Published in final edited form as:
Arch Gen Psychiatry. 2007 December ; 64(12): 1427–1434.

Exposure to Hurricane-Related Stressors and Mental Illness After Hurricane Katrina

Sandro Galea, MD, DrPH, **Chris R. Brewin, PhD**, **Michael Gruber, MA**, **Russell T. Jones, PhD**, **Daniel W. King, PhD**, **Lynda A. King, PhD**, **Richard J. McNally, PhD**, **Robert J. Ursano, MD**, **Maria Petukhova, PhD**, and **Ronald C. Kessler, PhD**

Department of Epidemiology, University of Michigan School of Public Health (Dr Galea), Ann Arbor; Department of Epidemiology, Columbia Mailman School of Public Health, New York, New York (Dr Galea); Department of Psychology, University College London, London, England (Dr Brewin); Department of Health Care Policy, Harvard Medical School, Boston, Massachusetts (Mr Gruber and Drs Petukhova and Kessler); Department of Psychology, Virginia Polytechnic and State University, Blacksburg (Dr Jones); Departments of Psychology and Psychiatry, Boston University, Boston, Massachusetts (Drs D. King and L. King); Department of Psychology, Harvard University, Cambridge, Massachusetts (Dr McNally); and Department of Psychiatry and Center for the Study of Traumatic Stress, Uniformed Services University, Bethesda, Maryland (Dr Ursano).

Abstract

Context: Uncertainty exists about the prevalence, severity, and correlates of mental disorders among people exposed to Hurricane Katrina.

Objective: To estimate the prevalence and associations between *DSM-IV* anxiety-mood disorders and hurricane-related stressors separately among prehurricane residents of the New Orleans metropolitan area and the remainder of the areas in Alabama, Louisiana, and Mississippi affected by Katrina.

Design: Community survey.

Setting and Participants: A probability sample of 1043 English-speaking prehurricane residents of the areas affected by Hurricane Katrina was administered via telephone survey between January 19 and March 31, 2006. The survey assessed hurricane-related stressors and screened for 30-day *DSM-IV* anxiety-mood disorders.

Main Outcome Measures: The K6 screening scale of anxiety-mood disorders and the Trauma Screening Questionnaire scale for posttraumatic stress disorder (PTSD), both calibrated against blinded structured clinical reappraisal interviews to approximate the 30-day prevalence of *DSM-IV* disorders.

Results: Prehurricane residents of the New Orleans metropolitan area were estimated to have a 49.1% 30-day prevalence of any *DSM-IV* anxiety-mood disorder (30.3% estimated prevalence of PTSD) compared with 26.4% (12.5% PTSD) in the remainder of the sample. The vast majority of respondents reported exposure to hurricane-related stressors. Extent of stressor exposure was more strongly related to the outcomes in the New Orleans metropolitan area subsample than the remainder of the sample. The stressors most strongly related to these outcomes were physical illness/injury and physical adversity in the New Orleans metropolitan area subsample and property loss in the remainder

Correspondence: Sandro Galea, MD, DrPH, Center for Social Epidemiology and Population Health, University of Michigan, 1214 South University Ave, Room 243, Ann Arbor, MI 48104 (sgalea@umich.edu)..

Financial Disclosure: Dr Kessler has been a consultant for Astra Zeneca, BristolMyersSquibb, Eli Lilly and Co, GlaxoSmithKline, Pfizer, Sanofi-Aventis, and Wyeth and has had research support for his epidemiological studies from BristolMyersSquibb, Eli Lilly and Co, Ortho-McNeil, Pfizer, and the Pfizer Foundation.

of the sample. Sociodemographic correlates were not explained either by differential exposure or reactivity to hurricane-related stressors.

Conclusions: The high prevalence of *DSM-IV* anxiety-mood disorders, the strong associations of hurricane-related stressors with these outcomes, and the independence of sociodemographics from stressors argue that the practical problems associated with ongoing stressors are widespread and must be addressed to reduce the prevalence of mental disorders in this population.

It is well established that natural disasters lead to increased prevalence of mental illness in the range of 5% to 40%,[1,2] although most increases are in the lower half of this range.[3-8] Much of the between-disaster variation is likely due to differential disaster severity and exposure,[9] as indicated by the fact that studies of people who experienced devastating loss in major natural disasters consistently document high prevalence of mental illness.[1,10] Assessment of individual stressors in natural disasters is nonetheless challenging, and our understanding of their effects on postdisaster mental illness remains limited.

Hurricane Katrina was the worst natural disaster in the United States in the past 75 years, creating a disaster region as large at as Great Britain, killing more than 1000 people, uprooting 500 000 others, and causing more than $100 billion in damage.[11] This vast devastation would lead us to expect a high prevalence of mental illness among people who lived through Katrina. Available evidence is consistent with this expectation.[12-14] However, no published research has yet considered the scope or variety of stressors experienced or the role played by disaster-related stressors in the mental illness of people who lived through Katrina. Such an investigation has the potential to be important in targeting intervention efforts, especially because Katrina exposed people to a wide variety of stressors, such as community disruption, job loss, and property loss,[15] many of which still persist 2 years after the hurricane.

We examined the prevalence of hurricane-related stressors and their associations with screening measures of *DSM-IV* anxiety and mood disorders using data from the Hurricane Katrina Community Advisory Group (CAG), a representative sample of 1043 prehurricane residents of the areas in Alabama, Louisiana, and Mississippi directly affected by Katrina who agreed to participate in a series of tracking surveys over several years to assess need for services and the pace of recovery efforts. Based on the much more devastating nature of the disaster in the 7 parishes defined by the Census Bureau as the New Orleans metropolitan area (henceforth New Orleans metro) than in the remainder of the hurricane area, we consider results separately in each of these 2 subsamples.

METHODS

SAMPLE

The CAG target population was English-speaking adult (aged ≥18 years) prehurricane residents of the counties (in Alabama and Mississippi) and parishes (in Louisiana) defined by the Federal Emergency Management Agency (FEMA) as directly affected by Hurricane Katrina.[16] Prehurricane residents of these areas were eligible for the sample regardless of whether they were in these areas at the time of the hurricane and regardless of the extent to which they or their property were affected by the hurricane. Census data suggest that only about 1% of this population was unable to speak English,[17] suggesting that the restriction of the sample to English speakers did not introduce major bias into the sample.

