

# The Impact of Hurricane Katrina on the Mental and Physical Health of Low-Income Parents in New Orleans

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The purpose of this study was to document changes in mental and physical health among 392 low-income parents exposed to Hurricane Katrina and to explore how hurricane-related stressors and loss relate to post-Katrina well-being. The prevalence of probable serious mental illness doubled, and nearly half of the respondents exhibited probable post-traumatic stress disorder. Higher levels of hurricane-related loss and stressors were generally associated with worse health outcomes, controlling for baseline sociodemographic and health measures. Higher baseline resources predicted fewer hurricane-associated stressors, but the consequences of stressors and loss were similar regardless of baseline resources. Adverse health consequences of Hurricane Katrina persisted for a year or more, and were most severe for those experiencing the most stressors and loss. Long-term health and mental health services are needed for low-income disaster survivors, especially those who experience disaster-related stressors and loss.

**H**urricane Katrina was one of the worst natural disasters in U.S. history (U.S. Department of Commerce, 2006). Beyond the physical devastation, the hurricane led to elevated health and mental health difficulties among survivors (Galea et al., 2007; Kessler, Galea, Jones, & Parker, 2006; Mills, Edmondson, & Park, 2007; Wang et al., 2007; Weisler, Barbee, & Townsend, 2006). Low-income, African American, single mothers were at particularly high risk for suffering these adverse effects (Adeola, 2009; Jones-DeWeever, 2008). Even among the most vulnerable groups, however, there is often considerable variation in survivors' resources, exposure, and responses (Dyson, 2006). The present study investigated how a sample of primarily single, low-income, African American women adjusted in the aftermath of Hurricane Katrina. Prehurricane data permitted an assessment of change in physical and mental health over time and of the role of material and social resources in protecting participants from both hurricane exposure and adverse outcomes following the event.

## Background

Each year, excluding droughts and war, nearly 500 incidents across the globe meet the Red Cross definition of a disaster (Norris, Baker, Murphy, & Kaniasty, 2005). A substantial literature has examined the mental and physical health effects of exposure to disasters (Galea, Nandi, & Vlahov, 2005; Rubonis & Bickman, 1991). Much of this research focuses on the short-term implications and indicates that disaster survivors evidence a wide range of reactions, including symptoms of posttraumatic stress disorder (PTSD) as well as other, often comorbid, conditions such as depression, anxiety, somatization, substance abuse, and physical illness (Kessler et al., 2006; Pfefferbaum & Doughty, 2001; Solomon & Green, 1992). Specific transient symptoms may include distressing worries, difficulties sleeping and concentrating, and disturbing memories, many of which dissipate over time with solid emotional support (Norris et al., 2005).

Findings on the long-term health and mental health consequences of disasters are somewhat mixed. Whereas some studies have noted enduring effects (Green et al., 1990; Lima, Pai, Santacruz, Lozano, & Luna, 1987; Stein et al., 2004; Thienkrua et al., 2006), the majority find that problems are relatively short-lived, with survivors recovering from the initial shock and trauma within a matter of weeks or months of the event (e.g., Cook & Bickman, 1990; Salzer & Bickman, 1999; Sundin & Horowitz, 2003). Indeed, a meta-analysis of 52 disaster studies indicated that effects attenuate as the number of weeks from the event elapse (Rubonis & Bickman, 1991). Moreover, as many as

This study was funded by NIH Grant R01HD046162, the National Science Foundation, the MacArthur Foundation, and the Princeton Center for Economic Policy Studies. We thank Thomas Brock and MDRC.

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1 half of survivors show resilience in the face of loss and trauma,  
2 displaying little or no grief beyond the first few months (Bonanno, 2008). Several personality factors appear to be associated  
3 with such resilience, including a tendency toward self-enhancement and positive emotions (Bonanno, Rennieke, & Dekel,  
4 2005). Likewise, certain demographic and contextual factors, including gender, education, social support, health, and less  
5 stress exposure, are associated with resilient functioning (Bonanno, Galea, Bucciarelli, & Vlahov, 2007). Nonetheless, the emotional  
6 and behavioral effects of Hurricane Katrina—which produced widespread community disruption, exposure to an  
7 array of known risk factors, and a protracted recovery—were more substantial than those resulting from most previous natural  
8 disasters (Galea, Tracy, Norris, & Coffey, 2008; Rateau, 2009; Sastry & VanLandingham, 2009).

### 17 Hurricane Katrina

19 Hurricane Katrina devastated the Gulf Coast region of the United States, contributing to the loss of nearly 2,000 lives and  
20 displacing approximately 1.5 million residents. Hurricane Rita occurred just 1 month later, also affecting some of the participants  
21 in this study. Hurricane Katrina was particularly stressful to the low-income and African American residents of New Orleans,  
22 many of whom were left homeless and isolated from their social and community networks (Adeola, 2009; Elliot & Pais,  
23 2006; Galea et al., 2008; Sharkey, 2007). In the city of New Orleans, which was most heavily affected by the levee  
24 breaks, it is estimated that 60% of the housing stock was destroyed (U.S. Department of Commerce, 2006). The hurricane  
25 also seriously damaged or destroyed educational and health facilities in the city, leading to numerous school closures,  
26 destruction of medical records, and reductions in the number of hospital beds and health clinics. Large numbers of evacuees  
27 have still not returned to New Orleans (Fussell, Sastry, & VanLandingham, in press).

29 Growing evidence suggests that the hurricane had both immediate and lasting adverse health and mental health consequences.  
30 A rapid-needs assessment of returning New Orleans residents conducted by the Centers for Disease Control and  
31 Prevention in October 2005 revealed that more than 50% of respondents showed signs of a “possible” need for mental  
32 health treatment (Centers for Disease Control and Prevention, 2006; Weisler et al., 2006). A study of families living in  
33 FEMA-subsidized hotels or trailers conducted in February of 2006 reported high rates of disability among caregivers of children,  
34 due to depression, anxiety, and other psychiatric problems (Abramson & Garfield, 2006). The survey also yielded  
35 high rates of reports of chronic health problems (34%) and numerous new mental health problems (nearly 50%) among  
36 children in these families. Another cross-sectional survey of 222 survivors found that over half (52%) continued to experience  
37 poor mental and physical health 15 months after Katrina (Kim, Plumb, Gredig, Rankin, & Taylor, 2008). Other  
38 researchers have noted an even longer term persistence of these symptoms (Galea et al., 2008; Ginzburg, 2008; Kessler et al.,  
39 2008; Schoenbaum et al., 2009; Wang et al., 2008), with young adults, women, parents of small children, and those with low  
40 income suffering the highest levels of PTSD and mental health

disorders (Bolin & Bolton, 1986; Galea et al., 2007; Jones-DeWeever, 2008; Kessler et al., 2008).

A major difficulty in assessing such effects, however, is the lack of information on the predisaster functioning. Few studies have access to true “baseline” information collected prior to the disaster. Among those studies of events that do have such data, few have been on the catastrophic scale of Hurricane Katrina. An extensive review by Norris et al. (2002) found that only 7 of the 160 studies reviewed had predisaster data on the individuals examined. Moreover, the samples used in these studies were generally small, with a median sample size of 149 across the 160 studies. The vast majority of disaster studies relied on postdisaster or retrospective data. Although it provides some measure of predisaster functioning, retrospective information is likely to be measured with error, leading to biased estimates of effects on postdisaster outcomes. For example, responses to retrospective questions about predisaster social support or living circumstances could be colored by postdisaster experiences. A closely related issue is that measures of the actual amount of stressors and loss during the course of a disaster may also be affected by the individual’s state of mind or mental health. For example, reports of actual stressors experienced during a disaster (e.g., fear that one’s life was in danger during the disaster) may be heightened by preexisting anxiety or depression. If so, it would not be surprising to find that anxiety or depression measured after the disaster is associated with reports of stressful experiences. However, this association would not provide information on whether the stressors heightened mental health problems.

One study examined how 1,043 survivors’ mental health changed from before to between 5 and 8 months after the hurricane (Kessler et al., 2006). Survivors’ reports of health problems were compared to those of 826 people who lived in hurricane-affected areas at the time of this survey and previously were participants in the National Comorbidity Survey–Replication (NCS–R), conducted between 2001 and 2003. This study found significantly higher rates of serious and mild–moderate rates of mental illness (based on the K6 screening scale; Kessler et al., 2002) among the post-Katrina sample, but found less suicidality among those in the post-Katrina sample. The much higher (doubled) rate of mental illness is striking. Unfortunately, because this study does not track individuals from before to after the storm, it is not possible to assess which pre-hurricane factors were protective against increases in mental illness and which were not.

