Nationwide Longitudinal Study of Psychological Responses to September 11

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Context The September 11, 2001, attacks against the United States provide a unique opportunity to examine longitudinally the process of adjustment to a traumatic event on a national scale.

Objective To examine the degree to which demographic factors, mental and physical health history, lifetime exposure to stressful events, September 11–related experiences, and coping strategies used shortly after the attacks predict psychological outcomes over time.

Design, Setting, and Participants A national probability sample of 3496 adults received a Web-based survey; 2729 individuals (78% participation rate) completed it between 9 and 23 days (75% within 9 to 14 days) after the terrorist attacks. A random sample of 1069 panelists residing outside New York, NY, were drawn from the wave 1 sample (n=2729) and received a second survey; 933 (87% participation rate) completed it approximately 2 months following the attacks. A third survey (n=787) was completed approximately 6 months after the attacks.

Main Outcome Measures September 11–related symptoms of acute stress, posttraumatic stress, and global distress.

Results Seventeen percent of the US population outside of New York City reported symptoms of September 11–related posttraumatic stress 2 months after the attacks; 5.8% did so at 6 months. High levels of posttraumatic stress symptoms were associated with female sex (odds ratio [OR], 1.64; 95% confidence interval [CI], 1.17-2.31), marital separation (OR, 2.55; 95% CI, 1.06-6.14), pre–September 11 physician-diagnosed depression or anxiety disorder (OR, 1.84; 95% CI, 1.33-2.56) or physical illness (OR, 0.93; 95% CI, 0.88-0.99), severity of exposure to the attacks (OR, 1.31; 95% CI, 1.11–1.55), and early disengagement from coping efforts (eg, giving up: OR, 1.68; 95% CI, 1.27-2.20; denial: OR, 1.33; 95% CI, 1.07-1.64; and self-distraction: OR, 1.31; 95% CI, 1.07-1.59). In addition to demographic and pre–September 11 health variables, global distress was associated with severity of loss due to the attacks ($\beta=.07$; $P=.008$) and early coping strategies (eg, increased with denial: $\beta=.08$; $P=.005$; and giving up: $\beta=.05$; $P=.04$; and decreased with active coping: $\beta=-.08$; $P=.002$).

Conclusions The psychological effects of a major national trauma are not limited to those who experience it directly, and the degree of response is not predicted simply by objective measures of exposure to or loss from the trauma. Instead, use of specific coping strategies shortly after an event is associated with symptoms over time. In particular, disengaging from coping efforts can signal the likelihood of psychological difficulties up to 6 months after a trauma.

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Most people encounter stressful events that can alter the course of their lives. Clinicians often see the mental and physical health consequences of such events.[1] On September 11, 2001, everyone in the United States was exposed to an incident unprecedented in scope and traumatic impact. Tens of thousands of people directly witnessed the terrorist attacks against the World Trade Center (WTC) and the Pentagon; others viewed the attacks and their aftermath via the media—most within half an hour after they occurred.[2] It has been argued that this national trauma "influenced and will continue to influence the clinical presentation of patients seeking health care services" across the country[3] and that it offers "an unfortunate opportunity to find out more about what something like this does to a country as a whole."[4]

Research after the Oklahoma City, Okla, bombing suggests that emotional responses to a terrorist attack can be highly variable.[5] Emotional, cognitive, and behavioral responses vary even within homogeneous samples of individuals who have been exposed to loss and trauma more generally.[6-8] Yet, information about the range and rates of distress to be expected following such a national trauma is limited. Unfortunately, potentially harmful myths about coping remain prevalent in lay and professional communities,[8] such as the expectation that subjective responses to trauma are proportional to the degree of objective loss experienced. Gaining information concerning the adjustment process can aid clinicians by identifying risk factors[9,10] and can inform the design of interventions for individuals coping with stressful life events.[11]

We conducted a longitudinal study of acute responses to the terrorist attacks

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of September 11 in a national probability sample of US residents, examining the emotional and behavioral impact of a single event within a representative adult sample. Respondents' mental and physical health histories were collected before the attacks, stress and coping responses were assessed 9 to 23 days after September 11, and follow-up assessments were made at approximately 2 and 6 months after the attacks. Because traumatic experiences may find expression in both trauma-specific and general outcomes, the present study examined the impact of the attacks on posttraumatic stress symptoms (eg, repeatedly reliving the trauma, repeatedly avoiding the trauma, hyperarousal), anxiety about future risk, and global distress. The goals of our study were to document over time the range of psychological responses to a national traumatic event; examine pre–September 11 and September 11–related factors that may explain variability in responses; and identify early predictors of global distress and posttraumatic stress symptoms in response to the attacks.

METHODS

Knowledge Networks Inc (KN), a Web-based survey research company, has recruited about 60 000 households to participate in their nationally representative Web-enabled panel, constituting the only Internet-based national probability sample in the United States. The distribution of the final sample in the KN panel closely tracks the distribution of US Census counts for the population on age, race, Hispanic ethnicity, geographic region, employment status, income, education, etc.[12] Knowledge Networks provides households in the panel with free Web access and an Internet appliance that uses a telephone line to connect to the Internet and uses a television as a monitor (WebTV). In return, panel members participate in 10- to 15-minute Internet surveys 3 to 4 times a month. The panel does not respond significantly differently over time to surveys than more "naive" survey respondents.[13] Survey responses are confidential; identifying information is never revealed without respondent approval. When panel members are assigned surveys, they receive notice in their password-protected e-mail account that the survey is available for completion. Surveys are self-administered and accessible any time of day for a designated period. Participants can complete a survey only once. Members may leave the panel at any time, and receipt of the WebTV and Internet service is not contingent on completion of any particular survey.

