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Stress and Well-Being in the Aftermath of the World Trade Center Attack: the Continuing Effects of a Communitywide Disaster

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Abstract

In this study, we examine the relationship between exposure to the World Trade Center disaster (WTCDD) and the well-being of adults living in New York City (NYC) at the time of the attacks by using a stress process model. One year after the attacks, we conducted a telephone survey of a cross-sectional random sample of city residents with an oversample of residents who had received mental health treatment since the attacks ($N = 2,368$). The survey gathered information about respondents' demographic characteristics, exposure to the WTCDD, other stressful events, and social psychological resources. The dependent variable (health status) was measured by using the Short Form-12 (SF-12) mental health and physical health scales. Overall, the greater the exposure to the events surrounding the WTCDD, the poorer the person's psychological well-being, even after controlling for demographic characteristics, other stressors, and social psychological resources. Exposure was only weakly related to physical well-being, once other factors were taken into account. The findings clearly show that individuals who experienced greater exposure to the WTCDD have more psychological problems than those who had less exposure 1 year after the attacks. Exposure did not seem to have such severe consequences for physical well-being. Thus, our study supports the continuation of mental health services to survivors of a community disaster well beyond the first year post disaster.

INTRODUCTION

Past research has been inconsistent about the long-term effects of community disasters. Some researchers have found few deleterious consequences of such traumatic events and contend that most people recover rather quickly (e.g., McFarlane, 1988,1989). Others have asserted that communitywide disasters have significant effects on psychological and physical health, especially in those instances in which there was a significant loss of life, extensive property damage, and severe economic disruptions of people's lives (Adams et al., 2002;Erikson, 1976;Freedy, Kilpatrick, & Resnick, 1993;Green, 1995;Norris et al., 2002).

Recent reviews of postdisaster samples identified several possible adverse outcomes: psychological problems (e.g., posttraumatic stress disorder [PTSD], depression, and anxiety), health problems and concerns, chronic problems in living, and psychosocial resource losses (Brewin, Andrews, & Valentine, 2000; Bromet & Dew, 1995; Norris et al., 2002; Rubonis & Bickman, 1991). Among direct survivors of the Oklahoma City bombing, 45% had postdisaster psychiatric disorders and 34% had PTSD (North et al., 1999). In addition, a comparison of Oklahoma City area residents to Indianapolis area residents, used as a control population,

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suggested that Oklahoma City residents reported about twice the psychological distress, PTSD, increased alcohol use, and smoking behavior, when compared to persons in the Indianapolis area (Smith, Christiansen, Vincent, & Hann, 1999). Studies after the Chernobyl nuclear accident found that psychological distress and complaints of physical problems were significantly more prevalent among residents near the plant when it exploded as compared to those from areas farther away (Adams et al., 2002; Bromet, Gluzman, Schwartz, & Goldgaber, 2002; Havenaar et al., 1996; Havenaar et al., 1997).

According to Norris and her associates (Norris et al., 2002; Norris, Friedman, & Watson, 2002), community disasters that are most likely to trigger severe, lasting, and pervasive psychological problems have the following characteristics: extreme and wide-spread damage to property, serious and ongoing economic difficulties for the community, high loss of life or threat to life, and intentional human cause. The terrorist attacks in New York City (NYC) on September 11, 2001, exhibit all of these characteristics. The attacks resulted in one of the largest death tolls of any disaster in the United States. Approximately 2,800 persons died as a direct consequence of the attacks (Centers for Disease Control, 2002), thousands were injured, and many residents directly witnessed the events. In addition, a large area around the World Trade Center (WTC) in Lower Manhattan's business district was destroyed, resulting in further social and economic hardships. Finally, the threat of additional terrorist attacks was in the news and continued to be a backdrop for the postdisaster period. Thus, WTC attacks offered an opportunity to examine the long-term consequences of this communitywide disaster on well-being.