It is also difficult, in the absence of baseline data, to account for variability in adaptive functioning among survivors. Even among the most vulnerable populations, there is often considerable heterogeneity in survivors’ responses to traumatic events. Baseline data permit an exploration of the economic, social, and health and mental health resources, alone and in combination, that might heighten vulnerability or strengthen resilience. Previous explanatory models of disaster responses have focused on the interrelationships between the severity of exposure and the resources available to the individual. Most of these models have posited that resources function to moderate or “buffer” the effects of hurricane experiences, influencing individuals’ perceptions of and their responses to the disaster. Survivors with initially low levels of health, social or economic resources are thought to be more vulnerable to the negative consequences of

1 the hurricane, and to experience relatively steeper declines in  
2 emotional and physical health outcomes. Social support has  
3 been shown to buffer against stress, and the lack of social sup-  
4 port has been identified as a risk factor of PTSD (Galea et al.,  
5 2008; Kaniasty & Norris, 2008; Ozer & Weiss, 2004; Weems  
6 et al., 2007).

7 Researchers have also looked at the loss of social support and  
8 other resources in explaining variability in stress responses.  
9 Within this context, the Conservation of Resources (COR) the-  
10 ory posits that it is the threatened or actual loss of health,  
11 social, or economic resources that leads to psychological distress  
12 (Hobfoll, 1989). According to COR, individuals strive to obtain  
13 and retain personal and social resources, and experience stress  
14 when circumstances threaten or diminish these resources.  
15 Resources tend to beget more resources, whereas a loss of  
16 resources tends to result in further loss. In particular, those indi-  
17 viduals who have fewer resources prior to a stressor are less  
18 equipped to invest resources in recovery, such that efforts to  
19 recover from losses lead to progressive depletion of resources.  
20 Previous research on natural disasters indicates that the loss of  
21 social, health, or economic resources is associated with declines  
22 in psychosocial functioning (Kaiser, Sattler, Bellack, & Dersin,  
23 1996; Sattler et al., 2002; Smith & Freedy, 2000; Sümer, Kar-  
24 anci, Berument, & ve Güneş, 2005).

25 Resources can also affect the degree of hurricane-related  
26 stress that is experienced. Differential access to resources prior  
27 to the storm, such as reliable information, transportation, and  
28 more geographically extended social networks, can affect varia-  
29 tions in exposure to the disaster (Adeola, 2009; Lieberman,  
30 2006; Stephens, Hamedani, Markus, Bergsieker, & Eloul, 2009).  
31 Hobfoll and Parris Stevens (1990) have posited that social sup-  
32 port may “directly prevent or limit resource loss and thereby  
33 insulate people from stressful circumstances” (p. 458). Likewise,  
34 Kaniasty and Norris (2009) noted that predisaster resources can  
35 influence the degree of disaster exposure. This was clearly the  
36 case with Hurricane Katrina, where low-income communities of  
37 color were more vulnerable to its impact (Adeola, 2009). Most  
38 high- and medium-income families evacuated in advance of the  
39 storm and secured places to stay in hotels, or with family and  
40 friends in other cities. Low-income families, in contrast, were  
41 disproportionately stranded in the city or in shelters after the  
42 storm, increasing the chance that they experienced deprivation,  
43 stress and fear (Elliot & Pais, 2006; Lavelle & Feagin, 2006;  
44 Spence, Lachlan, & Griffin, 2007). Brodie, Weltzien, Altman,  
45 Blendon, and Benson (2006) found that, among survivors who  
46 did not evacuate New Orleans, more than a third lacked a  
47 means of transportation. Others have noted that those with  
48 fewer economic resources are more likely to live in housing that  
49 is unable to withstand natural disasters (Ruscher, 2006; Weems  
50 et al., 2007). Moreover, those who are poor tend to receive and  
51 heed fewer evacuation warnings, heightening their risk for expo-  
52 sure (Dyson, 2006; Lieberman, 2006; Stephens et al., 2009).

## 53 54 55 **Current Study**

56 The current study examines the consequences of Hurricane  
57 Katrina on the physical and mental health of a particularly  
58 vulnerable group of survivors—low-income, predominantly  
59 African American, single mothers. Using a unique panel

dataset that follows individuals from more than a year before  
the hurricane to approximately 18 months afterwards, we docu-  
ment changes in the physical and mental health of study partic-  
ipants and examine how the degree of exposure to hurricane-  
related stressors experienced during the hurricane is related to  
their post-Katrina well-being. The existence of prehurricane  
data permits us to examine whether prehurricane  
resources—including economic, social, and health resource-  
s—had protective effects on posthurricane health outcomes. In  
particular, we examine the extent to which exposure to hurri-  
cane-related stressors, level of property damage, and water  
depth affected mental and physical health outcomes after Hur-  
ricanes Katrina and Rita after controlling for demographic and  
prehurricane mental and physical health. Given the extent to  
which mental health can affect perceptions of difficulties, we  
expected that objective measures of damage—such as flood  
depths obtained via geo-coding—would be less strongly related  
to prehurricane mental health than more subjective measures  
of perceived stressors and loss.

We also examine the protective role of resources that were  
available prior to Hurricane Katrina. Although previous studies  
have examined retrospective accounts of predisaster resources  
(or the buffering role of postdisaster resources), pre-Katrina  
data permit an examination of whether the social and material  
resources that the predominantly low-income, African American  
mothers had at their disposal prior to the natural disaster  
affected the severity of their exposure to the disaster.

## **Method**

### **Data Collection and Sample Characteristics**

Participants were initially part of a study of low-income par-  
ents who had enrolled in two community colleges in the city of  
New Orleans in 2004–2005. The purpose of the study was to  
examine whether performance-based scholarships affect aca-  
demic achievement and therefore also health and well-being  
(Brock & Richburg-Hayes, 2006). Baseline demographic and  
health information was collected for all of the 1,019 participants  
in the study. By the time Hurricane Katrina struck, 492 partici-  
pants had been enrolled in the program long enough to com-  
plete a 12-month follow-up survey, which included information  
on participants’ economic status, social support, and physical  
and mental health. After Hurricane Katrina, between May 2006  
and March 2007, 402 (81.7%) of those participants who had  
completed the 12-month survey were successfully located by a  
survey research firm and surveyed over the telephone. The post-  
disaster surveys, which were administered over the phone by  
trained interviewers, included the same questions as the pre-  
disaster 12-month follow-up survey, as well as a measure of PTSD  
and module that collected detailed information about hurricane  
experiences. Next, we refer to information from the baseline and  
12-month surveys as “pre-Katrina” data, and information from  
the more recent survey as “post-Katrina” data. The analyses in  
this study draw on a sample of 392 respondents who reported  
living in an area affected by Hurricane Katrina at the time the  
hurricane struck.

All the participants experienced the hurricane and most  
(98.0%) evacuated, however, their trajectories varied: 85.4%

**Table 1.** *Baseline Characteristics of the Sample*

	Study sample ( <i>N</i> = 392)
Age at the time of Hurricane Katrina, mean ( <i>SD</i> )	26.55 (4.45)
Female, % [95% CI]	95.9 [94.0–97.9]
African American, % [95% CI]	84.2 [80.6–87.8]
Non-Hispanic white, % [95% CI]	10.7 [7.7–13.8]
Number of children, mean ( <i>SD</i> )	1.92 (1.05)
Single (neither married nor cohabiting), % [95% CI]	64.0 [59.3–68.8]
Monthly individual earnings (\$), mean ( <i>SD</i> )	651.7 (686.2)
Monthly individual earnings (\$), median	600.0
Monthly family income (\$), median	1,358.4
Received public assistance <sup>a</sup> , % [95% CI]	64.3 [59.6–69.0]
Owned working car, % [95% CI]	72.9 [68.6–77.4]

<sup>a</sup>Any time during the month prior to the survey.

departed before the storm struck, while 4.9% left during the storm, and 9.6% left in the week of, or after, Katrina. The participants had moved an average of 2.5 times (*SD* = 0.4). At the time of the post-Katrina follow-up survey, 47.7% were living in the New Orleans MSA, 12.5% were living elsewhere in Louisiana, 24.9% were in Texas, 4.7 were in Georgia, and the remaining 10.2% were in other states.

Table 1 presents demographic information for the participants. The average age at the time of Hurricane Katrina was 26.6 years (*SD* = 4.5). The majority was female (95.9%). The majority was African American (84.2%), reflecting the demographics of the City of New Orleans in which 67.7% of the population was African American in 2004 (see Jones-DeWeever, 2008). Most were neither married nor cohabiting with a romantic partner (64.0%). More than two thirds (64.3%) received public assistance in the month prior to the pre-Katrina survey. Nearly three quarters (72.9%) owned a working car prior to the Hurricane.

## Measures

**Economic Status.** We used three measures of pre-Katrina economic status: the logarithm of total household income in the previous month; an indicator of the number of received public benefits in the past month including unemployment insurance, Supplemental Security Income, welfare and food stamps; and a measure of car ownership prior to Katrina. Car ownership is important both as a measure of wealth as well as a form of transportation that may have made it easier to evacuate in advance of the hurricane.

**Social Support.** Perceptions of social support were assessed at Times 1 and 2 using eight items from the Social Provisions Scale (Cutrona & Russell, 1987). These items assess the extent to which participants perceive that they have people in their lives who value them and on whom they can rely. Items are rated using a 4-point Likert-type scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Cronbach's alpha of this scale in this study was .84 for Time 1 (T1) and .81 for Time 2 (T2).

