



Published in final edited form as:

Psychol Trauma. 2017 May ; 9(3): 317–324. doi:10.1037/tra0000217.

Race Differences in Depression Vulnerability Following Hurricane Katrina

Jeanelle S. Ali, MS^a, Amy S. Farrell, MS^{a,b}, Adam C. Alexander, MS^b, David R. Forde, PhD^c, Michelle Stockton, PhD^d, and Kenneth D. Ward, PhD^b

^aDepartment of Psychology, The University of Memphis, 400 Innovation Drive, Memphis, Tennessee, United States, 38152-3450

^bDivision of Social and Behavioral Sciences, School of Public Health, The University of Memphis, 201 Robison Hall, Memphis, Tennessee, United States, 38152-3450

^cDepartment of Criminology & Criminal Justice, University of North Florida, 1 UNF Drive, Jacksonville, Florida, United States, 32224

^dSchool of Health Studies, University of Memphis, 106 Fieldhouse, Memphis, Tennessee, United States, 38152-3450

Abstract

OBJECTIVE—This study investigated whether racial disparities in depression were present after Hurricane Katrina.

METHOD—Data were gathered from 932 New Orleans residents who were present when Hurricane Katrina struck, and who returned to New Orleans the following year. Multiple logistic regression models evaluated racial differences in screening positive for depression (a score ≥ 16 on the Center for Epidemiologic Studies Depression scale), and explored whether differential vulnerability (pre-hurricane physical and mental health functioning and education level), differential exposure to hurricane-related stressors, and loss of social support moderated and/or reduced the association of race with depression.

RESULTS—A univariate logistic regression analysis showed the odds for screening positive for depression were 86% higher for African Americans than for Caucasians ($OR=1.86$ [1.28–2.71], $p=.0012$). However, after controlling simultaneously for sociodemographic characteristics, preexisting vulnerabilities, social support, and trauma-specific factors, race was no longer a significant correlate for screening positive for depression ($OR=1.54$ [0.95–2.48], $p=.0771$).

CONCLUSIONS—The racial disparity in post disaster depression seems to be confounded by sociodemographic characteristics, preexisting vulnerabilities, social support, and trauma-specific factors. Nonetheless, even after adjusting for these factors, there was a non-significant trend effect for race, which could suggest race played an important role in depression outcomes following Hurricane Katrina. Future studies should examine these associations prospectively, using stronger

assessments for depression, and incorporate measures for discrimination and segregation, to further understand possible racial disparities in depression after Hurricane Katrina.

Natural disasters increase rates of depression and post-traumatic stress disorder (PTSD; Kessler, Galea, Jones, & Parker, 2006; Norris et al., 2002; Sastry & VanLandingham, 2009), and ethnic minorities may face poorer psychological outcomes than Caucasians (Norris et al., 2002). Although evidence supports racial disparities in post-disaster PTSD (Alexander et al., 2016; Davis et al., 2012), empirical support for racial disparities in post-disaster depression is less conclusive. Among 292 pregnant women exposed to Hurricane Katrina (“Katrina”), African Americans were more likely than Caucasians to suffer from depression (Harville, Xiong, Pridjian, Elkind-Hirsch, & Buekens, 2009). Another study reviewed public opinion polls after Katrina and found African Americans, compared to Caucasians, were more likely to report being depressed as a result of Katrina (Philpot, Wylie, McGowen, & White, 2007).

Other studies show no racial disparities in post-disaster depression (Person, Tracy, & Galea, 2006; Tracy, Norris, & Galea, 2011). Tracy and colleagues (2011) found depression did not differ between Caucasians and non-Caucasians among 658 adult participants living in Texas before and after Hurricane Ike. Participants were surveyed 2–5 months after the hurricane and 4.9% were found to meet diagnostic criteria for depression. While the prevalence of depression did vary by income and educational attainment, no differences were found between ethnicities. However, there were few cases of depression among participants, which may have decreased statistical power to detect differences.

The literature still lacks clarity about whether race is an important risk factor to consider when examining depression after a disaster. Ethnic/racial effects are difficult to disentangle since disasters often affect homogenous communities (Bonanno, Brewin, Kaniasty, & LaGreca, 2010). In addition, studies often combine depression with other mood and anxiety disorders (Sastry & VanLandingham, 2009), which prevents the examination of racial disparities in depression.

Three specific hypotheses have been proposed that can help guide examinations of racial disparities in post-disaster depression. These hypotheses, which are the differential vulnerability hypothesis, differential exposure hypothesis, and social support deterioration hypothesis, have previously been assessed to understand racial disparities in PTSD (Alexander et al., 2016; Davis et al., 2012).

The *differential vulnerability hypothesis* posits that at a population level, various groups experience the same number of distressing or traumatic events (Kessler, 1979). However, minority groups are theorized to experience more intense emotional responses to these events. Heightened responses may be influenced by historical, economic, and social circumstances faced by disadvantaged groups. For example, Williams and colleagues (2010) reported internalized racism played a significant role in how African Americans experience distress. Indeed, a study by White and colleagues (2007) found African Americans were more likely than whites to experience feelings of anger and depression resulting from the

public response to Hurricane Katrina, and these feelings were explained by their perceptions of institutionalized racial discrimination.

Conversely, the *differential exposure hypothesis* proposes minorities experience considerably more stressful and traumatic events in their lives than Caucasians (Sternthal, Slopen, & Williams, 2011) and therefore disproportionately experience psychological distress. For example, African Americans often experience cumulative disadvantages throughout their lifespans. These disadvantages include racial discrimination, inequalities in education and economic resources, and physical and mental health disparities (Walsemann, Gee, & Geronimus, 2009). A recent study by Sternthal and colleagues (2011) found African Americans, compared to Caucasians, reported more exposure to psychosocial stressors, and psychosocial exposure partially explained the association of race with health status. One previous study found hurricane-related stressors (e.g., being displaced or financial loss) and exposures (e.g., presence during hurricane-force winds or being stranded) after Hurricane Ike was associated with increased risk of depression (Tracy et al., 2011). Although no ethnic differences were found, this study collapsed all ethnic minorities into a single group and did not examine African Americans separately.

Last, the *social support deterioration hypothesis* proposes the decline of social support causes significant distress among minorities (Barrera, 1986). Plant and Sachs-Ericsson (2004) noted African Americans experienced more difficulties than Caucasians in meeting basic needs such as obtaining food, clothing, and shelter. African Americans also relied more heavily on support received from families and communities for their well-being. As such, the destruction of families and communities from a natural disaster may disproportionately cause distress among African Americans. Prior to Hurricane Katrina, African Americans and Caucasians reported similar levels of social support. However, African Americans reported less social support post-disaster (Alexander et al., 2016).

To our knowledge, no research to date has systematically examined these hypotheses in post-disaster depression, although findings from post-disaster PTSD studies (Alexander et al., 2016; Davis et al., 2012) have suggested their utility in explaining differences between Caucasians and African Americans in psychological functioning in the aftermath of a disaster. The present study will evaluate post-disaster disparities in depressive symptoms among a population of ever smokers, who have substantially higher rates of depression than non-smokers (Luger, Suls, & Vander Weg, 2014; Fluharty et al., 2016). We expect to see greater preexisting vulnerabilities (e.g., poor mental health, low education, and poor health before Katrina), lower social support in the aftermath of Katrina, and greater hurricane-related stressful exposures among African Americans than Caucasians. We will also explore whether preexisting vulnerabilities, social support, and hurricane-related stressful exposures moderate the association of race with depressive symptomatology after Katrina. Last, we will explore if controlling for these factors, which may be confounded with race, will reduce racial disparities in depression after Katrina.

METHODS

Data were collected from a larger study investigating the effects of a natural disaster on tobacco use; this study is a secondary analysis of the larger dataset.

Sample Population and Recruitment

The target population was New Orleans adults (18–74 years old) who resided in New Orleans before Katrina and returned to New Orleans by the time of survey administration. New Orleans telephone numbers were purchased from Scientific Telephone Samples, CA, and records were kept on all calls to working and non-working numbers. Households were selected using random digit dialing, and a participant within a household was selected if they had smoked at least 100 cigarettes in their lifetime and spoke English. If multiple smokers resided in the household, then the smoker with the most recent birthday was interviewed. Substitutions were allowed when the eligible participant refused to participate or could not be reached. Households were listed as a non-contact after 25 attempts. Interviews occurred 14 to 17 months after Katrina (October 25, 2006 – January 20, 2007). On average, trained personnel contacted 17 residents a day. By the end of the data collection period, 1,531 eligible participants were contacted, of whom 65.5% ($n=1,003$) participated and completed the interview.

Interviews were completed using computer-assisted telephone interviewing, and lasted approximately 30 minutes. Verbal informed consent to complete the survey was obtained from participants. Upon completion, they received a \$10 gift to Target or Walmart. This protocol was approved by the XXXX Institutional Review Board.

Description of the Study Sample

This study included only African-American and Caucasian participants ($N=932$). Other racial or ethnic groups (e.g., Asians, Hispanics, and Latinos) were removed from the sample because there were too few participants in these groups to permit valid statistical analyses ($N=71$). Average age was 42.2 years and did not differ by race. The majority of the sample was female (53.7%) and 41.6% had a household income less than \$40,000. Household income varied between groups, as 33.3% of Caucasian households made at least \$40,000, while only 11.1% of African-American households made more than \$40,000. Most of the participants were current smokers (62.1%). Additional details on sample characteristics can be found in Table 1.

Measures

Depression—The primary outcome variable was screening positive for depression, based on a score of 16 or greater on the Center for Epidemiologic Studies Depression scale (CES-D) (Radloff, 1977). This scale consists of twenty questions that measure cognitive, affective, behavioral, and somatic symptoms of depression. CES-D scores range from zero to 60, and a score of 16 or greater has good sensitivity and specificity to identify individuals at risk for clinical depression (Lewinsohn, Seeley, Roberts, & Allen, 1997). The inter-item reliability for the CES-D in the present study was very high ($\alpha=.92$), and was similar for African American and Caucasian participants ($\alpha=.91$ and $\alpha=.92$, respectively).

Race—The primary independent variable was race. Participants were asked “how would you describe your racial group?”, and were given the following responses “Hispanic (Latino),” “Black,” “White,” and “Asian”. Only participants who self-identified themselves as “Black” or “White” were included in this study.

Pre-existing vulnerabilities—Two items from the Short-Form Health Survey (SF-36) assessed physical and mental health prior to Katrina. The SF-36 measures subjective functional health and well-being (Ware, 2000). The first item asked, “before Katrina how was your health,” and responses included “excellent,” “great,” “good,” and “poor.” The second item asked “during the last 30 days before Katrina, for how many days was your mental health not good?” and participants reported the number of days of poor mental health (minimum=0 and maximum=30). A participant who reported 14 days was identified as having frequent mental distress (Centers for Disease Control and Prevention, 1998).

Education was measured with one item, “what is your highest level of education?”, with 10 response choices ranging from “no school” to “completed advanced degree.” Due to skewing, this variable was dichotomized to less than 12 vs. at least 12 years of education.

Social support—Items from the Medical Outcomes Study Social Support scale (Sherbourne & Stewart, 1991) were used, “how often was someone available to ...” (1) “help you if you were confined to bed?”; (2) “help give you good advice about a crisis?”; (3) “love you and make you feel wanted?”; and (4) “do something enjoyable with?”. Responses included “none”, “some”, “most”, and “all the time”. All questions were asked twice, but were prefaced with either “during the last 30 days...” or “30 days before Katrina...” to measure current social support and social support before Katrina (min=0 and max=12). The inter-item reliability of both scales was high ($\alpha=.86$ and $\alpha=.81$, respectively). For analysis, social support before Katrina was subtracted from current social support to measure change in social support after Katrina.

The measures for social support before Katrina and change in social support were not normally distributed. In addition, social support before Katrina was skewed to the left, and 53.8% of the participants reported the maximum score for social support before Katrina. Both variables were not substantially improved by transformation; therefore, social support before Katrina was categorized for analyses into three levels: *high* (11–12), *moderate* (8–10), *low* (7) social support. By subtracting the continuous (0–12) social support score before Katrina from the after Katrina score, we created a 3-level, change in social support variable (change in social support after Katrina), *decreased* (social support (a decrease of 1 unit), and *increased* social support (an increase of 1 unit).

Hurricane Katrina stressful exposures—An 11-item checklist of Katrina-specific stressful exposures was created using questions from the Survey of Hurricane Katrina Evacuees (Brodie, Weltzien, Altman, Blendon, & Benson, 2006). Participants responded “yes” or “no” to items asking whether (1) “one or more persons of your immediate family was missing”; (2) “one or more persons of your extended family or one of more of your close friends was missing”; (3) “a member of your immediate family died because of Katrina”; (4) “a member of your extended family died or one of your close friends died

because of Katrina”; (5) “you spent time inside the Superdome”; (6) “you spent time inside the Convention Center”; (7) “you spent time in a public shelter”; (8) “you spent time at least a day outside on the street or overpass”; (9) “you were trapped in your home and had to be and (10) “you were trapped somewhere other than your home and had to be rescued”. 10 were only answered by participants who stayed in New Orleans during Katrina; individuals who left New Orleans during Katrina received scores of “0” on Items 5–10. The last question asked “as far as you know, was your home where you were living when Katrina struck...” responses included “destroyed”; “major damage”; and “minor damage”. To incorporate this item into the checklist, this variable was dichotomized to compare homes that were destroyed to those that were damaged or not damaged. A total exposure score was created by summing the 11 items (range of 0–11). Scores from the 11-item checklist were skewed to the right due to a majority of participants reporting no or only one stressful exposure. Therefore, the 11-item checklist of Katrina-specific stressful exposures was categorized into four levels: no events, one event, two events, and three or more events.

Because the distribution of total exposure scores was skewed and the checklist did not weigh items in terms of severity or consequences of the exposure, we created three categorical variables to reflect severe stressors, including having a family or friend who was missing in the aftermath of Katrina, having a family member or friend who died because of Katrina, and having one’s home damaged or destroyed. These three categorical variables were used as our primary exposure variable, and the 4-level categorical variable created from the total score (described above) was analyzed as a secondary independent variable.

Covariates—Covariates for analyses included sex, age, household income, smoking status, and lifetime PTSD—measured using the Short Screening Scale for DSM-IV Posttraumatic Stress Disorder (Breslau, Peterson, Kessler, & Schultz, 1999).

Plan of Analyses

The sample contained more Caucasian females and was slightly older than the New Orleans Metropolitan area population distribution in the 2000 U.S. census for Louisiana. Thus, the sample was weighted for race, sex, and age in each analysis to the known population (Kalton & Flores-Cervantes, 2003). Tobacco use was not weighted and was analyzed as a covariate.

First, bivariate analyses compared African American and Caucasian participants on preexisting, social support, and trauma-specific factors and sociodemographic characteristics. Categorical variable(s) were analyzed using Rao–Scott chi-square, which adjusts for sample design. Continuous variable(s) were assessed for normality using the Shapiro-Wilk test, and variable(s) that lacked normality were transformed using Box-Cox methods (Sakia, 1992) to improve distributions. These variables were then analyzed using independent samples t-tests.

Next, four logistic regression models, using PROC SURVEYLOGISTIC (SAS, 9.3), tested the association of race with screening positive for depression after Katrina (CES-D score 16) after adjusting for various sets of covariates. All models controlled for sociodemographic characteristics (sex, household income, smoking status) and PTSD. Additionally, the first model controlled for preexisting vulnerabilities (overall health before

Hurricane Katrina, frequent mental distress before Hurricane Katrina, and education level). The second model controlled for social support. The third model controlled for trauma-specific factors (home damage, the death of a family member or friend, and having a family member/friend missing after Katrina), and the fourth model controlled for all covariates. For each of the four models, interaction terms of race with preexisting vulnerabilities, social support, or trauma-specific factors also were tested, with non-significant terms ($p > .10$) removed by backward elimination.

No imputation methods were used for missing data in either bivariate or multivariable models because the amount of missing data was negligible (4.1% missing data for all variables). In comparing multivariable models, a change of 10% in the parameter estimate of the independent variable under study was considered evidence of confounding (Maldonado & Greenland, 1993). Lastly, as sensitivity analyses, all multivariable analyses were repeated with CES-D analyzed as a continuous rather than categorical dependent variable.

RESULTS

All interviews occurred 14 to 17 months after Katrina, and averaged 458.8 ($SD=27.8$) post-hurricane. The time interval (number of days) between exposure to Hurricane Katrina and completing the survey was not correlated with the primary dependent variable (screening positive for depression; $r=-.0004$, $p=.8977$) or with the primary independent variable (race; $p=.6290$). Likewise, time interval was not significantly correlated with other independent variables (listed in Table 2; all other p -values $> .0711$) except for death of a friend or relative ($r=-0.10$, $p=.0296$).

As shown in Table 1, African Americans had a higher average CES-D score (18.2 vs. 13.9 respectively, $p<.0001$) and higher odds of screening positive for depression (unadjusted $OR=1.86$ [1.28–2.71], $p=.0012$), compared to Caucasians. This association did not change after controlling for sociodemographic characteristics (adjusted $OR=1.85$ [1.20–2.86], $p=.0055$), which suggests little evidence of confounding (refer to Supplementary Table 2 for more details).

Table 2 depicts the association of race with screening positive for depression while controlling for preexisting vulnerabilities, social support, and exposure to hurricane-related stressors. Additionally, all models controlled for sociodemographic characteristics and PTSD. Pre-existing vulnerabilities, social support, and hurricane-related stressors did not moderate the association of race with depression after Katrina (please refer to the Supplementary Tables 3, 4, and 5 for details about interactions). When controlling for preexisting vulnerabilities (Table 2, Model 1), the odds of screening positive for depression were 86% higher for African Americans than for Caucasians ($OR=1.86$ [1.20–2.88], $p=.0055$). In addition, the odds for screening positive for depression were nearly 5 times greater for participants with frequent mental distress ($OR=4.93$ [2.22–10.94], $p<.0001$). Overall health and education before Katrina were not significantly associated with screening positive for depression, and there was no evidence of confounding.

The association of race with screening positive for depression was slightly lower when controlling for social support (at least a 7.5% percent change in odds ratio). The odds of screening positive for depression were 72% higher for African Americans than for Caucasians ($OR=1.72$ [1.09–2.70], $p=.0199$; Table 2, Model 2). Further, compared to participants with high social support before Katrina, the odds for screening positive for depression were 3 times greater for respondents with low social support before Katrina ($OR=2.97$ [1.64–5.38], $p=.0003$). Likewise, the odds for screening positive for depression were higher among participants who lost social support after Katrina than for participants whose social support remained unchanged ($OR=2.56$ [1.64–4.04], $p<.0001$).

A similar change in odds ratio was observed when controlling for hurricane-related stressful exposures (an almost 7% change in odds ratio). The odds for screening positive for depression were 73% higher for African Americans than for Caucasians ($OR=1.73$ [1.09–2.74], $p=.0199$; Table 2, Model 3). However, none of the hurricane-related stressful exposures (damage to the home or having family/friends who were missing or died due to Katrina) were significantly associated with depression. An additional analysis was conducted to evaluate the association of race with depression while controlling for total exposure to Katrina stressors (categorized as four levels based on total exposure score). In this analysis, odds for screening positive for depression were still higher for African Americans than Caucasians ($OR=1.78$ [1.13–2.82], $p=.0136$). Total exposure to Katrina was not associated with screening positive for depression (data not shown).

The largest change in the association of race with screening positive for depression occurred when controlling simultaneously for preexisting vulnerabilities, social support, and trauma-specific factors (at least a 17% change in odds ratio). Although non-significant, the odds of screening positive for depression were 54% higher for African Americans than for Caucasians ($OR=1.54$ [0.95–2.48], $p=.0771$; see Table 2, Model 4 for additional details).

An additional set of sensitivity analyses were conducted to analyze symptoms of depression (e.g. CES-D score) as a continuous variable using negative binomial regression. The same pattern of results emerged; race was a significant correlate for depressive symptoms in all analyses, except when controlling simultaneously for preexisting vulnerabilities, social support and trauma-specific factors, and socio-demographic characteristics (data not shown).

DISCUSSION

This study investigated whether racial disparities in depression were present after Hurricane Katrina. We also examined whether preexisting vulnerabilities, social support, and hurricane-related stressful exposures, which may be confounded with race, would moderate and/or reduce the racial disparity in depression symptomatology. Our findings show African Americans were almost twice as likely as Caucasians to screen positive for depression but this association was reduced (and became statistically non-significant) after simultaneously controlling for these confounding factors.

These findings help clarify the conflicting literature about racial disparities in symptoms of depression following a natural disaster. Our results conflict with previous studies that find no

association of race with likely depression after a disaster (Person et al., 2006; Tracy et al., 2011). These studies were limited in size and pre-disaster population representativeness. More notably, our findings are similar to results found by Sastry & Van Landingham (2009). In their study of 144 New Orleans residents displaced by Katrina one year after the disaster, they found African Americans were initially more likely to suffer from serious mental illness than Caucasians. However, after controlling for factors such as education, household income, and hurricane-related exposure, a racial disparity was no longer found. Although their study did not examine depression specifically, these findings suggest racial disparities in depression are partly due to confounding factors.

Our results also are consistent with previous research regarding race differences in post-disaster PTSD. For instance, Alexander and colleagues (2016) reported African Americans were more likely than Caucasians to screen positive for post-disaster PTSD. In addition, African Americans were more likely to have decreased post-disaster social support and increased pre-hurricane vulnerability and hurricane-related stressor exposure.

Independent of race, pre-disposing vulnerabilities and social support deterioration appear to be strong correlates of post-disaster depressive symptomatology. Previous research has indicated poor mental health prior to a natural disaster increases the risk for post-disaster depressive symptomatology (Sullivan et al., 2013). Similarly, increased social support following a traumatic event decreases the risk of being diagnosed with depression (Lincoln, Chatters, & Taylor, 2005), and loss of social support increases the risk for depression and other mental disorders (Davidson, Hughes, Blazer, & George, 1991). Unexpectedly, hurricane-related traumatic exposures, including the death of a family member or friend, did not increase the risk of screening positive for depression. Previous work by Tracy and colleagues (2011) also found hurricane-related traumatic events were not associated with depression. Social support and preexisting mental and physical health problems may be more important for understanding post-disaster depression, rather than hurricane-related traumatic events, which are commonly associated with PTSD.

Although these hypotheses were examined as possible confounders, future studies should examine these hypotheses as mediators, particularly social support deterioration and differential exposure, in prospective studies. The manner in which the differential vulnerability hypothesis is conceptualized prevents it from being tested using mediation, but the loss of social support and exposure to a natural disaster could potentially be tested using mediation analyses (MacKinnon, Fairchild, & Fritz, 2007). Findings from these studies may provide strong evidence for mechanisms by which post-disaster mental health disparities emerge.

Limitations of this study should be noted. First, the cross-sectional design prevents us from drawing conclusions about causal mechanisms. Second, the phone-based, self-report design of this study may produce misclassification and cause some error in the association of race with depression, along with the other risk factors. Third, the results may only be characteristic of people who used landline phones and returned to New Orleans at the time of the survey. Fourth, the sample was gathered from a population of current and former cigarette smokers. Although this population is of considerable interest given the strong

association between smoking and depression (Fluharty et al., 2016; Luger, Suls, & Vander Weg, 2014), these results may not generalize to non-smokers. Fifth, because social support scores were skewed, we created categories for social support which may not have used optimal cut-points and reduced statistical power. However, we used a well-established instrument (Sherbourne & Stewart, 1991), the observed associations were in the expected direction, and the pattern of results was unchanged when social support was analyzed as a continuous independent variable. Lastly, some degree of recall bias is likely in self-reports of perceived health status, mental health functioning, and social support, which are important independent variables in our study. In general, retrospective reports about subjective psychological functioning are not accurate compared to contemporaneous reports (e.g., Henry et al., 1994; Wells & Horwood, 2004). For example, approximately 10–25% of respondents in prospective survey studies inconsistently report whether they ever experienced a depressive episode (Aneshensel et al. 1987; Patten et al., 2011; Schraedley et al., 2002). Being depressed increases the risk of over-reporting past depressive events, although this occurs in only a minority of individuals (Aneshensel, et al., 1987; Schraedley et al., 2002). It is unclear to what extent being depressed causes over-reporting of other subjective states, such as perceived physical health or social support. Future studies need to quantify the extent of this bias and control it through the use of prospective designs that do not rely on retrospective reports of psychological functioning.

In conclusion, the odds for screening positive for depression were higher for African Americans than for Caucasians. However, racial disparities in post-disaster depression may be partially confounded by a combination of preexisting vulnerabilities, social support, and hurricane-related factors. Nonetheless, even when confounders are considered, substantial race differences remain in post-disaster depression. Considering these racial differences in vulnerability, social support, and exposure to traumatic events may have implications for the broader question of racial disparities in depression in the general population. Future research should explore other important risk factors, such as racial identity, discrimination, and segregation, which may explain the increased risk for depression among African Americans following a natural disaster.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was funded by PHS grant 1 R21 DA021782 (K.D. Ward, PI)

References

- Alexander, AC., Ali, JS., McDevitt-Murphy, ME., Forde, DR., Stockton, M., Read, M., Ward, KD. Racial Differences in Posttraumatic Stress Disorder Vulnerability Following Hurricane Katrina Among a Sample of Adult Cigarette Smokers from New Orleans. *Journal of Racial and Ethnic Health Disparities*. 2016. <http://doi.org/10.1007/s40615-015-0206-8>
- Aneshensel CS, Estrada AL, Hansell MJ, Clark VA. Social psychological aspects of reporting behavior: lifetime depressive episode reports. *Journal of Health and Social Behavior*. 1987; 28:232–246. [PubMed: 3680917]

- Barrera M. Distinctions between social support concepts, measures, and models. *American Journal of Community Psychology*. 1986; 14(4):413–445. <http://doi.org/10.1007/BF00922627>.
- Bonanno G, Brewin C, Kaniasty K, LaGreca A. Weighing the costs of disaster: consequences, risks, and resilience in individuals, families, and communities. *Psychological Science in the Public Interest*. 2010; 11(1):1–49. <http://doi.org/10.1177/1529100610387086>. [PubMed: 26168411]
- Breslau N, Peterson EL, Kessler RC, Schultz LR. Short screening scale for DSM-IV posttraumatic stress disorder. *The American Journal of Psychiatry*. 1999; 156(6):908–11. <http://doi.org/10.1176/ajp.156.6.908>. [PubMed: 10360131]
- Brodie M, Weltzien E, Altman D, Blendon RJ, Benson JM. Experiences of Hurricane Katrina evacuees in Houston shelters: Implications for future planning. *American Journal of Public Health*. 2006; 96(8):1402–1408. <http://doi.org/10.2105/AJPH.2005.084475>. [PubMed: 16571686]
- Centers for Disease Control and Prevention. Self-reported frequent mental distress among adults--United States, 1993–1996. *MMWR. Morbidity and Mortality Weekly Report*. 1998; 47(16):326–31. [PubMed: 9583900]
- Davidson JR, Hughes D, Blazer DG, George LK. Post-traumatic stress disorder in the community: an epidemiological study. *Psychological Medicine*. 1991; 21(3):713–21. [PubMed: 1946860]
- Davis TD, Sullivan G, Vasterling JJ, Tharp ALT, Han X, Deitch EA, Constans JI. Racial variations in postdisaster PTSD among veteran survivors of Hurricane Katrina. *Psychological Trauma: Theory, Research, Practice, and Policy*. 2012; 4(5):447–456. <http://doi.org/10.1037/a0025501>.
- Fluharty M, Taylor AE, Grabski M, Munafò MR. The Association of Cigarette Smoking with Depression and Anxiety: A systematic review. *Nicotine and Tobacco Research*. 2016 May 19. pii: ntw140. [Epub ahead of print] Review.
- Harville EW, Xiong X, Pridjian G, Elkind-Hirsch K, Buekens P. Postpartum mental health after Hurricane Katrina: a cohort study. *BMC Pregnancy and Childbirth*. 2009; 9:21. <http://doi.org/10.1186/1471-2393-9-21>. [PubMed: 19505322]
- Henry B, Moffitt TE, Caspi A, Langley J, Silva PA. On the “remembrance of things past”: a longitudinal evaluation of the retrospective method. *Psychological Assessment*. 1994; 6:92–101.
- Kalton G, Flores-Cervantes I. Weighting Methods. *Journal of Official Statistics*. 2003; 19(2):81–97.
- Kessler RC. A strategy for studying differential vulnerability to the psychological consequences of stress. *Journal of Health and Social Behavior*. 1979; 20(2):100–8. [PubMed: 479523]
- Kessler RC, Galea S, Jones RT, Parker HA. Mental illness and suicidality after Hurricane Katrina. *Bulletin of the World Health Organization*. 2006; 84(12):930–9. [PubMed: 17242828]
- Lewinsohn PM, Seeley JR, Roberts RE, Allen NB. Center for Epidemiologic Studies Depression Scale (CES-D) as a screening instrument for depression among community-residing older adults. *Psychology and Aging*. 1997; 12(2):277–87. [PubMed: 9189988]
- Lincoln KD, Chatters LM, Taylor RJ. Social Support, Traumatic Events, and Depressive Symptoms Among African Americans. *Journal of Marriage and the Family*. 2005; 67(3):754–766. [PubMed: 16429592]
- Luger TM, Suls J, Vander Weg MW. How robust is the association between smoking and depression in adults? A meta-analysis using linear mixed-effects models. *Addictive Behaviors*. 2014; 39(10):1418–29. <http://doi.org/10.1016/j.addbeh.2014.05.011>. [PubMed: 24935795]
- MacKinnon DP, Fairchild AJ, Fritz MS. Mediation analysis. *Annual Review of Psychology*. 2007; 58:593–614. <http://doi.org/10.1146/annurev.psych.58.110405.085542>.
- Maldonado G, Greenland S. Simulation study of confounder-selection strategies. *American Journal of Epidemiology*. 1993; 138(11):923–36. [PubMed: 8256780]
- 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):207–39. [PubMed: 12405079]
- Patten SB, Williams JV, Lavorato DH, Bulloch AG, D’Arcy C, Streiner DL. Recall of recent and more remote depressive episodes in a prospective cohort study. *Social psychiatry and psychiatric epidemiology*. 2012; 47(5):691–696. [PubMed: 21533819]
- Person C, Tracy M, Galea S. Risk factors for depression after a disaster. *The Journal of Nervous and Mental Disease*. 2006; 194(9):659–66. <http://doi.org/10.1097/01.nmd.0000235758.24586.b7>. [PubMed: 16971817]

