Cumulative Risk of Psychological Distress in College Students Effected by Hurricane Harvey

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Abstract: This study examines the relationship between prior trauma and post disaster psychological distress in a sample of college students exposed to Hurricane Harvey in Houston, Texas in 2017. College students (n = 324) receive treatment for psychological problems at very low rates, so screening for the most vulnerable students after a disaster is important. While the relationship between prior trauma and post-disaster psychological distress is well established, the evidence for prior disaster exposure as a risk factor outside of other trauma is mixed. Prior trauma was divided into two cumulative risk style indicators: prior traumatic experiences (excluding disasters) and prior disaster exposure. In multiple linear regression models, prior traumatic experiences were significant predictors of post-disaster symptoms of both post-traumatic stress disorder and depression following the hurricane. Prior disaster exposures were not significant in either case. Implications for future screening and analysis of risk factors are discussed.

Keywords: *Hurricane Harvey, college student, stress, depression.*

Introduction

College students may be particularly vulnerable to developing psychological distress following natural disasters. It is well established that exposure to disasters is associated with elevated psychological distress, including posttraumatic stress and depression symptom (Goldmann & Galea, 2014; Mebu, 2013; North et al. 2018). Outside of the context of disasters, mental disorders have been observed among college students globally (Okumusoglu, 2018). Estimates indicate 20.3% of college students, with only 16.4% of students effected receiving treatment (Auerbach et al., 2016). This low rate of treatment is especially concerning in the context of disaster related psychological distress. To our knowledge, disaster-related psychological distress has not been thoroughly examined in college students. Instead, the majority of disaster research has focused on the general adult population or children and adolescents (Neria et al., 2008; Tang et al., 2014). The purpose of this study was to explore symptoms of psychological distress in a sample of college students following Hurricane Harvey in 2017. Specifically, we sought to examine pre-disaster experiences of traumatic events, including previous exposure to other natural disasters, as risk factors for psychological distress symptoms.

Prior lifetime adversity is generally associated with an increased risk of negative mental health consequences such as symptoms of posttraumatic stress, depression, and generalized anxiety (Seery et al., 2010). The relationship between prior trauma and both post-traumatic stress disorder (PTSD) and depression is well supported in the disaster literature. More specifically, one study found that prior trauma other than disaster exposure was associated with an elevated risk of meeting diagnostic criteria for both PTSD and major depressive episodes in adolescent tornado victims (Adams et al., 2014). Further, a meta-analysis of disaster literature found that prior traumatic experiences put individuals at higher risk of receiving a diagnosis of depression following a natural disaster (Tang et al., 2014). Finally, the World Health Organization (WHO) World Mental Health Survey data showed that experiencing certain lifetime pre-

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disaster traumatic exposures, particularly sectarian, interpersonal, or sexual violence, were consistently associated with higher odds of disaster-related PTSD diagnosis (Bromet et al., 2017).

To date, it is not clear how prior natural disaster exposure contributes to the development of psychological distress after a disaster. While prior disaster experiences are considered risk factors for post-disaster distress, these experiences are often combined with other prior traumas in a single measure. For example, one study found that prior trauma was a significant predictor of PTSD in adults exposed to hurricanes in Florida in 2004 when combining prior-disaster exposure with other prior traumas (Cohen et al., 2016). Other evidence linking prior-disaster exposure and post-disaster psychological distress is mixed. The analysis by Bromet et al. (2017) found that prior-disaster exposure was not a consistent risk factor for post disaster PTSD diagnosis, while several other forms of prior trauma were. In a study of adolescents in Alabama and Missouri communities struck by tornados in 2011, prior disaster exposure was not associated with post disaster PTSD diagnosis (Adams et al., 2014). However, prior disaster exposure was found to be associated with a lower risk for diagnosis of a major depressive episode. The authors suggest this counterintuitive finding may be due to prior-disaster exposure preparing the adolescents to cope with the disaster and subsequent recovery, in effect providing some form of resilience. These mixed results show that the role of prior disaster exposure in post disaster psychological distress is still unclear.