**Hurricane Experiences.** We used three measures of hurricane experiences, two of which were based on individuals' survey responses. The first measure was a one-item question on respondents' assessments of the extent of damage to their personal property, rate on a 4-point scale ranging from 0 (*minimal*) to 3 (*enormous*). The second measure of hurricane experiences was a scale of the number of hurricane-related stressors experienced. The 17 questions, which assessed stressors experienced in the immediate aftermath of the storm, duplicated those used in a larger survey of the demographic and health characteristics, evacuation and hurricane experiences, and future plans of Hurricane Katrina evacuees. The scale was jointly designed by the *Washington Post*, the Kaiser Family Foundation, and the Harvard School of Public Health (Brodie et al., 2006). Participants were asked to indicate whether they had experienced any of the following conditions: (a) no fresh water to drink, (b) no food to eat, (c) felt their life was in danger, (d) lacked necessary medicine, (e) lacked necessary medical care, (f) had a family member who lacked necessary medical care, (g) lacked knowledge of safety of their children, and (h) lacked knowledge of safety of their other families members. These questions were asked about both Hurricane Katrina and Hurricane Rita. In addition, participants indicated whether a close friend or family member had lost their life due to the hurricane and its aftermath. A composite score (labeled as "hurricane-related stressors") was created with the count of affirmative responses to these 17 items. Inter-item reliability (KR-20) of the exposure scale was .84. The third measure gauges hurricane damage to the respondent's pre-Katrina home with the flood depth information for each address on September 2, 2005. This provides an objective measure of whether respondents lived in hard-hit areas. We were able to geo-code 372 of the 392 addresses; the remaining respondents used postoffice boxes which could not be matched with flood data.

**Psychological Distress.** The K6 scale of nonspecific psychological distress (Kessler et al., 2002) was used to assess DSM-IV mood and anxiety disorders within the previous 30 days. The K6 scale has been shown to have good psychometric properties (Furukawa, Kessler, Slade, & Andrews, 2003), and has been used in previous research on the psychological functioning of Hurricane Katrina survivors (e.g., Galea et al., 2007; Wang et al., 2007). It includes items such as "During the past 30 days, about how often did you feel so depressed that nothing could cheer you up"? Respondents answered on a 5-point rating scale ranging from 0 (*none of the time*) to 4 (*all the time*). Scale scores range from 0 to 24. A previous validation study (Kessler et al., 2003) suggests that a scale score of 0–7 can be considered as probable absence of mental illness, a score of 8–12 can be considered as probable mild or moderate mental illness (MMI) and a score of 13 or greater can be considered as probable serious mental illness (SMI). Cronbach's alpha of the K6 scale in this study was .72 for T1 and .80 for T2. Our use of the K6 permits direct comparisons with results in the Kessler et al.'s (2006) study of mental illness after Hurricane Katrina.

**PTSD Symptoms.** The Impact of Events Scale-Revised (IES-R), a 22-item self-report inventory of symptoms of PTSD (Weiss & Marmar, 1997) with good psychometric properties

(e.g., Creamer, Bell, & Failla, 2003), was used to measure PTSD symptoms as a result of hurricane experiences. The total score for this scale ranges from 0 to 88. Unlike the other mental health measures we used, this measure was specific to the respondent's hurricane experiences and was included only in the post-Katrina survey. Participants were asked how often, over the prior week, they were distressed or bothered by experiences related to the hurricane, with sample items including "Any reminders brought back feelings about it," "Pictures about it popped into my mind," and "I was jumpy and easily startled." The scale was rated in a 5-point scale, ranging from 0 (*not at all*) to 4 (*extremely*). Cronbach's alpha reliability for the IES-R scale in this study was .95.

**Perceived Stress.** The Perceived Stress Scale, or the PSS4 (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1991), was used to measure perceptions of stress. This four-item scale, which measures the degree to which events in one's life are perceived to be stressful, has been widely used in studies of the role of stress in the development of health problems. Participants answered on a 5-point ratingscale ranging from 0 (*never*) to 4 (*very often*). Cronbach's alpha of the PSS4 scale in this study was .73 for T1 and .75 for T2.

**Physical Health.** We assessed physical health using three measures. Respondents rated their health on a 5-point scale ranging from 1 (*excellent*) to 5 (*poor*). Respondent's body mass index (BMI) was calculated using a baseline report on height and pre- and posthurricane reported weight. Finally, we included a count of the number of diagnosed medical conditions, including diabetes, asthma, hypertension, and other conditions.

## Results

### Missing Data

Although the missing variables were not missing completely at random, the missing rate on each item was generally low, under 10%. Missing data were handled with multiple imputation: From the original data, five complete datasets with no missing variables were rendered using Amelia II (Honaker, King, & Blackwell, 2008) in R program. Each analysis was

conducted independently across the five datasets. Each result presented next represents an average of the five separate analyses. When appropriate, Rubin's (1987) correction was performed to derive the standard errors.

### Exposure

All but 8 individuals left their homes for at least one night due to Hurricane Katrina or Rita. Half (50.2%) of the sample reported "enormous" property damage associated with the storm. They experienced, on average, 4.08 hurricane-related stressors ( $SD = 3.50$ ). The most common stressor reported was "did not know if other family members were safe after Hurricane Katrina" (76.9%), which is consistent with the mass exodus of people from the area at the time of the storm. Substantial numbers also reported experiencing serious deprivation during Hurricane Katrina, including inadequate drinking water (26.0%), inadequate food (34.9%) or feeling that their lives were in danger (32.3%). In addition, 28.6% reported the death of a family member or close friend.

### Health and Mental Health Outcomes

Mental health outcomes, as measured by the K6, worsened significantly over the period from before to after the hurricane (Table 2). Based on established cutoffs (Kessler et al., 2003), the prevalence of MMI or SMI rose from 23.5% to 37.5% (McNemar test  $p < .001$ ), and that of probable SMI doubled (6.9%–14.3%,  $p < .001$ ). The prevalence of high perceived stress (scale score  $> 7$ ) rose from 20.2% to 30.9% ( $p < .001$ ). All physical health outcomes also experienced statistically significant increases in prevalence (see Table 2). PTSD symptoms were not assessed prior to the hurricane. At the time of the post-Katrina survey, 47.7% of participants were classified as having probable PTSD (average IES-R item score  $> 1.5$ ; Weiss & Marmar, 1997).

### Hurricane-Related Stressors and Property Damage as Predictors of Mental Health Outcomes

Sequential regression was used to determine if number of hurricane-related stressors, level of property damage, and the

**Table 2.** Prevalence of Physical Health and Mental Health Outcomes Before and After Hurricane Katrina

Outcome	Definition	Before Katrina	After Katrina	McNemar test
		% [95% CI]	% [95% CI]	<i>p</i> Value
MMI/SMI	Probable mild-moderate (K6 $> 7$ ) or serious (K6 $> 12$ ) mental illness	23.5 [19.3–27.7]	37.5 [32.7–42.3]	$< .001$
SMI	Probable serious (K6 $> 12$ ) mental illness	6.9 [4.4–9.4]	13.8 [10.4–17.2]	$< .001$
PTSD	Posttraumatic stress disorder: IES-R average score $> 1.5$	ND	47.7 [42.8–52.6]	NA
PSS	Perceived stress scale $> 7$	20.2 [16.2–24.1]	30.9 [26.3–35.4]	$< .001$
FPH	Fair or poor self-rated health status	12.8 [8.8–15.2]	19.1 [15.1–22.9]	$< .01$
HC	At least one diagnosed health condition	61.2 [56.4–66.0]	66.6 [61.9–71.3]	$< .05$
OVERW	Body mass index ( $\text{kg}/\text{m}^2$ ) $> 25$	67.1 [62.4–71.7]	72.9 [68.6–77.4]	$< .01$

Note. *p* Value is from a *t* test of the hypothesis that the change is equal to 0. CI = confidence interval; IES-R = Impact of Event Scale-Revised; ND = not determined; NA = not applicable.

