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Association of Posttraumatic Stress Disorder Symptoms With Migraine and Headache After a Natural Disaster

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Abstract

Objective: Previous research shows that migraine and general headache symptoms increase after traumatic events. Questions remain about whether posttraumatic stress disorder (PTSD) produces migraine/headache symptoms, or if individuals afflicted by migraine/headache are especially likely to develop PTSD. We test whether PTSD symptoms following a natural disaster are associated with higher odds of reporting frequent headaches/migraines postdisaster. We decompose PTSD into intrusion, avoidance, and hyperarousal symptom clusters to examine which, if any, are uniquely related to headache/migraine postdisaster.

Method: We use prospectively collected pre- and postdisaster data to explore whether overall PTSD symptoms and symptom clusters are associated with migraine/headache in a sample of Hurricane Katrina survivors. We account for severity of hurricane exposure and control for baseline migraine and headache problems to reduce the probability that heightened PTSD susceptibility among those who already suffered from the conditions could explain observed associations.

Results: PTSD symptoms were associated with higher odds of experiencing frequent headaches or migraines with a standard deviation change in PTSD score corresponding to over twice the odds (95% confidence interval [1.64, 2.68]) of having trouble with frequent headaches or migraines in the post-Katrina period. Each additional point on the intrusion subscale (sample *M* [SD] = 1.6 [1.1]) was associated with 55% higher odds of reporting frequent headache/migraine (95%

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confidence interval [1.03, 2.33]), but we found no association with avoidance or hyperarousal symptoms.

Conclusions: Clinicians and disaster planners should be aware that disaster survivors might be at heightened risk of migraine/headache episodes, and those experiencing intrusive reminders may be most affected.

Keywords

posttraumatic stress disorder; disaster; epidemiology

Disaster survivors suffer from a range of social, economic, and health consequences (Asad, 2015; Fussell, 2012; Lowe, Rhodes, & Scoglio, 2012; Norris, Friedman, Watson, et al., 2002; Norris, Friedman, & Watson, 2002; Rhodes et al., 2010), posttraumatic stress disorder (PTSD) among them. PTSD, a debilitating mental illness that sometimes develops following exposure to a distressing event, is characterized by traumatic intrusions, avoidance of traumatic reminders, and hyperarousal symptoms (American Psychiatric Association, 2000). Population-based studies suggest that up to 25% of natural disaster survivors experience PTSD, with higher prevalence among women and those with limited financial resources (Peterlin, Nijjar, & Tietjen, 2011). PTSD symptoms have been linked to a wide range of general medical conditions and complaints, including pain and gastrointestinal illness (Hoge, Terhakopian, Castro, Messer, & Engel, 2007; Pacella, Hruska, & Delahanty, 2013), metabolic syndrome (Heppner et al., 2009; Violanti et al., 2006), arthritis (Lauterbach, Yora, & Rakow, 2005; Norman et al., 2006; Weisberg et al., 2002), and immune system changes (Pace & Heim, 2011; Tucker, Jeon-Slaughter, Pfefferbaum, Khan, & Davis, 2010), among others (Boscarino, 2004; Schnurr & Jankowski, 1999). In the current study, we focus on the relationship between PTSD symptoms and migraine and general headache symptoms.

Previous research has shown migraine and general headache symptoms increase after traumatic events (Smitherman & Kolivas, 2013; van den Berg et al., 2008) and disproportionately affect women (Frayne et al., 2011), highlighting the need for research that explicitly focuses on women. The link between PTSD and headache has been repeatedly shown in studies of veterans (Afari et al., 2009; Rosenthal & Erickson, 2013; Theeler, Lucas, Riechers, & Ruff, 2013; Uhac et al., 2006), though most studies lack the predisaster data needed to control for respondents' underlying propensity to suffer headaches. In the aftermath of a human-made disaster, van den Berg and colleagues (2008) found that predisaster psychological problems, reported retrospectively during the postdisaster period, were significantly associated with higher scores on an inventory of postdisaster physical health symptoms (e.g., stomach ache, fatigue, headache, and backache). Although these results suggest that psychological factors may indeed worsen physical health outcomes, including headache (van den Berg et al., 2008), retrospective reports of predisaster psychological functioning may be influenced postdisaster psychological symptoms, which would bias results.

