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PTSD in Vietnamese Americans Following Hurricane Katrina: Prevalence, Patterns, and Predictors

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Abstract

One year after Hurricane Katrina devastated New Orleans, we assessed 82 adults from a population-based sample of the Vietnamese American community who had participated in a larger study of immigration weeks before the disaster. Although 21% met criteria for partial PTSD, only 5% of the sample met all PTSD criteria. Avoidance/numbing symptoms did not form a coherent cluster and were seldom confirmed, but intrusion, arousal, and interference were common. Severity of exposure to the flood waters, property loss, and subjective trauma were independently related to PTSD symptoms. Symptoms were highest among participants who were low in acculturation or who had high Katrina exposure in combination with prolonged stays in transition camps during emigration.

On August 29, 2005, Hurricane Katrina caused catastrophic damage on the Gulf Coast and over 1,000 deaths in Louisiana alone. The levee failures in New Orleans flooded a large sector of the city, including the principal Vietnamese enclave, resulting in the evacuation and displacement of its entire population (Vu, VanLandingham, & Do, 2008). Approximately one year postdisaster, we undertook a study of the consequences of Hurricane Katrina on the Vietnamese American community. We believed such a study could contribute to the disaster and trauma literature in three primary ways.

First, the present study should add to the body of knowledge about the effects of disaster on ethnic minority communities. In general, the empirical research on posttraumatic stress disorder (PTSD) among minorities is inadequate, but existing studies indicate that immigrants and particular ethnic groups often fare worse after disasters than persons who are of majority group status (for a review, see Norris & Alegria, 2005). After an earthquake in Australia, for example, non-English-speaking immigrant survivors showed significantly higher levels of PTSD symptoms and general distress than a matched sample of Australian-born survivors (Webster, McDonald, Lewin, & Carr, 1995). The authors discussed the possibility that limited acculturation may have exacerbated the impact of displacement, but did not directly measure the sample's level of acculturation. Similarly, after Hurricane Andrew, Spanish-prefering Latinos showed much higher PTSD symptom levels than did either English-prefering Latinos or non-Hispanic White participants, who did not differ (Perilla, Norris, & Lavizzo, 2002). In this study, ethnic differences in PTSD were partially explained by differences in acculturative stress, which was strongly related to PTSD. Together, these studies suggest that the Vietnamese American community in New Orleans may be at risk for adverse mental health outcomes, but other reports suggest that this might not be the case. The self-reliance of the Vietnamese American community in New Orleans

received considerable media attention after Hurricane Katrina (Chen, 2006; Leong, Airriess, Li, Chia-Chen Chen, & Keith, 2007; Shafte, 2006), and earlier research (Zhou & Bankston, 1998) has highlighted the strengths afforded by the community's close-knit character and residents' shared ethnic/cultural identity. The design of the present population-based study allowed us to examine how the Vietnamese American community fared overall and how individual differences in pre-event acculturation influenced post-event PTSD.

To our knowledge, only one previous study has specifically studied disaster effects among Vietnamese Americans. Chen et al. (2007) examined predictors of current PTSD symptoms (as measured by the Impact of Event Scale – Revised) in a convenience sample of Vietnamese American adults assessed an average of 7 months after Hurricane Katrina (range: February 2006 – February 2007). The study was important for showing the strong effect of financial strain on past-week symptoms, but did not examine other aspects of exposure or the phenomenology of postdisaster PTSD in this cultural group.

If one considers trauma rather than disasters *per se*, there is a larger body of research on Vietnamese Americans. Although clinical samples (e.g., Kinzie et al., 1990) and former political detainees (e.g., Mollica et al., 1998) have shown high prevalence of PTSD, population studies suggest that most immigrants have recovered from their traumatic experiences surrounding the war and their departure from Vietnam (Steel, Silove, Phan, & Bauman, 2002). The National Latino and Asian American Study (NLAAS), conducted in the U.S. using the Composite International Diagnostic Interview (CIDI), found negligible rates of PTSD in a nationally representative sample of 502 Vietnamese immigrants: 1.5% met lifetime criteria and 0.6% met past-year criteria (personal communication, David Takeuchi, December 1, 2007). Despite the important contributions of these studies, they are limited by their retrospective designs and/or focus on events in the distant past. Our study is unusual in its focus on PTSD among Vietnamese immigrants so close in time (approximately one year) to the traumatic event.

Second, the study of Vietnamese immigrants is of interest not only because it increases the inclusiveness and diversity of disaster research but also because it affords the opportunity to increase cross-cultural understanding of PTSD (e.g., Marsella, Friedman, & Spain, 1996; Phan & Silove, 1997). Addressing the phenomenology of PTSD requires us to go beyond the mere reporting of summary statistics, e.g., frequency of respondents meeting all DSM-IV criteria, to include an assessment of the patterns of symptoms acknowledged by the cultural group. Published empirical research on this question is rare but implies that the arousal dimension is most critical in the Vietnamese. In Mollica et al.'s (1998) study, arousal was most highly related to torture experience and most prevalent. The arousal dimension of the Harvard Trauma Questionnaire performed as well as the entire measure in detecting PTSD cases in a structured clinical interview (Smith Fawzi, Murphy, et al., 1997). For increasing phenomenological understanding, having data closer in time to the traumatic event could be especially useful. We examined the relative frequency of different PTSD symptoms and the strength of their relations to Katrina-related trauma.