The KN panel is developed using traditional probability methods for creating national survey samples and is recruited using stratified random-digit-dialed telephone sampling. Random-digit dialing provides a known nonzero probability of selection for every US household that has a telephone.

At the time of the wave 1 survey, the panel recruitment response rate was 44%, and 36% of the recruited panel was active and available for selection. To correct for possible nonresponse bias from panel recruitment and attrition, representative samples are selected for panel surveys by poststratification weighting of the panel to match the benchmarks from the most recent US government statistics for sex, age, race, ethnicity, education, and region. Samples are drawn with probabilities proportional to the panel weights using a systematic sample applied to the eligible panel members. The distributions for the panel samples resemble, within sampling error, the national population distributions for key demographic variables.

The design and all procedures for this study were approved by the institutional review boards of the University of California, Irvine, and the University of Denver, Denver, Colo.

Survey Design

Knowledge Networks administered the wave 1 survey between September 20 and October 4, 2001, assessing early coping strategies and acute stress symptoms in a national random sample of individuals. In total, 2729 adult KN panel members completed this survey, representing 78% of the 3496 sampled panelists. More than 75% of respondents completed this survey within 9 to 14 days after the attacks; the remainder completed it the following week.

A wave 2 survey designed by our research team was administered between November 10 and December 3, 2001, a 3-week span beginning 2 months after the attacks. Budgetary constraints and lack of full panel availability precluded follow-up of all wave 1 participants. A random sample of 1069 wave 1 adult panelists (aged ≥18 years) who completed the wave 1 measures and lived outside New York, NY, were contacted. Eighty-seven percent (n=933) completed the survey within the designated period. All wave 1 and wave 2 analyses were conducted on the 933 individuals who completed both surveys.

A wave 3 survey similar to wave 2 was sent to all adult panelists who completed waves 1 and 2 and remained part of the KN sample 6 months after the attacks. Ninety-two percent (n=787/860) of those fielded the survey completed it between March 16 and April 11, 2002, representing 84.4% of the wave 2 sample.

Surveys included background information, questions about experiences surrounding the terrorist attacks, and other constructs described herein. Several demographic variables were assessed for all KN panel members, including sex, age, marital status, race/ethnicity, education, and household income. Respondents received $5 for completion of the second and third surveys.

Health History

Mental and physical health history was assessed with a survey completed by 96.4% of our respondents between June 17, 2000, and September 4, 2001. Sixty percent of our sample completed these measures before December 31, 2000. Respondents reported whether they had ever had an anxiety disorder (eg, obsessive-compulsive disorder, generalized anxiety disorder) or depression and whether they had received such a diagnosis from a physician. Two scores were computed: the number of self-diagnosed and the number of physician-

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diagnosed mental health disorders (none, anxiety or depression, or both). Respondents also reported whether they had ever received a diagnosis from a physician of any of 28 disorders (eg, asthma, diabetes, hypertension). The total number of conditions endorsed provided a pre–September 11 physical health history.

Estimates from the 2000 National Health Interview Survey were compared with 25 000 interviews from the KN database on a variety of health measures. The average difference was only 1.0 percentage point across measures of past smoking, current smoking, and self-reported diabetes, ulcer, migraine headache, and stroke, supporting the validity of these health data (J. Michael Dennis, PhD, written communication, June 27, 2002).

Mental Health Outcomes

To assess early acute stress symptoms, at wave 1 respondents completed a modified and abbreviated version of the Stanford Acute Stress Reaction Questionnaire (SASRQ),[14] a measure often used to assess acute stress disorder (ASD).[15] Items on the SASRQ were modified to read at a 6.5-grade Kincaid reading level, and respondents reported whether they "experienced" or "did not experience" acute stress symptoms specific to the September 11 attacks. Rates of acute stress symptoms were determined using several of the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (*DSM-IV*) criteria for ASD (≥3 dissociative symptoms, ≥1 reexperiencing/intrusive symptom, ≥1 avoidance symptom, and ≥1 arousal/anxiety symptom).[15] Individuals meeting these cutoffs were classified as having high levels of acute stress symptoms. The SASRQ also assesses social (eg, the attacks "caused problems in my relationships with other people") and work-related (eg, the attacks "made it difficult for me to perform my work or other things I needed to do") functioning, enabling calculation of the percentage of respondents who reported acute stress symptoms with functional impairment. Because we did not assess all *DSM-IV* criteria (eg, feelings of fear, horror, or helplessness; duration of symptoms), respondents were not assumed to have ASD.

Because the SASRQ is specifically tailored to assess ASD within a month following an event, we used the Impact of Events Scale–Revised,[16] a well-validated and highly reliable measure, to assess posttraumatic stress symptoms at waves 2 and 3. This 22-item measure specifically assessed the extent to which respondents were distressed by September 11–related symptoms of intrusion, avoidance, and arousal as experienced in the past week, using a 5-point scale ranging from 0 to 4. Two scores were computed from these data: a continuous mean score of all items and a dichotomous index of high vs low posttraumatic stress symptoms. When computing the dichotomous score, symptoms were considered present if respondents reported having been at least moderately distressed by them in the prior week (score of 2 on a scale of 0-4).[17] Rates of posttraumatic stress symptoms were determined using several of the *DSM-IV* criteria for posttraumatic stress disorder (≥1 reexperiencing symptom, ≥3 avoidance symptoms, and ≥2 arousal symptoms).[15] Individuals meeting these cutoffs were classified as having high levels of posttraumatic stress symptoms. Participants also indicated the degree to which they felt that they or someone close to them was personally in danger as a result of the September 11 attacks, enabling calculation of the percentage of respondents who reported posttraumatic stress symptoms with this additional criterion. Because we did not assess all *DSM-IV* criteria (eg, degree of functional impairment, duration of symptoms), respondents were not assumed to have posttraumatic stress disorder. The symptom counts for the acute stress and posttraumatic stress measures were highly correlated ($r=0.55$; $P<.001$).

