

## Psychiatric Medication Use Among Manhattan Residents Following the World Trade Center Disaster

Joseph A. Boscarino,<sup>1,2,7</sup> Sandro Galea,<sup>3,4</sup> Jennifer Ahern,<sup>3</sup>  
Heidi Resnick,<sup>5</sup> and David Vlahov<sup>3,4,6</sup>

---

To assess medication use in New York after the September 11th attacks, a telephone survey was conducted in October 2001 ( $N = 1,008$ ). The prevalence of psychiatric medication use 30 days before the disaster was 8.9 and 11.6% 30 days after, a small but significant increase. The most important factor predicting postdisaster use was predisaster use—92% of those who used medications postdisaster used them predisaster. In addition, 3.3% used psychiatric medications 30 days postdisaster, but not 30 days before. Those who had panic attacks, posttraumatic stress disorder (PTSD), and insurance coverage, were the most likely medicated (26.5%). However, among those who used postdisaster medications ( $n = 129$ ), new users tended to be those with panic attacks (44.1%) and those with panic attacks and PTSD (69.2%).

---

**KEY WORDS:** pharmaceuticals; posttraumatic stress disorder; disasters; panic attack; service utilization.

---

### Introduction

Studies suggest that survivors of major disasters develop stress-related psychiatric disorders, including posttraumatic stress disorder (PTSD) and other mental health conditions (Green, 1991; Norris, 1992; Smith, North, McCool, & Shea, 1990). Although major disasters

are relatively rare, lasting effects are seen after disasters resulting in widespread property damage, significant loss of life, and financial disruption (Rubonis & Bickman, 1991). These elements were present in the September 11th terrorist attacks in New York City (NYC). Initial studies of the psychological effects after the September 11th attacks suggested a high prevalence of stress, PTSD, and depression (Galea et al., 2002).

Although population-level mental health service utilization has been documented following disasters (Smith, Christiansen, Vincent, & Hann, 1999), research often has focused on the impact among direct survivors (Carr, Lewin, Carter, & Webster, 1992; North et al., 1999). Furthermore, different utilization measures and time frames have made generalization difficult (Burkle, 1996; Gleser, Green, & Winget, 1981; Joseph, Yule, Williams, & Hodgkinson, 1993; Madakasira & O'Brien, 1987). In addition to psychosocial therapies (Foa, 2000), the core symptoms of PTSD have been found responsive to psychiatric medications, including antidepressants, anxiolytics, and mood stabilizers (Davidson, 2000; Friedman, Davidson, Mellman, & Southwick, 2000). To our knowledge, there

---

<sup>1</sup>Division of Health and Science Policy, New York Academy of Medicine, New York, New York.

<sup>2</sup>Research Service, Department of Veterans Affairs, New Jersey Health Care System, East Orange, New Jersey.

<sup>3</sup>Center for Urban Epidemiologic Studies, New York Academy of Medicine, New York, New York.

<sup>4</sup>Department of Epidemiology, Columbia University, Mailman School of Public Health, New York, New York.

<sup>5</sup>National Crime Victims' Research and Treatment Center, Medical University of South Carolina, Charleston, South Carolina.

<sup>6</sup>Johns Hopkins University, Bloomberg School of Public Health, Baltimore, Maryland.

<sup>7</sup>To whom correspondence should be addressed at Division of Health and Science Policy, Room 552, New York Academy of Medicine, 1216 Fifth Avenue, New York, New York 10029-5293; e-mail: jboscarino@nyam.org.

are no studies that report the postdisaster prevalence and correlates of psychiatric medication use at the population level. More effective public health planning, however, requires assessment of postdisaster mental health service utilization at this level. Previously we reported mental health service use in Manhattan following the September 11th attacks (Boscarino, Galea, Ahern, Resnick, & Vlahov, 2002). This study extends our previous report and presents findings related to prescription medication use immediately following the World Trade Center attacks.

## Method

### Participants

We undertook a random telephone survey of Manhattan residents living below 110th Street 5–8 weeks after September 11, 2001 ( $N = 1,008$ ). We surveyed below 110th Street because we wanted to assess the area most directly affected by the disaster. All English- or Spanish-speaking adults (over 17 years old) with telephones were potential study participants. The sample was selected using random-digit dialing. One adult per household was randomly selected for an interview. Sampling weights were developed and applied to our data to adjust for the number of household telephones and persons in the household. The cooperation rate for the survey was 64.3% (American Association for Public Opinion Research, 2000). A protocol was in place to provide assistance to participants who required mental health counseling. The Institutional Review Board of the New York Academy of Medicine reviewed and approved the study protocols.

### Data Collection and Survey Instruments

During the survey, we asked about mental health service utilization 30 days before and 30 days after September 11th. We asked if participants took any psychiatric medications prescribed by a doctor, such as antidepressants or sleeping pills, for personal or emotional problems in the 30 days before and the 30 days after the disaster. We also asked questions about demographic variables including age, race, gender, household income, education, and marital status. We asked if respondents had social support available to them in the 6 months before September 11th. We asked about lifetime exposure to traumatic events. We asked about stressful life events that a person could have experienced in the year before the events of September 11th (Freedy, Kilpatrick, & Resnick, 1993). We also

assessed a number of disaster event experiences (Freedy et al., 1993). These included directly witnessing the attacks, being afraid for one's life, having friends or relatives killed, being displaced from one's home, being involved in the rescue efforts, and losing one's job or possessions as a result of the attacks.

We used three measures of mental health status in our study: perievent panic attack, PTSD, and depression. The perievent panic attack measure was a modified version of the Diagnostic Interview Schedule (DIS) scale for panic attack (Robins, Marcus, Reich, Cunningham, & Gallagher, 1996). This measured symptoms that occurred during or shortly following the terrorist attacks (American Psychiatric Association, 1994). The PTSD measure used was a modified version of the DIS PTSD measure used in a national study and based on the *Diagnostic and statistical manual of mental disorders*, Fourth Edition (*DSM-IV*; American Psychiatric Association, 1994; Kilpatrick et al., 1998). Current PTSD was based on the presence of symptoms for any trauma within the previous 30 days. This scale had a Kappa coefficient of agreement with the clinician-administered, Structured Clinical Interviews for *DSM-III-R* (SCID) of 0.71 for current PTSD (Kilpatrick et al., 1998; Spitzer, Williams, & Gibbon, 1987). To measure current depression in the past 30 days, we used an adapted version of the SCID's major depressive episode scale (Spitzer et al., 1987). Additional information on all the measures used in this study can be found elsewhere (Boscarino et al., 2002).

### Statistical Analyses

We report psychiatric medication usage for 30 days before and after the attacks. We also assess postdisaster change using a paired McNemar test—a nonparametric test developed for pre/post studies (Sheskin, 2000). Point estimates and two-tailed 95% confidence intervals (CIs) are also given. Investigators have reported that both demographic and event-exposure factors are associated with adverse psychological outcomes, including PTSD and depression following traumatic exposures (Bromet, Sonnega, & Kessler, 1998; Kessler et al., 1995; Kulka et al., 1990). Increased mental health utilization also has been reported following exposure to traumatic events (Carr et al., 1992; Joseph et al., 1993; Smith et al., 1999). Following this research, we identified 8 demographic (e.g., age, education, income, race, marital status, etc.) and 10 event-exposure variables (e.g., loss of property, being displaced, witnessing the event, having friends or relatives killed, media exposure level, etc.) potentially associated with post-disaster outcomes and included these in our analyses.

We also included three mental health measures in these analyses—perievent panic attack, PTSD, and depression. While logistic regression was used to examine these associations in an exploratory predictive model, this analysis was limited because 92% of postdisaster drug users in our study were also predisaster users. Consequently, we used chi-squared automatic interaction detection (CHAID) analysis available through *Answer Tree* software to examine factors predicting “new” postdisaster drug use (SPSS, *Answer Tree* [version 2.1]). We defined new users as those who used psychiatric medications 30 days postdisaster, but not 30 days predisaster. CHAID analysis also was necessary because there were relatively few new users ( $n = 33$ ) within the timeframe studied. Hence, logistic regression is usually not recommended (Hosmer & Lemeshow, 2000; Zhang & Singer, 1999). CHAID is a nonparametric, stepwise “regression tree” analysis method that is more suited for analysis of skewed binomial data (Magidson, 1982; Zhang & Singer, 1999). Finally, for comparison, we conducted CHAID analyses among the total population ( $N = 988$ ) and among only those who used any psychiatric medications in the postdisaster period ( $n = 129$ ). We used the survey estimation (svy) commands in Stata, version 7 (Stata Corporation, 2001) to generate the main point estimates and the CIs reported (Table 1). This was required to adjust the data for the sampling design, which included case weights to adjust the data for the number of telephone lines per adult. These case weights also were used in our CHAID analysis. The stepwise selection used in the CHAID analyses was stopped when a variable had a  $p$  value  $>.05$ . All  $p$  values in the CHAID analysis were adjusted for multiple compar-

isons using the Bonferroni method (SPSS, *Answer Tree* [version 2.1]).

## Results

Among the 1,008 adults surveyed, 20 were excluded because of missing data. Overall, 52.0% percent of the sample were women, the mean age was 42 years ( $SD = 15$  years), and 71.6% were Whites. Age, gender, race, and residence distributions in our sample were comparable to estimates obtained by the 2000 U.S. Census for our sampling frame (Bureau of the Census, 2000).

In the survey, 8.8% (95% CI = 6.9–10.8) and 9.7% (95% CI = 7.7–11.8) of the adult residents had current PTSD or current depression, respectively (Table 1). A total of 19.4% (95% CI = 16.7–22.2) had professional visits for mental health problems 30 days after the disaster. Ten percent (10.0%; 95% CI = 7.9–12.0) had an increase in mental health visits during this time frame. Altogether, 11.6% (95% CI = 9.5–13.7) of residents took prescription psychiatric medications 30 days after September 11th, compared to 8.9% (95% CI = 7.1–10.8) 30 days before. In addition, among those taking psychiatric medications 30 days postdisaster, 3.3% (95% CI = 2.1–4.7) were not taking these 30 days before the disaster. A pre/post McNemar test suggested that 30 days postdisaster psychiatric medication usage increased, compared to 30 days before, McNemar's  $\chi^2(1, N = 988) = 16.9, p < .001$ .

As noted, the correlation between pre- and postdisaster drug use was high and only 3.3% ( $n = 33$ ) who used these medications in the postdisaster period, did not use them the month before the disaster. Consequently, we focused our analyses on these “new” users, because this use was more likely related to the September 11th attacks.

Consistent with our multivariate logistic regression analysis predicting medication use, our stepwise CHAID analysis (see Fig. 1) indicated that the first (and most significant) variable selected was having had a perievent panic attack,  $\chi^2(1, N = 988) = 22.7, p < .001$ . Altogether, 12.1% of those with perievent panic had taken a new medication postdisaster versus 2.1% without this condition. Among those with both panic and PTSD, however, 20.9% were newly medicated, versus 7.4% with panic but without PTSD,  $\chi^2(1, N = 124) = 4.6, p < .05$ . Furthermore, 26.5% of those with panic, PTSD, and health insurance were newly medicated, versus 0% of those with panic and PTSD but without health insurance,  $\chi^2(1, N = 43) = 4.8, p < .05$ . In addition, Fig. 1 shows that those exposed to two or more lifetime traumas and those who were female, were three times as likely as males (i.e., 6%) to have been medicated,  $\chi^2(1, N = 454) = 6.4, p < .05$ .

**Table 1.** Posttraumatic Stress Disorder, Depression, Panic Attack, and Mental Health Treatments 30 days following September 11th Terrorist Attacks ( $N = 988$ )

Outcomes	<i>N</i>	%	95% CI
Current PTSD – any	95	8.8	6.9–10.8
Current PTSD – World Trade Center related	78	7.5	5.7–9.3
Current depression	99	9.7	7.7–11.8
Perievent panic attack	124	12.6	10.2–14.9
Any mental health visits 30 days after	210	19.4	16.7–22.2
Any mental health visits 30 days before*	183	16.9	14.4–19.5
Increased mental health visits 30 days after	102	10.0	7.9–12.0
Any psychiatric medications 30 days after	129	11.6	9.5–13.7
Any psychiatric medications 30 days before**	103	8.9	7.1–10.8
Any new psychiatric medications 30 days after	33	3.3	2.1–4.7
Any mental health visits or psychiatric medications 30 days after	253	23.3	20.4–26.2

*Note.* PTSD = Posttraumatic stress disorder; CI = confidence interval. All *N*s shown are not weighted. All percents shown are derived from the application of sampling weights used to adjust the obtained sample for the number of telephone lines and adults in the household. *p* values shown are based on the pre/post McNemar test (see Sheskin, 2000).

\* $p < .01$ . \*\* $p < .001$ .

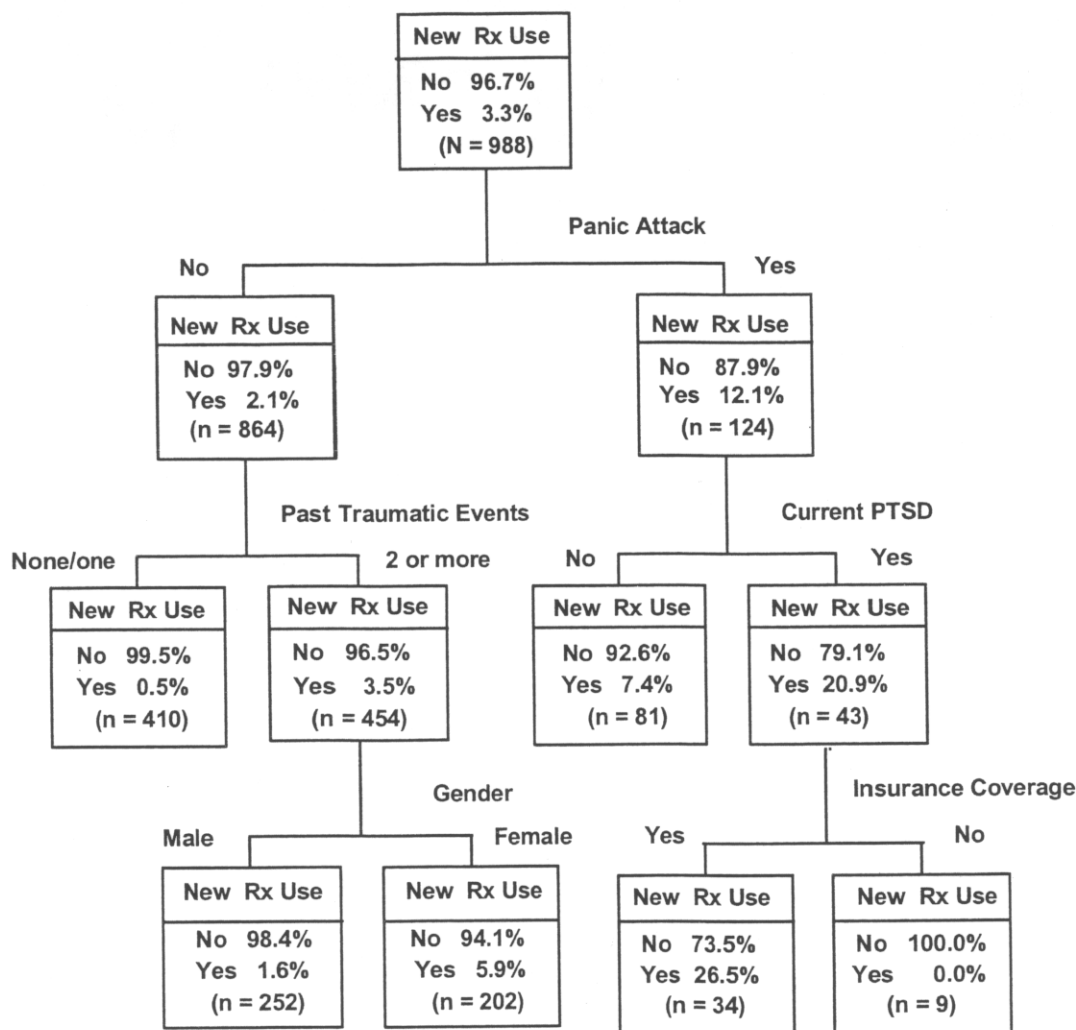


Fig. 1. Regression tree predicting new psychiatric medications 30 days postdisaster among total sample ( $N = 988$ ), based on demographic and risk-factor variables used in original analyses (see Boscarino et al., 2002). All  $p$  values shown adjusted for multiple comparisons using Bonferroni method (see SPSS, Answer Tree [Version 2.1]).

The results among those who took medications in the postdisaster period ( $n = 129$ ) further reinforce the significance of perievent panic and PTSD in the onset of postdisaster medication use (see Fig. 2). For example, among those who took psychiatric medications postdisaster, 44.1% had experienced perievent panic,  $\chi^2(1, N = 129) = 9.7$ ,  $p < .01$ . Among those who experienced perievent panic and PTSD, however, 69.2% took psychiatric medications postdisaster,  $\chi^2(1, N = 32) = 5.4$ ,  $p < .05$ .

## Discussion

Our study suggests that 11.6% of Manhattan adults south of 110th Street (104,000 persons) took psychiatric

medications for mental health reasons within 30 days after the World Trade Center disaster, which represented a moderate population increase compared to 30 days before (8.9%). While this increase in medication use was statistically significant, it was not large. Previously, we reported this also to be the case for postdisaster mental health service visits (Boscarino et al., 2002).

Studies that report postdisaster psychiatric medication usage are rare (Joseph et al., 1993), and this is especially true at the population level. Among direct survivors of the Oklahoma City bombing 41% sought professional mental health treatment within 6 months after the disaster (North et al., 1999). However, among the general population within the Oklahoma City metropolitan area, only 8.5% sought help 3 months postdisaster (Smith et al.,

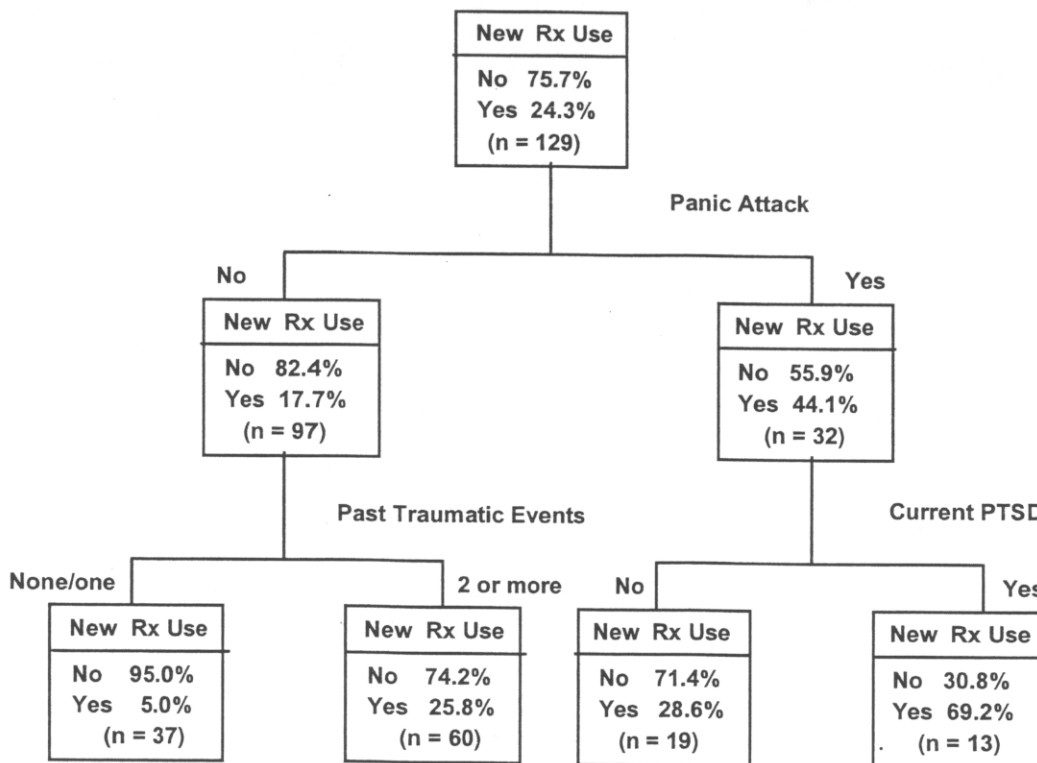


Fig. 2. Regression tree predicting new psychiatric medications among current drug users 30 days postdisaster ( $n = 129$ ), based on demographic and risk-factor variables used in original analyses (see Boscarino et al., 2002). All  $p$  values shown adjusted for multiple comparisons using Bonferroni method (see SPSS, Answer Tree [version 2.1]).

1999). This is substantially lower than the proportion of residents in our Manhattan study who reported seeking help 30 days after September 11th. Six months following the Newcastle earthquake in Australia, a community survey indicated that as many as 21.3% of adults used disaster-related support services, but these apparently included services other than mental health services (Carr et al., 1992). As these few studies suggest, because of different exposure factors, timeframes, and regional differences, it is difficult to predict population-level mental health utilization, except that it will usually be higher than it was before the disaster (Burkle, 1996; Gleser et al., 1981). Complicating the lack of comparability in postdisaster assessments is the fact that many studies tend to focus on emergency service utilization (Burkle, 1996; Gerrity & Flynn, 1997), rather than on population-level service use.

In our analyses, experiencing a perievent panic attack was associated with increased drug utilization. Previous work has shown that acute emotional responses are associated with the development of PTSD and depression after disasters (Harvey & Bryant, 1999). The significance of this, coupled with the lack of association between other event-exposure variables and service use, suggests

that perievent physiological reactions—and corresponding psychological perceptions of them—may be important factors in determining subsequent psychopathology and mental health utilization. Longitudinal research needs to explore the role that the perievent panic attack plays in predicting long-term use of mental health services and medications.

The conclusions we draw from this study should be interpreted with caution. At the time of the study, residents of NYC were on a heightened state of alert and concerned about further terrorist attacks. This may have affected service utilization. In addition, our study timeframe was short. We collected data using telephone interviews, raising the possibility of selection bias. We also should note that the population of Manhattan below 110th Street is largely White, affluent, and well educated, hence, it may be difficult to generalize these results to different populations. Finally, we only ascertained whether the residents used any psychiatric medications. Future research needs to examine specific medication use, as well as changes in the longer term. We plan additional research to evaluate factors that mediate longer-term utilization and health outcomes among those who experienced this tragedy.

## Acknowledgments

We are indebted to the interviewers at Schulman, Ronca, & Bucuvalas, Inc., and all participants who were involved in the study. This study was supported by grants from the United Way of New York City and The New York Community Trust (The September 11th Fund), and the National Institute on Drug Abuse of the National Institutes of Health (R01 DA14219-01S1).

## References

- American Association for Public Opinion Research. (2000). *Standard definitions: Final dispositions of case codes and outcomes rates for surveys*. Ann Arbor, MI: Author.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- Boscarino, J. A., Galea, S., Ahern, J., Resnick, H., & Vlahov, D. (2002). Utilization of mental health services following the September 11th terrorist attacks in Manhattan, New York City. *International Journal of Emergency Mental Health*, 4, 143–155.
- Bromet, E., Sonnega, A., & Kessler, R. C. (1998). Risk factors for DSM-III-R posttraumatic stress disorder: Findings from the national comorbidity survey. *American Journal of Epidemiology*, 147, 353–361.
- Bureau of the Census. (2000). *Census summary tape, file 3A (STF3A)*. Washington, DC: United States Department of Commerce.
- Burkle, F. M. (1996). Acute-phase mental health consequences of disasters: Implications for triage and emergency medical services. *Annals of Emergency Medicine*, 28, 119–128.
- Carr, V. J., Lewin, T. J., Carter, G. L., & Webster, R. A. (1992). Patterns of service utilization following the 1989 Newcastle earthquake: Findings from phase 1 of the quake impact. *Australian Journal of Public Health*, 16, 360–369.
- Davidson, J. R. T. (2000). Pharmacotherapy of posttraumatic stress disorder: Treatment options, long-term follow-up and predictors of outcomes. *Journal of Clinical Psychiatry*, 61(Suppl. 5), 52–59.
- Foa, E. B. (2000). Psychosocial treatment of posttraumatic stress disorder. *Journal of Clinical Psychiatry*, 61(Suppl. 5), 43–48.
- Freedly, J. R., Kilpatrick, D. G., & Resnick, H. S. (1993). Natural disasters and mental health: Theory, assessment, and intervention. *Journal of Social Behavior and Personality*, 8, 49–103.
- Friedman, M. J., Davidson, J. R. T., Mellman, T. A., & Southwick, S. M. (2000). Pharmacotherapy. In E. B. Foa, T. M. Keane, & M. J. Friedman (Eds.), *Effective treatments for PTSD: Practice guidelines from the International Society for Traumatic Stress Studies* (pp. 84–105). New York: Guilford Press.
- Galea, S., Ahern, J., Resnick, H., Kilpatrick, D., Bucuvalas, M., Gold, J., et al. (2002). Psychological sequelae of the September 11 terrorist attacks in New York City. *The New England Journal of Medicine*, 346, 982–987.
- Gerrity, E. T., & Flynn, B. W. (1997). Mental health consequences of disasters. In E. K. Noji (Ed.), *The public health consequences of disasters* (pp. 101–132). New York: Oxford University Press.
- Gleser, G. C., Green, B. L., & Winget, C. (1981). *Prolong psychosocial effects of disaster: A study of Buffalo Creek*. New York, Academic Press.
- Green, B. L. (1991). Evaluating the effects of disasters. *Psychological Assessment*, 3, 538–546.
- Harvey, A. G., & Bryant, R. A. (1999). The relationship between acute stress disorder and posttraumatic stress disorder: A 2-year prospective evaluation. *Journal of Consulting and Clinical Psychology*, 67, 985–988.
- Hosmer, D. W., & Lemeshow, S. (2000). *Applied logistic regression* (2nd ed.). New York, Wiley.
- Joseph, S., Yule, W., Williams, R., & Hodgkinson, P. (1993). Increased substance use in survivors of the Herald of Free Enterprise disaster. *British Journal of Medical Psychology*, 66, 185–191.
- Kessler, R. C., Sonnega, A., Bromet, E., Hughes, M., & Nelson, C. B. (1995). Posttraumatic stress disorder in the National Comorbidity Survey. *Archives of General Psychiatry*, 52, 1048–1060.
- Kilpatrick, D. G., Resnick, H. S., Freedly, J. R., Pelcovitz, D., Resnick, P. A., Roth, S., et al. (1998). The posttraumatic stress disorder field trial: Evaluation of the PTSD construct—criteria A through E. In T. Widiger, A. Frances, H. Pincus, R. Ross, M. First, W. Davis, & M. Kline (Eds.), *DSM-IV Sourcebook* (Vol. 4, pp. 803–844). Washington, DC: American Psychiatric Association Press.
- Kulka, R. A., Schlenger, W. E., Fairbank, J. A., Hough, R. L., Jordan, B. K., Marmar, C. R., et al. (1990). *Trauma and the Vietnam War generation: Report of findings from the National Vietnam Veterans Readjustment Study*. New York: Brunner/Mazel.
- Madakasira, S., & O'Brien, K.F. (1987). Acute posttraumatic stress disorder in victims of a natural disaster. *Journal of Nervous Mental Disease*, 175, 286–290.
- Magidson, J. (1982). Some common pitfalls in causal analysis of categorical data. *Journal of Marketing Research* 19, 461–471.
- Norris, F. H. (1992). Epidemiology of trauma: Frequency and impact of different potentially traumatic events on different demographic groups. *Journal of Consulting and Clinical Psychology*, 60, 409–418.
- North, C. S., Nixon, S. J., Shariat, S., Mallonee, S., McMillen, J. C., Spitznagel, E. L., et al. (1999). Psychiatric disorders among survivors of the Oklahoma City bombing. *Journal of the American Medical Association*, 282, 755–762.
- Robins, L. N., Marcus, L., Reich, W., Cunningham, R., Gallagher, T. (1996). NIMH Diagnostic Interview Schedule (Version IV). St Louis, MO: Department of Psychiatry, Washington School of Medicine.
- Rubonis, A. V., & Bickman, L. (1991). Psychological impairment in the wake of disaster: The disaster–psychopathology relationship. *Psychology Bulletin*, 109, 384–399.
- Sheskin, D. J. (2000). *Handbook of parametric and nonparametric statistical procedures* (2nd ed.). New York: Chapman & Hall.
- Smith, D. W., Christiansen, E. H., Vincent, R., & Hann, N. E. (1999). Population effects of the bombing of Oklahoma City. *Journal of the Oklahoma State Medical Association*, 92, 193–198.
- Smith, E. M., North, C. S., McCool, R. E., & Shea, J. M. (1990). Acute postdisaster psychiatric disorders: Identification of persons at risk. *American Journal of Psychiatry*, 147, 202–206.
- Spitzer, R. L., Williams, J. B., & Gibbon, M. (1987). *Structured clinical interview for DSM-III-R—Non-patient version*. New York: Biometrics Research Department, New York State Psychiatric Institute.
- Stata Corporation. (2001). *Stata* (Version 7.0). [Computer software]. College Station, TX: Stata Corporation.
- Zhang, H., & Singer, B. (1999). *Recursive partitioning in the health sciences*. New York: Springer.