**Table 3.** Sequential Regression of Hurricane, Demographic, and Prehurricane Health Variables on Posthurricane Health Outcomes

Variables	K6		PSS		IES-R		BMI		No. medical conditions		General health	
	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>	<i>B</i>	<i>SE</i>
Step 1												
No. hurricane stressors	0.40	0.07**	0.19	0.05**	2.34	0.31**	0.22	0.10*	0.13	0.02**	0.08	0.04*
Level of property damage	0.45	0.27	0.20	0.18	2.72	1.12*	0.16	0.36	0.14	0.08	0.08	0.06
Water depth (log)	-0.01	0.33	0.13	0.25	1.37	1.55	0.21	0.50	-0.24	0.10*	-0.12	0.10
<i>R</i> <sup>2</sup> Δ	.09**		.05**		.18**		.02		.11**		.06**	
Step 2 (Demographic variables controlled, not shown)												
No. hurricane stressors	0.40	0.08**	0.20	0.06**	2.09	0.33**	0.10	0.11	0.12	0.02**	0.08	0.03*
Level of property damage	0.51	0.28	0.28	0.19	2.99	1.12*	0.17	0.36	0.15	0.08	0.09	0.06
Water depth (log)	-0.11	0.34	0.12	0.26	0.78	1.56	0.01	0.51	-0.27	0.10*	-0.13	0.12
<i>R</i> <sup>2</sup> Δ	.02		.03		.03*		.05*		.01		.01	
Step 3 (Prehurricane physical and mental health controlled)												
No. hurricane stressors	0.30	0.07**	0.14	0.05*	1.82	0.33**	0.10	0.05	0.09	0.07**	0.05	0.03
Level of property damage	0.50	0.26	0.34	0.18	2.92	1.10*	-0.01	0.18	-0.09	0.07	0.07	0.06
Water depth (log)	-0.01	0.32	0.14	0.24	0.82	1.53	0.21	0.24	-0.20	0.09*	-0.12	0.09
Age	0.12	0.06	0.11	0.04*	0.89	0.27**	-0.01	0.04	0.02	0.02	0.01	0.01
Own a car	-0.65	0.57	-0.17	0.40	-4.19	2.47	0.60	0.38	-0.15	0.16	-0.09	0.12
No. children	-0.34	0.25	-0.35	0.17*	-0.74	1.07	-0.11	0.17	-0.06	0.07	-0.01	0.05
Personal income (log)	0.12	0.17	0.08	0.12	0.50	0.75	-0.02	0.11	0.00	0.05	0.00	0.03
Single	-1.29	0.82	-0.36	0.57	-2.77	3.52	-0.04	0.54	0.03	0.22	0.04	0.16
Minority	-0.11	0.94	-0.49	0.06	7.99	3.83*	0.70	0.57	0.35	0.24	-0.05	0.16
Months since Katrina	-0.00	0.10	-0.03	0.07	-0.37	0.42	0.07	0.07	0.01	0.03	0.01	0.02
Public assistance	0.20	0.36	0.25	0.25	-2.17	1.57	0.20	0.27	-0.08	0.10	-0.01	0.07
K6	0.20	0.08**	-0.02	0.05	1.02	0.33**	0.01	0.05	0.00	0.02	-0.02	0.01
PSS	0.35	0.09**	0.39	0.07**	0.53	0.41	-0.03	0.06	0.04	0.03	0.06	0.02**
BMI	0.01	0.04	-0.02	0.03	0.01	0.16	0.89	0.03**	0.02	0.01*	0.01	0.01
No. medical conditions	0.15	0.20	0.07	0.14	-0.39	0.86	-0.20	0.14	0.40	0.05**	0.02	0.04
General health	0.21	0.26	0.19	0.18	0.96	1.12	0.20	0.17	0.10	0.07	0.36	0.05**
Perceived social support	-0.00	0.06	-0.05	0.05	0.13	0.28	-0.01	-0.04	0.03	0.02	-0.01	0.01
<i>R</i> <sup>2</sup> Δ	.14**		.14**		.06**		.73**		.20**		.19**	
Mean ( <i>SD</i> )	6.71 (5.19)		5.39 (3.59)		33.26 (22.97)		29.31 (6.72)		1.82 (1.50)		1.52 (1.04)	
<i>R</i> <sup>2</sup>	.24**		.21**		.27**		.80**		.32**		.26**	
Adjusted <i>R</i> <sup>2</sup>	.21		.18		.24		.79		.29		.23	

\**p* < .05. \*\**p* < .008.

flood depth at participant's pre-Katrina addresses were predictive of posthurricane mental health outcome variables (i.e., K6, PSS4, and IES-R) and whether the relationship holds after prehurricane sociodemographic variables and physical and mental health are taken into account. Controls for sociodemographic characteristics at the time of the hurricane included the respondents' age, indicators for ethnicity, the number of children, an indicator for whether she or he was single, the logarithm of monthly income, an indicator for the number of forms of received public assistance (i.e., welfare, food stamps, unemployment insurance, or Supplemental Security Income), ownership of working car, and, in addition, the number of months since the hurricane that the follow-up survey took place. Controls for pre-Katrina health measures included each of the five physical and mental health measures obtained prior to the hurricane: K6, PSS4, BMI, number of diagnosable physical health problems, self-reported health, as well as social support. Number of stressors, level of property damage, and flood depth were entered in Step 1, demographic variables were entered in Step 2, and prehurricane physical and mental health problems as well as social support were entered in Step 3. Bonferroni type adjust-

ment was made for inflated Type I error; all alphas in model statistics (e.g., *R*) were set at .05/6 = .008.

Table 3 shows the results of the six univariate sequential regressions of the mental health and physical health outcomes on the measure of reported property damage, the number of reported hurricane-related stressors, and flood depth on September 2, 2005. When no additional controls were included (Step 1), there were large and significant associations between the number of hurricane stressors and all mental health outcomes, while the level of property damage was only predictive of PTSD. Flood depth was not predictive of any mental health outcomes. These associations between loss or stressors and mental health outcomes held even after adjusting for pre-Katrina sociodemographic characteristics, although they generally declined in magnitude (Table 3, Step 2). The results in the second step may still be biased if loss or number of hurricane-related stressors are associated with pre-Katrina health status, that is, those with poor baseline health may have been less able to avoid stressors or protect their property against loss. Results in the third step of Table 3 controlled for pre-Katrina physical and mental health status in addition to sociodemographic characteristics,

1 which reduced the parameter estimates for the number of hurri-  
 2 cane-related stressors and loss relative to those in the second  
 3 step. Even controlling for predisaster health status, there were  
 4 large and usually statistically significant adverse effects of loss  
 5 and stressors on mental health. Notably, many of the pre-Kat-  
 6 rina mental and physical health measures are predictive of post-  
 7 hurricane mental health, showing that the parameter estimates  
 8 for stressors are biased by their associations with pre-Katrina  
 9 mental health.

### 11 Hurricane-Related Stressors and Property 12 Damage as Predictors of Physical Health 13 Outcomes 14

15 There were smaller but still significant associations between  
 16 stressors and physical health outcomes (see Table 3). Even with  
 17 additional sociodemographic and prehurricane physical and  
 18 mental controls, the number of hurricane-related stressors was  
 19 strongly associated with the number of diagnosed medical con-  
 20 ditions. It was also predictive of BMI and general health rating  
 21 before any of the additional variables were included. Once they  
 22 were entered into the equation, however, the associations  
 23 between number of stressors and BMI and general health rating  
 24 were no longer significant at  $p < .05$  level. Prehurricane phys-  
 25 ical health measures are strongly associated with posthurricane  
 26 physical health.

### 28 Pre-Katrina Resources as Predictors of Exposure 29 to Hurricane-Related Stressors 30

31 Given that exposure to a greater number of hurricane-related  
 32 stressor was predictive of worse mental and physical health out-  
 33 comes, we examined the extent to which pre-Katrina resources  
 34 predicted the level of exposure. Higher resource individuals may  
 35 have been more able to avoid hurricane-related stressors and  
 36 loss. In addition, resources may have buffered individuals from  
 37 the adverse effects of stressors and property damage. To exam-  
 38 ine these hypotheses, we performed a standard multiple regres-  
 39 sion, with nine indicators of pre-Katrina resources: (a) number  
 40 of received public benefits in the past month (e.g., welfare bene-  
 41 fits, food stamps, unemployment insurance), (b) household  
 42 income (log transformed), (c) ownership of a working car, (d)  
 43 level of perceived social support, (e) mental health as measured  
 44 with K6, (f) level of stress as measured with PSS4, (g) physical  
 45 health as measured with BML, (h) number of diagnosed medical  
 46 condition, and (i) general health rating. We examined whether  
 47 these prehurricane variables predicted fewer stressors and losses.  
 48 Results (not shown in Table) indicate that owning a car prior to  
 49 the hurricane ( $B = -0.82$ ,  $SE = 0.039$ ,  $p < .05$ ), a higher pre-  
 50 hurricane household income ( $B = -0.35$ ,  $SE = 0.12$ ,  $p < .01$ ),  
 51 and a higher level of prehurricane perceived social support  
 52 ( $B = -0.09$ ,  $SE = 0.05$ ,  $p < .05$ ) were predictive of fewer num-  
 53 ber of stressors experienced. No other significant relationships  
 54 were found. Apparently, these resources minimized exposure to  
 55 stressors.