Previous postdisaster research has already documented a high prevalence of psychological symptoms and disorders among residents of NYC: 7.5% of those living south of 110th Street in Manhattan reported symptoms related to PTSD and 9.7% had symptoms of depression 1 month after the attacks (Boscarino, Galea, Ahern, Resnick, & Vlahov, 2002; Galea et al., 2002; Galea et al., 2003). These studies, however, have suffered from several shortcomings. First, with a few exceptions (e.g., Cwikel, Abdelgani, Goldsmith, Quastel, & Yevelson, 1997; Fagan, Galea, Ahern, Bonner, & Vlahov, 2003), they have rarely assessed the disaster's relationship to physical health. Yet, communitywide trauma has been shown to affect survivors physically, as well as mentally (Ironson et al., 1997; Palinkas, Downs, Petterson, & Russell, 1993). In their study of the consequences of the *Exxon Valdez* oil spill on people living in communities along Prince William Sound, for example, Palinkas and associates (1993) found that although the spill itself was not particularly life threatening, it disrupted subsistence food production (e.g., fishing), strained family and community relationships, and increased social inequality, all of which led to increased social tensions, drinking, and domestic conflicts. Individuals living in communities most affected by social changes related to the spill and cleanup efforts also reported greater psychological problems and somatic complaints.

Second, most post-9/11 studies did not select variables with an explicit theoretical model guiding which ones to include or exclude. In the present study, we use the stress process model (Dohrenwend & Dohrenwend, 1981; Pearlin, Lieberman, Menaghan, & Mullen, 1981; Thoits, 1995) to relate exposure to the WTC events and physical and mental well-being. This model suggests that individuals subjected to disordered or challenging environments, usually assessed in terms of exposure to psychological trauma or negative life events, are typically required to respond both physiologically, through changes in the neuroendocrine and hormone systems (Boscarino, 1997), and psychologically, usually through a revision of cognitive functioning (Thoits, 1995). Serious environmental challenges that result in significant biological and/or cognitive alterations are defined as stressful and referred to as *stressors* (Pearlin et al., 1981; Thoits 1995). The consequence of exposure to these stressors can be psychological and physical distress, often in the form of depression and health problems (Adams et al., 2002; Bromet et al., 2002; Cwikel et al., 1997; Thoits, 1995).

From a stress process perspective, therefore, the association between exposure to community disasters and well-being needs to be considered within the context of other aspects of survivors' lives, such as demographic characteristics, other stressors, and stress moderators. Women, people of color, and the poor are more likely to suffer physical and psychological difficulties after a community disaster when compared to men, whites, or wealthier individuals (Norris et al., 2002; Brewin et al., 2000). Negative life events, other traumas, or a history of psychological problems can add to the negative consequences of community disasters. Increased alcohol use, which has not been examined often in the disaster literature (Norris et al., 2002; Pfefferbaum & Doughty, 2001), may be an attempt at self-medication in the face of a community disaster (Vlahov et al., 2002), but it is usually a poor coping strategy (Thoits, 1995). A final risk factor specific to the NYC area is the continuing prospect of another terrorist attack. The new "terrorist threat" warning system and recent anthrax attacks may heighten residents' stress.

In addition, within this perspective, individuals can potentially call upon an array of social and psychological resources to deal with or reduce the adverse consequences of a disaster (Adams et al., 2002; Norris et al., 2002). Two of the most important of these stress moderators are social support and a psychological sense of empowerment or confidence (Norris et al., 2002). As the stress literature consistently notes, social support (emotional, instrumental, and informational) from others and coping resources such as high self-esteem enable a person to adapt to new situational demands, lower the stress associated with those demands, and, thus exhibit less physical and psychological distress (Pearlin et al., 1981; Thoits, 1995). To the extent that disaster survivors have such resources, they should have better psychological and physical health when compared to those who do not have them.

RESEARCH QUESTIONS

Three research questions guided this study. First, controlling for other factors identified as important in the stress model, is greater exposure to WTC events related to poorer psychological and physical health? Second, does the stress model provide an adequate conceptual framework for addressing the continuing consequences of a community disaster? That is, does it explain a significant amount of the variation in physical and mental health? Finally, using a clinical cut-point defining good versus poor psychological and physical health, are survivors who were highly exposed to the WTC unhealthy?

DATA AND METHODS

Using random-digit dialing (RDD), we conducted a household survey 1 year after the WTC, with an oversample of residents who reported receiving any mental health treatment after the attacks. (The latter respondents were identified by means of screener questions at the start of the survey and were sought so that we could evaluate the effectiveness of certain mental health treatments.) The population was also stratified by the five NYC boroughs and sampled proportionately. All English- or Spanish-speaking adults (18 years old or older) who were living in NYC and had a telephone at the time of the study and were living in NYC at the time of the attacks were potential study participants. When interviewers reached a person at a residential telephone number, they obtained verbal consent and then ascertained the area of residence in New York City. Interviewers then determined the number of adults in each household and selected one for an interview on the basis of the most recent birthday. Interviews occurred between October and December 2002. Questionnaires were translated into Spanish and then back-translated by bilingual Americans to ensure the linguistic and cultural appropriateness of the items. Trained interviewers using a computer-assisted telephone interviewing system conducted all of the interviews.