This paper addresses this important gap in the literature by examining whether prior-disaster exposure has a unique relationship with post disaster psychological distress or whether it is the accumulation of traumatic experiences that is important. Cumulative risk style approaches posit that exposure to multiple traumatic experiences put individuals at greater risk for psychological distress (Evans et al., 2013). Cumulative risk assessment measures multiple risks by dichotomizing risk factor exposures and summing them to create a summary score. It is used frequently in areas such as developmental psychology to measure the cumulative effects of stressful childhood traumas on developmental outcomes (Rutter & Stress, 1981; Sameroff et al., 1987) and environmental health to measure the combined effect of harmful environmental exposures (Environmental Protection Agency [EPA], 2003). Comparing prior disaster exposure to the cumulative risk indicator for non-disaster prior trauma will allow for distinguishing prior disaster exposure's unique contribution. Further, cumulative risk factors can show whether effects are steady or if there is a threshold of exposure at which psychological distress is different via the addition of quadratic terms. Through the addition of quadratic terms, one study found that a low number of lifetime adverse events were associated with better outcomes following recent adversity (Seery et al., 2010). This result was found in comparison to either no prior adversity at all or high numbers of lifetime adverse events, with the worst outcomes at the higher levels of prior adversity.

The goal of the present study was to understand the relationship between prior traumatic experiences, prior-disaster exposure, and symptoms of psychological distress following Hurricane Harvey in a sample of college students, an understudied population in disaster research. These relationships were examined while controlling for the impact of hurricane exposure, as well as demographics variables. Demographic variables of gender, age, race, and household income are regularly linked to post-disaster psychological outcomes (Goldman & Galea, 2014; Norris et al., 2002). The first aim was to understand the relationship between prior traumatic exposures and post-disaster psychological distress. Prior traumatic exposures (excluding prior disasters) were expected to have a significant relationship with post-disaster symptoms of both PTSD and depression. The second aim was to understand the relationship between prior-disaster exposure, separate from other prior trauma, and symptoms of post-disaster psychological distress. Prior disaster exposures were expected to have significant relationships with PTSD symptoms and depression symptoms. The third aim of this study was to determine whether these relationships were strictly linear or if there was a meaningful threshold of prior trauma exposure or prior-disaster exposure where symptoms notably differed. Significant quadratic effects were expected to detect a threshold effect in the linear relationships of prior trauma and prior disasters to psychological distress.

Methodology

Participants

Participants in this study were college students who experienced Hurricane Harvey in the Houston, Texas area. Participants completed an online survey about their experiences of Hurricane Harvey. Hurricane Harvey was noteworthy for being a particularly destructive storm with record-setting rainfall (Blake & Zelinsky, 2018) and for being the second costliest Hurricane in US history behind Hurricane Katrina in 2005 (National Hurricane Center, 2018). Area colleges and universities suffered class cancellations, property damage, and limited evacuations. (Roll, 2017; Watkins, 2017). The subset of data used for this study consisted of the 324 respondents who identified as university students at mid-sized university near the Gulf Coast. Only respondents who completed all survey items of interest were included. Participant demographics are described in Table 1.

Table 1. Descriptive Statistics for Demographics.

Variable	N	Percent
Total	324	100%
Gender (Female)	262	80.86%
Age Group		
18-24	175	54.01%
25-34	78	24.07%
35-44	46	14.20%
45-54	17	5.25%
55-64	8	2.47%
Race/Ethnicity		
White	161	49.69%
Black	32	9.88%
Hispanic	99	30.56%
Asian	18	5.56%
Other	14	4.32%
Household Income		
$10,000 - $24,999	94	29.01%
$25,000 - $49,999	82	25.31%
$50,000 - $74,999	66	20.37%
$75,000 - $149,999	62	19.14%
Above $150,000	20	6.17%

The sample was mostly female (80.86%) and over half (54.01%) were in the age range of 18-24. The sample was racially & ethnically diverse (49.69% of respondents identified as white/Caucasian/European American, 30.56% as Hispanic or Latino, 9.88% as black/African American/African, 5.56% as Asian, and 4.32% as "other" race). The majority of the sample (54.31%) reported household incomes less than $50,000 per year, with 29.01% of the sample reporting annual household incomes less than $25,000. In our subsequent analysis, age was dichotomized to represent traditional and nontraditional students, measuring whether the subjects were in the younger 18 to 24-year-old age group or any other later age group. Race was dichotomized to represent minority status. Household income was dichotomized to represent low income, defined as being in the lowest <$25,000 annual income group.

Procedures

This study examined a subset of data collected as part of a larger study. The data were collected between September 29th, 2017 and February 12th, 2018, roughly one to six months following Hurricane Harvey making landfall on August 25th, 2017. The University institutional review board (IRB) approved the initial data collection. Secondary analysis of this dataset received an exemption from the secondary university. Participants were recruited in four ways: online advertising on various websites, snowball recruitment asking respondents to email their contacts, student recruitment via the participant pool, and emails sent to all students and faculty on universal contact list. Participants completed an online survey hosted on the Qualtrics platform and were eligible to enter a drawing for a gift card by providing their contact information upon completion of the survey.