Respondents were selected from 3 sampling frames: the telephone numbers (land lines and cell phones) of the roughly 1.4 million families that applied for assistance from the American Red Cross (ARC); a random-digit dial (RDD) telephone frame of households in the areas affected by the hurricane; and a supplemental sample of hotels that housed FEMA-supported evacuees.

Surveying was carried out between January 19 and March 31, 2006, 5 to 7 months after the hurricane. As noted earlier, prehurricane residents of New Orleans metro were oversampled.

Although the use of RDD might seem impractical in a population where many people evacuated, evacuation was much more common in the New Orleans metro than the remainder of the affected areas. Furthermore, many evacuees had returned as of the time of the survey. Random-digit dial was useful in contacting these nonevacuees and returned evacuees. The vast majority of evacuees, in comparison, applied to the ARC for assistance and could be traced through contact information provided in the ARC applications for assistance. Other evacuees could be traced in the RDD sample through a call-forwarding service set up by Bell South in the wake of the hurricane, which forwarded calls to phone numbers anywhere in the country as requested by the person in whose name the prehurricane phone was registered. More details on sampling and adjustment for overlap of the frames are reported elsewhere.[18]

The sample of potential respondents we were able to contact and screen for eligibility represented 64.9% of those we attempted to reach. This low contact-screening rate reflects the special difficulties locating people after the massive disruption caused by Katrina. Screening-survey respondents were informed that joining the CAG required a commitment to participate in a number of follow-up surveys over several years and to provide tracing information if they moved. Screening-survey respondents were asked to consider these requirements carefully before agreeing because we wanted all respondents to participate in subsequent surveys. The 1043 respondents who agreed were administered the baseline CAG survey, the results of which are presented here. These respondents represent 41.9% of those we attempted to reach. This could have been increased up as much as 64.9% (ie, all the screening-survey respondents) if we had not required a commitment for long-term involvement in the CAG, but we felt that this commitment was needed because a central aim of the CAG was to track changes in adjustment over time.

Screening questionnaires administered to the full screening sample showed that those who did not join the CAG were similar to respondents on all sociodemographic variables but had a somewhat higher level of self-reported hurricane-related stress exposure than CAG members (assessed by asking respondents to rate their hurricane-related stress exposure on a 0-10 scale where 0 meant “no stress at all” and 10 meant “the most stress you can imagine a person having”) and more psychological distress than CAG members (assessed with a short series of questions about frequency of common anxiety-mood symptoms, responses to which were summed and normed to a 0-10 theoretical range). The median and interquartile range (IQR) (25th-75th percentiles) of reported hurricane-related stress exposure were 8.0 (IQR, 6.0-10.0) among nonrespondents and 7.0 (IQR, 5.0-9.0) among CAG members. The median and IQR of reported psychological distress were 2.9 (IQR, 1.2-4.4) among nonrespondents and 1.7 (IQR, 0.6-3.5) among CAG members. A weight was applied to the CAG data to adjust for these response biases. A within-household probability of selection weight was also used along with a poststratification weight to adjust for residual discrepancies between the CAG and the 2000 census population on a range of social, demographic, and prehurricane housing variables. The consolidated CAG sample weight, finally, was trimmed to increase design efficiency based on evidence that trimming did not significantly affect the estimated prevalence of anxiety-mood disorders.

MEASURES

Hurricane-Related Stressors—The survey included 29 structured questions developed based on pilot interviews about hurricane-related stressors. In addition, we asked an open-ended question—“What would you say are currently your most serious practical problems caused by Katrina?”—in an effort to discover any common stressors not covered in the structured questions. It should be noted that some respondents,especially evacuees to south

Texas, were subsequently exposed to Hurricane Rita. To capture information about these experiences, we asked all respondents whether they were exposed to Rita, and if so, we asked about stressors experienced in either hurricane. The full text of the interview schedule that includes the complete set of stressor questions is available elsewhere.[18]

Ten stressors emerged as sufficiently common to be considered in this analysis. Four were traumatic stressors in the sense specified in the *DSM-IV* for a diagnosis of posttraumatic stress disorder (PTSD): experiences that involved serious risk of death, death of a loved one (family member or close friend), victimization (burglary, robbery, physical assault, or sexual assault) due to lawlessness after the storm, and victimization of a loved one. The other 6 were for the most part nontraumatic stressors: physical illness or injury caused or exacerbated by the storm, extreme physical adversity (eg, sleeping in a church basement, difficulty obtaining adequate food or clothing), extreme psychological adversity (eg, living in circumstances where the respondent had to use the toilet or change clothes without adequate privacy, exposure to threats of violence), major property loss, income loss, and ongoing difficulties associated with housing (multiple moves or living in substantially worse posthurricane than prehurricane housing). Some cases of the latter 6 stressors were described by respondents in ways that implied that the stressors might have been traumatic (eg, a life-threatening injury, a threat of fatal violence), but no attempt was made to distinguish these cases from nontraumatic stressors because the open-ended reports of these events were often too imprecise to make this distinction clearly.

Mental Illness—The K6 scale of nonspecific psychological distress[19] was used to screen for *DSM-IV* anxiety disorders within 30 days of the interview.[20] Scores range from 0 to 24. Two independent validation studies found the K6 to have an area under the receiver operating characteristic curve between 0.86[19] and 0.89[21,22] in predicting diagnoses of mental illness based on comprehensive diagnostic interviews. Based on previous K6 validation and using the definition of the terms from SAMHSA (Substance Abuse and Mental Health Services Administration), scores of 13 to 24 were classified probable serious mental illness (SMI) while scores of 8 to 12 were classified probable mild/moderate mental illness (MMI) and scores of 0 to 7 were classified probable noncases. The designation of MMI represents respondents who were estimated to meet criteria for a *DSM-IV* anxiety-mood disorder but not SMI. Previous research has shown that MMI is of considerable public health importance because of its high prevalence, burden, and risk of transition to SMI.[23] A small clinical reappraisal study of 5 respondents selected randomly from each of these 3 K6 categories (SMI, MMI, noncase) with the Structured Clinical Interview for *DSM-IV* (SCID)[24] confirmed K6 classifications for 14 of 15 respondents. The exception was a respondent classified as having SMI by the K6 but MMI by the SCID based on a global assessment of functioning (GAF) score of 65 (a GAF score of 0-60 is required to diagnose SMI). These results, although based on only a small sample, suggest that the K6 has excellent psychometric properties (estimated in the SCID sample weighted to adjust for the sample-wide K6 distribution), including sensitivity (1.0 for SMI, 0.90 for MMI, and 1.0 for either SMI to MMI) and specificity (1.0).