Third, postdisaster research on Vietnamese immigrants promises to shed light on a longstanding assumption that prior trauma or adversity is a risk factor for PTSD related to a subsequent disaster. The evidence for this relationship is actually mixed, with some studies finding an adverse effect (Neria et al., 2006), others finding an inoculation effect (Norris & Murrell, 1988), and others finding no effect of exposure to severe stress in the past (Norris, Perilla, Riad, Kaniasty, & Lavizzo 1999). This lack of consistency in outcomes could be partially attributable to methodological challenges. In most disaster studies, "past trauma" refers to any one of a variety of past events occurring to different people at different times, and the events may or may not have been relevant to the disaster experience. Many

Vietnamese Americans in New Orleans experienced war-related displacement and lived for varying periods of time in transition camps that were at least in some cases tremendously stressful. In a large survey of Southeast Asian refugees in Canada, Beiser, Turner, and Ganesan (1989) found adverse effects of both camp location (those in Thailand being the most severe) and length of internment on current depressive symptoms. Although these “main effects” dissipated over time, our hypothesis is that past adversities interact with the severity of recent adversities to predict well-being. While there are substantial differences between the experiences of a refugee and those of a disaster victim, the relevance of this past adversity (evacuation from danger, loss of home, displacement) to the present one (evacuation from danger, loss of home, displacement) provided a compelling context in which to test the influence of prior experience on postdisaster symptoms of traumatic stress.

In summary, we aimed in this paper (a) to broaden the diversity of disaster research by determining the prevalence of Katrina-related PTSD and the influence of acculturation in a highly exposed population-based sample of Vietnamese immigrants who were assessed with the same instrument (CIDI for DSM-IV) that was used in the NLAAS; (b) to explore the phenomenon of PTSD in this cultural group by considering the patterns of PTSD symptoms and the strength of their relations with trauma exposure; and (c) to test the interactive effects of past and recent adversity, thereby addressing the long-standing question of whether prior relevant experience is a risk or protective factor for disaster victims.

The 82 participants in this study were originally interviewed a few weeks before Hurricane Katrina as part of a larger study on immigration. Although the sample was small, the study’s power was enhanced by several factors: the fact that this sample is population-based; our ability to control for predisaster functioning; and the magnitude of the stressors many people experienced. Studies of special populations are often by necessity small, but only they can fill the gaps created by the larger population studies that are generally limited to English and Spanish speaking adults.

Method

Participants

In the original study, households including Vietnamese-American working-age adults living in New Orleans were identified using a May 2005 register of Vietnamese American families that is maintained by the principal Catholic Church and principal non-governmental organization (NGO) in the area. This register includes both Catholic and non-Catholic Vietnamese American families. The investigators extracted from the population register a representative sample of households that appeared to contain at least one eligible respondent, i.e., someone who was between the ages of 25–49 and was born in Vietnam. These criteria were chosen because of the main objective of the original research, which was to examine the impact of international migration upon the health of immigrants who had lived substantial portions of their lives both in Vietnam and in the U.S. The 125 participants (73% response rate) were interviewed in June or July 2005, 1–3 months before Hurricane Katrina.

One year post-Katrina, we interviewed 82 (66%) of the original participants. Only two persons refused to be interviewed, with the rest of the attrition due to failure to locate the person (nearly all of these had not yet returned to the area). The participants were given a gift card for use at a local home building supply store or at a local retailer for their time. Although all participants were displaced for an extended period, 59 (72%) were again living at their pre-hurricane residence at the time of the interview, 17 (21%) were visiting and working on their homes, and 6 (7%) were interviewed elsewhere, all but 2 in or near New Orleans. Whereas our study is biased towards past residents who had the intention and

capacity to return to New Orleans, the 82 post-Katrina participants did not differ statistically (all χ^2 or t values *ns*) from the 45 original participants we were unable to re-interview in percentage of women, mean age or education, mean acculturation score, or means on any of the eight pre-Katrina health scales of the Short Form 36 (measures described below).

Both the original and post-Katrina interviews were conducted in Vietnamese (93%) or English (7%), as preferred by the respondent, by local Vietnamese American residents working at one of the principal NGOs in the area or by Vietnamese graduate students studying at Tulane University. At the time of Katrina, participants averaged 42 years of age ($SD = 5$, range 28–52) and had lived in the U.S. an average of 26 years ($SD = 5$, range 8–31). At the time of immigration, they averaged 16 years of age ($SD = 6$, range 6–38). Other characteristics of the sample are presented in Table 1.

