

# Aftermath of Terror: A Nationwide Longitudinal Study of Posttraumatic Stress and Worry Across the Decade Following the September 11, 2001 Terrorist Attacks

Dana Rose Garfin,<sup>1</sup> Michael J. Poulin,<sup>2</sup> Scott Blum,<sup>3</sup> and Roxane Cohen Silver<sup>3,4</sup>

<sup>1</sup>Sue & Bill Gross School of Nursing, University of California, Irvine, Irvine, California, USA

<sup>2</sup>Department of Psychology, University at Buffalo, Buffalo, New York, USA

<sup>3</sup>Department of Psychology & Social Behavior, University of California, Irvine, Irvine, California, USA

<sup>4</sup>Program in Public Health and Department of Medicine, University of California, Irvine, Irvine, California, USA

Research conducted in the early years after the September 11, 2001 (9/11) terrorist attacks in New York, Pennsylvania, and Washington, DC demonstrated adverse psychological outcomes among residents of the United States who were exposed to the attacks both directly and indirectly via the media. However, less is known about the impact of this collective trauma over time. Beginning at the end of December 2006, a longitudinal study of a nationally representative sample of U.S. residents (Cohort 2,  $N = 1,613$ ) examined the long-term effects of 9/11, with annual assessments administered every year for 3 years. We assessed rates of 9/11-related posttraumatic stress (PTS) annually during the first 2 years of the study; during the second and third years of the study, we assessed fear and worry regarding future terrorism. Rates of PTS among participants were compared with those assessed annually in a nationally representative sample between 2002 and 2004 (Cohort 1); results indicated a relatively stable pattern of 9/11-related PTS symptoms for 6 years following the attacks. Five to six years after 9/11, we found an association between 9/11-related PTS and both direct,  $B = 8.45$ , 95% CI [4.32, 12.59] and media-based (live television),  $B = 1.78$ , 95% CI [0.90, 2.65] exposure to the attacks. Six to 7 years post-9/11, fear and worry regarding future terrorism were predicted by 9/11-related PTS symptoms that had been reported approximately 5 years after the attacks,  $B = 0.04$ , 95% CI [0.03, 0.05]. The psychological legacy of 9/11 was perceptible among many U.S. residents throughout the decade that followed.

The September 11, 2001 (9/11) terrorist attacks were the most deadly acts of terrorism on American soil to date, and they challenged many residents of the United States' assumptions about their country's invulnerability, safety, and security.

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Correspondence concerning this article should be addressed to Roxane Cohen Silver, Ph.D., Department of Psychology & Social Behavior, 4201 Social & Behavioral Sciences Gateway, University of California, Irvine, Irvine, CA 92697-7085. E-mail [rsilver@uci.edu](mailto:rsilver@uci.edu)

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Like all terrorism, 9/11 was designed to create fear and anxiety in a population (Silver & Matthew, 2008). These unprecedented attacks were coordinated over several geographic locations and targeted high-profile, iconic national landmarks. Many U.S. residents who were not at the site of the attacks in New York City, rural Pennsylvania, or Washington, DC, witnessed them occur in real time on television. Individuals were also subsequently exposed to repeated graphic and violent images of the attacks via the media. Across the United States, people experienced this traumatic event together. Yet the long-term psychological impact of media-based exposure to 9/11 has been underexplored.

In the years immediately following 9/11, several epidemiological studies examined the nationwide psychological consequences of this trauma (Schlenger et al., 2002; Schuster et al., 2001; Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002). Results from these studies suggested that 9/11-related posttraumatic stress (PTS) was widespread, but a simple dose-response relationship between the degree of exposure and level of distress did not fully explain these responses (e.g., Silver et al., 2002), and some effects of 9/11 persisted at least three years after the attacks (e.g., Holman et al., 2008; Silver et al., 2013). A number of studies have explored the long-term effects of 9/11 in the New York City metropolitan area (e.g., Brackbill et al., 2009;