Given the special importance of PTSD in trauma situations, a separate PTSD screen was included based on the 12-item Trauma Screening Questionnaire (TSQ),[25] a validated screen for PTSD.[26] Our version differed from the original TSQ in using dimensional response options rather than a simple yes-no response format to assess 30-day symptom frequency (never, less than once a week, about once a week, 2 to 4 days a week, and most every day). A clinical reappraisal study was carried out to calibrate TSQ responses to *DSM-IV* PTSD with 30 respondents judged possible cases and 10 randomly selected others. A cutpoint on the factor-based 0-to-42 scale of TSQ responses (12 items, each scored 0-4) of 20+ was selected to approximate the SCID PTSD prevalence in the weighted (to adjust for oversampling of screened positives) clinical reappraisal sample. Sensitivity (0.89), specificity (0.93), and area

under the receiver operating characteristic curve (0.91) were all excellent for this dichotomous screen.

Sociodemographic Controls—We examined associations of K6 and TSQ approximations of *DSM-IV* diagnoses with several sociodemographic variables: age, sex, race/ethnicity, family income in the year before the hurricane, education, prehurricane marital status, and prehurricane employment status. Age was coded 18 to 39 years, 40 to 59 years, and 60 years or older. Race/ethnicity was coded non-Hispanic white, non-Hispanic black, and other (largely Hispanic and Asian). Family income was coded in quartiles where low was defined as less than or equal to 0.5 of the population median on the ratio of per-tax income to number of family members while low-average was defined 0.5+ through 1.0 on the same ratio; high-average, 1.0 + through 3; and high, 3+ on this ratio. Years of education were coded in 4 categories: 0 to 11, 12 (high school graduate), 13 to 15, and 16+ (college graduate). Marital status was coded married (including cohabiting, excluding separated), never married, and previously married (separated, widowed, divorced). Employment status, finally, was coded employed (including self-employed and full-time students), homemaker, retired, and other (largely unemployed and disabled).

ANALYSIS METHODS

Estimated prevalence of *DSM-IV* disorders and hurricane-related stressors were examined with cross-tabulations that distinguished prehurricane residents of the New Orleans metro from the remainder of the sample. The effects of sociodemographic variables, hurricane-related stressors, and their interactions in predicting the estimates of *DSM-IV* disorders were examined using logistic regression analysis.[27] Logistic regression coefficients and their standard errors were exponentiated to create odds ratios (ORs) and 95% confidence intervals (95% CIs) for ease of interpretation. Because the data were weighted, the Taylor series linearization method[28] was used to calculate design-based significance tests. Multivariate significance was calculated using Wald χ^2 tests based on design-corrected coefficient variance-covariance matrices. Statistical significance was evaluated using 2-sided .05-level tests.

RESULTS

ESTIMATED PREVALENCE OF *DSM-IV* ANXIETY-MOOD DISORDERS

The estimated prevalence of any 30-day *DSM-IV* anxiety-mood disorder based on the K6 was 31.2% in the total sample (Table 1) and significantly higher among prehurricane residents of the New Orleans metro (49.1%) than the remainder of the sample (26.4%; z=5.0, P<.001). Approximately one-third of respondents who screened positive for a *DSM-IV* anxiety-mood disorder were classified as having probable SMI (11.3%) and the other two-thirds as having probable MMI (19.9%). The ratio of probable SMI to MMI did not differ meaningfully in the New Orleans metro (0.53) compared with the remainder of the sample (0.59).

All respondents classified by the TSQ as having PTSD also were classified by the K6 as having an anxiety-mood disorder. The estimated prevalence of PTSD in the total sample was 16.3%, with a significantly higher estimate in the New Orleans metro (30.3%) than the remainder of the sample (12.5%; z=4.1, P<.001). The conditional estimated prevalence of PTSD given probable SMI was extremely high in both subsamples (98.1% in the New Orleans metro and 85.8% in the remainder of the sample; z=0.6, P=.54). The conditional estimated prevalence of PTSD given probable MMI, in comparison, was considerably lower (42.5% in the New Orleans metro and 24.8% in the remainder of the sample; z=1.6, P=.12).

ASSOCIATIONS OF SOCIODEMOGRAPHIC VARIABLES WITH ESTIMATED ANXIETY-MOOD DISORDERS

We examined sociodemographic correlates of estimated PTSD, of other estimated *DSM-IV* anxiety-mood disorders exclusive of PTSD, and of probable SMI or MMI separately in the New Orleans metro subsample and the remainder of the sample (Table 2). Estimated prevalence of any *DSM-IV* anxiety-mood disorder was consistently associated with age less than 60 years, female sex, education less than college graduation, low family income, "other" prehurricane employment status (largely unemployed and disabled), and being unmarried. In addition, Hispanic individuals and people of other racial/ethnic minorities exclusive of non-Hispanic black had significantly lower estimated prevalence of any disorder than non-Hispanic white individuals in the New Orleans metro as well as a significantly lower estimated prevalence of PTSD in the remainder of the sample. The strongest ORs in the New Orleans metro were for low income and other employment status with PTSD (4.0-5.3), whereas the strongest ORs in the remainder of the sample were for low education, low income, other employment status, and being unmarried with PTSD (4.7-17.7). Although some of the significant sociodemographic predictors of estimated SMI or MMI had different associations with estimated PTSD than with other estimated anxiety-mood disorders, these associations were inconsistent across geographic subsamples.