Measures

Background measures—Age and education were measured in years. Pre-Katrina mental health was measured at baseline (pre-Katrina) with the Mental Component Score (MCS) of the Short Form 36 (SF-36; in this sample, $\alpha = .92$). As described by Ware and Kosinski (2001), the MCS was scored as a weighted composite (based on factor loadings) of the eight standardized scales of the SF-36, which gives larger, positive weights to the Mental Health (.49 MH), Role-Emotional (.43 RE), Social Functioning (.27 SF), and Vitality (.24 VT) scales and smaller, negative weights to the General Health Perceptions (−.02 GH), Role-Physical (−.12 RP), Bodily Pain (−.10 BP), and Physical Functioning (−.23 PF) scales. Pre-Katrina scores in this sample were at national norms on PF, BP, VT, and SF, below norms on GH and MH, $t_s(81) > 3.43$, $p < .01$, and above norms on RP and RE, $t_s(81) > 2.74$, $p < .01$.

PTSD was not measured at baseline. The original study provided little information about trauma exposure, but it did assess the length of time spent in transition camps following emigration from Vietnam. This measure was used as proxy for the severity of adversity related to participants' departure (Beiser et al., 1989). Because of the non-normal distribution of the measure, it was coded into four categories, < 1 month, 1–5 months, 6–11 months, and 12 months or longer (see Table 1).

Acculturation was measured at baseline with an 8-item scale of preferences for Vietnamese vs. English or American language, social relationships, and food adapted from Anderson et al. (1993). (A ninth item, language for speaking with parents, was dropped because of limited variability.) All items were coded so that 1 = *only or mostly Vietnamese*, 2 = *Vietnamese and English/American equally*, and 3 = *only or mostly English/American*. The scale was scored as the mean of valid items multiplied by 8 (the equivalent of a sum, but adjusted for missing data at the item level) and had an alpha in this sample of .79. A detailed examination of item and scale frequencies revealed that higher scale scores in this sample were reflective of biculturalism, rather than assimilation into American culture. Whereas 70% of participants answered at least two questions by saying they had an equal preference for Vietnamese and English or American culture, only 7% answered two or more questions with a “mostly” or “only” preference for English/American culture (67% answered no question with a “mostly” or “only” English/American preference). In contrast, 88% answered at least two questions by saying they had preference for Vietnamese language or culture “mostly” or “only.”

Disaster and trauma exposure—We used three measures of disaster and trauma exposure (see Table 1). In the *Diagnostic and Statistical Manual of Mental Disorders*, Version IV, the American Psychiatric Association (APA, 1994) defined a traumatic event as one in which both of the following were present: “(1) the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious

injury, or a threat to the physical integrity of self or others (Criterion A1), and (2) the person's response involved intense fear, helplessness, or horror." (Criterion A2) (pp. 427–428). We refer to these dimensions, respectively, as objective trauma and subjective trauma. Objective trauma categorized persons in terms of their direct contact with the flood waters. Most participants (79%) evacuated from New Orleans before the hurricane struck, but the remainder evacuated after the levees breached (see Table 1). Loss was measured with the question, "Overall, how would you categorize the damages to your house and property because of the storm?" answered on a 5-point scale: *none or minimal damage, slight damage, moderate damage, severe damage, or total destruction*. Damage to home and property was extreme and pervasive (see Table 1).

Subjective trauma was measured by two questions on the CIDI PTSD module that assess Criterion A2 (terror/horror, helplessness); 74% of participants acknowledged one or both of these experiences. The strong sex difference, with all women but one reporting subjective trauma compared to 64% of the men, created almost a complete confound between sex and Criterion A2. Thus we created a combined categorical variable with three levels: untraumatized men ($n = 20$), traumatized men ($n = 36$), and traumatized women ($n = 25$).

PTSD—Past-year PTSD related to Hurricane Katrina was measured by a modified version of Module K of Version 2.1 of the Composite International Diagnostic Interview (CIDI), developed by the World Health Organization (WHO, 1997). The CIDI has been used widely in prior epidemiologic studies, including the NLAAS. The CIDI assesses all DSM-IV Criteria for PTSD (APA, 1994) as they emerge after a specified event.

Partial PTSD has been defined in various ways in past research. Commonly, investigators require that Criteria A (exposure), E (duration), and F (interference) be met, but ease Criteria B (intrusion), C (avoidance/numbing), and D (arousal) by requiring (a) 2 of the 3 symptom criteria be met, (a) B plus either C or D, or (c) one symptom from each cluster (see, for example, Breslau, Lucia, & Davis, 2004; Grubaugh et al., 2005; Mylle & Maes, 2004; Schnurr, Lunney, Sengupta, & Spiro, 2005). Because we were especially concerned with the construct validity of Criterion C in this sample (as shown in Results, the only prevalent C symptom correlated more highly with D symptoms than with other C symptoms), we defined partial PTSD as B plus either C or D (synonymous with B and D, in this case), together with E and F. We omitted A2 because we were examining relations between subjective trauma and other criteria.