Overall, 2368 individuals completed the questionnaire. Approximately, 7% of the interviews were conducted in Spanish. Using industry standards (American Association for Public

Opinion Research, 2000), the cooperation rate was approximately 63%, which is not very different from the rate reported in other September 11 studies using NYC samples (e.g., Galea et al., 2003).¹ A protocol was established to provide assistance to participants who required mental health counseling. Mean duration of the interviews was 44 minutes. Sampling weights were developed to correct for potential selection bias related to the number of telephone numbers and persons per house-hold, for stratification by borough, and for the oversample of treatment respondents. These weights allowed us to treat the sample as representative of the NYC population. The Institutional Review Board of the New York Academy of Medicine reviewed and approved the study's protocols.

Dependent Variables

Physical and psychological health status was assessed by using the Short Form-12, version 2 (SF-12-v2), one of the most extensively used assessments of well-being world-wide (Ware, Kosinski, Turner-Bowker, & Gandek, 2002). A shortened version of the Medical Outcome Study 36 Item Short-Form Health Survey (SF-36; Ware & Gandek, 1998), the SF-12-v2 assessed respondents along eight health dimensions during the previous 4 weeks using 12 items (Cronbach's $\alpha = .87$). Following recommended scoring algorithms, the items were converted into z-scores, weighted, and summed to form physical health and mental health summary scales (Ware et al., 2002). This algorithm was designed so that both scales would range from around 0 (worst health) to around 100 (best health), have a mean close to 50, and have a standard deviation close to 10. The physical health summary score consisted of items focusing on physical functioning, role-physical functioning, pain, and perceived general health (e.g., How pain interfered with normal work [including both work outside the home and housework], over the preceding 4 weeks.). The mental health summary measure stressed items on role-emotional functioning, mental health, vitality, and social functioning (e.g., Feeling downhearted and depressed, during the past 4 weeks). Although some published reports have questioned the utility of the summary scores (Johnson & Maddigan, 2004), most find that these measures have good validity and reliability (e.g., Fleishman & Lawrence, 2003; Lubetkin & Gold 2003; Ware, Kosinski, & Keller, 1996).

Independent Variables

Background Characteristics.—The analyses included six demographic variables: age, education, gender, marital status, ethnicity, and income. Age was coded to the nearest year. Education, gender, marital status, and self-reported race/ethnicity were dummy coded with college graduate, female, white, and married the included categories (i.e., coded 1). Household income was divided into seven categories—under \$20,000, \$20,000-\$29,999, \$30,000-\$39,999, \$40,000-\$49,999, \$50,000-\$74,999, \$75,000-\$99,999, and \$100,000+—and coded 1-7. Missing income data (15%) were coded as the mean value.

Stress/Risk.—The analyses also examined seven stressors or factors that placed the individual at risk for poor psychological and physical well-being. WTCD exposure was calculated as the sum of 14 possible events (yes, no) that the respondent could have experienced during the attacks.² Because of the skewed distribution, however, we recoded individuals reporting nine or more events to a score of 8.³ The negative life event scale (Freedy et al., 1993) was calculated as the sum of eight experiences that the respondent could have had in the

¹More specifically, the cooperation rate is composed of (1) completed interviews; (2) screenouts—respondents who were not living in New York City at the time of the interview, were not living in New York City on September 11, or did not speak English or Spanish; (3) quota outs—respondents who were eligible to be interviewed but were a gender or lived in a borough for which the required number of interviews had been completed; and (4) refusals (cooperation rate = completed interviews [2,369] + screenouts [4,985] + quota outs [117] completed interviews + screenouts + quota outs + refusals [4,330]). Our response rate, which is based on completed interviews divided by all eligible phone numbers and refusals, was 37% (completed interviews [2368]quota outs [117] + refusals [4,330] + residential phone but not interviewed by end of data collection [1,945]).