PREVALENCE OF HURRICANE-RELATED STRESSORS

The vast majority of respondents both in the New Orleans metro (91.9%) and in the remainder of the sample (81.7%) reported experiencing at least 1 of the 10 categories of hurricane-related stressors (Table 3). New Orleans metro respondents reported a higher prevalence of each stressor than respondents in the remainder of the sample. The 2 most frequently reported stressors were housing adversity (71.7% in the New Orleans metro; 34.1% in the remainder of the sample; z=8.6, P<.001) and property loss (70.2% vs 47.8%; z=4.9, P<.001). Other stressors occurred to between 33.6% and 46.3% (physical adversity) and 0.9% and 1.1% (life-threatening experience) of respondents.

ASSOCIATIONS OF HURRICANE-RELATED STRESSORS WITH ESTIMATED ANXIETY-MOOD DISORDERS

Because high intercorrelations among stressors made it difficult to assess the separate effects of individual stressors in predicting estimated mental disorders, we evaluated a series of logistic regression models that included additive and interactive effects of exposure to multiple stressors (Table 4). Model 1 included only sociodemographic predictors. Model 2 then added information about number of hurricane-related stressors, ignoring type of stressor. Information about number of stressors was significantly related to the outcomes in all but 1 instance (other probable anxiety-mood disorders in the subsample exclusive of the New Orleans metro; χ^2_7 = 13.7, P=.06). We then evaluated a series of 10 models, each adding 1 of the 10 stressors to model 2 to determine whether type of stressor predicted the outcomes net of number of stressors. (Detailed results are not reported but are available on request.) Three of these 10 were significant: physical illness/injury and physical adversity in the New Orleans metro and property loss in the remainder of the sample. When these significant adversities were added to model 2, the best-fitting specification included a single predictor to distinguish respondents exposed to 1 or more stressors vs none plus separate predictors for the 2 (in the New Orleans metro) or 1 (in the remainder of the sample) specific types of stressors that had effects significantly higher than the others. The latter model (model 3) improved significantly on model 2. We next considered a model that allowed for interactions among pairs of stressors (model 4). No significant interactions of this type were found. We also examined the ORs in model 4 for evidence of a consistently strong substantive pattern because the 44 *df* test (all logically possible pairs among the 10 stressors minus 1 *df* for the global count of stressors)

might have failed to detect substantively important patterns in a small number of pairs. No such evidence was found.

The best-fitting model 3 shows that physical illness/injury and physical adversity are associated with increased odds of the outcomes in the New Orleans metro (2.8-7.9) while financial loss is associated with increased odds in the remainder of the sample (2.8-5.6) (Table 5). The ORs for other stressors are 3.6-6.3 in the New Orleans metro and 1.5-1.8 in the remainder of the sample. The ORs are consistently higher in the New Orleans metro than the remainder of the sample with the exception of a higher OR associated with property loss in predicting estimated PTSD in the remainder of the sample.

JOINT EFFECTS OF SOCIODEMOGRAPHICS AND HURRICANE-RELATED STRESSORS

Analyses were conducted to determine whether the significant sociodemographic associations documented in Table 2 could be explained by differential exposure to hurricane-related stressors. They could not. (Detailed results are not reported but are available on request.) Indeed, 22 of the 27 statistically significant ORs in Table 2 remained significant at the .05 level after introducing controls for the stressors. The other previously significant ORs only changed modestly in substantive terms.

We also evaluated the possibility that the adverse effects of the hurricane-related stressors vary across sociodemographic subsamples. To increase statistical power, we combined the significant stressors from Table 5 into a single measure by generating individual-level predicted probabilities of the outcomes based on the coefficients in model 3. This summary measure was used in interaction with the sociodemographic variables. No more interactions were found to be statistically significant at the .05 level in these tests than would be expected by chance.

COMMENT

Five principal limitations need to be noted. First, mental disorders were estimated with screening scales rather than clinical interviews. Despite the fact that the K6 screening scale has been used in national surveys[20,29] and has been previously validated[19,21,22] and the fact that the modified TSQ was found to be valid in our clinical reappraisal study, screening scales are inevitably less precise than clinical interviews. This imprecision will generate attenuated associations, leading the results reported here on predictors to be conservative. Second, the survey response rate was low and the sampling frame excluded people who were unreachable by telephone, resulting in underrepresentation of the most marginalized and perhaps the most seriously ill people in the population. These sample limitations are likely to make the estimates of disorder and stressor prevalence conservative. Third, even though we interpreted the associations between stressors and disorders in causal terms, it is possible that unmeasured common causes (eg, prehurricane history of psychopathology that influenced both stressor exposure and posthurricane mental illness) influenced the observed associations. Caution is consequently needed in interpreting these associations. Fourth, the assessment of disaster-related stressors was necessarily retrospective, raising concerns about recall bias related to current mental illness. However, this concern is mitigated by evidence from longitudinal studies that reports of acute stress exposure have good test-retest reliability and are relatively free from recall bias.[30] In addition, because our assessment was conducted only 5 to 7 months after the hurricane, many of the hurricane-related stressors were still directly and immediately relevant to respondents at the time of their interviews. Fifth, no attempt was made to tease apart the effects of exposure to stressors related to Hurricane Katrina vs Hurricane Rita even though some of the respondents were exposed to Rita in the wake of Katrina. As noted in the section on measures, we asked respondents to include information about stressors related to Rita in their reports. The effects of Rita are consequently included in the results reported here.

Within the context of these limitations, the estimated prevalence of *DSM-IV* anxiety and mood disorders in the New Orleans metro was substantially higher than typically found in US population-based surveys of mental illness after natural disasters, while the estimated prevalence in the remainder of the sample was comparable with that in previous studies.[9,31] Previous reviews have noted that making comparisons of prevalence estimates across disasters is challenging because of the wide rangeof disaster experiences to which people in disasters are exposed. However, broadly speaking, the high estimated prevalence of anxiety-mood disorders in the New Orleans metro is consistent with the results of studies that considered persons in highly disaster affected areas,[1,10] while the lower estimated prevalence in the remainder of the sample is consistent with the results of previous studies in areas with lower disaster impact.[3,5] We found that the vast majority of respondents estimated to have SMI (98.1% in the New Orleans metro and 85.8% in the remainder of the sample) also screened positive for PTSD, reinforcing the notion that PTSD is the central form of psychopathology associated with natural disasters.[32]