Yehuda et al., 2009), and as illustrated in a review conducted at the 10-year anniversary of the attacks (see Neria, DiGrande, & Adams, 2011), the burden of posttraumatic stress disorder (PTSD) was substantial among highly exposed populations in the decade following 9/11. More recently, using data from the World Trade Center Health Registry (WTCHR), Bowler et al. (2012) reported that the prevalence of PTSD in police officers doubled between assessments conducted across the 2-year period of 2003 and 2004, and again during 2006 and 2007, which suggests that there is a need for long-term follow-up and care among people who were directly exposed. In a study of first responders conducted 11 to 13 years after the 9/11 attacks, Bromet et al. (2016) found a substantial percentage (9.7%) had current PTSD per criterion put forth in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association [APA], 1994). No studies, however, have assessed long-term consequences of 9/11-related symptomatology in a national sample of U.S. residents who were exposed to the attacks only via the media (see Neria et al., 2011, for a review).

Although distress symptoms dissipate relatively quickly after a community disaster (like a terrorist attack) for many people, others experience long-term effects, including elevated anxiety, depression, hostility, and PTSD (Green et al., 1990; Norris et al., 2002; Smid, van der Velden, Gersons, & Kleber, 2004). Delayed-onset PTSD may surface decades after the initial event, suggesting PTSD symptomatology does not necessarily follow a linear trajectory over time (Yehuda et al., 2009). This phenomenon has been documented in directly exposed samples of New York City residents post-9/11 (e.g., Boscarino & Adams, 2009), earthquake survivors (Su et al., 2010), members of peacekeeping missions in Somalia (Gray, Bolton, & Litz, 2004), and military combatants (Prigerson, Maciejewski, & Rosenheck, 2001).

September 11, 2001 was one of the first community disasters that many people witnessed through the media, via either live coverage (Silver et al., 2002), or delayed and frequently repeated recordings. Although media-based exposure to a traumatic event does not qualify as a trauma in the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev; *DSM-IV-TR*; APA, 2000), such exposure was associated with PTS symptoms (i.e., symptoms of PTSD that may exist with or without direct exposure) nationally in the days (Schlenger et al., 2002), months (Silver et al., 2002), and first years (Silver et al., 2006) following the attacks. The symptom structure of stress responses observed in individuals indirectly exposed to the 9/11 attacks was also similar to the symptom structure seen in people who have been directly exposed to a trauma (Suvak, Maguen, Litz, Silver, & Holman, 2008); over time, rates of PTS declined but were similar between people exposed directly and those exposed through the media (Silver et al., 2004). Delayed-onset PTS from media-based exposure also occurred; exposure to 9/11-related anniversary coverage was associated with an increased risk of new-onset PTSD in New York City residents (Bernstein et al., 2007).

The effects of media-based exposure to 9/11 were not without precedent. Reactions to the 1986 Challenger space shuttle explosion suggested that PTS can result from media-based exposure to a shocking catastrophe (Terr et al., 1999). Similarly, watching television coverage of the 1995 Oklahoma City bombing predicted PTS in children who had been neither exposed personally (e.g., near the bombing site) nor via a close other (e.g., lost a friend or family member to the bombing; Pfefferbaum et al., 2001).

Both direct and media-based exposure to 9/11 may influence residents of the United States over time, with potential long-term implications for physical and mental health. One consequence of early 9/11-related PTS was increased anxiety about future attacks (Holman & Silver, 2005), which was in turn associated with declines in cardiovascular health (Holman et al., 2008), alterations in everyday behaviors such as airline travel and shopping habits (Bonham, Edmonds, & Mac, 2006; Torabi & Seo, 2004), and political and policy preferences (Huddy, Feldman, Taber, & Lahav, 2005; Lerner, Gonzalez, Small, & Fischhoff, 2003). These findings, primarily from the first few years post-9/11, leave potential correlates of ongoing anxiety about future terrorism unknown.