12 months before the WTCD (e.g., divorce, death of spouse, problems at work). On the basis of an examination of the frequency distribution, we dummy coded respondents into three groups (no life events, one life event, and two or more life events), with no life events the excluded (reference) category. The fourth measure focused on exposure to 10 lifetime traumatic events (Freedy et al., 1993) other than the WTCD (e.g., forced sexual contact, attack with a weapon, serious accident). These items were summed, and nine or more traumatic events recoded to 8. The survey also assessed whether or not the person met criteria for having a perievent panic attack during the WTCD. This measure is a modification of the Diagnostic Interview Schedule (DIS)(Robins et al., 1999), phrased to assess symptoms that occurred during or shortly after the events of September 11 (American Psychiatric Association, 1994). The presence of 4 or more symptoms that reached their peak 10 minutes after they started out of 14 possible symptoms was sufficient to classify the person as having a perievent panic attack.⁴ Not meeting criteria was the reference category (coded 0). Fear of terrorism was the sum of three items about concern over terrorist attacks (another terrorist attack, an attack using biological weapons, an attack using a nuclear device). We dummy coded the scale so that respondents indicating very high fear of another terrorist attack (“very concerned” on all three items) were compared to respondents with low to moderate fear scores (reference category). The survey also inquired about the number of alcoholic drinks per day that the respondent had in the month just before the disaster and in the month before the interview. Increased alcohol use was dummy coded, with an increase of two or more drinks per day compared to all other postdisaster drinking. Finally, to control for previous mental health status, we adapted items from the structured clinical interview for DSM-III-R’s (SCID’s) major depressive episode interview (Spitzer, Williams, & Gibbon, 1987). More specifically, the survey asked eight questions about mood disturbances (e.g., slept more or less than normal, thought about hurting yourself) lasting more than 2 weeks at any point in their life. Respondents who said yes to five or more of the items and stated that the symptoms occurred together, were classified as meeting criteria for lifetime depression (yes, no). All of these measures were used and validated in other WTCD studies (Boscarino et al., 2004; Boscarino, Figley, & Adams, 2003; Galea et al., 2002; Galea et al., 2003).

Stress Moderators.—The last set of variables included one social and one psychological resource measure, which could reduce or moderate the effect of stress on well-being. The social support scale (Sherbourne & Steward, 1991) was the sum of four questions about emotional, informational, and instrumental support (e.g., Someone available to help you if you were confined to bed). These items were coded so that high scores indicated high social support (Cronbach’s $\alpha = .83$). The psychological resource was measured by a reduced form of Rosenberg’s self-esteem scale (Rosenberg, 1979). The scale was the sum of five items in the original scale (e.g., I certainly feel useless at times, On the whole, I am satisfied with myself) and scored so that high values on the scale indicated high self-esteem (Cronbach’s $\alpha = .73$).

²Specifically, the exposure measure consisted of a series of yes/no questions about the following events: (1) R was in the WTC at the time of the attacks, (2) R saw in person or on TV the disaster while it was happening, (3) R heard or felt impact of plane into WTC, (4) R feared being killed during the disaster, (5) relatives of R were killed or injured during the disaster, (6) friends of R were killed or injured during the disaster, (7) acquaintances of R were killed or injured, (8) R had difficulty breathing because of smoke or debris during the disaster, (9) R lost possessions or had possessions damaged as a result of the disaster, (10) R was injured as a result of the disaster, (11) R was involved in the rescue or recovery efforts after the disaster, (12) R was involved in other ways helping those affected by the disaster, (13) R had to move out of home because of the disaster, (14) R lost job because of the disaster.

³Because there was not an a priori method of assessing the severity of any individual exposure event, we decided that a simple summation of events experienced by the respondent was the best means to measure this stressor.

⁴The respondents were asked whether they felt any of 14 symptoms when they first heard about the WTCD and in the few hours after. The 14 symptoms were the following: like it wasn’t really happening, detached as if in a dream, fearful you were going crazy or losing control of your emotions or behavior, shortness of breath, dizziness, rapid heartbeat, trembling or shaking, sweating, hot flushes or chills, nausea or abdominal distress, body numbness or tingling sensations, choking, chest pain or discomfort, fear of dying. In addition, the respondent had to indicate that these emotional and physical reactions were at their worst within the first 10 minutes after they started.