Nearly one-fourth of New Orleans metro respondents and one-sixth of other respondents were exposed to traumatic hurricane-related stressors, while the vast majority of respondents (79%-90%) were exposed to other hurricane-related stressors. Comparing these estimates with other postdisaster samples is challenging because few previous studies either attempted to sample complete populations affected by large disasters or comprehensively assessed disaster-related stressors. However, to the extent that comparisons allow, it appears that the proportion of people experiencing hurricane-related stressors after Katrina was substantially higher than after other recent hurricanes, such as Hurricane Andrew in 1993[33] and Hurricanes Charley/Frances/Ivan/Jeanne in 2004.[34]

Although the hurricane-related stressors assessed here were significant predictors of estimated anxiety-mood disorders, the stressors with the highest ORs were different in the New Orleans metro (physical illness/injury and physical adversity) than the remainder of the sample (property loss). It is especially striking that the impact of property loss was less in the New Orleans metro than the remainder of the hurricane area even though property loss was much more commonly experienced in the New Orleans metro than the remainder of the hurricane area. One possible explanation for this difference is that personal property loss might have been experienced as less stressful in a situation where, as in the New Orleans metro, property loss was the norm in the population. Or it might be that evacuation and physical displacement, which occurred to the vast majority of prehurricane residents of the New Orleans metro, created a context in which property loss had much less of an emotional effect than in the rest of the hurricane area. It is also possible that the subjective stressfulness of property loss was lessened in the context of the situation in the New Orleans metro, where many people were exposed to even worse stressors, such as death and injury and extreme physical adversity. But these are merely speculations. The only certain conclusion that can be drawn from the results regarding variation in the relative effects of specific stressors in New Orleans and the remainder of the hurricane area is that we have much more to learn about the ways in which multiple exposures and disaster context influence the effects of individual disaster-related stressors.

The findings that women, young people, and people with low socioeconomic status were at comparatively high risk of anxiety-mood disorders are consistent with previously documented correlates of mental illness after disasters[9,31] and other traumas.[35] Importantly, though, these same associations are found in community epidemiological surveys in the absence of disasters, suggesting that these associations might be related to preexisting mental disorders.[14] Consistent with this possibility, these sociodemographic associations were not explained by exposure to hurricane-related stressors. Nor did we find evidence that the associations of hurricane-related stressors with estimated anxiety-mood disorders differ meaningfully in subsamples defined by these sociodemographic factors.

The finding that Hispanic individuals and people of other minorities exclusive of non-Hispanic black had significantly lower estimated prevalence of anxiety-mood disorders than non-Hispanic white individuals is difficult to interpret. Previous research has found elevated prevalence of postdisaster mental illness among Hispanic people,[36] although this was largely Puerto Rican and Dominican individuals whereas the prehurricane Hispanic people in the Katrina area were largely Mexican-American. However, caution is needed in interpreting this finding, because the number of respondents in our minority subsample is quite small (35 respondents) and includes Asian as well as Hispanic individuals. Future research will need much larger samples to investigate ethnic differences in disaster response, noting that elevated prevalence among Hispanic people could well vary substantially among Mexican-American people compared with other segments of the Hispanic population.

The results lead to 4 conclusions. First, the stressors considered here appear to have played a critical role in the high prevalence of hurricane-related anxiety-mood disorders. Second, the fact that the associations between hurricane-related stressors and estimated anxiety-mood disorders were stronger in the New Orleans metro than the remainder of the hurricane area suggests that undetermined vulnerability or contextual factors were present in the New Orleans metro that remain understood. Third, the observation that hurricane-related stressor exposure was widespread and comparable across sociodemographic subsamples means that the impact of the hurricane on mental health was widespread rather than concentrated in any one particular segment of the population. This, in turn, suggests that efforts to address the problem of increased mental illness in the wake of the hurricane must address the needs of persons in all segments of society rather than target specific population segments. This may be particularly challenging for prehurricane residents of the New Orleans metro, many of whom are now living throughout the country. Fourth, evidence that avoidable stressors associated with the slow government response to Hurricane Katrina (eg, physical adversity) had important implications for the mental health of people who lived through Katrina argues strongly for the importance of efficient provision of practical and logistical assistance in future disasters, not only on humanitarian grounds, but also as a way to minimize the adverse mental health effects of disasters.

Acknowledgements

Funding/Support: The Hurricane Katrina Community Advisory Group (CAG) is supported by grant R01 MH070884-01A2 from the US National Institute of Mental Health with supplemental support from the Federal Emergency Management Agency (FEMA) and the Assistant Secretary for Planning and Evaluation, Department of Health and Human Services.

Role of the Sponsor: The funders had no role in the design or conduct of the study nor in the collection, management, analysis, or interpretation of the data or in the preparation, review, or approval of the manuscript.

Additional Information: A public-use dataset of the baseline CAG survey is available through the Interuniversity Consortium for Political and Social Research (ICPSR) at the University of Michigan. For details on data acquisition, go to http://www.hurricanekatrina.med.harvard.edu.

REFERENCES

1. Canino G, Bravo M, Rubio-Stipec M, Woodbury M. The impact of disaster on mental health: prospective and retrospective analyses. Int J Ment Health 1990;19:51–69.
2. Madakasira S, O'Brien KF. Acute posttraumatic stress disorder in victims of a natural disaster. J Nerv Ment Dis 1987;175(5):286–290. [PubMed: 3572380]
3. Caldera T, Palma L, Penayo U, Kullgren G. Psychological impact of the hurricane Mitch in Nicaragua in a one-year perspective. Soc Psychiatry Psychiatr Epidemiol 2001;36(3):108–114. [PubMed: 11465781]