Anxiety about future terrorist attacks was assessed at waves 2 and 3 with 2 items modified from the Vaughan perceived risk scale (Elaine Vaughan and Carolyn Wong, unpublished data, 2002). Respondents reported how often in the past week they had fears about the possibility of another terrorist attack (eg, bioterrorism, hijacking) or whether they worried that an act of terrorism would personally affect them or a family member in the future. This scale demonstrates high internal consistency across diverse community populations (eg, elderly poor, Latinos, lower-income African Americans and whites, college students) (the Cronbach α ranges from .79-.87; for our sample, $\alpha=.83$), high test-retest reliability (coefficient=0.86), and acceptable discriminant validity (Elaine Vaughan and Carolyn Wong, unpublished data, 2002).

Global distress in the prior week was assessed at wave 2 with the Hopkins Symptom Checklist (HSCL),[18] a standardized scale of psychological symptoms, and at wave 3 with the 18-item Brief Symptom Inventory (BSI-18),[19,20] a related standardized scale that has substantial methodological and conceptual overlap with the HSCL.[20,19] Both measures assess the degree to which respondents are distressed by symptoms of depression, anxiety, and somatization. These measures have demonstrated excellent reliability in field studies.[18-20] The HSCL provides a global index of psychological symptoms (mean of 25 items) that is similar to the Global Severity Index from the Symptom Checklist 90, with excellent internal reliability for this sample (Cronbach $\alpha=.94$). The BSI-18 provides an analogous global distress score across 18 items measured on a scale of 0 to 4, as described in the BSI-18 user's manual.[20] The internal consistency for this sample was excellent (Cronbach $\alpha=.93$). Global distress scores from waves 2 and 3 were highly correlated ($r=0.64$; $P<.001$).

Prior Exposure to Stressful Life Events

Occurrence of stressful events before the attacks was assessed at wave 2 using a checklist on which participants reported whether they had ever experienced any of 30 negative life events (eg, natural disaster, death of family member, child abuse) and, if so, at what age(s) these events occurred (and, if chronic,

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their duration). This measure was developed based on open-ended coding of lifetime traumas reported by a primary care community sample[1] and has provided overall rates of specific traumas in this sample that map onto epidemiological surveys conducted in other representative community samples.[21-23] The number of stressful events during childhood, adulthood, and the prior year were computed and each was used as a continuous variable.

September 11–Related Experiences

Respondents completed several items exploring their September 11–related experiences, including the hours per day they watched TV coverage of the attacks and their degree of exposure to and loss due to the attacks. Items were modified from our prior work on the southern California firestorms[24] and from the work of Koopman and colleagues.[25] Severity of exposure was assessed with an item measuring physical proximity to the attacks on a 7-level continuum measured as a continuous variable, with 0 indicating no firsthand exposure to the attacks as they occurred; 1, watching the attacks live on TV; 2, talking on the telephone with someone in the WTC, Pentagon, or on a plane during the attacks; 3, close enough to hear or feel the attacks, the building(s) collapse, or the planes crash; 4, close enough to witness the attacks and/or people evacuating, falling, or jumping from the WTC or Pentagon; 5, within a few blocks of the WTC, Pentagon, or Pennsylvania crash site at the time of attacks; and 6, inside the WTC or Pentagon at the time of the attacks. The severity of September 11–related loss was assessed using a 6-level continuum, with 0 indicating no loss; 1, property loss of someone close; 2, personal loss of property; 3, injury of someone close; 4, death of someone close; and 5, personal injury in the attacks. The number of losses (a continuous variable) was also computed.

Coping Strategies

At wave 1, respondents completed the Brief COPE,[26] a measure of 14 different coping strategies (2 items per strategy) used in response to a particular stressor: self-distraction, active coping, denial, substance use (alcohol or other drugs), emotional support seeking, instrumental support seeking, behavioral disengagement (ie, "giving up"), venting, positive reframing, planning, humor, acceptance, religion, and self-blame. Participants indicated on a 4-point scale (1 indicates "I didn't do this at all" and 4, "I did this a lot") the frequency with which they used each strategy to cope with the terrorist attacks. Because emotional and instrumental support seeking were highly correlated, they were combined into a single measure of "support seeking."

Overview of Analyses

Statistical analyses were conducted with Stata, version 7.0 (Stata Corp, College Station, Tex). Data were weighted to adjust for differences in the probabilities of selection and nonresponse both within and between households. Poststratification weights were calculated by deriving weighted sample distributions along various combinations of sex, age, race/ethnicity, region, metropolitan status, and education. Similar distributions were calculated using the most recent US Census Bureau Current Population Survey data and the KN panel data. Cell-by-cell adjustments over the various univariate and bivariate distributions were calculated to make the weighted sample cells match those of the US Census and the KN panel. This process was repeated iteratively to reach convergence between the weighted sample and benchmark distributions from the 2001 Current Population Survey and the US Census Bureau.[27]

All statistics calculated from the KN panel are subject to sampling variability as well as nonsampling error. Quality control and edit procedures are used to minimize the effects of these errors on final survey estimates. Sampling error and confidence intervals (CIs) can be estimated from the sample. For example, the 90% CI for a statistical estimate of 50% from a sample size of 933 is 50% ± 3.4 or 46.6-53.4. The estimated design effects are 1.2, 1.6, and 1.7 for waves 1, 2, and 3, respectively.