Continuous measures of posttraumatic stress were created by counting the number of affirmative responses to intrusive symptoms (Count B, range 0–5), avoidance/numbing symptoms (Count C, range 0–7), arousal symptoms (Count D, range 0–5), and all symptoms (Count BCD, range 0–17). Psychometric data are presented in results.

Data Analysis

We present frequencies of participants meeting all and partial criteria, each criterion, and each symptom of PTSD. Because of the modest sample size, most statistical tests were conducted using the continuous measures. Because of the nature of the dependent variable (a count of PTSD symptoms), we initially specified a Poisson distribution for the regression analyses (general linear model in SPSS) and relied heavily on Gagnon, Doron-LaMarca, Bell, O'Farrell, and Taft (2008) for guidance. Model 1 included only background variables. Education was substantially correlated with acculturation ($r = .43, p < .001$) and explained no variance in the number of PTSD symptoms when acculturation was controlled, $\chi^2 < 1$. Thus the four background variables studied in the final analysis were pre-Katrina mental health (MCS), time in transition camp, age, and acculturation. In addition to the background variables, Model 2 included the two measures of objective exposure, and Model 3 included

subjective exposure. Subjective exposure was expressed as two dummy variables, with untraumatized men serving as the reference category. The first contrast, traumatized men, captures the effect of subjective trauma on PTSD symptoms among men, whereas the second, traumatized women, captures the combined effects of trauma and being female, which cannot be separated in these data. The final model (Model 4) additionally included two interaction terms. Although many studies have included “past trauma” as a covariate (main effect) in regression analyses, the influence of past experience on disaster-specific PTSD is more appropriately conceptualized as an interaction, wherein past adversity modifies the effects of recent adversity. Interaction terms were scored as the product of mean deviations, which reduces their correlations with the component measures. As outlined here, the study questions required 10 predictors of PTSD symptoms. Although this exceeds the “rule of thumb” of 10 participants per predictor variable, the rule was violated only in the last model (Model 4) when the interaction terms were entered. The overall stability of the results between Steps 3 and 4 lent confidence that this violation was not a problem. Two people were excluded from analysis due to missing data, including the one woman who did not meet Criterion A2.

Preliminary analyses showed overdispersion, with overly large values on the deviance, one of the indicators of model fit, which should approach 1.0. Fit was improved by changing the specification of the distribution from Poisson to negative binomial, as recommended by Gagnon et al. (2008). For example, Model 1 deviance χ^2/df was 2.99 when estimated with a Poisson distribution, and 0.99 when estimated with a negative binomial distribution.

Results

Prevalence of PTSD Symptoms and Criteria in the Total Sample

Table 2 shows the alphas and means on PTSD measures. The alphas were adequate except for Criterion C. The low alpha was attributable to C4, “loss of interest in usual activities,” which was negatively correlated to the total. Arousal was the most internally consistent cluster of symptoms and the most prevalent. Participants averaged two arousal symptoms, one intrusion symptom, and one avoidance symptom (< 1 if loss of interest is omitted).¹

Table 3 shows percentages experiencing each specific PTSD symptom and meeting each criterion. In the total sample, 46% met Criterion B by showing one of more symptoms of intrusion. By far, the most prevalent symptom was intrusive thoughts (41%). In contrast, only 7% met Criterion C by showing three or more symptoms of avoidance or numbing. The only highly frequent symptom in this cluster was loss of interest, which was not related to the other C symptoms. Omitting this symptom from the algorithm did not greatly change the results (6% prevalence vs. 7%). Few respondents reported efforts to avoid people, places, or thoughts that reminded them of the event, even though these symptoms are often common even among people who do not meet Criterion C.² Almost half (49%) of the sample met

¹Although this sample was too small to produce generalizable factor analysis results, the low internal consistency of Criterion C suggested that an exploratory principle components analysis would be helpful in understanding the relationships of items within this sample. All factor loadings referred to here were $\geq .56$. Criterion C items distributed across four factors: C4 (loss of interest) loaded with arousal items to create a very strong factor explaining 31.5% of the scale variance; C1 (avoidance of thoughts) and C2 (avoidance of people/places) loaded with intrusion items explaining 14.9% of the variance; C5–C7 (estrangement, emotional numbing, foreshortened future) loaded together as a numbing factor explaining 9.2% of the variance; and C3 (amnesia) created a weak, single-item factor explaining 6.1% of the variance. In Smith Fawzi, Pham, et al.’s (1997) factor analysis ($n = 73$) avoidance of activities loaded on arousal, and avoidance of thoughts created its own single-item factor; loss of interest, however, did load appropriately with other indicators of numbing.