Measures

Note that our measures included measures with formative indicators (e.g., Hurricane Exposure, prior exposure). Internal consistency was not calculated for these measures as it is inappropriate to do so (Bollen & Bauldry, 2011; Hardin et al., 2011).

Hurricane exposure.

The Hurricane Related Traumatic Experience-Revised (HURTE-R) (Vernberg et al., 1996) survey was used to assess location during the hurricane, perceived life threat, actual life threat, and immediate loss or disruption experienced due to the hurricane. Subscales including perceived life threat, actual life threat, and immediate loss/disruption were calculated by summing their constituent items. Perceived life threat was assessed with one item scored "No" (0) or "Yes" (1) ("At any time during the Hurricane, did you think you might die?"). Actual life threat was assessed with 6 items scored "No" (0) or "Yes" (1) (e.g., "Did you get hit by anything falling or flying during the Hurricane?"). Immediate loss/disruption was measured with 10 items scored "No" (0) or "Yes" (1) (e.g., "Did you move to a new place because of the Hurricane?").

Posttraumatic stress symptoms.

The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5) (Blevins et al., 2015) is a standardized 20-question measure used to assess posttraumatic stress symptoms experienced in the past month. Items included questions such as "in the past month, how much were you bothered by repeated, disturbing, and unwanted memories of the stressful experience?" Each item used a 5-point Likert type scale (0 = "not at all," 4 = "extremely"). Scores were summed to create a total summary score ranging from 0 to 80. The internal consistency of the PCL-5 in this sample was very good (Cronbach's α = .96).

Depression symptoms.

The Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001) is an 8-item measure used to assess the severity of depression symptoms experienced in the prior two weeks. Example symptoms included "feeling down, depressed, or hopeless," "trouble falling or staying asleep, or sleeping too much," and "poor appetite or overeating." Items used a 4-point scale from 0 ("not at all") to 3 ("nearly every day"). A ninth item asked respondents to assess the difficulty associated with any problems reported in the first eight items. Summary scores were calculated by summing the first eight items, giving a total score ranging from 0 to 24. The PHQ-9 displayed good internal consistency in this sample (Cronbach's α = .93).

Prior exposure

Participants also reported prior lifetime traumatic experiences and natural disaster experience on author-generated questions. Participants reported experiencing any prior disaster or personal trauma on a single yes/no question ("Have you been exposed to previous (prior to Harvey) natural disasters or personal traumas?"). If they answered yes, participants were asked to select the types of disasters/traumas from a multiple-choice question listing three prior disasters ("Other Hurricanes", "Tornados", "Earthquakes") and seven traumatic experiences ("Sexual Abuse", "Physical Abuse", "Family Violence", "Community Violence", "Shootings", "Life Threatening Illness", "Life Threatening Accident"). Participants could select as many as applied and were also given the option to supply an additional free text answer if they selected the "other" option.

Cumulative risk indicators

Separate indicators for prior traumatic exposure and prior disaster exposure were calculated by summing the constituent dichotomized exposures (0 = No, 1= Yes) endorsed by survey respondents. Seven traumatic experiences were summed to create the prior personal trauma indicator (theoretical range 0-7) and three prior disaster exposures were summed to create the prior disaster indicator (theoretical range 0-3). The "other" option and free text field were not included in these calculations to ensure consistent measurement across subjects.

Statistical Approach

Analyses for this study were conducted in SAS software version 9.4. To address our first two aims, understanding the relationship between prior trauma and symptoms of psychological distress following a hurricane, a multiple linear regression model was fit with the prior traumatic experiences and prior disaster exposure as explanatory variables of interest. We controlled for hurricane exposure & demographic factors, with PTSD symptoms as the outcome. A separate multiple regression linear model was fit with prior trauma and prior disaster exposure as explanatory variables of interest, also controlling for hurricane exposure and demographics, with depression symptoms as the outcome. Modeling diagnostics showed multivariate normality and no multicollinearity in either model, though both models presented arbitrary heteroskedasticity not consistent with common transformation techniques, which was controlled for by using heteroskedasticity consistent standard errors. To explore our third aim, which was identifying potential threshold effects in the relationship of prior trauma, prior disasters, and symptoms of psychological distress, quadratic terms for significant explanatory variables of interest were added to the models to detect threshold effects. Alpha levels of .05 were set *a priori* for all tests of statistical significance.