Statistical Analysis

First, we examined frequency distributions and bivariate scatterplots, which indicated no significant violation of the assumptions underlying linear models. Next, we assessed whether or not the sample matched the population of NYC. Then we calculated the basic descriptive statistics for the sample. Finally, a series of ordinary least-squares (OLS) regressions were estimated to investigate the unique association between personal characteristics, stress/risk factors, and social psychological resources and each dependent variable. The regression analyses proceeded in three steps. Model 1 estimated the association between the demographic variables and the health status measures. Next, we included the stress and other risk factors in the equation (model 2). The final model incorporated the resource/moderator variables (model 3). Each model focused on a particular aspect of the stress process and how a set of variables helped to explain variation in physical and mental well-being.

We tested interaction terms for exposure to the WTC/D and all demographic, stress/risk, and social psychological resource variables. However, because none of these interactions reached statistical significance, we presented the additive models only. A final set of analyses used a standard cut-point on the well-being measures to differentiate respondents with potentially clinically poor physical and/or psychological health from those who are relatively healthy. We used the survey estimation (svy) command set in Stata, version 7 (Stata Corporation, 2001), to generate frequency distributions and OLS regression models. This estimation procedure adjusted the data for our sampling design, which included stratification by city borough and case weights, as noted earlier.

RESULTS

An analysis comparing the sample and Census data for NYC (Table 1) indicated no difference for age, gender, race, or borough. Thus, the sample seemed representative of NYC and was not demographically biased by the cooperation rate or sample selection. The demographic characteristics of the sample are shown in Table 2. We highlight the fact that 15% reported increased drinking post 9/11, 11% met criteria for perievent panic attack during the WTC/D, more than 40% currently had a high fear of future terrorist attacks, and 19% met criteria for lifetime depression.

The OLS regression results for the SF12-v2-physical health (Table 3) revealed that demographic characteristics as a block explained 18% of the variation in this outcome (model 1). Adding the stress/risk variables increased the R^2 to 0.22. Unexpectedly, exposure to the WTC/D was not significantly related to physical health when controlling for other stress variables (model 2). This lack of an association changed, however, after social psychological resources were taken into account (model 3). There was, however, no statistically significant improvement in model 3's overall explanatory power compared to that of model 2 ($R^2 = 0.22$ for both models). This finding indicated that including the stress moderator variables in the model adds little to our understanding of physical health, once demographic and stress/risk factors have been taken into account.

Specific results for model 3 showed that younger respondents, the better educated, and those with higher income perceived their physical health as better when compared to their older, less educated, and poorer counterparts. For the stress and resource factors, WTC/D exposure, two or more negative life events, and more traumatic events were associated with poorer physical health, and high self-esteem was related to better physical health. These variables were, however, overshadowed by demographic characteristics.

The regression models for the SF-12 mental health scale suggested a different pattern of relationships. Demographic characteristics explained only 5% of the variance in this outcome

as a block (model 1). Introducing stress/risk and psychological social resource factors in the equations (models 2 and 3) increased the explained variance to 27% and then to 37%. As shown for model 3, older respondents and African Americans had better psychological health, and women scored lower on this measure of well-being. In terms of the stress/risk factors, WTCD exposure, negative life events, meeting of criteria for panic attack, fear of terrorism, increased drinking, and meeting of criteria for lifetime depression lowered mental health. Social support and self-esteem were, as expected, associated with better psychological well-being. In contrast to the physical health results, the stress/risk and stress moderator factors were more central to our understanding of psychological well-being than were demographic characteristics.

Finally, we divided the respondents on the two well-being measures into “healthy” and “unhealthy” categories. For both SF-12-v2 scales, a standardized score below 31 suggested that the individual could be classified as clinically unhealthy (Ware et al., 2002). For the physical health measure, 201 or 7.1% (weighted) of NYC adults were classified as being in clinically poor health; for the mental health measure this figure was 232 or 6.5% (weighted). The critical question, given the preceding analyses, was whether or not greater WTCD exposure was related to poor mental health in a linear fashion. Therefore, we classified respondents into low-(zero to one event), moderate-(two to three events), high-(four to five events), and very-high-(six plus events) exposure groups. As expected, there was a strong association between exposure and mental health ($\chi^2 = 26.3$, $df = 3$, $p < .001$). More specifically, only 5.3% of the respondents in the low-exposure category were classified as unhealthy on the SF-12-mental health component, whereas 8.2% of the moderate-exposure group were unhealthy, 11.2% of the high-exposure group were unhealthy, and 15.7% of the very-high-exposure group were unhealthy. A trend test using orthogonal polynomial effects coding in our full multivariate model (Cohen & Cohen, 1983, pp. 242-244) showed a strong linear trend ($x_1: b = -.51$, $p < .001$) between exposure and poor mental health. This result suggested a dose-response relationship between WTCD exposure and postdisaster psychological problems. The findings of the analyses for the physical health measure were not statistically significant, indicating no discernible trend between exposure and physical well-being.

DISCUSSION

This study provided further evidence for the adverse consequences of community disasters in general, and the WTCD in particular, on the mental health of survivors. Taking into account background, stress/risk, and stress moderator variables, greater exposure to WTCD events was still statistically related to poorer mental and physical health. In addition, the stress process model proved to have better explanatory power for mental health than for physical health. This result is not surprising, given that the model was developed with a focus on psychological problems (Pearlin et al., 1981; Thoits, 1995). Nevertheless, both models explained a fair amount of the variation in the dependent variables, 22% for physical health and 37% for mental health. Finally, although about 7% of the sample were classified as unhealthy for our mental health measure, this designation became much more likely as WTCD exposure increased from low to very high. In fact, a respondent who had a very high exposure was three times more likely to be classified as psychologically unhealthy when compared to a respondent who had low exposure.

One important omission of much previous research is that few studies assess the consequences of exposure to the WTCD for physical health. Other studies examining the long-term physical health effects of community disasters tend to present mixed evidence. For example, assessments of the physical health of people living near the Chernobyl nuclear power plant when it exploded find little evidence for actual physical harm, but strong negative consequences for perceptions of physical health (Adams et al., 2002; Bromet et al., 2002; Havenaar et al.,

1997). Research on community disasters, however, tends to focus on psychological well-being. Thus, our results add to the sparse literature on the physical health consequences of such events.

In addition to examining the continued effect of the WTCD, we also aimed to document the utility of the stress process model for examining the association between exposure and the physical and psychological well-being of New Yorkers. Although the model was better at predicting psychological health, it did moderately well by explaining about a fifth of the variation in physical health. Thus, the stress process model showed good utility and has been used in other disaster research (Adams et al., 2002; Norris et al., 2002).

In terms of the three sets of factors identified by the stress process model, our findings show that demographic characteristics have only a weak association with psychological health, and a much stronger relationship with physical health. The stress/risk factors, on the other hand, have a stronger association with psychological health. Finally, although self-esteem is related to physical and psychological health in all of the analyses, the stress moderators as a set have a much stronger association with mental health than with physical health. None of these findings contradicts previous research on stress and well-being (Thoits, 1995).

The multivariate regression analyses showed that increased alcohol consumption was associated with poor mental health but unrelated to physical health 1 year after the attacks. We cannot, however, assess the causal relationship between these two variables. On the one hand, the stress of exposure may exacerbate predisaster problems with alcohol. On the other, higher rates of alcohol use post disaster may relate to its use as a means to cope with stress and negative affect whereby individuals attempt to self-medicate symptoms. This strategy could intensify symptomatology, interfering with resolution of the traumatic experiences, hindering mental health services, and prolonging postdisaster psychological problems. Whichever is the case, increased alcohol use may be a significant problem in the aftermath of this disaster and prolong psychological difficulties. Given the paucity of research on alcohol use after community disasters (Norris et al., 2002), future researchers should pay more attention to this potentially serious risk factor for poor mental health.

LIMITATIONS

The results of this study need to be viewed within the context of its limitations and strengths. There are several limitations to our study. First, we omitted individuals who did not have a telephone and those who did not speak either English or Spanish. Given that the sample matched the 2000 Census for NYC, elimination of households without a telephone did not appear to introduce much bias. We were limited, however, in generalizing to other ethnic/language groups in NYC. Very little research has focused on how the WTC attacks affected the physical or mental health of immigrant communities or the wide variety of ethnic groups living in NYC. Future researchers should act to fill this gap. Communitywide disasters may not have as deleterious effect on individuals within such groups, because most are highly integrated, with strong self-help connections. Second, our outcome measures of well-being were based on self-report. We needed to keep in mind that these measures as such were subjective perceptions. Nevertheless, other studies suggest that self-report health measures may be good predictors of future health compared to “objective” measures, such as a physician’s assessment of a person’s health and morbidity or laboratory tests (Ferraro & Farmer, 1999). In addition, the F-12-v2 is a well-established measure and has been extensively validated in numerous studies throughout the world (Ware et al., 2002). Finally, and most importantly, the data are cross-sectional and cannot be used to test causal relationships. The analyses are based on the theoretical associations underlying the stress process. It is possible that individuals who have certain characteristics or experiences that we have not measured are more likely both to be distressed and to report greater exposure. Further studies using

longitudinal data may begin to disentangle the causal relationships examined in the present study.

These limitations should not overshadow the strengths of the study, which include the use of a large random sample representative of NYC, the assessment of physical and mental well-being by using standard scales, and the focus on a specific event that meets criteria for communitywide disaster. Therefore, the clear conclusion of our study is that such severe events do have long-lasting consequences for people's mental well-being. It is possible that physical health problems may be related to exposure and that such consequences may not be manifested for a longer period. Thus, continuing investigation of the WTCDD seems highly warranted.

Given the long-term potential that psychological problems are elevated by a community disaster, what are the implications for disaster preparedness and response? First, our study shows that 6.5% of the individuals in NYC are potentially mentally unhealthy. For NYC, that percentage translates into more than a half-million people at risk, with the risk tripling for those in the very-high-exposure-to-the-WTCDD category. A short screener listing a number of disaster experiences could identify survivors who may warrant a more thorough assessment for psychological difficulties. Second, studies clearly show the importance of social support to the well-being of disaster survivors (Norris et al., 2002). Thus, mental health services need not only to focus on the individual survivor, but to seek ways to improve his or her social support network. Third, careful attention should be paid to people who have to move from their home or lose their job as a result of a community disaster. Although the topic is not examined explicitly here, previous studies indicate that in industrialized countries, these two experiences may have the most long-lasting consequences for the mental health of survivors (Galea et al., 2002, 2003; Norris et al. 2002). Fourth, NYC residents continue to be fearful of future terrorist attacks; such fears have a negative relationship with psychological health. Perhaps, less public emphasis by government officials on safety concerns and, instead, implementation of specific safety strategies (e.g., evacuation plans for all multistory buildings in urban areas) may actually lower fear and prepare individuals better in the event of future terrorist attacks. Finally, both individuals in the community and mental health professionals ought to concentrate their efforts on assisting individuals who have a history of mental health problems, who experience a perievent panic attack shortly after the disaster, or who have a significant increase in postdisaster drinking.

As Norris, Friedman, and Watson (2002, p. 248) contend, "Disasters are enormously complex events. They affect large numbers of people simultaneously and require public health responses encompassing multiple levels of intervention . . . and varying degrees of intensity." Responses to the financial difficulties and housing needs of survivors can ameliorate their short-term lack of basic necessities. More long term, however, is the problem of general well-being, which seems to be compromised by community disasters. For disasters caused by human intent—and the WTCDD is one of them—long-term problems may linger for years after the event (Norris et al., 2002) and require sustained efforts to assist survivors in their attempts to cope with the traumatic event.

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Table 1
Demographic Characteristics of Sample Compared to 2000 U.S. Census

Characteristic	Weighted Percentage from Sample (n)	Percentage from U.S. Census	χ^2 (<i>p</i> -Value)
Age			
18-24	15.2(245)	13.2	1.9(0.86)
25-34	24.0(537)	22.5	
35-44	22.2(567)	20.8	
45-54	18.7(454)	16.7	
55-64	10.1(272)	11.3	
65+	9.8(247)	15.5	
Gender			
Male	46.2(1016)	46.2	0.00(1.00)
Female	53.8(1352)	53.8	
Race			
White	39.2(1015)	38.7	2.01(0.74)
African American	26.3(606)	23.0	
Asian	5.2(99)	10.1	
Hispanic	25.7(559)	24.7	
Other	3.5(89)	3.6	
Borough			
Bronx	15.4(375)	15.4	0.13(1.00)
Brooklyn	29.7(704)	29.7	
Queens	28.3(602)	28.4	
Manhattan	21.1(548)	21.1	
Staten Island	5.4(139)	5.5	

Note. All percentages are weighted and all *ns* are unweighted.

Table 2
Weighted Percentage and (Unweighted n) for the Sample

<i>Variables^a</i>	Weighted Percentage Unweighted n)
Other independent variables	
College graduate	
No	59.9(1,304)
Yes	40.1(1,053)
Married/living together	
No	53.3(1,433)
Yes	46.7(935)
African American	
No	73.7(1,762)
Yes	26.3(606)
Income	
<\$20,000	18.4(476)
\$20,000-\$29,999	12.5(293)
\$30,000-\$39,999	9.6(245)
\$40,000-\$49,999	23.7(508)
\$50,000-\$74,999	13.5(327)
\$75,000-\$99,999	8.4(202)
\$100,000+	14.0(317)
Negative life events	
None	56.2(1,197)
One Event	27.0(642)
Two or More events	16.8(529)
Increase in drinking	
No	85.4(1,997)
Yes	14.6(371)
Perievent panic attack	
No	89.2(2,034)
Yes	10.8(334)
High terrorism fear	
No	57.9(1,334)
Yes	42.1(1,034)
Lifetime depression	
No	81.0(1,747)
Yes	19.0(621)
	Mean (standard deviation)
Age	41.31(15.74)
Exposure to WTCD events	2.76(1.69)
Traumatic events	1.72(1.85)
Social support	10.80(3.63)
Self-esteem	17.85(2.69)
Dependent variables	Mean (standard deviation)
SF-12-v2-physical health	50.93(10.28)
SF-12-v2-mental health	47.97(10.19)

^aWTCD = World Trade Center disaster, SF-12-v2 = Short Form-12, version 2.

Table 3
Regression Coefficients and (Standard Errors) for Short Form-12, Version 2 Physical and Mental Health Scales Regressed on Demographic, Stress, and Social Resource Variables (n = 2,218)

Dependent Variables	SF-12-v2 Physical Health			SF-12-v2 Mental Health		
	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)	Model 1 b (SE)	Model 2 b (SE)	Model 3 b (SE)
Demographics						
Age	-.21 (.02)***	-.22 (.02)***	-.22 (.02)***	.05 (.02)***	.02 (.01)	.03 (.01)*
College graduate	2.66 (.52)***	2.62 (.51)***	2.67 (.51)***	-.25 (.54)	.04 (.49)	-.57 (.46)
Female	-.80 (.48)	-.82 (.49)	-.90 (.49)	-1.82 (.51)***	-1.39 (.46)**	-1.75 (.43)***
Married	.29 (.51)	.25 (.51)	.30 (.52)	.94 (.52)	.28 (.46)	.20 (.43)
African American	-.93 (.61)***	-.67 (.59)***	-.77 (.60)	1.97 (.58)***	1.79 (.51)***	1.31 (.49)**
Income	1.07 (.13)***	1.01 (.13)***	.86 (.13)***	.77 (.14)***	.67 (.13)***	.23 (.13)
Stress/Risk						
Exposure WTCD		-.30 (.15)*	-.32 (.15)*		-.53 (.13)***	-.53 (.12)***
1- Negative life event		-.70 (.56)**	-.56 (.56)		-1.59 (.54)***	-1.08 (.49)***
2+ Negative life events		-2.18 (.76)***	-1.84 (.77)*		-4.17 (.70)***	-2.90 (.68)***
Traumatic events		-.46 (.14)***	-.45 (.14)***		-.17 (.14)	-.17 (.12)
Perceived panic attack		-2.13 (.86)*	-1.63 (.87)		-4.67 (.78)***	-3.13 (.76)***
Terrorism fear		-.99 (.50)*	-.88 (.51)		-1.45 (.48)**	-1.02 (.45)*
Increase in drinking		-.85 (.62)	1.01 (.62)		-1.87 (.66)**	-1.70 (.59)**
Lifetime depression		-.25 (.69)	.78 (.71)		-7.59 (.66)***	-5.50 (.65)***
Social psychological resources						
Social support			.05 (.08)			.34 (.06)***
Self-esteem			.33 (.11)**			1.18 (.09)***
Constant	55.08	58.23	52.10	42.96	50.27	26.37
R ²	.18	.22	.22	.05	.27	.37

Note. SF-12-v2 Short Form-12, version 2; WTCD World Trade Center disaster.

* $p < .05$,

** $p < .01$,

*** $p < .001$, two-tailed test.