Analyses were designed to address (1) levels of posttraumatic stress symptoms and psychological distress during the 6 months following the terrorist attacks; (2) how pre–September 11 physical and mental health status, lifetime and recent stressors, and September 11–related experiences were associated with patterns of posttraumatic stress symptoms and distress over time; and (3) the relation between early coping strategies and patterns of posttraumatic stress symptoms and distress over the 6 months following the terrorist attacks after adjusting for relevant demographics, pre–September 11 physical and mental health status, lifetime and recent stressors, and September 11–related experiences.

Weighted rates of acute and posttraumatic stress symptoms were examined using descriptive analyses of SASRQ and Impact of Events Scale–Revised symptoms. Generalized estimating equation population-averaged models with a logit link[28] were used to estimate odds ratios (ORs) for predictors of patterns of posttraumatic stress symptoms during the 6 months following the attacks. Outcome variables in these models were the dichotomized (high vs low) acute (wave 1) and posttraumatic (waves 2 and 3) stress symptom scores. Continuous posttraumatic stress symptom scores were also analyzed longitudinally with random-effects maximum likelihood regression models. These analyses produced essentially identical results to those using the dichotomized symptom scores; analyses using the dichotomized scores are presented. Random-effects maximum likelihood regression models were used to examine how pre–September 11 physical and mental health status, lifetime and recent stressors, September 11–related experiences, and coping behaviors (all examined as continuous variables) were associated with patterns of global distress over time. Continuous global distress scores assessed at waves 2 and 3 were the outcome of interest in these models.

In each analysis, significant predictors from 5 groups of variables (demo-

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graphics, pre–September 11 health, September 11–related exposure and loss, lifetime exposure to trauma, and coping behaviors) were tested for inclusion in the final models. Nonsignificant variables ($P>.05$) were removed from analyses to provide the most parsimonious model. The final models were estimated adjusting for demographics, pre–September 11 mental and physical health, September 11–related experiences, and time. Tables present adjusted ORs and standardized β levels as the relative effect size for each variable.

Missing values for income were imputed by KN using the mean income score for each respondent's census block. Cases with missing data on other variables (eg, race/ethnicity, marital, physical, mental health status) were dummy coded to allow inclusion in the analyses and maintain the size and integrity of the sample.

RESULTS

The Sample

TABLE 1 presents the weighted demographic breakdown of participants from waves 1 and 2 and provides a comparison with September 2001 Current Population Survey benchmarks from the US Census Bureau.[27] Unweighted data are very similar and are available on request from the author. Table 1 suggests that we were successful in obtaining a representative sample of the US population at each wave with respect to key demographic characteristics. Most weighted differences are within sampling error, although middle-income households tend to be overrepresented.

Analysis of Nonparticipants

Individuals who completed the wave 2 survey (n=933) were not significantly different from nonrespondents (n=136) on pre–September 11 physical and mental health history, sex, marital status, race/ethnicity, education, or income. Nonrespondents were, however, significantly younger (mean, 42 years) than respondents (mean, 48 years; $t_{1066}=4.99$; $P<.001$). There were no significant differences in wave 1 coping responses or wave 1 acute stress symptoms between those who completed the wave 2 survey and those who did not.

Of the wave 2 respondents, 84.4% (n=787) completed the assessment at wave 3. Individuals who completed the wave 2 survey but did not complete wave 3 were no different from the wave 3 respondents on pre–September 11 physical and mental health history, sex, marital status, race/ethnicity, education, or income. Nonrespondents to the wave 3 survey were, however, significantly younger (mean, 45 years) than respondents (mean, 49 years; $t_{930}=2.33$; $P=.02$).

Exposure to the September 11 Attacks

Thirty-eight percent (weighted n=358) of the sample reported no direct firsthand exposure to the attacks as they occurred and 60% (weighted n=560) reported watching them occur live on TV. Of the

Table 1. Demographic Composition of the Samples and Comparisons with US Census Data

	Wave 1 (9-23 d Afterward), No. (Weighted %†)	Wave 2 (2 mo Afterward), No. (Weighted %†)	US Census* Weighted†
Sex			
Male	1322 (47.8)	467 (47.7)	48.0
Female	1407 (52.2)	466 (52.3)	52.0
Age range, y			
18-24	223 (10.9)	67 (9.7)	13.3
25-34	474 (20.6)	155 (20.8)	18.1
35-44	577 (21.9)	191 (21.4)	21.7
45-54	567 (17.9)	192 (18.7)	18.9
55-64	416 (13.3)	155 (14.4)	11.9
≥65	472 (15.3)	173 (14.9)	16.1
Marital status			
Married	1691 (61.3)	561 (59.7)	57.1
Single	520 (21.9)	179 (22.0)	24.1
Separated/divorced/widowed	476 (16.8)	175 (18.2)	18.8
Race			
White	2138 (80.0)	748 (80.8)	83.2
Black/African American	265 (12.3)	79 (11.5)	11.9
American Indian	38 (1.7)	13 (1.8)	0.9
Asian/Pacific Islander	42 (1.9)	15 (1.8)	4.0
Other	88 (4.1)	28 (4.1)	. . .
Ethnicity			
Non-Hispanic	2379 (89.3)	819 (89.5)	89.2
Hispanic	213 (10.6)	65 (10.4)	10.8
Education			
Less than high school	247 (15.7)	87 (15.2)	15.8
High school diploma or equivalent	952 (32.8)	316 (32.2)	33.0
Some college	685 (24.0)	237 (23.8)	19.3
Associate degree	119 (3.5)	47 (4.5)	7.8
Bachelor degree or beyond	703 (24.0)	237 (24.3)	24.1
Household income, $			
<10 000	133 (5.6)	49 (5.9)	7.4
10 000-24 999	448 (19.2)	159 (19.1)	18.4
25 000-49 999	1052 (39.6)	363 (39.6)	28.5
50 000-74 999	612 (20.8)	216 (21.9)	20.0
≥75 000	480 (14.8)	143 (13.5)	25.7
Region			
Northeast	558 (19.7)	178 (16.6)	19.1
Midwest	566 (21.5)	185 (23.1)	22.9
South	1016 (36.4)	362 (37.0)	35.6
West	589 (22.4)	208 (23.3)	22.4

*Source: Current Population Survey, US Bureau of the Census, September 2001.[26] Ellipses indicate data not available.
†Weights adjust estimates for sampling design and poststratification to census characteristics. Some of the variables have missing data and the numbers do not add up to the total. For wave 1, 75% responded within 9 to 14 days.

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2% of the sample with direct firsthand exposure, 3 individuals were on the telephone with someone in the WTC, Pentagon, or a plane when the attacks occurred; 1 was close enough to hear or feel the attacks or a plane crash; 1 was close enough to witness them and/or people evacuating, falling, or jumping; 2 were within a few blocks of the attacks; and 2 were in the WTC or Pentagon at the time. Ninety-six percent (weighted n=896) did not experience loss in the attacks, 14 knew someone close who lost property in the attacks, 3 personally lost property, 5 knew a close person who was injured, 8 knew a close person who died, and 1 person was personally injured in the attacks.

At wave 1, respondents indicated how much they watched TV news coverage about the attacks in the week following them. Fifteen percent watched coverage less than 1 hour per day; 43% watched approximately 1 to 3 hours per day; 26% watched 4 to 6 hours per day, and 16% watched more than 6 hours per day. Only 6 individuals (0.6 % of our sample) reported watching no TV coverage of the attacks during the week following September 11.

Acute and Posttraumatic Stress Symptoms

TABLE 2 presents the adjusted percentages of individuals who reported acute stress symptoms as well as those who reported symptoms with functional impairment at wave 1. These symptoms were strongly correlated with self-reported functioning in the acute period for the sample as a whole (r=0.67; P<.001). Table 2 also presents the adjusted percentages of individuals at waves 2 and 3 who reported posttraumatic stress symptoms and the percentage who met the additional requirement of feeling that they or someone close to them was in danger as a result of the September 11 attacks.

On average, respondents reported 4.99 (95% CI, 4.61-5.38) positive acute stress symptoms at wave 1, 4.22 (95% CI, 3.74-4.49) positive posttraumatic stress symptoms at wave 2, and 1.81 (95% CI, 1.52-2.10) positive symptoms at wave 3. The mean level of posttraumatic stress symptoms (scale, 0-4) 2 months after the attacks was 0.68 (95% CI, 0.64-0.73), and dropped significantly by 6 months (0.36; 95% CI, 0.32-0.40).

Fears of Future Terrorism

Two months after the attacks, nearly two thirds of the sample (64.6%; n=606) reported fears of future terrorism at least sometimes, and 59.5% (n=557) reported fear of harm to family as a result of terrorism. Six months after the attacks, fears of future terrorism were still present at least sometimes for 37.5% (n=306) and fear of harm to family was reported by 40.6% (n=332).

Predictors of Posttraumatic Stress Symptoms

TABLE 3 presents the adjusted ORs for predictors of posttraumatic stress symptoms during the 6 months following the attacks. After adjusting for pre–September 11 mental and physical health and time of survey, the odds of experiencing high levels of posttraumatic stress symptoms were significantly higher for women and for individuals who used denial, self-distraction, or self-blame; sought social support; or disengaged from coping efforts. The odds of experiencing high levels of posttraumatic stress symptoms were reduced by the use of acceptance. Substance use was not independently associated with posttraumatic stress symptoms. We also assessed severity of exposure as a dichotomous variable of direct exposure (including "watching the attacks live on TV") vs no direct exposure. Direct vs no direct exposure was a significant predictor in model 1 (P=.01) but not in model 2 (P=.37). Watching the attacks on live TV was also a significant predictor in model 1 (P=.03) but not in model 2 (P=.45). After adjusting for wave 1 avoidance symptoms, behavioral disengagement (OR, 1.34; 95% CI, 1.01-1.76), self-blame (OR, 1.53; 95% CI, 1.03-2.28), and denial (OR, 1.35; 95% CI, 1.10-1.67) remained significant predictors of subsequent posttraumatic stress symptoms. This suggests that the

Table 2. Respondents Reporting September 11–Related Acute or Posttraumatic Stress Symptoms During the 6 Months Following the Attacks*

	Wave 1 (9-23 d)†		Wave 2 (2 mo)		Wave 3 (6 mo)	
	Weighted No. (Unweighted No.)	Weighted % (SE)	Weighted No. (Unweighted No.)	Weighted % (SE)	Weighted No. (Unweighted No.)	Weighted % (SE)
Type of symptoms						
Dissociative	316 (279)	31.7 (1.47)	. . .	. . .	. . .	. . .
Reexperiencing	410 (387)	41.1 (1.56)	473 (459)	47.5 (1.56)	214 (204)	26.3 (1.50)
Avoidance	304 (268)	30.5 (1.46)	266 (255)	26.5 (1.38)	94 (93)	11.6 (1.09)
Arousal/anxiety	583 (560)	58.5 (1.56)	295 (277)	29.6 (1.43)	89 (87)	11.2 (1.07)
Acute or posttraumatic stress symptoms‡	123 (104)	12.4 (1.27)	169 (159)	17.0 (1.40)	48 (49)	5.8 (0.92)
Both acute stress symptoms and functional impairment§	89 (70)	8.9 (0.85)	. . .	. . .	. . .	. . .
Both posttraumatic stress symptoms and perceived threat‖	. . .	. . .	107 (98)	10.8 (1.17)	34 (36)	3.4 (0.63)