Results

Descriptive statistics for measures of hurricane exposure, personal trauma, and psychological distress are presented in Table 2.

Table 2. Descriptive Statistics for Measures.

Variable	N	Percent	M(SD)	Min	Max
Hurricane Exposure					
Perceived Life Threat (Yes)	68	20.99%			
Actual Life Threat			.47 (.79)	0	4
Immediate Loss/Disruption			1.68 (1.88)	0	7
Prior Trauma					
Prior Traumatic Experiences			.70 (1.21)	0	6
Prior Disaster Exposures			.75 (.69)	0	3
Psychological Distress					
PTSD (PCL-5 Summary Score)			18.16 (18.47)	0	73
Depression (PHQ-9 Summary Score)			6.69 (6.44)	0	24

Descriptives and correlations between PTSD symptoms, depression symptoms, and individual prior disaster and prior traumatic experiences are presented in Table 3. In our sample, PTSD symptoms and depression symptoms were strongly correlated ($r(322) = .80$, $p < .001$). Of the three prior disaster exposures, only earthquakes were associated with PTSD symptoms ($r(322) = -.11$, $p < .05$). None of the three prior disaster exposures were associated with depression symptoms. Six of the seven individual prior traumas were significantly correlated with either PTSD or depression symptoms. Community violence was not correlated with either PTSD or depression.

Table 3. Counts of Prior Exposures and Correlations with PTSD & Depression Symptoms

Variables	Number Endorsed *n* (%)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. PTSD		1										
2. Depression		.80***	1									
3. Other Hurricanes	189 (58.33%)	.00	.03	1								
4. Tornados	36 (11.11%)	.07	.06	.20***	1							
5. Earthquakes	17 (5.25%)	-.11*	-.07	.06	.09	1						
6. Sexual Abuse	37 (11.42%)	.19***	.23***	.19***	.06	-.04	1					
7. Physical Abuse	38 (11.73%)	.18**	.24***	.15**	.12*	.04	.44***	1				
8. Family Violence	44 (13.58%)	.09	.14*	.23***	.15**	-.01	.42***	.56*	1			
9. Community Violence	22 (6.79%)	.02	.04	.23***	.26***	-.06	.06	.09	.11	1		
10. Shootings	18 (5.56%)	.16**	.12*	.15**	.26***	.06	.17**	.20***	.18**	.36***	1	
11. Life Threatening Illness	40 (12.35%)	.11*	.15**	.18***	.14*	.04	.22***	.24***	.15**	.09	.15**	1
12. Life Threatening Accident	28 (8.64%)	.23***	.21***	.17**	.24***	.07	.17**	.13*	.17**	.18**	.36***	.25***

Note: * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

In order to examine prior traumatic experiences and prior disaster exposures as explanatory variables for PTSD and depression symptoms, two separate multiple linear regressions were run with PTSD and depression symptoms as the outcome, respectively. Heteroscedasticity consistent standard errors were utilized in both models to account for suspected heteroscedasticity of residuals while retaining the scale of the outcome variables. Both models controlled for measures of exposure during Hurricane Harvey, including perceived life threat, actual life threat, and immediate loss/disruption.

PTSD Symptoms

The model predicting PTSD symptoms was statistically significant ($F(9, 314)= 21.01$, $p < .001$) with adjusted $R^2 = .36$ (see Table 4 for full results). Testing the significance of the individual predictors, prior trauma was a significant predictor of PTSD symptoms ($\beta = 3.39$, $se = .90$, $t = 3.75$, $p < .001$), indicating that the modelled value for the PCL-5 summary score increased by 3.39 for each additional prior traumatic exposure. Prior disaster exposure was not a significant predictor of PTSD symptoms ($\beta = -1.01$, $se = 1.31$, $t = -.77$, $p = .44$). Among measures of hurricane exposure,

actual life threat (β = 3.89, se = 1.53, t = 2.53, p = .01) and immediate loss/disruption (β = 3.84, se = .60, t = 6.42, p = <.001) were significant predictors of PTSD symptoms. Female gender was a significant demographic covariate (β = 3.67, se = 1.81, t = 2.02, p = .04). Adding a quadratic term for prior trauma to detect threshold effects was not significant (p = .76).

Table 4. Regression Results for Multiple Regression Model Predicting PTSD Symptoms, with Heteroscedasticity Consistent Standard Errors

Variable	β	95%CI	se	t	p
Intercept	3.36	[-1.41, 8.13]	2.43	1.39	.17
Prior Trauma					
Prior Traumatic Experiences	3.39	[1.61, 5.17]	.90	3.75	<.001***
Prior Disaster Exposures	-1.01	[-3.59, 1.56]	1.31	-.77	.44
Hurricane Exposure					
Perceived Life Threat	3.84	[-.98, 8.64]	2.45	1.57	.12
Actual Life Threat	3.89	[.87, 6.91]	1.53	2.53	.01**
Immediate Loss/Disruption	3.83	[2.66, 5.01]	.60	6.42	<.001***
Demographics					
Gender (Female)	3.68	[.10, 7.26]	1.82	2.02	.04*
Young Age (18-24)	.52	[-2.93, 3.98]	1.76	.30	.77
Minority Status	.98	[-2.55, 4.50]	1.79	.55	.59
Low Income	1.17	[-3.06, 5.40]	2.15	.54	.59

Note: * $p \le .05$, ** $p \le .01$, ***$p \le .001$

Depression Symptoms

The multiple linear regression model predicting depression symptoms was also significant ($F(9, 314)$= 13.38 , $p < .001$) with adjusted R^2 = .26 (see Table 5 for full results). Examining the individual predictors, prior trauma was a significant predictor of depression symptoms (β = 1.46, se = .30, t = 4.83, p < .001), indicating that the modelled value for the PHQ-9 summary score increased by 1.46 for each additional prior traumatic exposure. Prior disaster exposure was not a significant predictor of depression symptoms (β = -.21, se = .45, t = -.48, p = .62). Among the measures of hurricane exposure, only immediate loss/disruption was significant (β = 1.10, se = .45, t = -.48, p = .62). Adding a quadratic term for prior trauma also failed to achieve significance in the depression model (p = .62).

Table 5. Regression Results for Multiple Regression Model Predicting Depression Symptoms, with Heteroscedasticity Consistent Standard Errors

Variable	β	95%CI	se	t	p
Intercept	1.75	[-.06, 3.55]	.92	1.90	.06
Prior Trauma					
Prior Traumatic Experiences	1.46	[.87, 2.06]	.30	4.83	<.001***
Prior Disaster Exposures	-.22	[-1.10, .66]	.45	-.48	.63
Hurricane Exposure					
Perceived Life Threat	1.07	[-.64, 2.78]	.87	1.23	.22
Actual Life Threat	.72	[-.42, 1.86]	.60	1.24	.22
Immediate Loss/Disruption	1.10	[.68, 1.51]	.21	5.18	<.001***
Demographics					
Gender (Female)	1.40	[-.05, 2.83]	.73	1.90	.06
Young Age (18-24)	.14	[-1.11, 1.39]	.63	.22	.83
Minority Status	.26	[-1.06, 1.56]	.67	.38	.70
Low Income	1.19	[-.32, 2.69]	.77	1.56	.12

Note: * $p \le .05$, ** $p \le .01$, ***$p \le .001$

Discussion

In the first aim of the study, we sought to understand the cumulative risk of exposure to multiple traumatic experiences (excluding disasters) and post-disaster psychological distress. Our findings support this relationship among our sample of college students exposed to Hurricane Harvey. The models revealed that higher numbers of prior traumatic experiences were associated with consistently increased severity in post-disaster PTSD and depression symptoms, when controlling for prior disaster exposure, hurricane exposure, and demographic characteristics. This is a useful contribution because it describes the relationship between accumulated prior trauma and the expected outcomes on these validated measures of PTSD and depression symptoms, as measured in their respective validated measures.

Examining the second aim of our study, the results did not support a relationship between prior disaster exposure and PTSD symptoms. Two of the prior disaster exposures, other hurricanes and tornadoes, were not correlated with PTSD symptoms, while prior earthquake exposure displayed a weak negative relationship with PTSD symptoms. When controlling for non-disaster-related prior traumatic exposure in addition to hurricane exposure and demographics, the cumulative risk style disaster indicator was not a significant predictor of PTSD symptoms in this sample. These findings are consistent with the past finding of no relationship between any prior disaster exposure and post-disaster PTSD, (Adams et al., 2014) and consistent with findings that prior disaster exposure was not consistently related to post-disaster PTSD (Bromet et al., 2017).

A cumulative risk style indicator measuring prior personal trauma could prove important for screening college students to identify those most vulnerable to psychological distress following natural disasters. Not only can college students be vulnerable in the wake of a disaster, but they are a vulnerable population for multiple traumas. For example, one study found that 84% of college student have experienced traumatic events, and one-third had experienced four or more traumatic events (Vrana & Lauterbach, 1994). To further exacerbate the problem, given that there are low levels of treatment for existing mental disorders among college students, it will be important in the wake of large-scale disasters to effectively screen and guide the most vulnerable to appropriate treatments. This is vital as college is already an especially stressful time for both traditional and non-traditional students (Pedrelli et al., 2015).

When considering post-disaster psychological distress, it is important to account for traumatic history, even when the primary interest is in a particular traumatic event, such as a recent disaster. In one study, 85% of college undergrads reported suffering at least one traumatic event during their lifetime, with a mean of 2.79 traumatic events out of a total of 23 possible traumas (Frazier et al., 2009). Individuals who experience multiple traumatic events display higher symptom severity for psychological distress, above those experienced by individuals with a single traumatic exposure (Green et al., 2000). This relationship has been shown in children (Evans et al., 2013), young adults (Green et al., 2000), and older adults (Ogle et al., 2014). Without accounting for the presence of prior trauma, and indeed multiple such traumas, estimates of a trauma of interest's impact may be overstated.

However, when deciding on variables to include in a cumulative risk indicator, it is important for there to be a strong theoretical foundation for its inclusion, and the variables should have an association with the outcome in question (Evans, Li, and Whipple, 2013), Given the mixed evidence for the relationship of prior disaster exposure to post disaster psychological distress, the contribution of prior disaster exposure to the predictive power of any such cumulative risk indicator needs to be thoroughly evaluated. This is especially important as interpersonal traumas are more consistent indicators of post disaster PTSD than prior disasters (Bromet et al., 2017) and interpersonal traumas are associated with much higher rates of lifetime PTSD prevalence. (Kessler et al., 1995).

Further, no relationship was found between prior disaster exposure and depression symptoms. None of the three prior disaster exposures were individually correlated with depression symptoms. When controlling for non-disaster prior trauma, hurricane exposure, and demographics, the cumulative risk style prior disaster indicator was not a significant predictor of depression symptoms. This was contrary to the finding by Adams et al. (Adams et al., 2014), which found lower odds for post-disaster depression for adolescents with prior disaster exposure.

Notably, in this study of college students who experienced Hurricane Harvey, few of the demographic variables were significant predictors of either PTSD or depression. Female gender was significant in the PTSD model, but not the depression model. Being in the age group of 18-24 was not significant compared to being in older age groups. Similarly, minority racial/ethnic status and low household income were not significant either. This is not entirely without precedent in the literature. In a study of PTSD prevalence in college students, female gender and low SES were significant risk factors for trauma exposure in college students, but were not significant predictors of PTSD in complex models accounting for trauma severity (Read et al., 2011). In the analysis of WHO survey data [8], both age and education had significant associations with disaster related PTSD on their own, but these relationships were not significant when tested as part of complex models.

Conclusions

Among college students exposed to Hurricane Harvey, previous traumatic experiences were strongly associated with PTSD and depressive symptoms following the hurricane. Prior disaster exposures had little to no association with PTSD or depression symptoms following the hurricane. As for the hurricane itself, during the disaster, the actual life threat experienced was associated only with PTSD symptoms following the hurricane while the immediate disruption to the students' lives following the disaster was associated with both PTSD and depression.

Recommendations

Given the impact of disaster exposure and cumulative risk indicators, it is important the college students are screened for post disaster symptoms. Further, it may be easily accessible and effective mental health services are not readily available for college students during a disaster. Thus, it will be important that services be provided to college students,

and that these services known and easily accessible to college students. As we know, several effective interventions could be used to help cope with the stress of the disaster (Houston et al., 2017).

Limitations

There are several limitations to consider when evaluating the results of this study. First, the sample was collected through a combination of convenience sampling and snowball sampling, resulting in a sample that is not particularly representative of any population. Second, although method bias could be present, measures were taken to decrease method bias. Third, this subset of data is only cross sectional, so we cannot measure change over time. With no pre-storm baseline data, we cannot directly account for any pre-existing psychological distress the subjects may already have been experiencing or any prior diagnoses for psychological disorders related to their history of trauma, which would allow us to better understand the impact the hurricane on the symptom severity.

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