4. Cao H, McFarlane AC, Klimidis S. Prevalence of psychiatric disorder following the 1988 Yun Nan (China) earthquake: the first 5-month period. Soc Psychiatry Psychiatr Epidemiol 2003;38(4):204–212. [PubMed: 12664231]
5. Kohn R, Levav I, Donaire I, Machuca M, Tamashiro R. Psychological and psychopathological reactions in Honduras following Hurricane Mitch: implications for service planning. Rev Panam Salud Publica 2005;18(45):287–295. [PubMed: 16354426]
6. Norris FH, Perilla JL, Riad JK, Kaniasty K, Lavizzo EA. Stability and change in stress, resources, and psychological distress following natural disaster: findings from Hurricane Andrew. Anxiety Stress Coping 1999;12:363–396.
7. Shultz JM, Russell J, Espinel Z. Epidemiology of tropical cyclones: the dynamics of disaster, disease, and development. Epidemiol Rev 2005;27:21–35. [PubMed: 15958424]
8. van Griensven F, Chakkraband ML, Thienkrua W, Pengjuntr W, Lopes Cardozo B, Tantipiwatanaskul P, Mock PA, Ekassawin S, Varangrat A, Gotway C, Sabin M, Tappero JW, Thailand Post-Tsunami Mental Health Study Group. Mental health problems among adults in tsunami-affected areas in southern Thailand. JAMA 2006;296(5):537–548. [PubMed: 16882960]
9. Galea S, Nandi A, Vlahov D. The epidemiology of post-traumatic stress disorder after disasters. Epidemiol Rev 2005;27:78–91. [PubMed: 15958429]
10. David D, Mellman TA, Mendoza LM, Kulick-Bell R, Ironson G, Schneiderman N. Psychiatric morbidity following Hurricane Andrew. J Trauma Stress 1996;9(3):607–612. [PubMed: 8827660]
11. Rosenbaum S. US health policy in the aftermath of Hurricane Katrina. JAMA 2006;295(4):437–440. [PubMed: 16434635]
12. Centers for Disease Control and Prevention. Assessment of health-related needs after Hurricanes Katrina and Rita: Orleans and Jefferson parishes, New Orleans area, Louisiana, October 17-22, 2005. MMWR Morb Mortal Wkly Rep 2006;55(2):38–41. [PubMed: 16424857]
13. Centers for Disease Control and Prevention. Surveillance in hurricane evacuation centers: Louisiana, September-October 2005. MMWR Morb Mortal Wkly Rep 2006;55(2):32–35. [PubMed: 16424855]
14. Kessler RC, Galea S, Jones RT, Parker HA. Mental illness and suicidality after Hurricane Katrina. Bull World Health Organ 2006;84(12):930–939. [PubMed: 17242828]
15. Gallup Poll News Service. At least 100,000 Katrina victims still separated from families, October 14. http://poll.gallup.com/content/default.aspx?ci=19225&pg=1&VERSION=p. Accessed September 18, 2007
16. FEMA: Families Recovering … Communities Rebuilding. http://www.fema.gov/hazard/hurricane/2005katrina. Accessed September 18, 2007
17. Bureau of the Census. US Department of Commerce; Washington, DC: 2000. Census summary tape, file 3A (STF-3A).
18. Hurricane Katrina Community Advisory Group. http://www.hurricanekatrina.med.harvard.edu. Accessed September 18, 2007
19. Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, Howes MJ, Normand SL, Manderscheid RW, Walters EE, Zaslavsky AM. Screening for serious mental illness in the general population. Arch Gen Psychiatry 2003;60(2):184–189. [PubMed: 12578436]
20. Centers for Disease Control and Prevention. Serious psychological distress: early release of selected estimates based on data from the January-March 2004 National Health Interview Survey. http://www.cdc.gov/nchs/data/nhis/earlyrelease/200409_13.pdf. Accessed September 14, 2005
21. Furukawa TA, Kessler RC, Slade T, Andrews G. The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. Psychol Med 2003;33(2):357–362. [PubMed: 12622315]
22. Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK, Normand SL, Walters EE, Zaslavsky AM. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol Med 2002;32(6):959–976. [PubMed: 12214795]
23. Kessler RC, Merikangas KR, Berglund P, Eaton WW, Koretz DS, Walters EE. Mild disorders should not be eliminated from the DSM-V. Arch Gen Psychiatry 2003;60(11):1117–1122. [PubMed: 14609887]

24. First, MB.; Spitzer, RL.; Gibbon, M.; Williams, JBW. Structured Clinical Interview for DSM-IV Axis I Disorders, Research Version, Non-patient Edition (SCID-I/NP). Biometrics Research, New York State Psychiatric Institute; New York, NY: 2002.
25. Brewin CR, Rose S, Andrews B, Green J, Tata P, McEvedy C, Turner S, Foa EB. Brief screening instrument for post-traumatic stress disorder. Br J Psychiatry 2002;181:158–162. [PubMed: 12151288]
26. Brewin CR. Systematic review of screening instruments for adults at risk of PTSD. J Trauma Stress 2005;18(1):53–62. [PubMed: 16281196]
27. Hosmer, DW.; Lemeshow, S. Applied Logistic Regression. 2nd ed.. John Wiley & Sons; New York, NY: 2001.
28. Wolter, KM. Introduction to Variance Estimation. Springer-Verlag; New York, NY: 1985.
29. Substance Abuse and Mental Health Services Administration. Results from the 2003 National Survey on Drug Use and Health: national findings. http://www.oas.samhsa.gov/NHSDA/2k3NSDUH/2k3results.htm#ch8. Accessed September 28, 2006
30. Norris FH, Kaniasty K. A longitudinal study of the effects of various crime prevention strategies on criminal victimization, fear of crime, and psychological distress. Am J Community Psychol 1992;20(5):625–648. [PubMed: 1485614]
31. Norris FH, Friedman MJ, Watson PJ, Byrne CM, Diaz E, Kaniasty K. 60,000 disaster victims speak: part I, an empirical review of the empirical literature, 1981-2001. Psychiatry 2002;65(3):207–239. [PubMed: 12405079]
32. Breslau N, Chase GA, Anthony JC. The uniqueness of the DSM definition of post-traumatic stress disorder: implications for research. Psychol Med 2002;32(4):573–576. [PubMed: 12102371]
33. Garrison CZ, Bryant ES, Addy CL, Spurrier PG, Freedy JR, Kilpatrick DG. Post-traumatic stress disorder in adolescents after Hurricane Andrew. J Am Acad Child Adolesc Psychiatry 1995;34(9):1193–1201. [PubMed: 7559314]
34. Acierno R, Ruggiero KJ, Galea S, Resnick HS, Koenen K, Roitzsch J, de Arellano M, Boyle J, Kilpatrick DG. Psychological sequelae from the 2004 Florida hurricanes: implications for postdisaster intervention. Am J Public Health 2007;97(suppl 1):S103–S108. [PubMed: 17413067]
35. Brewin CR, Andrews B, Valentine JD. Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. J Consult Clin Psychol 2000;68(5):748–766. [PubMed: 11068961]
36. Galea S, Vlahov D, Tracy M, Hoover DR, Resnick H, Kilpatrick D. Hispanic ethnicity and post-traumatic stress disorder after a disaster: evidence from a general population survey after September 11, 2001. Ann Epidemiol 2004;14(8):520–531. [PubMed: 15350950]