56 To test whether these resources buffered the impact of expo-  
 57 sure to stressors, we estimated each of the six health and mental  
 58 health outcome variables, using the nine pre-Katrina resource  
 59 variables and the number of hurricane-related stressors experi-

enced (first block), as well as the interaction terms between the  
 resource variables and measures of stressors as predictors (sec-  
 ond block). Bonferroni correction ( $p < .008$ ) was used and con-  
 tinuous predictors were centered prior to analysis. Two  
 significant interaction effects were found: exposure to Disaster  
 Stressors  $\times$  Car Ownership on BMI ( $B = 2.99$ ,  $SE = 0.10$ ,  
 $p < .008$ ) and exposure to Disaster Stressors  $\times$  Predisaster K6  
 on postdisaster general health rating ( $B = -0.012$ ,  $SE = 0.004$ ,  
 $p < .008$ ). We found no other evidence that the effects of expo-  
 sure to stressors were smaller for those with higher prehurricane  
 resources. Although resources may have reduced trauma expo-  
 sure, they did not appear to have buffered individuals from the  
 mental health effects, and to a lesser extent physical health, of  
 trauma and loss.

## Discussion

Rates of mental and physical illness rose sharply among partic-  
 ipants in this study and remained elevated for at least 1 year  
 following Hurricane Katrina. Fully 13.8% of the sample had  
 probable SMI, up from 6.9% before the hurricane. Moreover,  
 nearly half (47.7%) had probable PTSD, which is higher than  
 rates reported in previous studies of Hurricane Katrina survi-  
 vors (Galea et al., 2007, 2008; Kessler et al., 2008) and speaks  
 the particular vulnerabilities of the mostly young, low-income,  
 African American mothers in our study. Indeed, recent studies  
 have revealed higher rates of mental illness among Hurricane  
 Katrina survivors who were single, African American, low-  
 income, Hurricane-exposed, female, or between the ages of 18  
 and 34 (Galea et al., 2007; Kessler et al., 2008). When combined  
 with the additional stressor of having small children, these risk  
 factors conspire to create a high prevalence of PTSD. More gen-  
 erally, these findings are consistent with previous research,  
 which has highlighted the particular burden of disasters that is  
 carried by women of color and the poor (Adeola, 2009; Norris  
 et al., 2002).

There were also significant increases in reported fair or poor  
 health, the presence of at least one diagnosed medical condition,  
 and the proportion of our sample that was overweight. Although  
 most previous disaster research has focused on the mental health  
 consequences, these findings suggest that survivors also bear a  
 significant toll to their physical health. Moreover, most earlier  
 studies of both mental and physical health have relied solely on  
 post-Katrina samples or compared separate samples drawn from  
 before and after the hurricane. By taking into account prehurricane  
 assessments of both mental and physical health, our findings  
 provide more definitive evidence that mental and physical health  
 declines were coincident with the hurricane.

There were strong adverse effects of hurricane-associated stres-  
 sors and loss on mental health outcomes: Individuals who experi-  
 enced more stressors and property damage were more likely to  
 experience symptoms of mental illness, PTSD, and marginally  
 higher levels of perceived stress. This is consistent with a previous  
 study in which severe housing damage predicted psychological  
 distress among Hurricane Katrina survivors 1 year after the  
 storm (Sastry & VanLandingham, 2009). The effects of loss and  
 stressors on physical health were more muted, although more  
 stressors predicted more diagnosed medical conditions.

1 Although research indicates that individuals with higher  
2 resources experience less loss and fewer stressors as the result of  
3 disaster (Adeola, 2009; Sattler et al., 2002), we found only  
4 mixed support for this pattern. Higher personal income, more  
5 perceived social support, and ownership of a car predicted  
6 fewer hurricane-related stressors, but other resources, such as  
7 receipt of public benefits and mental and physical health, did  
8 not. In the case of Hurricane Katrina, the degree of loss was  
9 geographically widespread and devastating, producing relatively  
10 egalitarian storm damage. These findings are consistent with  
11 those of a study of Thai survivors of the 2004 tsunami, which  
12 showed that those who were displaced by the tsunami had simi-  
13 lar pretsunami levels of income and education as those who  
14 were not displaced (Frankenberg et al., 2008; van Griensven  
15 et al., 2006).

16 We found very little evidence that baseline economic, social  
17 and health resources buffered the adverse effects of hurricane-  
18 related stressors and loss on health. The lack of buffering  
19 effect is surprising, particularly since the resource variables  
20 include a measure of social support, which has a well-docu-  
21 mented, positive association with disaster recovery (Kaniasty  
22 & Norris, 1993). Weems et al. (2007) found a relatively low  
23 association between post-Katrina social support and PTSD  
24 symptoms suggesting that social support systems were over-  
25 whelmed and had not sufficiently mobilized to mitigate dis-  
26 tress. Indeed, in contrast to more circumscribed events, the  
27 “collective trauma” of Katrina disrupted some of the very  
28 resources that might have been marshaled, with potential sup-  
29 port providers either scattered around the country or too  
30 burdened themselves to provide ample help to network mem-  
31 bers (Fussell, in press; Galea et al., 2007; Weisler et al.,  
32 2006). Moreover, even in intact networks, an initial mobiliza-  
33 tion of help is often followed by a deterioration of perceived  
34 social support (Arata, Picou, Johnson, & McNally, 2000;  
35 Erickson, 1976; Kaniasty & Norris, 1993; Norris & Kaniasty,  
36 1996).

### 37 38 39 Limitations

40 In interpreting the results of this study, several limitations  
41 should be kept in mind. First, this study relied largely on self-  
42 report measures, which are susceptible to subjective biases. Our  
43 reliance on a screening tool of nonspecific distress further limits  
44 the scope of the study. An analysis of the effects of resources on  
45 specific psychiatric problems commonly observed in the after-  
46 math of a disaster (e.g., PTSD, depression, grief) could reveal  
47 differential associations informative to the planning of therapeu-  
48 tic interventions for disaster survivors. Moreover, clinical inter-  
49 views would have been preferable to screening scales of mental  
50 disorders, as the latter provide less precise and more conserva-  
51 tive estimates (Kessler et al., 2008).

52 Additionally, our index of social support did not distinguish  
53 among types of perceived social support (e.g., emotional, infor-  
54 mational, tangible), limiting our ability to discern whether spe-  
55 cific forms of support led to fewer hurricane-related stressors. It  
56 would have also been helpful to obtain additional descriptive  
57 information about the composition of the participants’ social  
58 networks, a factor that was shown to influence depressive symp-  
59 tomatology among Hurricane Andrew survivors (Haines, Beggs,

& Hurlbert, 2002). Data on the support provided by partici- 5  
pants to others in the aftermath of disaster would also be bene-  
ficial in future research, as social demands, particularly on  
women, can increase stress and influence psychological out-  
comes (Jones-DeWeever, 2008).

Although we were fortunate to locate over 80% of our pre-  
Katrina sample, those who were not located may have been  
more marginalized and have suffered even higher levels of psy-  
chopathology, potentially rendering our prevalence estimates  
conservative. Finally, participants in this study are not represen-  
tative of the entire population affected by the hurricanes, reduc-  
ing the generalizability of the findings. Nonetheless, by  
highlighting the experience of poor, predominately African  
American, single mothers—a population that is faced with mul-  
tiple stressors and of higher risk of adverse outcomes—our find-  
ings shed light on to a particularly vulnerable, underserved,  
understudied group.

### Implications for Research

In earlier research on Hurricane Katrina, Galea et al. (2007)  
pointed out that the absence of baseline information limits the  
ability to draw causal inferences about the effects of hurricane-  
related stressors on mental health. More generally, baseline  
information is often lacking in studies on the health and mental  
health effects of disasters. Our results indicate that controlling  
for baseline sociodemographic measures, mental health, and  
physical health results in a modest reduction in estimates of the  
effects of stressors and loss. Although our broad conclusion is  
consistent with previous research demonstrating that disaster-  
related stressors and loss produce significant adverse health and  
mental health effects, our results suggest that estimates of the  
mental and physical health consequences of disasters are likely  
to be upwardly biased, but not so much as to eliminate the  
effect of the disaster.

Future research should consider the longer term trajectories  
of recovery and symptoms. Our findings document increases in  
mental and physical health problems associated with the hurri-  
canes, which raises questions about the persistence of mental  
illness over time. Comparisons with other surveys are informa-  
tive. Galea et al. (2007) found that, 5–7 months after the hurri-  
cane, the rates of moderate to severe mental illness (MMI/SMI) 6  
and severe mental illness (SMI) in their metropolitan New  
Orleans sample were 32.0% and 17.0%, which are comparable  
to our rates of 37.2% and 13.8%, respectively, approximately  
1-year post-Katrina. Yet Kessler et al. (2008) reported signifi-  
cant increases in rates of PTSD and SMI from the time period  
of 5–8 months after the hurricane to approximately a year later.  
It may be the case that, left untreated, PTSD and severe mental  
illness become more entrenched over time, while more moderate  
symptoms attenuate. Indeed, in models estimating the popula-  
tion distribution of untreated mental health problems resulting  
from Hurricanes Katrina and Rita, Schoenbaum et al. (2009)  
determined that the prevalence of moderate symptoms peaked  
at between 7- and 12-month post-Katrina, while severe  
symptoms continued to climb over the 1st year, persisting for  
25–30 months after the storm. Future research should employ  
additional waves of postdisaster data to determine the longer  
term trajectories and mediators of functioning. Growth curve

1 modeling of change would permit researchers to explore whether  
 2 the associations between prehurricane resources and symptoms  
 3 persist over time.