²For example, the CIDI was used in a study of Mississippi Katrina victims. Among persons living south of I-10 ($n = 272$), 39% reported C1 and 23% reported C2 (compared to 6 and 9% in this Vietnamese American sample). However, loss of interest was the most common C symptom and equally prevalent in both samples (43% Mississippi vs. 44% Vietnamese American) (personal communication, Sandro Galea and Melissa Tracy, November 27, 2007).

Criterion D by showing two or more arousal symptoms. Hypervigilance was most frequent (63%). Two-thirds (67%) of the sample met Criterion E (duration of at least one month), and one third (36%) met Criterion F (impaired functioning). Thus all criteria were highly common except Criterion C, which was rare. Approximately one-fourth of the sample (26%) met partial or full PTSD criteria, which did not require C if D was present, but only 5% met all PTSD criteria (4% if loss of interest is omitted). Twenty persons (24%) met partial or full criteria when A2 was included in the partial-PTSD algorithm. Onset occurred within one week for 80% of partial or full PTSD cases. Only two participants (both in the partial PTSD group) reported current symptoms at one year post.

PTSD Symptoms and Criteria by Subjective Trauma and Sex

Tables 2 and 3 also provide breakdowns of the data by subjective trauma (PTSD Criterion A2) and sex. A strong relationship between trauma exposure and the symptom helps to establish that the symptom is a consequence of trauma exposure and thus a meaningful indicator of PTSD as opposed to general distress. There was a strong between-group difference for the total number of PTSD symptoms, with untraumatized men averaging the fewest symptoms (1.5), traumatized women averaging the most symptoms (5.8), and traumatized men meeting being in-between (3.2). The results were comparable for Criteria B and D, but there was no difference between groups on Criterion C without C4. Percentages meeting all or partial PTSD criteria were 52% among traumatized women, 19% among traumatized men, and 5% among untraumatized men. Thus, in general, the data establish a link between the subjective experience of trauma and reported symptoms, although this was less true for Criterion C.

Predictors of PTSD Symptoms

Primary model for total number of symptoms—The regression analysis predicting the total number of Katrina-related PTSD symptoms is shown in Table 4. Model 1 included only the background variables. Neither pre-Katrina mental health nor time spent in transition camps was significantly related to the dependent variable, but age had an adverse effect. The age range of this sample is 28–52; thus the age effect essentially places middle age adults at higher risk relative to young adults. Acculturation, the strongest predictor, was inversely related to symptoms. Given the distribution of scores on this measure, this finding indicates that bicultural participants (equal preferences for Vietnamese and American language and culture) experienced fewer PTSD symptoms than did participants with stronger preferences for Vietnamese language and culture.

Model 2 included objective exposure variables as well as the background variables. Both severity of exposure to the flood waters and severity of property damage were independently related to the number of PTSD symptoms, although the effect of the latter was stronger. Model 3 also included subjective exposure variables that captured whether the participant experienced terror, horror, or helplessness related to Katrina. With untraumatized men serving as the reference category, significant effects emerged for both contrasts, traumatized men and traumatized women.

Two interaction terms were included in the final model, Model 4. The interaction between property damage (recent adversity) and time in transition camp (past adversity) was significantly associated with the number of PTSD symptoms. When the interaction was plotted using the nonstandardized coefficients from Table 4 (Aiken & West, 1991), it was shown to be synergistic in form. The difference between high and low property loss was one symptom given low time in transition camp but two symptoms given high time in transition camp.

Models for separate criteria—When the analyses were repeated for the subscales, there were some differences. For Criterion B (re-experiencing), there was no effect of acculturation. Subjective trauma exposure had, by far, the strongest associations with symptoms: for traumatized men, $B = 1.33$, $SE B = 0.46$, $p < .01$; for traumatized women, $B = 2.17$, $SE B = 0.43$, $p < .001$. Severity of property damage had a marginal main effect on symptoms, $B = 0.33$, $SE B = 0.17$, $p < .06$, but no interactive effect.

In the model for Criterion C (avoidance/numbing, with C4 omitted), the only variable that was even marginally predictive was subjective exposure, specifically the contrast, traumatized women, $B = 1.03$, $SE B = 0.56$, $p = .07$.

In the model for Criterion D (arousal), acculturation was inversely associated with symptoms, $B = -0.09$, $SE B = 0.03$, $p < .01$. Subjective trauma again showed strong effects: for traumatized men, $B = 0.83$, $SE B = 0.30$, $p < .01$; for traumatized women, $B = 1.19$, $SE B = 0.30$, $p < .001$. As in the primary analysis, there was an interaction between past and recent adversity specific to property loss, $B = 0.27$, $SE B = 0.13$, $p < .05$.

Supplemental analysis—We tested one final regression model for the total number of PTSD symptoms that included all of the variables from the primary analysis except that the interaction terms crossing exposure and past adversity (time in transition camp) were replaced by interaction terms crossing exposure and acculturation. As in the primary analysis, acculturation showed a main effect, $B = -0.10$, $SE B = 0.03$, $p < .01$, but neither interaction term was associated with PTSD symptoms. Thus the protection afforded by bicultural identity did not appear to be confined to persons with either lesser or greater exposure to Katrina.

Discussion

Hurricane Katrina afflicted New Orleans' Vietnamese Americans badly, causing many to experience displacement, severe property loss, and trauma. A past-year PTSD prevalence of 5% is within the range of results from previous disaster studies (Galea, Nandi, & Vlahov, 2005) and compared to the NLAAS base rate of $< 1\%$, it could be considered substantial. However, it is strikingly low when compared to the results from the Hurricane Katrina Community Advisory Group (CAG), which concluded that the prevalence of PTSD among pre-hurricane residents of New Orleans was approximately 30% (Galea et al., 2007).

Two explanations of the low prevalence of PTSD in this sample need to be considered. The first possibility is that PTSD was under-diagnosed because of issues related to Criterion C. Avoidance/numbing symptoms did not form a coherent cluster and, except for "loss of interest in usual activities" (C4), were seldom confirmed. Moreover, the number of Criterion C symptoms was unrelated to severity of exposure in the regression analysis. It is not unusual in disaster research for Criterion C to be met less often than other criteria (Norris et al., 2002), but our results are more extreme than usual. Other studies of Vietnamese American samples have also reported lower prevalence and internal consistency of avoidance/numbing symptoms, especially relative to the prevalence and diagnostic accuracy of arousal symptoms (Smith Fawzi, Murphy, et al., 1997).

PTSD symptoms other than avoidance/numbing were frequent in this sample and were meaningfully related to trauma exposure, suggesting they were not simply measures of general distress. They related to sex and age in ways that were consistent with past research (Norris et al., 2002). Our findings of elevated risks for middle-aged adults (who bear much of the household leadership burden) and for those who suffered severe property losses have been reported in other research focusing on the mental health impacts of Katrina (Sastry &

VanLandingham, 2008). Despite limited power, we detected theoretically meaningful interactions between recent and past adversity in predicting PTSD. When partial PTSD, which does not require C if D is present, was considered together with full PTSD, the prevalence was substantial (26%) and much closer to the CAG study result (30%).³ However, all but two of the participants who met either full or partial PTSD criteria reported that the symptoms had dissipated within the year since the event. Thus, even if PTSD was prevalent for some time, the weight of the evidence points to quick recovery, i.e., resilience.

Various protective factors of the Vietnamese American community in New Orleans may have fostered resilience. Members of this community have strong family, social, and economic ties not only to each other but to other Vietnamese Americans living outside of the affected area (Zhou & Bankston, 1998). As news of Katrina's devastation spread, Vietnamese Americans across the country contributed to relief work via NGOs and religious organizations. Rates of return during the first year post-Katrina were higher for Vietnamese residents of New Orleans than for other groups (Vu, VanLandingham, & Do, 2008), which also speaks to their psychological and social strengths. However, while the community as a whole showed strengths, our analyses indicated that more traditional members of the community (i.e., those low in acculturation) fared less well than did bicultural members, suggesting, as did Webster et al. (1995) and Perilla et al. (2002), that the ability to function in both the culture of origin and the host culture promotes the abilities of immigrants to recover from the impact of major disasters.

In summary, our results are open to more than one interpretation, but the two explanations are not as discrepant as they may at first appear. Despite some issues, the weight of the evidence has indicated that PTSD is a meaningful outcome to study among Vietnamese Americans, and partial PTSD was prevalent enough after Hurricane Katrina to raise concerns about the community's mental health needs during that first stressful year. Additional research on the meaning, modes of expression, and measurement of Criterion C is warranted. The most serious effects occurred among participants who were most traditional in their cultural preferences or who had experienced greater adversity during emigration from Vietnam, findings that may be relevant for future efforts to serve immigrant communities after disasters (see Kaplan & Kim Huymh, 2007). Yet it also appears that this community's trauma-related outcomes were less severe than they might have been given the severity of stressors most people experienced and other research findings from Hurricane Katrina. This implies some protective features related to being Vietnamese.

Our study had important shortcomings. The sample was small, which limited both the number of factors we could legitimately examine and the statistical procedures we could employ. The confounding of sex and subjective trauma added complexity to our design. The original study provided little data on past trauma or PTSD. It is possible that participants who were particularly avoidant were least likely to return to New Orleans, which could introduce a source of bias.

These issues notwithstanding, the study also had several strengths. The prospective design allowed us to control for predisaster mental health; it is notable that this variable had little to do with postdisaster symptoms of PTSD. We had a reasonable response rate from a population-based sample, and while we cannot rule out selection biases, we do know that there was no selection with regard to pre-Katrina acculturation or health. We used the CIDI PTSD module, which assessed all DSM-IV criteria for PTSD and allowed comparisons with

³Although clinically validated in a subset of the CAG sample ($n = 40$), the measure used in the CAG included only intrusion and arousal symptoms (Galea et al., 2007). The difference between the two measures prevented us from making more precise comparisons of symptom prevalence, particularly as they related to Criterion C.

the NLAAS. The issues with Criterion C may be troubling, but at least we were able to ascertain that these issues exist. The strengths of the effects compensated for the small sample size so that we were able to detect effects of particular interest, such as the interactions between past and recent adversities. Altogether, we believe that this study enhances understanding of the consequences of disasters on immigrants and cultural minority groups who have been understudied in past research.