Table 1

Estimated 30-Day Prevalence of *DSM-IV* Anxiety-Mood Disorders[a]

Disorder	% (SE)		
	New Orleans Metro (n=594)	Remainder of Sample (n=449)	Total (N=1043)
Any anxiety-mood disorder			
MMI	32.0 (3.7)	16.6 (2.4)	19.9 (2.1)
SMI	17.0 (2.6)	9.8 (2.1)	11.3 (1.8)
Any (MMI or SMI)	49.1 (3.3)	26.4 (3.1)	31.2 (2.6)
PTSD			
PTSD given MMI	42.5 (8.9)	24.8 (7.0)	30.9 (5.8)
PTSD given SMI	98.1 (1.0)	85.8 (7.6)	89.7 (5.4)
PTSD total	30.3 (3.7)	12.5 (2.2)	16.3 (2.0)

Abbreviations: Metro, metropolitan area; MMI, mild/moderate mental illness; PTSD, posttraumatic stress disorder; SMI, serious mental illness.

[a] Estimates of anxiety-mood disorders were based on the K6 and Trauma Screening Questionnaire scales. See the “Methods” section for details.

Table 2

Bivariate Associations of Sociodemographic Variables With Estimated 30-Day *DSM-IV* Anxiety-Mood Disorders[a,b]

Characteristic	PTSD		Other MMI or SMI		Any MMI or SMI	
	New Orleans Metro (n=594)	Remainder of Sample (n=449)	New Orleans Metro (n=594)	Remainder of Sample (n=449)	New Orleans Metro (n=594)	Remainder of Sample (n=449)
Age, y						
18-39	2.9 (0.7-12.6)	1.8 (0.5-5.6)	1.3 (0.4-5.0)	2.0 (0.7-6.0)	2.2 (0.8-6.5)	2.0 (0.8-4.7)
40-59	2.0 (0.6-6.9)	1.3 (0.4-4.3)	1.5 (0.7-3.6)	3.0 (1.1-8.4)[c]	1.9 (0.8-4.2)	2.1 (0.9-5.1)
≥60	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]
χ^2_2	2.2	1.0	1.0	4.3	2.5	3.3
Sex						
Female	2.7 (1.3-5.9)[c]	2.7 (1.1-6.3)[c]	1.3 (0.6-2.9)	2.0 (0.9-4.2)	2.1 (1.1-3.9)[c]	2.3 (1.2-4.5)[c]
Male	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]
χ^2_1	6.4[c]	5.0[c]	0.4	2.9	4.9[c]	5.8[c]
Race/ethnicity						
Non-Hispanic white	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]
Non-Hispanic black	1.9 (0.8-4.8)	1.0 (0.4-2.3)	0.5 (0.2-1.2)	1.5 (0.7-3.3)	1.1 (0.5-2.3)	1.2 (0.6-2.3)
Hispanic or other	0.5 (0.1-1.6)	0.0 (0.0-0.1)[c]	0.3 (0.1-0.9)[c]	3.5 (1.0-11.6)[c]	0.3 (0.1-0.8)[c]	1.3 (0.4-3.9)
χ^2_2	4.0	15.7[c]	5.6	4.4	5.4	0.5
Education						
Less than high school	3.9 (1.3-11.7)	7.9 (1.5-40.6)[c]	0.7 (0.3-1.9)	1.3 (0.5-3.6)	2.1 (0.9-4.8)	2.8 (1.1-6.6)[c]
High school	1.8 (0.5-5.9)	3.2 (0.7-15.2)	0.8 (0.3-2.1)	1.7 (0.6-4.8)	1.2 (0.5-2.9)	2.1 (0.9-5.1)
Some college	2.9 (1.0-8.3)	4.0 (0.8-18.7)	1.7 (0.8-3.9)	0.6 (0.2-1.5)	2.5 (1.2-5.2)	1.2 (0.5-2.9)
College graduate	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]
χ^2_3	7.3	6.8	2.8	5.6	7.8[c]	7.6
Family income (prehurricane)						
Low	4.1 (1.3-12.6)[c]	17.7 (2.1-145.6)[c]	0.8 (0.3-2.1)	3.8 (1.1-13.0)[c]	1.7 (0.7-4.5)	7.1 (2.4-20.7)[c]
Low-average	4.0 (1.5-10.6)[c]	6.2 (0.6-61.7)	0.7 (0.3-1.7)	2.3 (0.6-8.7)	1.7 (0.8-3.5)	3.2 (1.0-10.5)
High-average	2.0 (0.8-5.5)	4.3 (0.4-43.8)	0.9 (0.3-2.5)	1.6 (0.4-6.2)	1.2 (0.6-2.7)	2.2 (0.7-7.2)
High	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]
χ^2_3	10.0[c]	12.8[c]	0.7	5.8	2.3	17.5[c]
Occupational status (prehurricane)						
Employed	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]
Housewife	1.1 (0.3-4.3)	1.0 (0.2-5.7)	0.2 (0.0-0.8)[c]	4.5 (0.8-26.5)	0.4 (0.1-1.4)	2.9 (0.8-11.3)
Retired	1.4 (0.3-7.9)	1.4 (0.4-5.1)	1.0 (0.4-2.7)	1.5 (0.5-4.7)	1.2 (0.4-3.5)	1.5 (0.6-3.6)
Other	5.3 (2.3-12.4)[c]	4.7 (1.8-12.0)[c]	1.0 (0.4-2.5)	3.5 (1.4-8.7)[c]	2.9 (1.3-6.6)	4.7 (2.2-9.9)[c]
χ^2_3	15.0[c]	12.2[c]	5.5	8.4[c]	10.4[c]	17.3[c]
Marital status (prehurricane)						
Married or cohabiting	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]	1.0 [Reference]
Previously married	2.3 (1.0-5.0)[c]	8.0 (3.2-20.0)[c]	0.8 (0.3-1.9)	3.8 (1.7-8.9)[c]	1.5 (0.8-3.0)	5.8 (3.0-11.3)
Never married	2.1 (0.7-6.5)	5.1 (1.8-15.0)[c]	0.8 (0.3-2.2)	1.1 (0.3-4.7)	1.4 (0.5-3.7)	2.5 (1.1-5.5)[c]
χ^2_2	4.9	21.1[c]	0.4	10.1[c]	1.5	27.8[c]

Abbreviations: Metro, metropolitan area; MMI, mild/moderate mental illness; PTSD, posttraumatic stress disorder; SMI, serious mental illness.

[a] Estimates of anxiety-mood disorders were based on the K6 and Trauma Screening Questionnaire scales. See the "Methods" section for details.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

[b]Values are given as odds ratio (95% confidence interval).

[c]Significant at the .05 level, 2-sided test.

Table 3

Prevalence of Exposure to Hurricane-Related Stressors

Exposure Type	% (SE)	
	New Orleans Metro (n=594)	Remainder of Sample (n=449)
Stressors, No.		
1	12.8 (1.8)	31.7 (3.2)
2	19.5 (2.2)	22.5 (2.8)
3	16.4 (2.8)	9.9 (2.0)
4	15.4 (2.8)	7.6 (1.6)
≥5	27.8 (4.3)	10.1 (2.3)
Any	91.9 (1.6)	81.7 (2.4)
Trauma		
Life-threatening experience	1.1 (0.4)	0.9 (0.6)
Victimized	11.8 (3.6)	5.4 (1.5)
Death of loved one	21.3 (3.1)	7.4 (1.7)
Loved one victimized	19.3 (3.7)	9.3 (1.9)
Any trauma	39.2 (4.3)	17.0 (2.5)
Other stressor		
Property loss	70.2 (3.1)	47.8 (3.4)
Income loss	28.3 (2.9)	20.0 (2.5)
Physical illness or injury	21.5 (3.2)	15.9 (2.4)
Housing adversity	71.7 (3.2)	34.1 (3.0)
Physical adversity	46.3 (3.6)	33.6 (3.3)
Psychological adversity	29.2 (3.8)	21.1 (2.9)
Any other stressor	90.0 (1.8)	79.0 (2.6)

Abbreviation: Metro, metropolitan area.

Table 4

Model Fitting for Associations of Hurricane-Related Stressors With Estimated 30-Day *DSM-IV* Anxiety-Mood Disorders[a]

	New Orleans Metro (n=594)									Remainder of Sample (n=449)								
	PTSD			Other MMI or SMI			Any MMI or SMI			PTSD			Other MMI or SMI			Any MMI or SMI		
Model[b]	χ^2	*P* Value	*df*	χ^2	*P* Value	df	χ^2	*P* Value	*df*	χ^2	*P* Value	df	χ^2	*P* Value	*df*	χ^2	*P* Value	*df*
M1	59.5	<.001	17	21.8	.19	17	44.4	<.001	17	74.5	<.001	18	42.6	<.001	18	83.0	<.001	18
M2-M1	31.2	<.001	7	45.8	<.001	7	59.0	<.001	7	36.6	<.001	7	13.7	.06	7	22.2	<.001	7
M3-M1	35.6	<.001	3	35.0	<.001	3	57.8	<.001	3	10.8	<.001	2	7.8	.02	2	16.4	<.001	2
M4-M3	47.7	.37	45	60.6	.06	45	34.8	.86	45	22.4	>.99	45	38.8	.73	45	31.8	.93	45

Abbreviations: M, model; Metro, metropolitan area; MMI, mild/moderate mental illness; PTSD, posttraumatic stress disorder; SMI, serious mental illness.

[a]Estimates of anxiety-mood disorders were based on the K6 and Trauma Screening Questionnaire scales. See the “Methods” section for details.

[b]The predictors in M1 consist of the sociodemographic variables in Table 2. The predictors in M2 include those in M1 plus 7 dummy variables for the number of stressors to which the respondent was exposed. The predictors in M3 include those in M1 plus a single dummy variable for exposure to 1 or more stressors and either dummy variables for physical illness/injury and physical adversity (in the New Orleans metro) or a dummy variable for property loss (in the remainder of the sample). The predictors in M4 include those in M3 plus a separate dummy variable for each of the 45 logically possible 2-way interactions among the 10 stressors.

Table 5

Multivariate Associations of Hurricane-Related Stressors With Estimated 30-Day *DSM-IV* Anxiety-Mood Disorders[a]

Stressor	Odds Ratio (95% CI)		
	PTSD	Other MMI or SMI	Any MMI or SMI
New Orleans Metro			
Physical injury/illness	2.8 (1.2-6.6)[b]	7.4 (2.8-19.5)[b]	6.5 (2.9-14.6)[b]
Physical adversity	7.9 (3.2-19.7)[b]	3.2 (1.4-7.2)[b]	6.0 (2.9-12.3)[b]
Any other stressor[c]	3.6 (0.7-20.2)	6.3 (1.8-21.4)	5.5 (2.0-15.0)[b]
Remainder of Sample			
Property loss	5.6 (1.8-17.8)[b]	2.8 (1.3-6.3)[b]	4.2 (2.0-8.9)[b]
Any other stressor[c]	1.8 (0.6-5.2)	1.5 (0.5-4.3)	1.7 (0.7-4.0)

Abbreviations: CI, confidence interval; metro, metropolitan area; MMI, mild/moderate mental illness; PTSD, posttraumatic stress disorder; SMI, serious mental illness.

[a] Estimates of anxiety-mood disorders were based on the K6 and Trauma Screening Questionnaire scales. See the "Methods" section for details. Coefficient estimates are based on M3 in Table 4.

[b] Significant at the .05 level, 2-sided test.

[c] Each predictor is a dichotomy coded 1 for respondents who experienced the stressor and 0 for respondents who did not experience the stressor. The dichotomy defining any other stressor includes all stressors other than physical illness/injury and physical adversity in the New Orleans metro subsample and all stressors other than property lost in the remainder of the sample.