### 4 5 6 **Implications for Intervention**

7 The findings also have important implications for the plan-  
 8 ning of postdisaster psychological care services. Efforts to iden-  
 9 tify and provide timely, evidence-based services to those with  
 10 preexisting psychological vulnerabilities could potentially  
 11 prevent or attenuate adverse postdisaster outcomes and the pro-  
 12 gression into more SMI (Schoenbaum et al., 2009). The persis-  
 13 tence of negative mental and physical health symptoms 1 year  
 14 after the disaster indicates that long-term treatment is needed.  
 15 Regrettably, however, many of those in need of care in the  
 16 months after the hurricane do not receive it (Chan, Lowe, Zwie-  
 17 bach, & Rhodes, 2008; Schoenbaum et al., 2009; Wang et al.,  
 18 2008). This is not unusual—even under normal circumstances  
 19 the majority of low-income adults in the United States with  
 20 health problems and SMI do not receive adequate care (Wang,  
 21 Demler, & Kessler, 2002; Young, Klap, Sherbourne, & Wells,  
 22 2001). Nonetheless, because survivors of disasters are known to  
 23 have a higher risk of health and mental health problems, there  
 24 is compelling reason to target services to members of this group.  
 25 Most of the participants were single mothers, suggesting that  
 26 timely intervention could offset problems in younger generations  
 27 as well. Furthermore, since many survivors of disasters come  
 28 into contact with service agencies after a disaster, there may be  
 29 unique opportunities to offer or refer to treatment. The high  
 30 rates of health and mental health problems among low-income  
 31 survivors of Hurricane Katrina, coupled with the low rates of  
 32 care, indicate that this was not successfully accomplished in the  
 33 case of this natural disaster.

### 34 35 36 **Policy Implications**

37 In addition to health and mental health services, women of  
 38 color, particularly those with young children, should be pro-  
 39 vided with additional economic and educational resources  
 40 throughout the difficult recovery process. Affordable housing  
 41 would help to promote the immediate safety as well as the long-  
 42 term stability of fragile young families that are represented in  
 43 this study. Likewise, the inclusion of women in the post-Katrina  
 44 work force, both through the skills-training and enforcement of  
 45 anti-discrimination laws, will help the survivors benefit from the  
 46 influx of economic resources into the region (Jones-DeWeever,  
 47 2008). Finally, educational resources and assistance are vitally  
 48 needed to ensure that survivors can return to their educational  
 49 goals with a renewed sense of hope and strength.

50  
51  
52 **Keywords:** African Americans; women; single parents; Hurricane  
 53 Katrina; New Orleans; natural disasters; post-traumatic stress  
 54 disorder; health outcomes

### 55 56 57 **References**

58 Abramson, D., & Garfield, R. (2006). *On the Edge: Children and Fam-  
 59 ilies Displaced by Hurricanes Katrina and Rita Face a Looming Medical*

- and Mental Health Crisis*. New York: Columbia University, Mailman School of Public Health. Retrieved May 26, 2008, from [http://www.ncdp.mailman.columbia.edu/files/On%20the%20Edge%20L-CAFH%20Final%20Report\\_Columbia%20University.pdf](http://www.ncdp.mailman.columbia.edu/files/On%20the%20Edge%20L-CAFH%20Final%20Report_Columbia%20University.pdf) **7**
- Adeola, F. O. (2009). Katrina cataclysm: Does duration of residency and prior experience affect impacts, evacuation, and adaptation behavior among survivors? *Environment and Behavior*, *41*, 459–489.
- Aptekar, L. (1994). *Environmental Disasters in Global Perspective*. New York: GK Hall/Macmillan. **8**
- Arata, C. M., Picou, J. S., Johnson, G. D., & McNally, T. S. (2000). Coping with technological disaster: An application of the Conservation of Resources model to the Exxon Valdez oil spill. *Journal of Traumatic Stress*, *13*, 23–39.
- Bolin, R., & Bolton, P. (1986). *Race, Religion, and Ethnicity in Disaster Recovery* (Monograph No. 42). Boulder, CO: University of Colorado, Institute of Behavioral Science.
- Bonanno, G. A. (2008). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely adverse events? *Psychological Trauma: Theory, Research, Practice, and Policy*, *1*, 101–113.
- Bonanno, G. A., Galea, S., Bucchiarelli, A., & Vlahov, D. (2007). What predicts psychological resilience after disaster? The role of demographics, resources, and life stress. *Journal of Consulting and Clinical Psychology*, *75*, 671–682.
- Bonanno, G., Rennicke, C., & Dekel, S. (2005). Self-enhancement among high-exposure survivors of the September 11th terrorist attack: Resilience or social maladjustment? *Journal of Personality and Social Psychology*, *88*, 984–998.
- Brock, T., & Richburg-Hayes, L. (2006). *Paying for Persistence: Early Results of a Louisiana Scholarship Program for Low-Income Parents Attending Community College*. New York: MDRC.
- Brodie, M., Weltzien, E., Altman, D., Blendon, R. J., & Benson, J. M. (2006). Experiences of Hurricane Katrina evacuees in Houston shelters: Implications for future planning. *American Journal of Public Health*, *96*, 1402–1408.
- Centers for Disease Control and Prevention. (2006). Assessment of health-related needs after Hurricanes Katrina and Rita—Orleans and Jefferson Parishes, New Orleans area, Louisiana, October 17–22, 2005. *Morbidity and Mortality Weekly Report*, *55*, 38–41.
- Chan, C. S., Lowe, S. R., Zwiebach, L., & Rhodes, J. E. (2008, April). *Psychological Distress Among Hurricane Katrina Survivors and Barriers to Mental Health Service Utilization: A Longitudinal Study*. Poster presented at the Psychology and Social Justice Conference 2008, New York.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). Global measure of perceived stress. *Journal of Health and Social Behavior*, *24*, 385–396.
- Cohen, S., & Williamson, G. M. (1991). Stress and infectious disease in humans. *Psychological Bulletin*, *109*, 5–24.
- Cook, J. D., & Bickman, L. (1990). Social support and psychological symptomatology following a natural disaster. *Journal of Traumatic Stress*, *3*, 541–556.
- Creamer, M., Bell, R., & Failla, S. (2003). Psychometric properties of the Impact of Event Scale-Revised. *Behavior Research and Therapy*, *41*, 1489–1496.
- Cutrona, C. E., & Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. In W. H. Jones & D. Perlman (Eds.), *Advances in Personal Relationships* (Vol. 1, pp. 37–67). Greenwich, CT: JAI Press.
- Dyson, M. E. (2006). *Come Hell or High Water: Hurricane Katrina and the Color of Disaster*. New York: Basic Books.
- Elliot, J. R., & Pais, J. (2006). Race, class, and Hurricane Katrina: Social differences in human response to disaster. *Social Science Research*, *35*, 295–321.