*Ellipses indicate data not applicable.
†Wave 1 rates are based on analyses conducted on the 933 respondents who also participated in wave 2. For wave 1, 75% responded within 9 to 14 days.
‡Wave 1 data represent the percentage of respondents reporting high levels of September 11–related acute stress symptoms (eg, ≥3 dissociative symptoms, ≥1 reexperiencing symptom, ≥1 avoidance symptom, and ≥1 arousal symptom). Data from waves 2 and 3 represent the percentage of respondents reporting high levels of September 11–related posttraumatic stress symptoms (eg, ≥1 reexperiencing symptom, ≥3 avoidance symptoms, and ≥2 arousal symptoms).
§Percentage reporting September 11–related acute stress symptoms and impaired functioning 9 to 23 days after the attacks.
‖Percentage reporting September 11–related posttraumatic stress symptoms and severe threat to self or close other's life in attacks.

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ability of the behavioral disengagement strategy to predict these symptoms is not due simply to it being confounded with avoidance symptoms at wave 1.

Predictors of Global Distress

Mean levels of global distress were 0.35 (95% CI, 0.31-0.38) at 2 months and 0.36 (95% CI, 0.31-0.40) at 6 months after the attacks. TABLE 4 presents unstandardized and standardized adjusted regression coefficients for predictors of global distress over the 6 months. After adjusting for pre–September 11 mental health status, demographics, and time, the severity of loss experienced in the attacks and several coping behaviors significantly predicted higher levels of distress. Specifically, individuals who used denial, self-distraction, or self-blame; sought social support; or disengaged from coping efforts had significantly higher levels of distress, whereas those who engaged in active coping reported significantly lower levels of distress during the 6 months following the attacks. Substance use was not independently associated with global dis-

Table 3. Predictors of Acute and Posttraumatic Stress Symptoms During the 6 Months Following the September 11 Attacks*

	Model 1†		Model 2‡	
	Adjusted OR (95% CI)	*P* Value	Adjusted OR (95% CI)	*P* Value
Demographics				
Female sex	1.64 (1.17-2.31)	.004	1.42 (1.01-2.01)	.04
Separated§	2.55 (1.06-6.14)	.04	1.54 (0.57-4.17)	.39
Self-reported pre–September 11 health				
Physician-diagnosed mental disorder	1.84 (1.33-2.56)	.001	1.60 (1.15-2.21)	.005
Physician-diagnosed physical illness	0.93 (0.88-0.99)	.02	0.96 (0.91-1.01)	.10
Severity of exposure to September 11 attacks	1.31 (1.11-1.55)	.002	1.16 (0.95-1.42)	.14
Early coping behaviors				
Acceptance	. . .	. . .	0.71 (0.56-0.89)	.003
Behavioral disengagement	. . .	. . .	1.68 (1.27-2.20)	.001
Denial	. . .	. . .	1.33 (1.07-1.64)	.009
Sought social support	. . .	. . .	1.47 (1.19-1.82)	.001
Self-blame	. . .	. . .	1.66 (1.12-2.47)	.01
Self-distraction	. . .	. . .	1.31 (1.07-1.59)	.007

*Data are based on 921 respondents and 2623 observations. OR indicates odds ratio; CI, confidence interval. Ellipses indicate data not applicable.The following blocks of variables were tested for inclusion in the models: demographics (ie, sex, age, marital status, race/ethnicity, education, and income); pre–September 11 physician-diagnosed physical illness and mental disorders (self-diagnosed and physician-diagnosed depression and anxiety disorders); lifetime exposure to stressful life events (ie, childhood, adulthood, and prior-year events); September 11–related experience (ie, severity of exposure, number and severity of losses related to the attacks); and early coping strategies. Variables not listed in the tables were nonsignificant ($P>.05$) and were removed from the final models.

†Model 1 includes the significant pre–September 11 and September 11–related correlates of posttraumatic stress symptoms. The Wald χ^2 for model 1 is 80.32 ($P<.001$).

‡Model 2 includes all significant predictors from model 1 along with coping behaviors significantly associated with posttraumatic stress symptoms. The Wald χ^2 for model 2 is 182.86 ($P<.001$).

§Married, single, and widowed respondents were not significantly different from each other in these analyses and comprise the reference group in these comparisons.

Table 4. Longitudinal Random Effects Model of Global Distress During the 6 Months Following the September 11 Attacks*

	Model 1†				Model 2‡			
	Regression Coefficient	β	*z* Score	*P* Value	Regression Coefficient	β	*z* Score	*P* Value
Demographics								
Sex	0.12	.15	5.07	.001	0.11	.14	4.49	.001
Aged ≥60 y§	–0.08	–.08	–2.60	.009	–0.08	–.08	–2.79	.005
Separated‖	0.36	.10	4.30	.001	0.29	.08	3.51	.001
Income	–0.01	–.07	–2.64	.008	–0.01	–.08	–2.92	.004
Self-reported pre–September 11 health								
Physician-diagnosed mental disorder	0.25	.29	10.66	.001	0.23	.27	10.20	.001
Self-reported mental disorder	0.11	.09	3.04	.002	0.11	.09	3.12	.002
Total No. of recent traumas	0.03	.07	2.36	.02	0.02	.05	1.70	.09
September 11–related experiences								
Severity of exposure	0.05	.07	2.48	.01	0.03	.05	1.57	.12
Severity of loss	0.05	.06	2.25	.02	0.06	.07	2.67	.008
Early coping behaviors								
Active coping	. . .	. . .	. . .	. . .	–0.05	–.08	–3.06	.002
Behavioral disengagement	. . .	. . .	. . .	. . .	0.05	.05	1.99	.04
Denial	. . .	. . .	. . .	. . .	0.04	.08	2.79	.005
Sought social support	. . .	. . .	. . .	. . .	0.04	.06	1.97	.05
Self-blame	. . .	. . .	. . .	. . .	0.22	.16	5.02	.001
Self-distraction	. . .	. . .	. . .	. . .	0.03	.05	1.96	.05

*Data are based on 924 cases and 1708 observations. See Table 3 footnotes for description of models. β is the standardized regression coefficient allowing comparisons of relative strength of association between predictors in the model, and *z* is the significance test for the regression coefficient.

†For model 1, sigma_u = .30; sigma_e = .29; rho = .51; likelihood ratio χ^2 = 228.73; and $P<.001$.

‡For model 2, sigma_u = .29; sigma_e = .29; rho = .49; likelihood ratio χ^2 = 295.93; and $P<.001$.

§Individuals younger than 60 years are not significantly different from one another and comprise the reference group in this comparison.

‖Married, single, widowed, and divorced individuals are not significantly different from one another and comprise the reference group in this comparison.

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Table 5. Zero-Order Correlations Between Early Coping Behaviors, Lifetime Exposure to Stressful Events, and Pre–September 11 Health Status

	Lifetime Exposure to Stressful Life Events*				Pre–September 11 Health Status†	
	Total	Child	Adult	Prior Year	Mental	Physical
Acceptance	.17‡	.11‡	.16‡	.02	–.01	.07§
Active coping	.09‖	.05¶	.08‖	.11‡	.02	.02
Behavioral disengagement	.07§	.05¶	.01	.10‖	.12‡	–.02
Denial	–.06§	–.04	–.04	.01	.09‖	–.02
Sought social support	.10‡	.03	.16‡	.11‡	.06¶	.05¶
Self-blame	–.02	.01	–.03	.12‡	.05¶	–.07§
Self-distraction	.04	.07§	.04	.08‖	.07§	.05¶

*Early coping behaviors were analyzed as continuous variables. Stressful events were measured as a count of the total number of events reported (total), the total number prior to age 18 years, the total number experienced as an adult, and the total number of events reported in the prior year, not including the September 11 attacks (n = 925).
†Pre–September 11 health status refers to the number of physician-diagnosed physical illnesses and mental health disorders (self-reported); self-diagnosed mental health disorders were also examined but none of the associations were significant.
‡$P<.0001$.
§$P<.01$.
‖$P<.001$.
¶$P<.05$.

tress. In analyses that adjusted for wave 1 acute stress symptoms to account for possible confounding by personality dimensions, active coping ($\beta=-.08$; $P=.006$), self-blame ($\beta=.14$; $P<.001$), and denial ($\beta=.07$; $P=.01$) all remained significant predictors of global distress over time. When direct exposure (including watching the attacks live on TV) was compared with no direct exposure, direct exposure was a significant predictor of global distress in model 1 ($P=.02$) but not in model 2 ($P=.07$). Watching the attacks on live TV was also a significant predictor in model 1 ($P=.03$) but not in model 2 ($P=.10$).

Correlates of Coping Strategies

To help explain these results, we identified preexisting factors associated with respondents' use of specific coping strategies shortly after the attacks. TABLE 5 presents correlations between significant coping strategies and lifetime exposure to stress and pre–September 11 mental and physical health status. Despite the relations between several coping strategies and these preexisting factors, they do not explain the relations between coping and psychological outcomes because the coping strategies were significant even after pre–September 11 factors were controlled for in the analyses presented in Tables 3 and 4.

We also examined relationships between particular coping strategies and demographic characteristics. Although several coping strategies were related to sex, age, marital status, race/ethnicity, income, and education, the effects of coping strategies were consistently stronger than the demographic effects in all analyses reported in Tables 3 and 4, and interactions between coping strategies and demographic variables were not significant in the analyses.

COMMENT

The unparalleled nationwide impact of the September 11 attacks, coupled with the representative nature of this national sample, the pre–September 11 assessment of mental and physical health histories, and the early collection of emotional and behavioral responses to these events, has allowed a longitudinal examination of individuals' responses to a major traumatic event. Overall, our data show that 6 months after the events of September 11, the effects continued throughout the country among individuals who were, for the most part, not directly affected by the attacks (although lack of any exposure to the attacks was very rare in our sample). Posttraumatic stress symptoms, while declining over the 6 months, still remained elevated. Moreover, individuals continued to have substantial anxiety about future terrorist attacks personally affecting themselves or those close to them.

There is a growing body of literature on reactions to the September 11 events.[29-31] However, several methodological differences between investigations make comparisons of rates of trauma-related symptoms across studies difficult. First, the time frame for data collection has varied. Because a series of national events have occurred since the original September 11 attacks (eg, anthrax in the mail, the initiation of military action in Afghanistan, an initially suspicious plane crash in New York City), the timing of assessments is critical. Second, studies have differed in their mode of survey administration. We used a relatively new method that offers greater anonymity than face-to-face or telephone interviews, and research that has compared interview modes has found that Web-based data collection improves the accuracy of reports of sensitive topics.[32-34] Third, studies have differed in the measures used to assess psychological outcomes. Unfortunately, at this point there is no single accepted self-report measure of posttraumatic symptoms, although many have been developed.[35] Thus, differences in rates of symptoms across samples may be attributable to differences in timing, methods, and/or measures.

In our study, demographic factors, pre–September 11 mental and physical health status, and severity of exposure to and loss due to the September 11 events played a significant role in explaining posttraumatic stress symptoms and global distress over time. Strikingly, however, the use of several specific coping strategies in the immediate aftermath of the attacks consistently and significantly predicted psychological outcomes over time, even after adjusting for all relevant demographics, pre–September 11 mental and physical health status, prior lifetime exposure to stressful events, and severity of exposure to or loss as a result of the attacks. In fact, coping strategies assessed shortly after the attacks were the strongest predictors of posttraumatic stress symptoms, and their strength as predictors of global distress was sec-

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ond only to prior mental health disorders. Actively coping in the immediate aftermath of the attacks was the only strategy that appeared to be protective against ongoing distress. In fact, the absence of greater numbers of "protective" coping strategies (eg, planning, support seeking) was indeed surprising. However, immediately disengaging from coping efforts (eg, "giving up," denial, self-distraction) appeared to increase the likelihood of experiencing ongoing distress and posttraumatic stress symptoms.

This is not the first time that an early giving-up response has been identified as problematic: it has signaled distress prospectively among breast and prostate cancer patients[36,37] as well as severe negative health consequences over time among gay men with human immunodeficiency virus infection.[38,39] In fact, early efforts to avoid or disengage from a stressor may be particularly dysfunctional in the face of an ongoing threat,[40,41] which is unfortunately true about terrorist attacks in the United States today. Our findings suggest that individuals who report such responses may be at particular risk for subsequent difficulties.

This study addresses several methodological limitations that have plagued prior research on trauma-related stress.[9,42] Only a few previous studies were able to collect acute responses[24,29,43] or investigate the long-term progression of responses to trauma starting with early baseline assessments.[24,43-45] Moreover, samples are typically small and demographically or ethnically homogeneous; the median sample size for studies of adjustment following disaster is 159,[9] and most current research following trauma is conducted on nonminority, middle-class respondents.[9,42] Finally, very few studies have been able to collect data before the stressful event has occurred[46-49]; yet, without information on preevent functioning, one cannot disambiguate the effects of the incident on later outcomes.

However, our study also has some limitations. First, although we successfully obtained a broad representative sample of the US population, our sample overrepresented middle-income (and underrepresented high-income) respondents. Study respondents were also somewhat older than nonrespondents, although both had a mean age in their 40s. Our use of poststratification and design weights in our analyses also ensured that this factor did not unduly bias our results.

Second, some of our assessments were necessarily retrospective (eg, assessment of life events), and, although our outcome measures overlapped substantially, the actual instruments used were not identical over time. Moreover, our mental and physical health history data were self-reports of physician diagnoses and self-diagnoses, and we had measures of only 2 preexisting psychiatric conditions (depressive and anxiety disorders). However, they are 2 of the most common types of mental disorders[50] and they were successful in predicting both our post–September 11 outcomes.

Third, we only assessed coping strategies at a single point. However, there is substantial evidence for the temporal stability of coping responses.[51-54] Importantly, early assessments of coping in our study predicted psychological outcomes over time. It is possible that dysfunctional coping responses shortly after a trauma set a number of other adverse forces into play, which, in turn, help to sustain the negative effects.

Fourth, although we have conducted a number of statistical controls in our analyses (eg, controlling for preexisting mental health history and acute stress symptoms) that support the plausibility of a causal role for coping strategies in psychological outcomes over time, the nature of survey data precludes a conclusion about causality. No nonexperimental study can demonstrate whether coping responses and symptoms are causally related. Even after careful evaluations of key alternative explanations, our data can only support this interpretation.

Finally, although we were guided by the *DSM-IV* in the diagnostic criteria we used for both acute and posttraumatic stress symptoms, we did not measure all criteria for ASD and posttraumatic stress disorder (eg, symptom duration). Due to space and time limitations, we could not assess functional impairment at waves 2 or 3. While we clearly specified that the symptoms be September 11–specific, it is possible that respondents could have attributed preexisting symptoms to the events of September 11. Whereas such posttraumatic stress symptoms appear to mimic the pattern of symptoms identified in the *DSM-IV*, most of our respondents were not directly exposed to the trauma and, therefore, cannot meet full *DSM-IV* criteria (or caseness).[55] In fact, a series of design and sampling decisions, as well as budgetary constraints, precluded data collection on New York City residents at all 3 waves, and they were not included in these longitudinal analyses. Without a representative sample of individuals who were directly exposed to the attacks, it is unclear whether the findings from this report would be generalizable to individuals with such exposure.

In sum, this investigation demonstrates that the effects of a major national trauma are not limited to those directly affected by it and that the degree of response cannot be predicted simply by objective measures of exposure to or loss as a result of the trauma. This is important information, as it suggests that relying on unfounded assumptions about who will be most affected by a traumatic event is not useful. Health care professionals should be aware that potentially disturbing levels of trauma-related symptoms can be present even in individuals who are not directly exposed to a trauma, particularly when the trauma is a massive national tragedy such as the September 11 attacks. Rather than considering these symptoms as evidence of psychiatric disorders per se, their presence in a substantial proportion of individuals may in fact represent a normal response to an abnormal event. Information gleaned from this ongoing study of a representative sample of the country may help identify individuals at risk for subsequent difficulties. With these data, we

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hope trauma-related educational and intervention efforts that are designed and implemented among health care professionals and the community at large will be better informed, more cost-effective, and more sensitive to the needs of the populace.

Author Contributions: Dr Silver, as principal investigator, had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analyses.
Study concept and design: Silver, Holman, McIntosh, Poulin, Gil-Rivas.
Acquisition of data: Silver, Holman, McIntosh, Poulin, Gil-Rivas.
Analysis and interpretation of data: Silver, Holman, McIntosh, Poulin, Gil-Rivas.
Drafting of the manuscript: Silver, Holman.
Critical revision of the manuscript for important intellectual content: Silver, Holman, McIntosh, Poulin, Gil-Rivas.
Statistical expertise: Holman.
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