In addition to the dearth of research utilizing pre- and postevent data to examine the association between PTSD and migraine, studies to date have inadequately explored whether the different symptom clusters of PTSD—intrusion, avoidance, and hyperarousal—are

uniquely related to migraine or headache complaints. Extant literature suggests, but does not explicitly demonstrate, that PTSD avoidance symptoms might be most strongly associated with migraine and general headache. For example, in a study of patients with recurring headaches, those with persistent headache were found to become fearful and avoidant of situations that might exacerbate their pain (Asmundson, Norton, & Yeloso, 1999). Similarly, avoidance coping has been associated with increased headache intensity and migraine chronicity (Corchs et al., 2011; Martin, Reece, & Forsyth, 2006; Rollnik, Karst, Fink, & Dengler, 2001). In an analysis of neurological outpatients, avoidance coping was associated with increased headache intensity, while direct coping decreased headache severity (Marlowe, 1998; Martin, 2010). Finally, in a natural disaster context, Polusny and colleagues (2008) found that PTSD avoidance symptoms, but not intrusive or hyperarousal symptoms, were associated with higher postdisaster health care utilization, controlling for predisaster utilization (Polusny et al., 2008), although this study was not headache specific.

In short, outstanding questions not resolved by previous research include (a) whether PTSD produces migraine and other headache symptoms, or whether individuals afflicted by migraines and headaches are particularly likely to develop PTSD, and (b) whether specific clusters of PTSD symptoms may be particularly important for migraine and other headache symptoms. Longitudinal data, and an analysis of cluster-specific symptoms, are needed to answer these questions.

This is the first study to explore the relationship between PTSD symptoms and migraine and general headaches using both pre- and postdisaster data, which allows us to isolate the effects of PTSD on symptoms net of baseline propensity to suffer migraine or frequent headaches. We hypothesized that PTSD symptoms would be associated with the odds of experiencing frequent migraines and headaches, and that this association would vary by PTSD symptom cluster. We examined this relationship in a sample of women who survived Hurricane Katrina and who reported on migraine and general headaches prior to the hurricane. Hurricane Katrina, which flooded 80% of New Orleans, Louisiana, damaged nearly 75% of homes in the city and killed over 1,500 in the state (Kates, Colten, Laska, & Leatherman, 2006), was followed by Hurricane Rita less than 1 month later. By focusing on those with predisaster reports of migraine and general headaches, we reduce the probability that heightened PTSD susceptibility among participants who already suffered from migraine and general headaches could explain observed associations and strengthen causal inferences regarding the relationship between PTSD and postdisaster migraines and general headaches. We explore this relationship using total PTSD symptoms and PTSD symptom clusters to provide insight into whether the symptom clusters are differentially related to migraine and general headaches.

Method

This study used data collected by the Resilience in Survivors of Katrina (RISK) project, a longitudinal study of 1,019 Hurricane Katrina survivors. Respondents were originally recruited from two New Orleans community colleges to participate in a randomized-design program aimed at increasing academic persistence in community colleges, called the Opening Doors Evaluation (Brock & Richburg-Hayes, 2006). Participants ranged from 18 to

34 years old and were required to have at least one dependent child under 19, a household income under 200% of the federal poverty level, and a high school diploma or equivalent. Baseline data were collected prior to Hurricane Katrina between November 2003 and February 2005. Data collection for the Opening Doors Evaluation's 12-month follow-up survey was interrupted when Hurricane Katrina struck on August 29, 2005, at which point the study was redesigned to become the RISK Project. RISK followed the Opening Doors Evaluation respondents to collect post-Katrina data on mental, physical, social, and economic wellbeing. Institutional Review Boards at Harvard and Princeton approved this study.

Between 7 and 19 months after Katrina struck (March 2006 to March 2007), RISK located and conducted follow-up surveys by phone with 711 of the original Opening Doors respondents. Because Hurricane Katrina interrupted an active wave of data collection, 402 of these respondents had been surveyed twice by the Opening Doors Evaluation prior to Hurricane Katrina, and were asked about the experiences with headaches or migraines since Hurricane Katrina. The remaining 309 had been surveyed once, and were asked about the experiences with headaches or migraines in the past 12 months. We excluded 223 members of the latter group for whom we could not establish the temporal order of hurricane exposure and migraine or headache symptoms at follow-up.