- Erickson, K. T. (1976). *Everything in Its Path: Destruction of Community in the Buffalo Creek Flood*. New York: Simon & Schuster.
- Frankenberg, E., Friedman, J., Gillespie, T. W., Ingwersen, N., Pynoos, R. S., Rifai, I., et al. (2008). Mental health in Sumatra after the tsunami. *American Journal of Public Health, 98*, 1671–1677.
- Furukawa, T. A., Kessler, R. C., Slade, T., & Andrews, G. (2003). The performance of the K6 and K10 screening scales for psychological distress in the Australian National Survey of Mental Health and Well-Being. *Psychological Medicine, 33*, 357–362.
- Fussell, E. (in press). Help from Family, Friends, and Strangers during Hurricane Katrina: Finding the Limits of Social Networks. In L. Weber & L. Peek (Eds.), *Displaced: Voices From the Katrina Diaspora*. Austin, TX: University of Texas Press.
- Fussell, E., Sastry, N., & VanLandingham, M. (in press). Race, socioeconomic status, and return migration to New Orleans after Hurricane Katrina. *Population & Environment*.
- Galea, S., Brewin, C. R., Gruber, M., Jones, R. T., King, D. W., King, L. A., et al. (2007). Exposure to hurricane-related stressors and mental illness after Hurricane Katrina. *Archives of General Psychiatry, 64*, 1427–1434.
- Galea, S., Nandi, A., & Vlahov, D. (2005). The epidemiology of post-traumatic stress disorder after disasters. *Epidemiologic Reviews, 27*, 78–91.
- Galea, S., Tracy, M., Norris, F., & Coffey, S. F. (2008). Financial and social circumstances and the incidence and course of PTSD in Mississippi during the first two years after Hurricane Katrina. *Journal of Traumatic Stress, 21*, 357–368.
- Ginzburg, H. M. (2008). Long-term psychiatric consequences of Hurricane Katrina. *Psychiatric Annals, 38*, 81–91.
- Green, B. L., Lindy, J. D., Grace, M. C., Gleser, G. C., Leonard, A. C., Korol, M., et al. (1990). Buffalo Creek survivors in the second decade: Stability of stress symptoms. *American Journal of Orthopsychiatry, 60*, 43–54.
- Haines, V. A., Beggs, J. J., & Hurlbert (2002). Exploring the structural contexts of the support process: Social networks, social statuses, social support, and psychological distress. *Advances in Medical Sociology, 8*, 269–292.
- Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist, 44*, 513–524.
- Hobfoll, S. E., & Parris Stevens, M. A. (1990). Social support during extreme stress: Consequences and intervention. In B. R. Sarason, I. G. Sarason, & G. R. Pierce (Eds.), *Social Support: An Interactional View* (pp. 454–481). New York: John Wiley & Sons.
- Honaker, J., King, G., & Blackwell, M. (2008). Amelia II: A program for missing data [Computer Software]. Retrieved June 5, 2009, from <http://gking.harvard.edu/amelia/>
- Jones-DeWeever, A. (2008). *Women in the Wake of the Storm: Examining the Post-Katrina Realities of the Women of New Orleans and the Gulf Coast*. Washington, DC: Institute for Women's Policy Research.
- Kaiser, C. F., Sattler, D. N., Bellack, D. R., & Dersin, J. (1996). A conservation of resources approach to a natural disaster: Sense of coherence and psychological distress. *Journal of Social Behavior and Personality, 11*, 459–476.
- Kaniasty, K., & Norris, F. H. (1993). A test of the social deterioration model in the context of natural disaster. *Journal of Personality and Social Psychology, 64*, 395–408.
- Kaniasty, K., & Norris, F. H. (2008). Longitudinal linkages between perceived social support and posttraumatic stress symptoms: Sequential roles of social causation and social selection. *Journal of Traumatic Stress, 21*, 274–281.
- Kaniasty, K., & Norris, F. H. (2009). Distinctions that matter: Received social support, perceived social support and social embeddedness after disasters. In Y. Neria, S. Galea, & F. Norris (Eds.), *Mental Health Consequences of Disasters*. New York: Cambridge University Press.
- Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L., et al. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine, 32*, 959–976.
- Kessler, R. C., Barker, P. R., Colpe, L. J., Epstein, J. F., Groerer, J. C., Hiripi, E., et al. (2003). Screening for serious mental illness in the general population. *Archives of General Psychiatry, 60*, 184–189.
- Kessler, R. C., Galea, S., Gruber, M. J., Sampson, N. A., Ursano, R. J., & Wessely, S. (2008). Trends in mental illness and suicidality after Hurricane Katrina. *Molecular Psychiatry, 13*, 374–384.
- Kessler, R. C., Galea, S., Jones, R. T., & Parker, H. A. (2006). Mental illness and suicidality after Hurricane Katrina. *Bulletin of the World Health Organization, 84*, 930–939.
- Kim, S. C., Plumb, R., Gredig, Q. N., Rankin, L., & Taylor, B. (2008). Medium-term post-Katrina health sequelae among New Orleans residents: Predictors of poor mental and physical health. *Journal of Clinical Nursing, 17*, 2335–2342.
- Lavelle, K., & Feagin, J. R. (2006). Hurricane Katrina: The race and class debate. Retrieved from <http://www.monthlyreview.org/0706lavelle.htm>
- Lieberman, R. C. (2006). “The storm didn’t discriminate”: Katrina and the politics of color blindness. *The Du Bois Review, 3*, 7–22.
- Lima, B., Pai, S., Santacruz, H., Lozano, J., & Luna, J. (1987). Screening for the psychological consequences of a major disaster in a developing country: Armero, Colombia. *Acta Psychiatrica Scandinavica, 76*, 345–352.
- Mills, M. A., Edmondson, D., & Park, C. L. (2007). Trauma and stress response among Hurricane Katrina evacuees. *American Journal of Public Health, 97*(Suppl. 1), S116–S123.
- Norris, F. H., Baker, C. K., Murphy, A. D., & Kaniasty, K. (2005). Social support mobilization and deterioration after Mexico’s 1999 flood: Effects of context, gender and time. *American Journal of Community Psychology, 36*, 15–28.
- Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry: Interpersonal and Biological Processes, 65*, 207–239.
- Norris, F. H., & Kaniasty, K. (1996). Received and perceived social support in times of stress: A test of the social support deterioration-deterrence model. *Journal of Personality and Social Psychology, 71*, 498–511.
- Ozer, E. J., & Weiss, D. S. (2004). Who develops posttraumatic stress disorder? *Current Directions in Psychological Science, 13*, 169–172.
- Pfefferbaum, B., & Doughty, D. E. (2001). Increased alcohol use in a treatment sample of Oklahoma City bombing victims. *Psychiatry, 64*, 296–303.
- Rateau, M. R. (2009). Differences in emotional well-being of hurricane survivors: A secondary analysis of the ABC news Hurricane Katrina anniversary poll. *Archives of Psychiatric Nursing, 23*, 269–271.
- Rubin, D. B. (1987). *Multiple Imputation for Nonresponse in Surveys*. New York: J. Wiley & Sons.
- Rubonis, A. V., & Bickman, L. (1991). Psychological impairments in the wake of disaster: The disaster-psychopathology relationship. *Psychological Bulletin, 109*, 384–389.
- Ruscher, J. B. (2006). Stranded by Katrina: Past and present. *Analyses of Social Issues and Public Policy, 6*, 33–38.
- Salzer, M., & Bickman, L. (1999). The short- and long-term psychological impact of disaster: Implications for mental health interventions and policy. In R. M. Gist & B. Lubin (Eds.), *Response to Disaster: Psychosocial, Community, and Ecological Approaches* (pp. 63–82). New York: Taylor & Francis.

- 1 Sastry, N., & VanLandingham, M. (2009). One year later: Mental illness  
2 prevalence and disparities among New Orleans residents displaced by  
3 Hurricane Katrina. *American Journal of Public Health, 99*, S725–  
4 S731.
- 5 Sattler, D. N., Preston, A., Kaiser, C. F., Olivera, V. E., Valdez, J., &  
6 Schlueter, S. (2002). Hurricane Georges: A cross-national study exam-  
7 ining preparedness, resource loss, and psychological distress in the U.  
8 S. Virgin Islands, Puerto Rico, Dominican Republic, and the United  
9 States. *Journal of Traumatic Stress, 15*, 339–350.
- 10 Schoenbaum, M., Butler, B., Kataoka, S., Norquist, G., Springgate, B.,  
11 Sullivan, G., et al. (2009). Promoting mental health recovery after  
12 Hurricanes Katrina and Rita. *Archives of General Psychiatry, 66*,  
13 906–914.
- 14 Sharkey, P. (2007). Survival and death in New Orleans: An empirical  
15 look at the human impact of Katrina. *Journal of Black Studies, 37*,  
16 482–501.
- 17 Smith, B. W., & Freedy, J. R. (2000). Psychosocial resource loss as a  
18 mediator of the effects of flood exposure on psychological distress  
19 and physical symptoms. *Journal of Trauma Stress, 13*, 349–357.
- 20 Solomon, S. D., & Green, B. L. (1992). Mental health effects of natural  
21 and human-made disasters. *PTSD Research Quarterly, 3*, 1–3.
- 22 Spence, P. R., Lachlan, K. A., & Griffin, D. R. (2007). Crisis communi-  
23 cation, race, and natural disasters. *Journal of Black Studies, 37*, 539–  
24 554.
- 25 Stein, B., Elliott, M., Jaycox, L., Collins, R., Berry, S., Klein, D., et al.  
26 (2004). A longitudinal study of the psychological consequences of the  
27 September 11, 2001 terrorist attacks: Reactions, impairment, and  
28 help-seeking. *Psychiatry, 67*, 105–117.
- 29 Stephens, N. M., Hamedani, M. G., Markus, H. R., Bergsieker, H. B.,  
30 & Eloul, L. (2009). Why did they “choose” to stay? Perspectives of  
31 Hurricane Katrina observers and survivors. *Psychological Science, 20*,  
32 878–886.
- 33 Sümer, N., Karancı, A. N., Berument, S. K., & ve Güneş, H. (2005).  
34 The role of personal resources in predicting psychological distress fol-  
35 lowing the 1999 Marmara, Turkey Earthquake. *Journal of Traumatic*  
36 *Stress, 18*, 331–342.
- 37 Sundin, E. C., & Horowitz, M. J. (2003). Horowitz’s “Impact of event  
38 scale.” Evaluation of 20 years of use. *Psychosomatic Medicine, 65*,  
39 870–876.
- 40 Thienkrua, W., Cardozo, B. L., Chakkraband, M. L. S., Guadamuz, T.  
41 E., Pengjuntr, W., Tantipiwatanaskul, P., et al. (2006). Symptoms of  
42 posttraumatic stress disorder and depression among children in tsu-  
43 nami-affected areas in southern Thailand. *Journal of the American*  
44 *Medical Association, 296*, 549–559.
- 45 U.S. Department of Commerce. (2006). *Gulf Coast Recovery: 7 Months*  
46 *After the Hurricanes*. Washington, DC: Economics and Statistics  
47 Administration. Retrieved May 20, 2007, from <http://www.esa.doc.gov/Reports/2008/April2006.pdf>
- 48 van Griensven, F., Chakkraband, M. L. S., Thienkrua, W., Pengjuntr,  
49 W., Cardozo, B., Tantipiwatanaskul, P., et al. (2006). Mental health  
50 problems among adults in tsunami-affected areas in southern  
51 Thailand. *Journal of the American Medical Association, 296*, 537–548.
- 52 Wang, P. S., Demler, O., & Kessler, R. C. (2002). Adequacy of treat-  
53 ment for serious mental illness in the United States. *American Journal*  
54 *of Public Health, 92*, 92–98.
- 55 Wang, P. S., Gruber, M. J., Powers, R. E., Schoenbaum, M., Speier, A.  
56 H., Wells, K. B., et al. (2007). Mental health service use among Hurri-  
57 cane Katrina survivors in the eight months after the disaster. *Psychi-*  
58 *atric Services, 58*, 1403–1411.
- 59 Wang, P. S., Gruber, M. J., Powers, R. E., Schoenbaum, M., Speier, A.  
H., Wells, K. B., et al. (2008). Disruption of existing mental health  
treatments and failure to initiate new treatment after Hurricane Kat-  
rina. *American Journal of Psychiatry, 165*, 34–41.
- Weems, C. F., Watts, S. E., Marsee, M. A., Taylor, L. K., Costa, N.  
M., Cannon, M. F., et al. (2007). The psychosocial impact of Hurri-  
cane Katrina: Contextual differences in psychological symptoms,  
social support, and discrimination. *Behaviour Research and Therapy,*  
*45*, 2295–2306.
- Weisler, R. H., Barbee, J. G., IV, & Townsend, M. H. (2006). Mental  
health and recovery in the gulf coast after Hurricanes Katrina and  
Rita. *Journal of the American Medical Association, 296*, 585–588.
- Weiss, D. S., & Marmar, C. R. (1997). The impact of events scale-  
revised. In J. P. Wilson & T. M. Kean (Eds.), *Assessing Psychological*  
*Trauma and PTSD: A Practitioner's Handbook* (pp. 399–411). New  
York: Guilford.
- Young, A. S., Klap, R., Sherbourne, C. D., & Wells, K. B. (2001). The  
quality of care for depressive and anxiety disorders in the United  
States. *Archives of General Psychiatry, 58*, 55–61.