- Philpot TS, Wylie K, McGowen E, White IK. Feeling the Pain of My People: Hurricane Katrina, Racial Inequality, and the Psyche of Black America. *Journal of Black Studies*. 2007; 37(4):523–538. <http://doi.org/10.1177/0021934706296191>.
- Plant EA, Sachs-Ericsson N. Racial and ethnic differences in depression: the roles of social support and meeting basic needs. *Journal of Consulting and Clinical Psychology*. 2004; 72(1):41–52. <http://doi.org/10.1037/0022-006X.72.1.41>. [PubMed: 14756613]
- Radloff LS. The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. *Applied Psychological Measurement*. 1977; 1(3):385–401. <http://doi.org/10.1177/014662167700100306>.
- Sakia RM. The Box-Cox transformation technique: a review. *The Statistician*. 1992; 41(2):169–178.
- Sastry N, VanLandingham M. One year later: mental illness prevalence and disparities among New Orleans residents displaced by Hurricane Katrina. *American Journal of Public Health*. 2009; 99(Suppl 3):S725–31. <http://doi.org/10.2105/AJPH.2009.174854>. [PubMed: 19890178]
- Schraedley PK, Turner RJ, Gotlib IH. Stability of retrospective reports in depression: traumatic events, past depressive episodes, and parental psychopathology. *Journal of Health and Social Behavior*. 2002; 43:307–316. [PubMed: 12467255]
- Sellers RM, Caldwell CH, Schmeelk-Cone KH, Zimmerman MA. Racial identity, racial discrimination, perceived stress, and psychological distress among African American young adults. *Journal of Health and Social Behavior*. 2003; 44(3):302–17. [PubMed: 14582310]
- Sherbourne CD, Stewart AL. The MOS social support survey. *Social Science & Medicine* (1982). 1991; 32(6):705–14. [PubMed: 2035047]
- Sternthal MJ, Slopen N, Williams DR. Racial disparities In health: How much does stress really matter? *Du Bois Review*. 2011; 8(1):95–113. <http://doi.org/10.1017/S1742058X11000087>.
- Sullivan G, Vasterling JJ, Han X, Tharp AT, Davis T, Deitch EA, Constans JI. Preexisting mental illness and risk for developing a new disorder after hurricane Katrina. *The Journal of Nervous and Mental Disease*. 2013; 201(2):161–6. <http://doi.org/10.1097/NMD.0b013e31827f636d>. [PubMed: 23364127]
- Tracy M, Norris FH, Galea S. Differences in the determinants of posttraumatic stress disorder and depression after a mass traumatic event. *Depression and Anxiety*. 2011; 28(8):666–75. <http://doi.org/10.1002/da.20838>. [PubMed: 21618672]
- Walsemann KM, Gee GC, Geronimus AT. Ethnic differences in trajectories of depressive symptoms: disadvantage in family background, high school experiences, and adult characteristics. *Journal of Health and Social Behavior*. 2009; 50(1):82–98. [PubMed: 19413136]
- Ware JE. SF-36 health survey update. *Spine*. 2000; 25(24):3130–9. [PubMed: 11124729]
- Wells JE, Horwood LJ. How accurate is recall of key symptoms of depression? A comparison of recall and longitudinal reports. *Psychological Medicine*. 2004; 34:1001–1011. [PubMed: 15554571]
- White IK, Philpot TS, Wylie K, McGowen E. Feeling the Pain of My People: Hurricane Katrina, Racial Inequality, and the Psyche of Black America. *Journal of Black Studies*. 2007; 37(4):523–538. <http://doi.org/10.1177/0021934706296191>.
- Williams DR, Mohammed SA, Leavell J, Collins C. Race, socioeconomic status, and health: complexities, ongoing challenges, and research opportunities. *Annals of the New York Academy of Sciences*. 2010; 1186:69–101. <http://doi.org/10.1111/j.1749-6632.2009.05339.x>. [PubMed: 20201869]