For this analysis, we focused exclusively on women, who made up 96% of the follow-up sample. In addition to excluding men (n= 24), we omitted respondents missing baseline migraine/headache information (n= 10), migraine/headache reports at follow-up (n =2), PTSD symptoms at follow-up (n= 6), as well as those missing information on race, age, or public benefits status at baseline (n =22). Finally, we excluded subjects whose home locations could not be matched to flood depth information (n = 15). The resulting sample of 409 served as our primary study population, though we also report results of sensitivity analyses on a subset of these respondents for whom we had complete data on more detailed hurricane-related experiences (n= 326).

Outcome

Participants surveyed twice prior to Hurricane Katrina answered yes or no to the following question: "Since Hurricane Katrina, have you had trouble with frequent headaches or migraines?" Participants who had been surveyed once prior to the disaster answered yes or no to the following question: "In the past 12 months, have you had trouble with frequent headaches or migraines?" As noted above, we excluded 223 respondents who answered this question within a year of surviving Hurricane Katrina, as we could not establish the temporal ordering of Hurricane Katrina and migraine/headache symptoms.

Exposure

At follow-up, we administered the Impact of Event Scale–Revised (IES-R), a 22-item self-report inventory (Weiss & Marmar, 1997) with good psychometric properties (Creamer, Bell, & Failla, 2003), to measure hurricane-induced PTSD symptoms. Scores are computed as the mean of items, ranging from 0 to 4 (Weiss & Marmar, 1997). Participants were asked

how much experiences related to Hurricane Katrina distressed or bothered them over the prior week, from 0 (*not at all*)to 4 (*extremely*). Three subscales are also included in the IES-R: (a) Intrusion (eight items, e.g., "pictures about it popped into my mind"), (b) Avoidance (eight items, e.g., "I stayed away from reminders about it"), and (c) Hyperarousal (six items, e.g., "I was jumpy and easily startled"). Cronbach's alpha reliability for the IES-R full and subscales in this study were full-scale = .95, Intrusion = .90, Avoidance = .84, Hyperarousal = .89.

Covariates

We adjusted for respondent characteristics that could confound associations between frequent post-Katrina migraines/headaches and PTSD symptoms. These covariates included whether subjects reported having a problem with "frequent headaches or migraines" at baseline, as associations between baseline experiences of frequent headaches or migraines and the development of PTSD symptoms could produce spurious associations. We also adjusted for whether they, or someone in their household, received food stamps, cash assistance or welfare, or unemployment benefits at baseline and for age and race/ethnicity. With less than 20% of food stamp recipients receiving cash assistance or welfare, but nearly 90% of welfare recipients also receiving food stamps, including both of these variables allowed us to understand variability in economic wellbeing. Unemployment status allowed us to capture a second distinct facet of baseline socioeconomic status. We included age and race/ethnicity because they represented potentially important predictors of opportunities that could shape recovery after the hurricanes.

We also controlled for severity of hurricane exposure, which is a determinant of PTSD symptoms and could also affect migraine or headache risk directly, for example through injury or environmental exposures (Centers for Disease Control and Prevention, 2012). To adjust for severity of exposure in our main models, we used geocoded address and flood records to control for flood depth in participants' homes. We included an indicator of whether respondents had participated in one versus two waves of data collection prior to Hurricane Katrina to account for any systematic differences between participants that could have been related to both health and PTSD. Because participants were originally recruited through the Opening Doors evaluation, our initial models included randomization group assignment. We later dropped this variable from analyses because it was unrelated to our outcomes of interest.

To more stringently control for severity of hurricane exposure, we ran two sensitivity analyses that further adjusted for the number of traumas suffered during Hurricane Katrina and Hurricane Rita. Of the 409 respondents in our sample, 326 provided complete detailed data on hurricane-related traumas. Respondents indicated whether they had experienced each of the following eight traumas during Hurricane Katrina and then repeated the inventory for Hurricane Rita: (a) no fresh water to drink, (b) no food to eat, (c) felt their life was in danger, (d) lacked necessary medicine, (e) lacked necessary medical care, (f) had a family member who lacked necessary medical care, (g) lacked knowledge of safety of children, and (h) lacked knowledge of safety of other family members. We also included an indicator variable for bereavement based on whether participants reported having lost a close

friend, neighbor, or family member as a result of Hurricane Katrina or Hurricane Rita, which made landfall just 26 days after Katrina. Finally, we adjusted for self-reported home damage —categorized as either (a) none, minimal, or not serious; (b) moderate or substantial; or (c) enormous damage/home was destroyed—because it has been linked to postdisaster psychological outcomes (Fussell & Lowe, 2014). These exposure variables were included because they have been previously linked to postdisaster psychological outcomes and could also affect headache and migraine symptoms through mechanisms other than PTSD. In the first sensitivity analysis, we conducted a complete case analysis that included the 326 respondents with complete hurricane exposure data. Those with complete versus missing hurricane exposure data differed on several variables included in our model; compared to respondents with complete hurricane-related trauma data, those who did not provide a detailed inventory of traumas had less severe PTSD hyperarousal symptoms, were less likely to report trouble with headaches or migraines at follow-up, and were slightly younger, on average. The two groups did not show differences in baseline socioeconomic status or flooding depth. Because those with complete versus missing hurricane exposure data differed on some covariates, however, we also conducted a second sensitivity analysis based on multiply imputed hurricane exposure data.

Statistical Analysis

We used logistic regression to assess whether PTSD symptoms predicted the odds of reporting frequent headaches or migraines since surviving Katrina. We estimated effects associated with total PTSD score, as well as with PTSD symptom clusters. All models controlled for potential confounders, including problems with headaches or migraines at baseline, severity of hurricane exposure, and baseline socioeconomic and demographic covariates.

Because PTSD and migraine/symptom data were collected at the same follow-up wave, it is also possible that suffering frequent headaches or migraines at baseline predicted more severe PTSD symptoms at follow-up, adjusting for hurricane exposure. Although all models controlled for baseline migraine/headache, we further explored the extent to which associations between frequent migraines/headaches and PTSD might be endogenous or the product of reverse causation. To do this, we regressed measures of PTSD symptoms on baseline headache report, controlling for baseline social and demographic covariates, as well as for flood depth. Similarly, we explored whether PTSD symptoms at follow-up were predictive of baseline migraine/headache. All analyses were conducted in Stata 12.1 SE.

Results

Our sample comprised predominantly Black (85.1%) women, mean age 25.2 years, two thirds of whom received food stamps at baseline (see Table 1). Respondents were severely impacted by Hurricanes Katrina and/or Rita. Approximately 40% reported that their homes were destroyed or suffered enormous damage, and nearly 28% lost a close friend, neighbor, or family member due to the hurricanes. The proportion of women reporting a problem with frequent headaches or migraines increased from 15.2% at baseline to 56.5% in the post-Katrina period.

PTSD symptoms were associated with higher odds of experiencing frequent headaches or migraines since surviving Katrina (see Table 2). Each point on the mean IES-R (range 0–4), which was roughly the standard deviation in this sample, corresponded to over twice the odds (95% confidence interval [1.64, 2.68]) of having trouble with frequent headaches or migraines in the post-Katrina period. Intrusive symptoms—but neither avoidance nor hyperarousal PTSD symptom clusters—predicted higher odds of frequent headache/migraine. Each additional point on the intrusion subscale (sample M [SD] = 1.6[1.1]) was associated with 55% higher odds of reporting frequent headache/migraine (95% confidence interval [1.03, 2.33]). Results were consistent when we examined associations only among the 326 respondents with complete data on hurricane-related trauma (see Table 2). Analyses that relied on multiply imputed hurricane exposure variables were also consistent; point estimates describing relations between PTSD symptom scores and headaches or migraines were within 10% of those reported in our main model.

In addition to demographic characteristics, hurricane exposure predicted PTSD symptoms. Importantly, suffering frequent headaches or migraines prior to the hurricane was not predictive of PTSD symptom severity controlling for hurricane exposure level (see Table 3), which means that reverse causation is an unlikely explanation for our findings. Null associations between baseline problems with headache/migraine and later PTSD symptoms were also consistent across all PTSD symptom clusters. Finally, using a different approach to explore endogeneity and reverse causation, we found that post-Katrina PTSD symptoms were not associated with odds of baseline headache/migraine problems (see Table 4). Results showing that preexisting problems with headaches or migraines did not predict PTSD symptom severity were consistent when we controlled for detailed measures of hurricane exposure severity.

Discussion

We found a strong association between PTSD symptoms and odds of suffering frequent headaches/migraines in the 7 to 19 months following Hurricane Katrina. Decomposing PTSD symptoms into intrusion, avoidance, and hyperarousal clusters, only intrusive symptoms were predictive of concurrent frequent migraines/headaches. Interestingly, hurricane exposure, as indicated by a combination of objective and subjective severity measures, was not associated with headache/migraine after controlling for PTSD symptoms. In seeking alternative explanations for the observed associations, we do not see evidence that endogeneity or reverse causation could help explain results. Specifically, migraine/headache sufferers appear to be no more likely to develop more intrusive symptoms after trauma than are those without migraine/headache problems. The only cluster associated with elevated odds of frequent migraines/headaches consisted of intrusive posttraumatic symptoms. Traumatic intrusions were associated with concurrent—but not previous—migraine/headache.

The specificity of the association between intrusion symptoms and migraine suggests that confounding by severity of hurricane exposure is also unlikely to explain our results. If severe hurricane exposure affected migraine/headache incidence via disrupted medical care or exposure to environmental triggers, we would expect the three symptom clusters to be

equally useful in predicting odds of suffering from migraines/headaches. However, we only detect an association with intrusion symptoms. Further, covariates capturing severity of hurricane exposure did not attenuate the relationship between intrusive reminders and migraine.

Our data did not allow us to explore whether experiencing intrusive reminders increased risk of migraines through direct physiological or behavioral changes, or if individuals predisposed to developing intrusion symptoms after trauma also suffered elevated risk of postdisaster headache problems. Existing literature is only partially informative here. In a case study of one World War II veteran who developed PTSD 37 years after the conflict, Cas-siday and Lyons (1992) suggested that intrusive reminders increased migraine incidence only after the veteran underwent physiological changes as he aged. Future research that more directly examines the precise mechanisms through which intrusive reminders increase the risk of migraines and frequent headaches would be valuable. One part of this research agenda should include characterizing the relationship between PTSD symptoms and different headache and migraine types. A deeper understanding of which migraine or headache types are most sensitive to PTSD symptoms would be useful in both screening and treating patients.

Prospectively collected pre-Katrina data on migraines and headaches is a major strength of our study because it allows us to adjust for underlying propensity to suffer from migraines or headaches as is the availability of multiple hurricane exposure measures. Despite these strengths, PTSD and migraine/headache symptoms were self-report and recalled, which can introduce bias, and were collected at the same follow-up wave such that our study can only describe associations. Second, a single item, self-reported measure of migraine/headache does not provide information about severity, duration, frequency, or cause, nor does it allow us to gauge the clinical relevance of the complaints. More detailed information about headache and migraine symptoms would be crucial for investigating potential mechanisms linking PTSD and migraine/headache symptoms, and for helping to inform decisions about screening or treatment protocols. Finally, we note that our study population of mainly Black, low-income mothers is not representative of the general population, and that relationships of interest could vary across different populations.

Conclusion

Our results suggest that disaster survivors might be at heightened risk of migraine or headache episodes, and that those experiencing intrusive reminders after the disaster may be most affected. Previous research has recommended screening migraineurs, especially male sufferers, for PTSD (Peterlin et al., 2011). Clinicians considering whether to adopt PTSD screening for their patients should be aware that PTSD symptoms were associated with headaches or migraines in an all-female sample as well. A second implication of our findings is that clinicians might consider paying particular attention to intrusive PTSD symptoms as risk factors for headache or migraine problems. With natural disasters expected to increase in frequency and severity due to global climate change (Van Aalst, 2006), researchers should continue to explore the wide-reaching and synergistic mental and physical health consequences of disasters.

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Table 1:

Sample Characteristics

Variable	Number reporting	*M (SD)* or percent
Experienced frequent headaches or migraines prior to baseline interview	409	15.2
Had trouble with frequent headaches or migraines since Katrina	409	56.5
Proportion non-Hispanic White	409	10.5
Proportion non-Hispanic Black	409	85.1
Proportion Hispanic	409	2.4
Proportion other race/ethnicity	409	2.0
Proportion in a household that received food stamps at baseline	409	62.6
Proportion in a household that received cash assistance/welfare at baseline	409	13.2
Proportion in a household that received unemployment benefits at baseline	409	5.4
Age at baseline	409	25.2 (4.5)
Posttraumatic stress disorder symptom clusters		
Impact of Event Scale Intrusion score (range: 0–4)	409	1.6 (1.1)
Impact of Event Scale Avoidance score (range: 0–4)	409	1.5 (1.0)
Impact of Event Scale Hyperarousal score (range: 0–4)	409	1.2 (1.1)
Impact of Event Scale total score (range: 0–4)	409	1.5 (1.0)
Hurricane-related trauma		
Katrina flood depth (feet)	409	1.5 (2.2)
Proportion that suffered no, minimal, or not serious home damage	348	16.1
Proportion that suffered moderate or substantial home damage	348	42.0
Proportion that suffered enormous home damage/home was destroyed	348	42.0
Proportion with a close friend or family member killed as a result of Hurricanes Katrina or Rita	407	27.8
Number of hurricane-related traumas (range: 0–16)	338	3.6 (3.3)

Table 2:

Odds Ratios of Having Frequent Headaches or Migraines Since Hurricane Katrina for Posttraumatic Stress Disorder (PTSD) Symptom Scores and Covariates

	Odds ratios of having frequent headaches/migraines since Katrina							
	Model 1[a]		Model 2[b]		Model 3[C]		Model 4[d]	
Variable	*OR*	95% CI	*OR*	95% CI	*OR*	95% CI	*OR*	95% CI
Impact of Event Scale Avoidance score	.91	[.67, 1.23]			1	[.69, 1.45]		
Impact of Event Scale Hyperarousal score	1.43	[.97,2.12]			1.14	[.72, 1.82]		
Impact of Event Scale Intrusion score	1.55*	[1.03, 2.33]			1.93**	[1.18,3.16]		
Impact of Event Scale total score			2.10***	[1.64,2.68]			2.27***	[1.69,3.04]
Experienced frequent headaches or migraines prior to baseline interview	4.20***	[2.05, 8.60]	4.19***	[2.06, 8.54]	4.19***	[1.86,9.47]	3.99***	[1.79,8.91]
Household received food stamps at baseline	1.26	[.78, 2.04]	1.23	[.76, 1.98]	1.39	[.79, 2.46]	1.39	[.79, 2.44]
Household received cash assistance/welfare at baseline	2.13*	[1.06,4.31]	2.04*	[1.02,4.10]	2.07	[.91,4.71]	1.97	[.87, 4.43]
Household received unemployment benefits at baseline	1.55	[.57, 4.20]	1.67	[.62, 4.52]	1.27	[.40, 4.04]	1.39	[.44, 4.37]
Race/ethnicity (non-Hispanic White = reference)								
Non-Hispanic Black	.7	[.33, 1.47]	.7	[.33, 1.47]	.66	[.28, 1.56]	.63	[.27, 1.49]
Hispanic	.71	[.14,3.57]	.73	[.15,3.63]	.64	[.11,3.55]	.59	[.10,3.27]
Other race/ethnicity	.73	[.13,4.22]	.74	[.13,4.07]	.47	[.06, 3.77]	.5	[.06, 3.98]
Age in years	1.04	[.99, 1.10]	1.04	[.99, 1.10]	1.01	[.95, 1.07]	1.01	[.95, 1.07]
Home flooding depth (feet)	.95	[.86, 1.06]	.96	[.87, 1.07]	.91	[.80, 1.03]	.91	[.80, 1.04]
In two pre-Katrina survey waves	1.78	[1.00,3.19]	1.84*	[1.04,3.28]	1	[1.00, 1.00]	1	[1.00, 1.00]
Close friend or family member killed as a result of Hurricane Katrina or Rita (no = reference)					1.14	[.61,2.10]	1.19	[.65,2.19]
Hurricane-related home damage (none, minimal, not serious = reference)								
Moderate or substantial home damage					.75	[.36, 1.56]	.76	[.37, 1.59]
Enormous home damage/home was destroyed					.81	[.36, 1.80]	.82	[.37, 1.82]
Hurricane-related trauma count					1.05	[.96, 1.15]	1.05	[.96, 1.14]

Note. *OR* = odds ratio; Cl = confidence interval.

[a]PTSD symptoms represented by cluster scores, whole sample included ($n = 409$).

[b]PTSD symptoms represented by total score, whole sample included ($n = 409$).

[c]PTSD symptoms represented by cluster scores, adjusted for hurricane trauma count as sensitivity analysis ($n = 326$).

[d]PTSD symptoms represented by total score, adjusted for hurricane trauma count as sensitivity analysis ($n = 326$).

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3:

Association of Posttraumatic Stress Disorder (PTSD) Symptoms With Baseline Characteristics and Hurricane Katrina Exposure

	PTSD symptoms predicted by baseline characteristics and Hurricane Katrina exposure							
	Model 1[a]		Model 2[b]		Model 3[c]		Model 4[d]	
Variable	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Experienced frequent headaches or migraines prior to baseline interview	−.04	[−.30, .23]	−.07	[−.37, .23]	−.08	[−.35, .20]	.07	[−.24,37]
Household received food stamps at baseline	.12	[−.09, .33]	.14	[−.09, .38]	.13	[−.08,35]	.06	[−.17,30]
Household received cash assistance/welfare at baseline	.12	[−.17, .41]	.11	[−.22, .43]	.13	[−.17, .43]	.13	[−.20, .46]
Household received unemployment benefits at baseline	−.05	[−.47, .37]	−.01	[−.49, .46]	−.16	[−.60, .27]	.06	[−.42, .54]
Race/ethnicity (Non-Hispanic White = reference)								
Non-Hispanic Black	.45**	[.13, .78]	.44*	[.08, .81]	.44**	[.11, .78]	.49*	[.12, .85]
Hispanic	.83*	[.16, 1.50]	.75	[−.01, 1.51]	.76*	[.06, 1.45]	1.04**	[.27, 1.81]
Other race/ethnicity	.37	[−.37, 1.10]	.35	[−.49, 1.18]	.37	[−.39, 1.14]	.38	[−.47, 1.22]
Age in years	.04***	[.02, .06]	.04**	[.02, .06]	.03**	[.01,.05]	.04***	[.02, .07]
Home flooding depth (feet)	.05*	[.01, .10]	.06*	[.01,.11]	.04	[−.01, .08]	.07**	[.02,. 12]

Note. CI = confidence interval.

[a]PTSD symptoms total score, whole sample included (n= 409).

[b]PTSD intrusion symptom score, whole sample included (n= 409).

[c]PTSD avoidance symptom score, whole sample included (n= 409).

[d]PTSD hyperarousal symptom score, whole sample included (n= 409).

*p < .05.

**p < .01.

***p < .001.

Table 4:

Odds Ratios of Having Frequent Headaches/Migraines at Baseline for Posttraumatic Stress Disorder (PTSD) Symptom Scores and Covariates

	Odds ratios of having frequent headaches/migraines at baseline			
	Model 1[a]		Model 2[b]	
Variable	*OR*	95% CI	*OR*	95% CI
Impact of Event Scale Avoidance score	.87	[.59, 1.30]		
Impact of Event Scale Hyperarousal score	1.54	[.92, 2.56]		
Impact of Event Scale Intrusion score	.71	[.41, 1.21]		
Impact of Event Scale total score (transformed to 0–4 scale)			.96	[.72, 1.29]
Household received food stamps at baseline	1.11	[.60, 2.05]	1.07	[.58, 1.96]
Household received cash assistance/welfare at baseline	1.39	[.63, 3.03]	1.39	[.64, 3.05]
Household received unemployment benefits at baseline	.55	[.12,2.48]	.57	[.13,2.55]
Race/ethnicity (Non-Hispanic White = reference)				
Non-Hispanic Black	.61	[.26, 1.44]	.62	[.26, 1.45]
Hispanic	1.63	[.33,8.01]	1.83	[.38, 8.83]
Other race/ethnicity	2.26	[.44, 11.56]	2.26	[.44, 11.49]
Age in years	1	[.93, 1.06]	1	[.94, 1.06]
Home flooding depth (inches)	.96	[.83, 1.10]	.96	[.84, 1.10]

Note. OR = odds ratio; CI = confidence interval.

[a] PTSD symptoms represented by cluster scores, whole sample included ($n = 409$).

[b] PTSD symptoms represented by total score, whole sample included ($n = 409$).

* $p < .05$.

** $p < .01$.

*** $p < .001$.