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Table 1

Sample Characteristics and Trauma Exposure by Sex (N = 82)

	Men (n = 56)		Women (n = 26)		All (N = 82)	
	n	%	n	%	n	%
Pre-Katrina demographic characteristics						
Religion						
Catholic	52	92.9	24	92.3	76	92.7
Buddhist	2	3.6	2	7.7	4	4.9
None	2	3.6	0	0	2	2.4
Education						
< 12 years	22	39.3	9	34.6	31	37.8
12 years	16	28.6	10	38.5	26	31.7
> 12 years	18	32.1	7	26.9	25	30.5
Occupation						
Unemployed	3	5.5	3	13.6	6	7.8
Unskilled work	14	25.5	3	13.6	17	22.1
Skilled work	24	43.6	6	27.3	30	39.0
Professional/entrepreneur	14	25.5	10	45.5	24	31.2
Marital status						
Never married	6	10.7	0	0	6	7.3
Married	47	83.9	23	88.5	70	85.4
Formerly married	3	5.4	3	11.5	6	7.3
Immigration characteristics						
Time in transition camp						
< 1 month	9	16.1	8	30.8	17	20.7
1–5 months	16	28.6	7	26.9	23	28.0
6–11 months	19	33.9	9	34.6	28	34.1
12 months or longer	12	21.4	2	7.7	14	17.1
Year of entry into US						
1975–1976	20	36.4	11	42.3	31	38.3
1977–1979	9	16.4	2	7.7	11	13.6

	Men (<i>n</i> = 56)		Women (<i>n</i> = 26)		All (<i>N</i> = 82)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
1980–1987	20	36.4	9	34.6	29	35.8
1988–1999	6	10.9	4	15.4	10	12.3
Hurricane Katrina experiences						
Objective trauma (flood exposure)						
Evacuated before hurricane	46	83.6	18	69.2	64	79.0
Escaped on foot or car, kept dry	6	10.9	2	7.7	8	9.9
Swam or rescued (boat/helicopter)	3	5.5	6	23.1	9	11.1
Damage to home/property						
Slight	11	19.6	3	11.5	14	17.1
Moderate	16	28.6	7	26.9	23	28.0
Severe	21	37.5	13	50.0	34	41.5
Total	8	14.3	3	11.5	11	13.4
Subjective trauma						
Met PTSD Criterion A2	36	64.3	25	96.2	61	74.4

Table 2

Mean Number of PTSD Symptoms by Sex and Subjective Trauma

Measure	α	Untraumatized men (men not meeting Criterion A2, $n = 20$)			Traumatized men (men meeting Criterion A2, $n = 36$)			Traumatized women (women meeting Criterion A2, $n = 25$)			All			
		M	SD	Range	M	SD	Range	M	SD	Range	M	SD	Range	$F(2, 78)$
Count BCD	.85	1.5 ^a	2.3	0-7	3.2 ^a	2.9	0-9	5.8 ^b	3.7	0-16	3.6	3.4	0-16	11.89**
Count B	.67	0.2 ^a	0.4	0-1	0.6 ^a	0.9	0-3	1.6 ^b	1.4	0-5	0.8	1.1	0-5	12.20**
Count C	.55	0.5 ^a	0.8	0-2	0.8 ^{ab}	0.8	0-3	1.2 ^b	1.5	0-6	0.8	1.1	0-6	3.39*
Count C w/o C4	.74	0.2	0.4	0-1	0.3	0.6	0-3	0.7	1.5	0-6	0.4	1.0	0-6	1.80
Count D	.84	0.9 ^a	1.3	0-4	1.8 ^a	1.8	0-5	3.0 ^b	1.8	0-5	1.9	1.8	0-5	9.30**

Note. Count B = number of intrusive symptoms. Count C = number of avoidance/numbing symptoms. D = number of arousal symptoms. Groups sharing superscripts did not differ in Bonferroni post-hoc tests (conducted only if Omnibus F significant at $p < .05$).

* $p < .05$.