Table 1

Characteristics of the study population by race (weighted estimates)

Variable	Unweighted N (Weighted %) or Weighted Mean (SD)			P
	Total (N=932)	Caucasians (n=666)	African Americans (n=266)	
Age [†]	42.2 (15.1)	42.9 (13.6)	41.2 (18.4)	.1566
Sex				.3063
Females	595 (53.7%)	428 (32.9%)	167 (20.8%)	
Males	337 (46.3%)	238 (26.2%)	99 (20.1%)	
Household Income				<.0001
Less than \$40,000	361 (41.6%)	214 (17.4%)	147 (24.3%)	
At least \$40,000	430 (44.4%)	354 (33.3%)	76 (11.1%)	
Refused to Answer	141 (14.0%)	98 (8.5%)	43 (5.5%)	
Smoking status				.0012
Former Smoker	449 (37.9%)	341 (25.7%)	108 (12.2%)	
Current Smoker	483 (62.1%)	325 (33.4%)	158 (28.7%)	
Posttraumatic stress disorder ^{††}				.6470
No	696 (75.2%)	498 (45.7%)	198 (29.5%)	
Yes	209 (24.8%)	151 (14.4%)	58 (10.4%)	
CES-D Score	15.63 (13.1)	13.89 (11.3)	18.15 (16.5)	<.0001
Depression ^b				.0011
No	584 (60.0%)	441 (39.1%)	143 (20.9%)	
Yes	348 (40.0%)	225 (20.0%)	123 (20.0%)	

^aScores four or higher on Breslau's 7-item scale for posttraumatic stress disorder indicated symptomatology.

^bScores sixteen or higher on the CES-D indicated depressive symptomatology.

[†]Age was transformed using Box-Cox methods to improve the distribution of the variable.

^{††}Variables that have missing values include posttraumatic stress disorder (N=27), overall health (N=3), and education (N=7). Because there was less than 5% missing data for each variable, statistical tests for association were completed without adjustment for missing data.

Table 2

Results for screening positive for depression after Hurricane Katrina according to race, preexisting, social support, and trauma-specific factors, odds ratio and 95% confidence intervals

Variable	Model 1 ^a OR (95% CI)	Model 2 ^b OR (95% CI)	Model 3 ^c OR (95% CI)	Model 4 ^d OR (95% CI)
Race				
Caucasian American	REF			
African American	1.86 (1.20–2.88) *	1.72 (1.09–2.70) *	1.73 (1.09 2.74) *	1.54 (0.95–2.48)
Overall health before Hurricane Katrina				
Excellent	REF			
Great	0.86 (0.46–1.60)			0.81 (0.43–1.53)
Good	1.07 (0.62–1.85)			1.00 (0.54–1.84)
Poor	1.49 (0.65–3.42)			1.17 (0.48–2.83)
Frequent mental distress before Hurricane Katrina				
No	REF			
Yes	4.93 (2.22–10.94) *			4.88 (2.18–10.92) *
Education before Hurricane Katrina				
Less than 12 years of education	REF			
At least 12 years of education	1.14 (0.61–2.13)			1.13 (0.60–2.13)
Social support before Hurricane Katrina				
High	REF			
Moderate	0.97 (0.57–1.66)			1.04 (0.60–1.82)
Low	2.97 (1.64–5.38) *			2.61 (1.43–4.77) *
Change in social support after Hurricane Katrina				
Remained the same	REF			
Increased	0.93 (0.42–2.06)			1.02 (0.46–2.29)
Decreased	2.56 (1.64–4.04) *			2.83 (1.74–4.60) *
Home damage^e				
Minor			REF	
Major			1.44 (0.90–2.29)	1.42 (0.86–2.36)
Destroyed			1.66 (0.87 3.16)	1.72 (0.90–3.27)

Variable	Model 1 ^a OR (95% CI)	Model 2 ^b OR (95% CI)	Model 3 ^c OR (95% CI)	Model 4 ^d OR (95% CI)
Death of friend or family member [‡]				
No			REF	
Yes			1.11 (0.70–1.76)	1.25 (0.77–2.03)
Missing friend or family member				
No			REF	
Yes			0.77 (0.49–1.21)	0.82 (0.51–1.33)

* $P < .05$

^a**Model 1:** Association of race with screening positive for depression after Hurricane Katrina, controlling for preexisting factors and sex, household income, smoking status, and posttraumatic stress disorder (N=897).

^b**Model 2:** Association of race with screening positive for depression after Hurricane Katrina, controlling for social support factors and sex, household income, smoking status, and posttraumatic stress disorder (N=905).

^c**Model 3:** Association of race with screening positive for depression after Hurricane Katrina, controlling for trauma-specific factors and sex, household income, smoking status, and posttraumatic stress disorder (N= 902).

^d**Model 4:** Association of race with screening positive for depression after Hurricane Katrina, controlling for preexisting, social support, and trauma-specific factors and sex, household income, smoking status, and posttraumatic stress disorder (N=894).