast. Because of the nature of data collection and the strategies used to obtain the data, readers should exercise caution in generalizing beyond the scope of this study to all disaster survivors or disaster circumstances.

Nevertheless, despite these and other limitations we have provided some important “first of its kind” findings that explore mental health and suicide ideation among adult survivors in the disaster zone of Hurricane Harvey. Our results are similar to what other studies have found in other post-disaster settings. Additional work on post-disaster mental health symptomatology needs to continue. Work focusing on who is vulnerable, what makes them vulnerable, and what protective factors and resources can act as mitigators in that exposure to risk is important to cataloging a complete understanding of mental health sequelae in the post-disaster context. We believe our work has made a contribution to that literature, but there is much work to be done with more carefully controlled studies moving forward.

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## Authorship

Fitzpatrick was the primary lead for this manuscript. In consultation with Spialek, he designed the outline for the paper, wrote extensively throughout all sections of the paper, consulted with Spialek on the analysis, formatting and constructed the tables, and provided the primary observations and conclusions. Spialek is the co-investigator and provided guidance on the writing and outline of the paper. He revised sections throughout the paper including data and methods, analytical strategies, and results.

## Protection of Human Subjects

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and the University of Arkansas IRB approved all procedures involving human subjects/patients. Written informed consent was obtained from all subjects.

## Declaration of Competing Interest

No known conflict of interest exists for either author in the

preparation of this manuscript.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at [doi:10.1016/j.jad.2020.08.072](https://doi.org/10.1016/j.jad.2020.08.072).

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