** $p < .01$.

Table 3

PTSD Symptoms and Criteria by Sex and Subjective Trauma

	Untraumatized men (n = 20)		Traumatized men (n = 36)		Traumatized women (n = 25)		All	
	n	%	n	%	n	%	n	%
Criterion B (1+ symptoms)	3	15.0 ^a	14	38.9 ^b	20	80.0 ^c	37	45.7
B1. Intrusive thoughts	3	15.0	13	36.1	17	68.0	33	40.7
B2. Nightmares	0	0	2	5.6	3	12.0	5	6.2
B3. Re-experiencing	0	0	3	8.3	8	32.0	11	13.6
B4. Upset over reminders	0	0	2	5.6	5	20.0	7	8.6
B5. Physiological reactivity	0	0	2	5.6	6	24.0	8	9.9
Criterion C (3+ symptoms)	0	0	2	5.6	4	16.0	6	7.4
C1. Avoided thoughts	0	0	2	5.6	5	20.0	7	8.6
C2. Avoided people/places	1	5.0	2	5.6	2	8.0	5	6.2
C3. Amnesia	0	0	2	5.6	2	8.0	4	4.9
C4. Loss of interest	5	25.0	18	50.0	13	52.0	36	44.4
C5. Estrangement	0	0	1	2.8	2	7.4	3	3.7
C6. Emotional numbing	2	10.0	2	5.6	3	12.0	7	8.6
C7. Foreshortened future	1	5.0	0	0	4	16.0	5	6.2
Criterion D (2+ symptoms)	5	25.0 ^a	17	47.2 ^b	18	72.0 ^c	40	49.4
D1. Trouble sleeping	6	30.0	12	33.3	16	64.0	34	42.0
D2. Irritability	2	10.0	12	33.3	15	60.0	29	35.8
D3. Trouble concentrating	2	10.0	9	25.0	14	56.0	25	30.9
D4. Hyper-vigilance	7	35.0	24	66.7	20	80.0	51	63.0
D5. Startle	0	0	8	22.2	10	40.0	18	22.2
Criterion E (duration)	6	30.0 ^a	27	75.0 ^b	21	84.0 ^b	54	66.7
Criterion F (interference)	5	25.0 ^a	9	25.0 ^a	15	60.0 ^b	29	35.8
Partial or full PTSD	1	5.0	7	19.4 ^a	13	52.0 ^b	21	25.9
Full PTSD (all criteria A-F)	0	0	1	2.8	3	12.0	4	4.9
								3.57

Note. Single *df* tests were conducted only when valid and only at the criterion level; groups sharing superscripts did not differ.

*
 $p < .05$,
**
 $p < .01$.

Table 4

Trauma Exposure and Katrina-Related PTSD Symptoms: Results of Poisson (Negative Binomial) Regression Analyses (n = 80)

	Model 1			Model 2			Model 3			Model 4		
	B	(SE B)	χ^2	B	(SE B)	χ^2	B	(SE B)	χ^2	B	(SE B)	χ^2
Background variables												
Pre-Katrina mental health	-0.04	(0.13)	< 1	-0.08	(0.13)	< 1	-0.20	(0.14)	1.99	-0.22	(0.14)	2.58
Time in transition camp	-0.07	(0.12)	< 1	-0.09	(0.11)	< 1	0.04	(0.12)	< 1	0.02	(0.11)	< 1
Age	0.05	(0.02)	5.14*	0.05	(0.02)	4.37*	0.04	(0.02)	5.31*	0.05	(0.02)	7.15**
Acculturation	-0.12	(0.04)	10.48***	-0.11	(0.03)	10.25***	-0.10	(0.03)	9.55***	-0.08	(0.03)	7.01**
Objective exposure to Katrina												
Exposure to flood waters				0.272	(0.137)	3.95*	0.27	(0.14)	3.91*	0.16	(0.16)	1.08
Severity of property damage				0.431	(0.116)	13.85***	0.41	(0.11)	14.43***	0.32	(0.13)	5.74*
Subjective trauma exposure												
Traumatized men							0.91	(0.28)	10.38***	0.90	(0.29)	9.99**
Traumatized women							1.40	(0.28)	24.32***	1.41	(0.29)	23.80***
Interactions												
Flood exposure by time in transition camp										-0.06	(0.12)	< 1
Property damage by time in transition camp										0.23	(0.12)	3.90*
Model statistics												
Deviance χ^2/df = ratio	74.08/75 = 0.99			64.42/73 = 0.88			52.60/71 = 0.74			50.61/69 = 0.73		
Pearson χ^2/df = ratio	51.93/75 = 0.69			45.01/73 = 0.62			38.94/71 = 0.55			37.88/69 = 0.55		
Omnibus test likelihood ratio $\chi^2 (df)$	$\chi^2 (4) = 13.59^{**}$			$\chi^2 (6) = 23.24^{***}$			$\chi^2 (8) = 35.07^{***}$			$\chi^2 (10) = 37.06^{***}$		

Note. PTSD = posttraumatic stress disorder. The dependent variable is the number of B, C, and D symptoms, which had a potential range of 0 – 17 and an actual range of 0 (25%) to 16 (1%). Model omnibus test is against intercept-only model. Subjective trauma exposure was a categorical variable with untraumatized men as the reference category.

* $p < .05$.

** $p < .01$.

*** $p < .001$.