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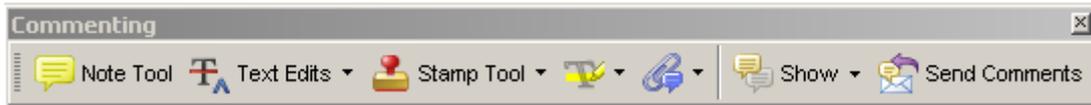
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## USING E-ANNOTATION TOOLS FOR ELECTRONIC PROOF CORRECTION

### Required Software

Adobe Acrobat Professional or Acrobat Reader (version 7.0 or above) is required to e-annotate PDFs. Acrobat 8 Reader is a free download: <http://www.adobe.com/products/acrobat/readstep2.html>

Once you have Acrobat Reader 8 on your PC and open the proof, you will see the Commenting Toolbar (if it does not appear automatically go to Tools>Commenting>Commenting Toolbar). The Commenting Toolbar looks like this:



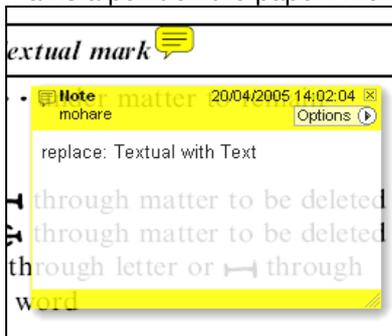
If you experience problems annotating files in Adobe Acrobat Reader 9 then you may need to change a preference setting in order to edit.

In the "Documents" category under "Edit – Preferences", please select the category 'Documents' and change the setting "PDF/A mode:" to "Never".



### Note Tool — For making notes at specific points in the text

Marks a point on the paper where a note or question needs to be addressed.

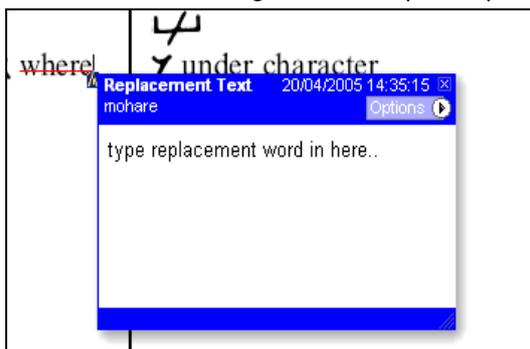


How to use it:

1. Right click into area of either inserted text or relevance to note
2. Select Add Note and a yellow speech bubble symbol and text box will appear
3. Type comment into the text box
4. Click the X in the top right hand corner of the note box to close.

### Replacement text tool — For deleting one word/section of text and replacing it

Strikes red line through text and opens up a replacement text box.

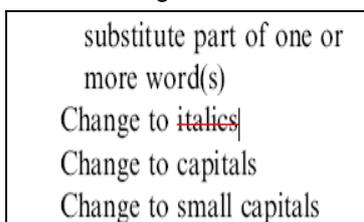


How to use it:

1. Select cursor from toolbar
2. Highlight word or sentence
3. Right click
4. Select Replace Text (Comment) option
5. Type replacement text in blue box
6. Click outside of the blue box to close

### Cross out text tool — For deleting text when there is nothing to replace selection

Strikes through text in a red line.



How to use it:

1. Select cursor from toolbar
2. Highlight word or sentence
3. Right click
4. Select Cross Out Text

Approved tool — For approving a proof and that no corrections at all are required.

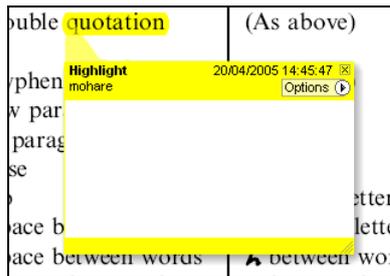


How to use it:

1. Click on the Stamp Tool in the toolbar
2. Select the Approved rubber stamp from the 'standard business' selection
3. Click on the text where you want to rubber stamp to appear (usually first page)

Highlight tool — For highlighting selection that should be changed to bold or italic.

Highlights text in yellow and opens up a text box.

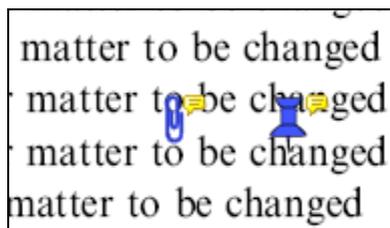


How to use it:

1. Select Highlighter Tool from the commenting toolbar
2. Highlight the desired text
3. Add a note detailing the required change

Attach File Tool — For inserting large amounts of text or replacement figures as a files.

Inserts symbol and speech bubble where a file has been inserted.

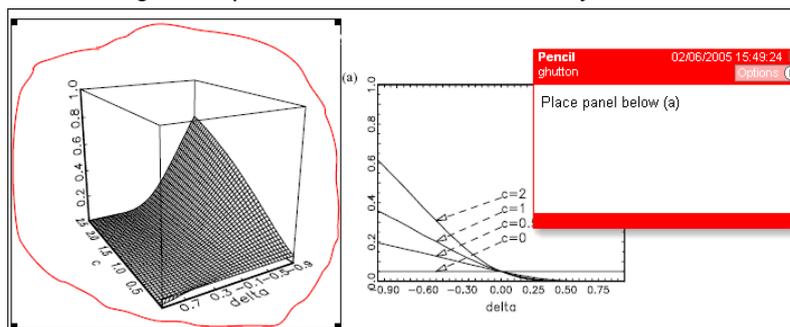


How to use it:

1. Click on paperclip icon in the commenting toolbar
2. Click where you want to insert the attachment
3. Select the saved file from your PC/network
4. Select appearance of icon (paperclip, graph, attachment or tag) and close

Pencil tool — For circling parts of figures or making freeform marks

Creates freeform shapes with a pencil tool. Particularly with graphics within the proof it may be useful to use the Drawing Markups toolbar. These tools allow you to draw circles, lines and comment on these marks.



How to use it:

1. Select Tools > Drawing Markups > Pencil Tool
2. Draw with the cursor
3. Multiple pieces of pencil annotation can be grouped together
4. Once finished, move the cursor over the shape until an arrowhead appears and right click
5. Select Open Pop-Up Note and type in a details of required change
6. Click the X in the top right hand corner of the note box to close.

## Help

For further information on how to annotate proofs click on the Help button to activate a list of instructions:

