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Overview of Findings from the World Trade Center Disaster Outcome Study: Recommendations for Future Research after Exposure to Psychological Trauma

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Abstract

In this article we review findings from the World Trade Center Disaster (WTCD) Outcomes Study, a prospective cohort study of 2,368 New York City (NYC) adults funded by the National Institutes of Health after the September 11 attacks. The findings reported were based on a baseline survey conducted one year after the disaster and a follow-up conducted two years post-disaster. One of the goals of this research was to assess the effectiveness of post-disaster treatments received by NYC residents following the attacks. Among the major findings of this study were the relatively small increase in mental health service utilization and the fact that only brief worksite interventions seemed to be an effective post-disaster treatment intervention. Specifically, those who received more conventional post-disaster interventions, such as formal psychotherapy sessions and/or psychotropic medicines, seemed to have poorer outcomes. Since this study was designed to assess treatment outcomes, use advanced measurement techniques, and incorporate propensity score matching to control for bias, these treatment findings were unexpected and raised clinical questions. Additional findings were also discussed related to minority group members, alcohol abuse, the onset and course of posttraumatic stress disorder post-disaster, and other findings. Future research is recommended to resolve the issues raised by this important study, especially as this relates to treatment outcomes.

Keywords

Posttraumatic stress disorder; *PTSD*; *disaster*; *mental health*; *alcohol abuse*; *treatment*; *effectiveness*; *outcomes*; *barriers to care*; *brief interventions*; *World Trade Center Disaster*; *September 11*

Following the September 11 terrorist attacks in New York City (NYC), several large-scale epidemiologic studies were funded by the National Institutes of Health to examine the impact of this event on area residents. The study, Impact of Mental Health Services in NY after WTC Disaster (Research Grant R01# MH-66403, Boscarino PI), was one of these investigations. It's primary purpose was to assess the impact of post-event treatments received by NYC residents following the World Trade Center Disaster (WTCD). The secondary purpose was to describe the prevalence of PTSD and related mental disorders among area residents and to identify risk and protective factors for such outcomes. The WTCD was a unique event in US history and represented the largest war-related loss of life on US soil since the American Civil War (Centers

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for Disease Control, 2002). In response to this disaster, NYC agencies and institutions, as well as those in surrounding communities, provided an extensive array of mental health treatment services for area residents. In NYC, these services were made available to the public through the federally-funded "Project Liberty" program, which offered mental health services to the general public at no or little cost (Felton, 2002). Our study offered a unique health services research opportunity and was specifically designed to assess mental health outcomes associated with this service delivery effort (Boscarino, Adams, & Figley, 2004).

STUDY OVERVIEW AND METHOD

The data for this study come from a prospective cohort study of adults who were living in NYC on the day of the disaster. Detailed information on the basic study design has been published elsewhere (Adams & Boscarino, 2005a; Adams & Boscarino, 2005b; Adams & Boscarino, 2006; Adams, Boscarino, & Galea, 2006a; Adams, Boscarino, & Galea, 2006b; Boscarino, Figley, Adams, Galea, Resnick, et al., 2004; Boscarino, Galea, Ahern, Resnick, & Vlahov, 2002; Boscarino & Adams, 2008; Boscarino, Galea, Ahern, Resnick, &Vlahov, 2003; Boscarino, Galea, et al., 2004; Boscarino, Adams, & Figley, 2004; Boscarino, Adams, & Figley, 2005; Boscarino, Adams, Foa, et. al., 2006; Boscarino, Adams, Figley, Galea, et al., 2006; Boscarino, Adams, Stuber, & Galea, 2005; Boscarino, Adams, & Galea, 2006; Galea, Boscarino, Resnick, & Vlahov, 2003; Vlahov et al., 2004; Vlahov et al., 2002). Briefly, using random-digit dialing, a baseline telephone survey was conducted a year after the WTCD attack. As part of the overall study design, residents who reported receiving mental health treatment a year after the attack were "over-sampled" by use of screener questions at the beginning of the survey. The baseline population was also stratified by the 5 NYC boroughs and gender, and was sampled proportionately. Questionnaires were translated into Spanish and then back-translated by bilingual Americans to ensure linguistic and cultural appropriateness. Approximately 7% of these interviews were conducted in Spanish. The baseline survey occurred between October and December 2002 and a follow-up survey occurred one-year later, between October 2003 and February 2004. The data collection procedures were the same for both surveys. Trained interviewers using computer-assisted telephone interviewing (CATI) conducted all interviews. All interviewers were supervised and monitored by the survey contractor in collaboration with the investigative staff. The mean duration of the interview was 45 minutes for the baseline and 35 minutes for the follow-up survey. The Institutional Review Board (IRB) of The New York Academy of Medicine (NYAM) reviewed and approved the study's original protocol. The Geisinger Health System (GHS) IRB subsequently approved the analyses related to the current study.

For the baseline study, 2,368 individuals completed the survey. We were able to re-interview 1,681 of these respondents in the follow-up survey. Using industry-standard survey definitions, the baseline cooperation rate was 63% and the re-interview rate for the follow-up study was 71% (Adams, Boscarino, & Galea, 2006b), consistent with previous epidemiological investigations (Galea et al., 2002). Sampling weights were developed for each wave to correct for potential selection bias related to the number of telephone numbers and persons per household and for the over-sampling of treatment-seeking respondents (Boscarino, Adams, & Figley, 2004). Demographic weights also were used with the follow-up data, to adjust for slight differences in response rates by different demographic groups, a common practice in panel surveys (Groves et al., 2004). With these survey adjustments, the study database is considered representative of adults who were living in NYC on the day of the WTCD attack (Boscarino, Adams, & Figley, 2004).

The basic data analyses in our study focused on answering the following specific research questions.

- Who sought mental health treatment after this event?

- What were the barriers encountered to seeking treatment after this event?
- What were the mental health outcomes among those who received treatment?
- What types of post-disaster interventions were the most effective?
- What were the risk and protective factors for experiencing adverse mental health outcomes after this event?

Earlier research regarding the health consequences of disasters and other traumatic events guided our original study. The post-disaster literature relevant to the WTCD at the time related to the survivors of the Oklahoma City bombing. Among direct survivors of that incident, 45% had post-disaster psychiatric disorders and 34% had PTSD (North et al., 1999). Another study of the same event found that 62% of residents of the Oklahoma City metropolitan area experienced at least one direct stress-related outcome due to the bombing (Smith, Christiansen, Vincent, & Hann, 1999). In addition, a comparison of Oklahoma City area residents to Indianapolis area residents, used as a control group, suggested that Oklahoma residents reported about twice the psychological distress, PTSD, increased alcohol use, and increased smoking behavior, compared to persons in the Indianapolis area (Smith et al., 1999). Although some investigators have contended that persons recover quickly from these experiences (e.g., McFarlane, 1988; McFarlane, 1989), others suggested that large-scale community disasters could result in significant psychological problems and poorer health outcomes post-disaster (Brewin, Andrews, & Valentine, 2000; Bromet & Dew, 1995: Rubonis & Bickman, 1991). Thus, the research literature at the time suggested that the psychological impact of the WTCD event would be significant. In addition, previous studies of the consequences of PTSD suggested that the impact of this disorder could be substantial (Kessler, 2000; Kulka et al., 1990). Other research suggests that PTSD was not only associated with mental health problems but also with alterations in physical health status (Boscarino, 1996; Boscarino, 1997; Boscarino & Chang, 1999a; Boscarino & Chang, 1999b; Boscarino, 2004; Boscarino, 2006; Boscarino, 2008; McFarlane, Atchison, Rafalowicz, & Papay, 1994; Schnurr & Green, 2004). Furthermore, other research has suggested that survivors of these events have increased psychological difficulties, chronic problems in living, and significant psychosocial resource loss (Adams et al., 2002; Bromet & Dew, 1995; Norris et al., 2002), possibly amplifying adverse health outcomes (Adams & Boscarino, 2006; Boscarino, 1995).

RESEARCH FOCUS

Psychobiological-Stressor Model

Although level of exposure and disaster-related loss are commonly associated with the impact of these events on well-being (Caldera, Palma, Penayo, & Kullgren, 2001; Galea et al., 2002; Geonjian et al., 2001; Mecocci et al., 2000), there are other risk factors involved. Research suggests that increased PTSD vulnerability often occurs among those with a history of mental health disorders, child abuse, or a history of previous traumas (Boscarino, Adams, & Figley, 2004; Breslau, Chilcoat, Kessler, & Davis, 1999; Shalev, 1996). Demographic and socioeconomic factors also are known to affect these experiences (Adams & Boscarino, 2005a). In addition, research has identified the role of social support among those exposed to traumatic stress, both in terms of protecting individuals from PTSD onset (Adams & Boscarino, 2006), and in terms of influencing effective treatments (Boscarino, 1995; van der Kolk, McFarlane, & van der Hart, 1996). In summary, the degree of exposure, social/cultural variables, and other factors, such as self-esteem and other character traits, are known to enhance or reduce the impact of traumatic stress exposures on mental health (Boscarino, Adams, & Figley, 2004). In addition, while many psychosocial components of traumatic stress exposures are now recognized (Adams, Figley, & Boscarino. 2008), the underlying biological bases of these syndromes have also become apparent (Boscarino, 1996; Boscarino & Chang, 1999a;

Boscarino & Chang 1999b; Boscarino, 2004; Boscarino, 2008; van der Kolk, 1996; Chrousos, 1995). Thus, we would expect long-term health issues to emerge in traumatized populations, including increases in substance use, changes in help-seeking behaviors, and the onset of chronic health conditions (Boscarino, 2004; Boscarino, 2008). This psychobiological-stressor model guided the original study design.

Outcomes Research Design

As we note below, our WTCD sample represents one of the limited number of population-based studies that prospectively examined post-disaster mental health services and health outcomes for these interventions following a major traumatic event (Boscarino et al., 2002; Boscarino et al., 2003; Boscarino, Galea, et al., 2004; Boscarino, Adams, & Figley, 2004; Boscarino, Figley, Adams, et al., 2004; Boscarino, Adams, & Figley, 2005; Boscarino, Adams, Foa, et. al., 2005; Boscarino, Adams, Stuber, et. al., 2005). In addition to descriptive research, our data enabled us to test specific hypotheses about the relationships between trauma experiences, the impact of different interventions, risk and protective factors, and long-term mental health outcomes. We note that our study was specifically designed as an outcomes study and was implemented to answer these kinds of research questions using a cohort study design (Boscarino and Chang 1999c; Figley, Carbonell, Boscarino, & Chang, 1999; Hulley, Cummings, Browner, Grady, & Newman, 2007; Rogers et al. 2000; Rosenheck, Stolar, & Fontana, 2000).

The survey instruments used in this research included reliable scales and health services research measures that had been used and validated in previous research (Freedy, Kilpatrick & Resnick., 1993; Kilpatrick, Acierno, Resnick, & Sanders, 1997; Kilpatrick et al., 2000; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993) and recent traumatic stressor research (Adams & Boscarino, 2005a; Adams & Boscarino, 2005b; Adams & Boscarino, 2006; Adams, Boscarino, & Galea, 2006a; Adams, Boscarino, & Galea, 2006b; Boscarino et al., 2002; Boscarino, Adams, & Figley, 2004; Boscarino, Galea, et al., 2003; Boscarino, Galea, et al., 2004; Boscarino, Figley, Adams, et al., 2004; Boscarino, Adams, & Figley, 2005; Boscarino, Adams, Foa, et al., 2006; Boscarino, Adams, Stuber, et. al., 2005; Boscarino, Adams, & Galea, 2006; Boscarino & Adams, 2008; Galea, Boscarino, et al., 2003). A summary of these scales and measures is presented below in Table 1. Briefly, most of these data were prospectively collected and included the following core measures: (1) demographic characteristics; (2) WTCD exposure variables; (3) exposure to other traumatic events; (4) WTCD rescue and recovery involvement; (5) stressful life experiences; (6) mental health, medical, and other services received pre- and post-disaster; (7) prescription medication use pre- and post-disaster; (8) use of alternative health services pre- and post-disaster; (9) substance use pre- and post-disaster; (10) barriers to care; (11) self-esteem, social support, functional health status and work productivity; (12) post-traumatic stress disorder; (13) major depressive disorder; (14) psychological symptoms in past 30 days; and (15) community-level indicator data (see Table 1).

MAIN STUDY FINDINGS

Mental Health Service Use – Baseline (Year 1)

The demographic profile for our study population is presented in Table 2. As reported previously, our weighted final sample closely matched the demographic profile of adult NYC residents (Adams et al., 2006b). As can be seen in Table 2, more than half of our population was a member of a minority group, 57% were female, and about 30% had high exposure to the WTCD event, meaning that they had fairly extensive exposure to the attack and its aftermath (Boscarino, Adams, & Figley, 2004). Analyses from one year post-disaster showed that prevalence of current PTSD was about 5% and the prevalence of current major depression was

about 12% (Table 3). Furthermore, 20% of New Yorkers had had mental health visits in the past 12 months and 12.9% reported one or more of these mental health visits was related to the WTCD event. Compared to the year before the attacks, 8.6% of New Yorkers had increased post-disaster mental health visits and 5.3% had a new post-disaster treatment episode in the 12 months post-disaster (Table 3). In terms of medications, 8.1% used psychotropic drugs (Boscarino, Adams, & Figley, 2004). Post-disaster psychotropic medication use related to the WTCD event was 4.5%. Increased post-disaster medication use, compared to the year before the disaster, was 4.1% and new medication episodes occurred among 3% of New Yorkers (Boscarino, Adams, & Figley, 2004). As with outpatient visits, post-disaster medication usage was lower than expected (Boscarino, Adams, & Figley, 2004).

In multivariate logistic regression analyses, increased mental health visits were associated with younger age, peri-event panic attack, negative life events, and depression. In addition, WTCD-related visits had a positive "dose-response" association with level of WTCD exposure ($p < 0.0001$ for trend). WTCD-related visits also were positively associated with peri-event panic, anxiety, lower self-esteem, PTSD, and depression. Increased post-disaster medication use was positively related to PTSD and depression, and negatively associated with African American status. WTCD-related medication use also was positively related to younger age, female gender, WTCD exposure level, negative life events, PTSD, anxiety, and lower self-esteem.

In summary, while the percentage of New Yorkers seeking post-disaster treatment did not increase substantially from the pre-disaster period, the volume of visits among existing patients apparently increased. We concluded that exposure to WTCD events was related to post-disaster PTSD and depression, as well as WTCD-related mental health service use in New York. However, contrary to expectations, although the WTCD did have an impact on treatment seeking among existing patients, it did not substantially increase mental health treatment seeking among the general NYC population (Boscarino, Adams, & Figley, 2004). Given the availability of post-disaster mental health services (Felton, 2002), it was thought that services use would be much higher.

Mental Health Service Use – Follow-up (Year 2)

Analysis of treatment seeking at follow-up (i.e., year 2 post-disaster) revealed that there were some increases in obtaining treatment in comparison to before the WTCD. The most noteworthy increase was for psychotropic medication use, which went from 8.5% before the WTCD to 12% two years after the attack ($p < .001$). Two years after the WTCD, 24% of NYC adults had received some type of mental health treatment in the form of therapy or medication in the past 12 months. This was an increase from the baseline survey (i.e., year 1 post-disaster), which was 20%. In addition, at follow-up, the majority of the time NYC residents reported that their post-disaster treatment was related to the WTCD, which was not the case one-year post-disaster. Detailed multivariate analyses for those who sought treatment after the WTCD in the year 2 follow-up survey suggested that those who experienced negative life events were more likely to seek counseling and those with low self-esteem were more likely to take psychotropic medications. Finally, those who reported that their counseling or medication use was related to the WTCD, were more likely to report greater exposure to the WTCD event. (Results available on request.)

Treatment Barriers

A second focus of the original study was to examine potential barriers related to using mental health services in NYC after the WTCD. When we examined at baseline those who met criteria for PTSD or major depression post-disaster, only 45% reported using post-disaster mental health services and only 33% indicated that they sought these services for WTCD-related problems (Boscarino, Adams, Stuber, et al., 2005). In a multivariate logistic model, only

WTCD exposure was significant in predicting post-disaster service use among persons with these psychological disorders. For service utilization related to the WTCD, results indicated that African Americans were less likely to have had mental health visits compared to Whites, while those who had a regular doctor, had greater exposure to WTCD events, and those who had a peri-event panic attack were more likely to have such visits. In terms of medication use, 26% of these PTSD-depression cases used psychotropic drugs in the year after the WTCD and 16% reported that this use was related to the disaster. Multivariate results, again, suggested that African Americans were less likely to use post-disaster medications, whereas persons 45 + years old, those with a regular doctor, those exposed to more WTCD events, and those who had a peri-event panic attack were more likely to have taken medications related to the disaster (Boscarino, Adams, Stuber, et al., 2005). When we asked this group of respondents at baseline why they did not seek help, many indicated that they did not think that they had a problem, that they had the help of family and friends, or that they tried to solve these problems on their own (Boscarino, Adams, Stuber, et al., 2005).

Racial and Ethnic Group Results

The discovery of racial/ethnic disparities in seeking treatment led us to assess the association between race/ethnicity and psychological health status in more detail at baseline (Adams & Boscarino, 2005a). When we did this, there was no evidence of racial/ethnic differences for PTSD, PTSD symptom severity, or the likelihood of being classified in poor physical health on the SF-12 physical health scale, once other risk factors were controlled. In fact, African Americans were less likely to meet criteria for major depression or to be classified as unhealthy on the SF-12 mental health scale (Adams & Boscarino, 2005a). Only for peri-event panic attack were there significant differences by ethnicity, with both African Americans and Puerto Ricans more likely to meet criteria for this mental disorder relative to Whites (Adams & Boscarino, 2005a).

Functional Health Status Outcomes

Using baseline data, we also examined the relationship between exposure to the WTCD and functional health status following the attacks based on the SF-12 scale. Overall — the greater the exposure to WTCD events, the poorer psychological well-being — even after controlling for demographic characteristics, other stressors, and social psychological resources (Adams & Boscarino, 2005b). Exposure was only weakly related to physical well-being, however, once other factors were controlled.

We also examined the consequences of the WTCD longitudinally. In ordinary least-squares regression models that contained demographic characteristics, stress risk factors, and stress moderators as independent variables, level of exposure to the disaster was associated with follow-up (i.e., year 2 post-disaster) physical and psychological well-being. However, we found that level of exposure was not related to these outcomes, once the baseline (year 1) measure of the follow-up dependent variable was controlled in these models. This suggested that disaster exposure did not continue to have a lasting negative impact on physical or psychological health status (Adams, Boscarino, & Galea, 2006a).

Our results did indicate that experiencing a WTCD-related peri-traumatic panic attack was related to poorer physical health status post-disaster at baseline, while meeting the criteria for alcohol dependence post-disaster was associated with poorer mental health status at baseline (Adams, Boscarino, & Galea, 2006a). At follow-up, however, and contrary to expectations, WTCD-related peri-traumatic panic attack did not have an adverse impact on health, once other risk factors were controlled (Boscarino & Adams, 2008).

Results Related to PTSD Onset and Course

As noted, our results suggested that the prevalence of PTSD 12 months post-disaster was about 5% (Boscarino, Adams, & Figley, 2004). Further analyses suggested that there were significant associations between PTSD at baseline and being female, being younger, having lower self-esteem, having lower social support, having greater WTCD event exposures, having greater lifetime traumatic events, and having a history of depression (all *p*-values < 0.05; Adams & Boscarino, 2006). However, the results were different for PTSD at follow-up (year 2 post-disaster). At follow-up, being middle-aged, being Latino, having lower self-esteem, having more negative life events, and having higher traumatic life events were now significant predictors of PTSD (Adams & Boscarino, 2006). Noteworthy was that WTCD event exposure now was not significant at follow-up. Further analyses suggested that the onset of "delayed PTSD" at follow-up tended to be associated with the onset of negative life events and decreases in self-esteem, not with previous WTCD event exposure, per se. (Adams & Boscarino, 2006). The finding for self-esteem and PTSD outcomes are shown in Figure 1. As can be seen, increased self-esteem is associated with remitted PTSD at follow-up (i.e., PTSD at baseline, but not at follow-up) and decreased self-esteem is associated with delayed PTSD at follow-up (i.e., no PTSD at baseline, but PTSD at follow-up). Also noteworthy is that the resilient PTSD cases (i.e., no PTSD at baseline or follow-up) have the lowest levels of low self-esteem of any of the PTSD groups studied (see Figure 1).

Alcohol Abuse

Since research has suggested that exposure to psychological trauma was associated with increased abuse of alcohol (Boscarino, Adams, & Galea, 2006), we analyzed alcohol consumption, binge drinking, and alcohol dependence among study participants at one year and two years post-disaster. In multivariate models controlling for demographic factors, other stressor exposures, psychological resources, and history of anti-social behavior, we found that greater exposure to the WTCD event was associated with greater alcohol consumption at one year and two years after this event (Boscarino, Adams, & Galea, 2006). In addition, our analyses indicated that exposure to the WTCD was associated with binge drinking at one year after but not two years after this event. Alcohol dependence, assessed as present in either year 1 or year 2, also was positively associated with greater WTCD exposure. Posttraumatic stress disorder was not associated with alcohol use, once WTCD exposure and other covariates were controlled. In addition, we found that our alcohol abuse measures were positively associated with most adverse mental health measures, including PTSD, depression, anxiety, and poor functional health status (Adams, Boscarino, & Galea, 2006a).

Treatment Effectiveness

Conventional Interventions—As noted above, a central focus of our study was to use our prospective, population-based research design to evaluate intervention outcomes among those who obtained post-disaster mental health services, which were made widely available in NYC post-disaster (Felton, 2002). This basic prospective evaluation design was used successfully in past mental health effectiveness studies (Bovasso, Eaton, & Armenian, 1999). To assess the effectiveness of various psychotherapy treatments, we identified individuals who either had PTSD or subsyndromal PTSD (Galea et al., 2003) at baseline and who were re-interviewed at follow-up (n = 490). Using a propensity score method (Rosenbaum & Rubin, 1983), we then matched cases that received different types of post-disaster interventions to comparable cases that did not. For these analyses we compared outcomes at follow-up for several standards of treatment that patients received (e.g., those receiving 3−6 psychotherapy sessions for 30 minutes or more post-disaster vs. those that did not, etc.).

The health outcomes examined included alcohol dependence, binge drinking, mental health symptoms, SF-12 physical and mental health status, and PTSD. For these analyses, propensity

scores were used to match treated cases to untreated controls. These results, based on conditional logistic regression, suggested that conventional post-disaster interventions for traumatic stress exposures appeared to be ineffective. That is, participants in our study who received traditional psychotherapy at baseline were not less symptomatic based on our outcome measures at follow-up, compared to those individuals with baseline PTSD who did not receive these interventions. In fact, our results suggested, paradoxically, that the treated cases often had worse outcomes than the untreated cases. In addition, this treatment exposure revealed a negative dose-response effect, whereby the more treatment a patient received, the worse his or her mental health outcomes at follow-up. When we examined outcomes for all respondents, regardless of whether they met the case definition or not for PTSD or depression, these results were basically the same. In other words, those who received psychotherapy, regardless of their level of psychological impairment at baseline, had worse outcomes at follow-up. (Results available upon request.)

Brief Interventions—When we assessed the effects of brief emergency mental health counseling post-disaster, the results were different. Although there has been controversy associated with this modality (Gist & Devilly, 2002; Kaplan, Iancu & Bodner, 2001; van Emmerik, Kamphuis, Hulsbosch, & Emmelkamp, 2002), consistent with some reports (e.g., Basoglu, Salcioglu, Livanou, & Kalender, 2005), we found that brief post-disaster interventions significantly reduced mental health problems and symptoms up to two years after these interventions (Boscarino, Adams, & Figley, 2005; Boscarino, Adams, Foa, et al., 2006). In our study, about 10% of NYC adults reported receiving some type of crisis interventions conducted by mental health professionals within a year after the attacks (Table 3). Based on our sample, approximately 7% of NYC adults (~ 425,000 persons) reported receiving employer-sponsored, worksite crisis interventions related to the WTCD. These interventions were delivered at the worksite and were defined as a brief session related to coping with the World Trade Center disaster shortly after this event, directed by a mental health professional and arranged by area employers for their employees. Crisis interventions following traumatic events have been utilized for a number of years (Gist & Devilly, 2002; Kaplan, Iancu, & Bodner, 2001; van Emmerik et al., 2002).

However, the effectiveness and safety of these interventions have been challenged (Boscarino, Adams, Foa, et al., 2006; Gist & Devilly, 2002).

In the past, evaluation of these interventions has been hampered by limited research designs (Boscarino, Adams, Foa et al., 2006). The purpose of our recent study was to conduct a more advanced and focused analysis of preliminary findings reported elsewhere based on a multivariate covariate model (Boscarino, Adams, & Figley, 2005). Our initial analysis, which examined both mental health and alcohol abuse outcomes, suggested that those who attended 1−3 brief sessions had significantly better outcomes 2 years post-disaster (Boscarino, Adams, & Figley, 2005). Based on these initial findings we refined our analysis and expanded the number of covariates to control for potential bias and confounding. The latter was achieved through use of more advanced propensity score matching to assess the “average treatment” effect of worksite interventions (Boscarino, Adams, Foa, et al., 2006).

A description of the services received by employees at the worksite and the patient's rating of these services are shown in Table 4. The data for this analysis was based on a subset of 1,121 employed adults interviewed by telephone in our household WTCD survey at baseline and at follow-up. For the current study, we used propensity scores to match worksite intervention cases ($n = 150$) to worksite nonintervention controls ($n = 971$) using a 1:5 matching ratio based on a bias-corrected, nearest-neighbor algorithm (Boscarino, Adams, Foa, et al., 2006). Unlike more conventional mental health treatments, these worksite interventions appeared to be effective across a spectrum of outcomes, including reduced alcohol dependence, binge

drinking, depression, PTSD severity, and reduced anxiety symptoms (Table 5;Boscarino, Adams, Foa, et al., 2006). While this propensity study had limitations, it suggested that brief post-disaster crisis interventions may be effective for employees following mass exposure to psychologically traumatic events. None of the other interventions that we studied came close to achieving these results. The reasons for the effectiveness of the brief worksite interventions were unclear and warrant further investigations. Other than for the outcome of alcohol dependence and binge drinking, those who received conventional therapy sessions tended to do worse after these interventions. In addition, the more conventional sessions they received, the worse they did in terms of PTSD, depression, anxiety, and global severity, a worrisome finding. As discussed previously, our study included extensive risk factor data (see Table 1); we used these data to "risk adjust" our treatment models. For conventional treatments, this risk adjustment made little difference.

CONCLUSION

As noted, following exposure to the WTCD, the majority of individuals exposed to these events generally did not seek mental health treatment, even though some clearly experienced mental problems (Boscarino, Adams, Stuber, et al., 2005). In addition, some persons experienced delayed mental health problems two years after the initial exposure (Adams & Boscarino, 2006). Our main study objective was to undertake analyses that could provide insight related to the impact of treatment-seeking and the onset of mental health problems following a major traumatic event exposure — information that could inform health professionals about the consequences of exposure to psychological trauma and the impact of treatment interventions following such events. Our study's main findings are as follows:

- Generally, those who sought mental health treatment after the WTCD tended to be individuals who sought treatment *before* this event. They also tended to be individuals highly exposed to the WTCD event. Conversely, symptomatic individuals who did not seek treatment tended to be members of minority groups, did not have health insurance coverage, and tended to have sought informal support from friends and neighbors.
- Those who experienced "delayed" PTSD after the WTCD event (i.e., no PTSD at baseline, but PTSD at follow-up), tended to be Hispanic, non-native born, to have recently experienced lower self-esteem and/or negative life events. Contrary to expectations, the degree of WTCD exposure did not predict delayed PTSD. Persistent PTSD cases (i.e., had PTSD at baseline and at follow-up) were similar to delayed cases, except that these cases had higher exposure to the WTCD events and they had a history of mental health disorders *before* the WTCD event.
- The outcomes of mental health treatment after the WTCD attack and what types of interventions were the most beneficial were a major focus of our research. Our findings suggested that early brief interventions at the worksite were the most effective post-disaster treatment. In addition, informal support seeking from friends, neighbors, and from spiritual communities also appeared beneficial. Conversely, those who received more extensive post-disaster interventions (e.g., formal psychotherapy sessions for 30 minutes or more) did not benefit and, in fact, they appeared to have worse outcomes. The reasons for the latter finding were unclear, since we controlled for an extensive number of risk factors in these analysis, presumably controlling for selection bias and confounding.
- In terms of those who were the most resilient to mental health problems following the WTCD event, they tended to be males, older persons, those with higher self-esteem and stronger social support. They also tended to be persons *without* a history of mental

health problems *before* the WTCD event. Finally, they tended to be persons with fewer lifetime traumatic events and those with fewer stressful life events in the past year.

- Our study suggests that exposure to psychological trauma is associated with increases in problem drinking and alcohol abuse long after exposure and that these substance use outcomes tend to be associated with other adverse mental health outcomes post-exposure.

RECOMMENDATIONS

Based on our study findings, our recommendations for future post-trauma research include the following:

- Additional research is needed related to why receiving brief post-disaster treatment interventions were effective.
- Conversely, research is needed to confirm that those who received conventional post-disaster treatments actually did worse, and if so, why this may have been the case.
- Additional research is needed to determine why clearly symptomatic members of minority groups tended not to seek post-disaster treatment. For example, was this because of differences in perceived stigma, because of informal or alternative treatment-seeking, or some other reason?
- Further research is needed to determine the effectiveness and nature of informal social support and alternative interventions in protecting individuals from post-disaster mental health problems.
- Research is recommended related to factors that affect post-disaster resiliency. For example, persons with higher self-esteem post-disaster tended to be protected from future mental health problems. Some research questions are: Why were these persons protected from mental health problems? Should self-esteem be a focus of post-event interventions in the future? In the past, post-disaster interventions have usually focused on psychopathology, rather than on wellness and positive psychological factors. Our research suggests that this clinical focus might be misplaced.
- Our study suggests that exposure to psychological trauma may be associated with increases in problem drinking and alcohol abuse after these exposures and deserves further investigation.

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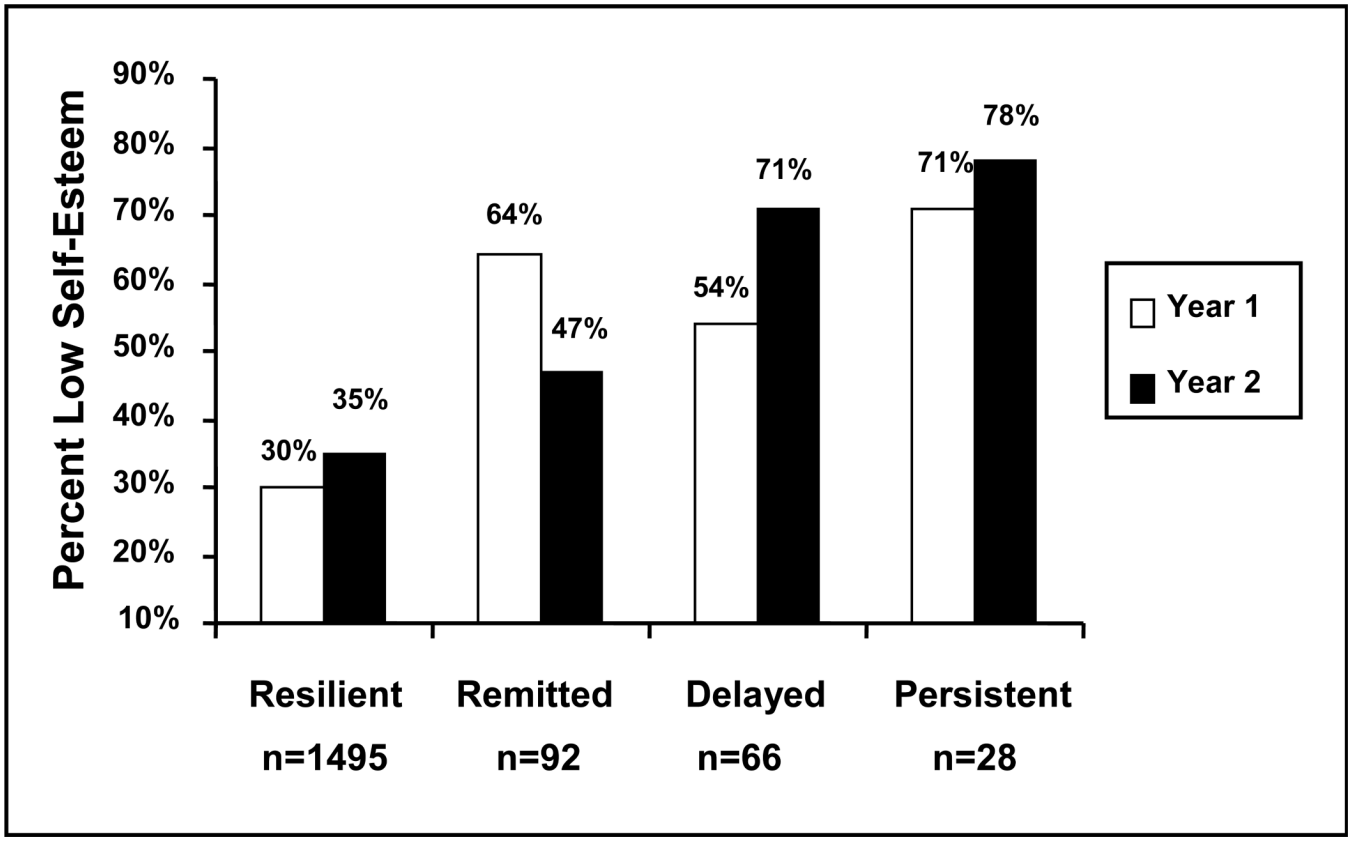

Figure 1.
Percent of Respondents Having Low Self-Esteem by PTSD Status at Follow-up*
*PTSD groups were defined as follows: Resilient = no PTSD in year 1 or year 2; Remitted = PTSD in year 1 but not year 2; Delayed = no PTSD in year 1 but PTSD in year 2; Persist = PTSD in year 1 and year 2.
Figure adopted with permission from Lippincott Williams & Wilkins (copyright 2006): Adams, RE, Boscarino, JA. (2006). Predictors of PTSD and delayed-PTSD after disaster: The impact of exposure and psychosocial resources. *Journal of Nervous and Mental Disease, 195*, 485 −493.

Table1

Core Measurement Instruments in WTCD Outcome Study*

Measurement Area	Measure 1	Measure 2	Measure 3	Measure 4
1. Mental health status	DSM-IV PTSD for lifetime, past 12 months/ 30 days	DSM-IV major depression for lifetime, past 12 months/30 days	BSI-18 Psychological symptom scale past 30 days	
2. Substance use	Q-F of tobacco use	Q-F of alcohol use	Binge drinking	CAGE alcohol dependence scale
3. Care visits, treatments & interventions	Outpatient visits & hospitalizations	Outpatient mental health visits & hospitalizations	Psychotropic medication use	Mental health interventions & access to care
4. Stress exposures	Level of exposure to WTC disaster events	Traumatic exposures in lifetime & past 12 months.	Stressful life events in the past 12 months	
5. Social/community resources	Social support in past 12 months	NORC Social capital scale	Assistance from friends & neighbors	Zip code-level census & NYC health data
6. Psychological resources	Rosenberg self-esteem scale	Anomie hostility scale		
7. Functional status	SF-12: mental & physical functioning past 30 days	Reported work productivity past 30 days		
8. Demographic measures	Age, gender, income, education, ethnicity, race	Work status, immigration status, language spoken	Religion, church attendance	Household composition
9. Other measures	Use of Alternative services	Disaster rescue & recovery involvement	Reported medical history	

WTCD = World Trade Center Disaster

*For more detailed discussion of measures used, see: Boscarino, JA, Adams, RE, Figley, CR. (2004). Mental health service use 1-year after the World Trade Center disaster: implications for medical care. *General Hospital Psychiatry*, *26*, 346−358.

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Table 2

Demographic Profile for Baseline (Year 1) and Follow-up (Year 2) for WTCD Outcome Study*

	1 Year Post Disaster (N=2368)		2 Years Post Disaster (N=1681)	
Demographics	**Percent (N)**	**95% CI**	**Percent (N)**	**95% CI**
Age				
18−29	27.2 (483)	24.8−29.7	22.7 (284)	20.1−25.6
30−44	34.2 (866)	31.8−36.7	32.9 (596)	30.1−35.8
45−64	28.8 (726)	26.5−31.1	32.5 (586)	29.8−35.4
65+	9.8 (248)	8.5−11.4	11.9 (215)	10.1−13.9
Gender				
Male	46.2 (1016)	43.6−48.8	46.2 (693)	43.2−49.3
Female	53.8 (1352)	51.2−56.4	53.8 (988)	50.7−56.9
Race				
White	39.3 (1015)	36.9−41.7	43.0 (782)	40.1−45.9
African American	26.3 (606)	24.2−28.6	26.0 (422)	23.4−28.7
Hispanic/Latino	25.7 (559)	23.5−28.1	24.1 (367)	21.5−26.9
Asian	5.2 (99)	4.1−6.6	4.6 (62)	3.4− 6.1
Other	3.5 (89)	2.7−4.5	2.4 (48)	1.7− 3.4
Borough of Residence				
Manhattan	21.1 (555)	19.8−22.5	21.0 (411)	19.5 −22.6
Bronx	15.6 (373)	14.4−16.8	15.5 (252)	14.1−17.0
Brooklyn	30.1 (707)	28.5−31.7	30.3 (490)	28.4−32.2
Queens	27.9 (594)	26.4−29.4	27.7 (423)	26.0−29.5
Staten Island	5.4 (139)	4.7− 6.2	5.5 (105)	4.65 −6.3
Exposure to WTCD				
Low Exposures	26.5 (510)	24.2−28.9	26.7 (362)	24.0−29.6
Moderate Exposures	44.0 (1003)	41.4−46.6	43.9 (719)	40.9−47.0
High Exposures	22.0 (594)	20.0−24.2	21.8 (416)	19.4−24.4
Very High Exposures	7.5 (261)	6.4− 8.8	7.6 (184)	6.3− 9.1

* Note: All N's are unweighted. Percentages and confidence intervals shown represent the weighted data (i.e., adjustments to the sample for the number of telephone lines and adults in the household, the treatment over-sample, and survey stratification). CI = Confidence interval; WTCD = World Trade Center Disaster.

Table 3

Baseline Psychological Disorders and Mental Health Service Utilization Following the World Trade Center Disaster in New York City (N = 2,368)

Outcomes	Unweighted N[†]	Weighted %	95%CI[*]
Mental Health Status			
PTSD Ever	284	8.15	6.87−9.42
PTSD since WTCD	196	5.25	4.23−6.26
Depression Ever	621	19.00	17.11−20.83
Depression since WTCD	416	11.76	10.29−13.22
Mental Health Visits			
Any Mental Health Treatment Visits Ever	1242	38.98	36.56−41.39
Any Mental Health Treatment Visits since WTCD	766	19.99	18.20−21.77
Any Mental Health Treatment Visits related to WTCD	547	12.88	11.51−14.25
Increased Mental Health Treatment Visits since WTCD	332	8.57	7.36−9.79
New Mental Health Treatment Visit since WTCD	189	5.28	4.32−6.25

For additional information, see: Boscarino, JA, Adams, RE, Figley, CR. (2004). Mental health service use 1-year after the World Trade Center disaster: Implications for medical care. *General Hospital Psychiatry*, *26*, 346−358.

[*] CI = Confidence interval; WTCD = World Trade Center Disaster.

[†] All N's are unweighted. Percentages and confidence intervals shown represent the weighted data (i.e., adjustments to the sample for the number of telephone lines and adults in the household, the treatment over-sample, and survey stratification).

Table 4

Descriptive Statistics for Brief Intervention Exposures in Baseline Survey (N = 2,368)*

Intervention Characteristics	% (Weighted)	95% CI	N (Unweighted)
Number of Brief Crisis Sessions			
None	89.9	88.4−91.3	2012
One	4.4	3.4−5.6	123
Two to Three	3.6	2.9−4.5	134
Four or more	2.1	1.7−2.8	89
Percent any Brief Crisis Sessions	10.2	8.9−11.8	356
Number of Brief Crisis Sessions at Worksite			
None	93.5	92.4−94.5	2124
One	3.4	2.6−4.4	103
Two to Three	2.3	1.8−2.8	99
Four or more	0.9	0.6−1.3	42
Percent any Brief Crisis Sessions at Worksite	6.5	5.5−7.6	244
Content of Brief Sessions, among those having any sessions (*n* = 356)			
Educated about Stress Symptoms	63.7	56.2−70.7	244
Talked about Experiences	62.9	55.0−70.1	264
Taught to Cope with Things	65.1	57.8−71.7	246
Taught to Think Positively	64.1	56.8−70.8	238
Taught to Evaluate Thoughts	57.7	50.4−64.6	206
Taught to Deal with Emotions	69.1	61.8−75.5	255
Taught to Relax	65.9	58.6−72.4	245
Reported Helpfulness of Crisis Intervention Sessions, among those having any sessions (*n*=356)			
Not at All Helpful	17.7	12.0−25.4	47
Helped a Little	24.5	18.9−31.1	84
Helped Some	25.4	20.2−31.6	101
Helped a Lot	32.4	26.0−39.5	124

Table adopted with permission from Lippincott Williams & Wilkins (copyright 2006): Boscarino, JA, Adams, RE, Foa, EB, Landrigan, PJ. (2006). A propensity score analysis of brief worksite crisis interventions after the World Trade Center disaster: Implications for intervention and research. *Medical Care, 44*, 454−462.

* All N's are unweighted. Percentages and confidence intervals shown represent the weighted data (i.e., adjustments to the sample for the number of telephone lines and adults in the household, the treatment over-sample, and survey stratification). CI = Confidence interval; WTCD = World Trade Center Disaster.

Table 5

Summary Results for Brief Worksite Interventions for 7 Outcomes at Follow-up*

	PTSD Diagnosis	Depression Diagnosis	Alcohol Dependence	Binge Drinking	Mean PTSD Symptom Level	Mean Depression Symptom Level	Mean Anxiety Symptom Level
Significance level	NS	$p < .05$	$p < .01$	$p < .05$	$p < .05$	$p < .05$	$p < .10$
Impact of treatment vs. no treatment**	-	7.2%	4.8%	5.5%	.8	1.8	1.4

* For additional information, see: Boscarino, JA, Adams, RE, Foa, EB, Landrigan, PJ. (2006). A propensity score analysis of brief worksite crisis interventions after the World Trade Center disaster: Implications for intervention and research. *Medical Care, 44*, 454−462.

** As an example of the brief treatment outcome impact, the results for depression suggest that the prevalence of depression was about 7% lower among treated cases at follow-up compared to matched untreated cases. Likewise, treated cases had lower mean depression symptom scores by about 2 points compared to matched untreated cases.