In the present study, we examined the long-term consequences of 9/11 on the U.S. resident populace, measured by 9/11-related PTS and anxiety over future terrorism. Data from separate longitudinal studies of two nationally representative U.S. samples were examined. Cohort 1 was assessed at 1, 2, and 3 years following the attacks (i.e., between 2002 and 2004). Although some data from this study have been reported elsewhere (Silver et al., 2002; Silver et al. 2006; Silver et al., 2004), rates of PTS presented here are previously unpublished. Cohort 2 was assessed three times between 2006 and 2009. A comparison between Cohorts 1 and 2 (both demographically representative of the U.S. population) helped to illustrate both short-term and longer-term responses to the 9/11 attacks among residents of the United States. Using data from Cohort 2, predictors of long-term responses to 9/11 were compared with predictors of post-9/11 distress (identified in previous work), including gender, ethnic minority status, and socioeconomic status (DiGrande, Neria, Brackbill, Pulliam, & Galea, 2010; Silver et al., 2002; Silver et al., 2006); prior mental health difficulties (Silver et al., 2002); and levels of lifetime adversity (Galea et al., 2002; Holman & Silver, 2005; Silver et al., 2006).

We hypothesized that 9/11 would leave a measurable psychological legacy on the American populace. Specifically, we anticipated that: (a) although the prevalence of PTS would decrease, a small percentage of U.S. residents would report high 9/11-related PTS for many years after the attacks; (b) variables that predicted high post-9/11 PTS in the short- and medium-term (i.e., demographic indicators, prior mental health, negative life events, 9/11-related exposure) would continue to be associated with elevated PTS over time; and (c) long-term 9/11-related PTS would be associated with anxiety about future acts of terrorism over time.

## Method

### Participants

Knowledge Networks, Inc. (KN), a Web-based survey research company, recruited a nationally representative Web-enabled panel in the early 2000s using traditional probability methods available at the time for creating national survey samples via stratified “random digit dial” (RDD) telephone sampling. Stratified RDD provided a known, nonzero probability of selection for every U.S. household that had a telephone and thus produced population estimates with less bias than would a simple random sample. The distribution of the KN Panel closely tracked the distribution of the census counts for the U.S. population on age, gender, race, Hispanic ethnicity, geographical region, employment status, income, education, and other demographic variables.

To ensure sample representativeness, KN provided panel households who were not already Web-enabled with free Web access and an appliance with which they could connect to the Internet. In return, panel members participated in 10- to 15-minute Internet surveys, three to four times a month. Panel members were not assigned more than one survey per week, nor more than one study on a particular topic within a 3-month period. For individuals with Internet access, KN allocated points that were redeemable for cash. The panel did not respond to surveys significantly differently over time than “naïve” survey respondents (Dennis, 2001). Members could leave the panel at any time, and receipt of the appliance and Internet service was not contingent upon completion of any particular survey.

Survey responses were confidential and panelists’ identities were never revealed. Panel members received notice in their password protected email account when a survey was available for completion. Surveys were self-administered, accessible for a designated period, and could be completed only once.

### Procedure

#### Administration of surveys.

**Cohort 1: 2002 to 2004.** These previously unpublished data came from a longitudinal study that drew its nationally representative sample from the KN panel and implemented an identical method of data collection as was used in Cohort 2 (described below). Data were collected at the 1-year anniversary of the 9/11 attacks; we fielded online surveys to a national sample between September 20 and October 24, 2002. Overall, 75% of all eligible adults completed the 1-year anniversary survey about their responses to the 9/11 attacks. These individuals were recontacted approximately 2 years (between September 12 and October 31, 2003) and 3 years (September 12 and November 2, 2004) after the 9/11 attacks. We successfully maintained a substantial portion of the eligible adult sample at each wave (a 74.0% participation rate at the 2-year anniversary and a 79.0%

participation rate at the 3-year anniversary; see Silver et al., 2006, for details on additional waves of data collection among this Cohort that are not reported here.) Data from Cohort 1 were not used in any inferential statistics; data are only presented to illustrate national prevalence of PTS across the decade.

**Cohort 2: 2006–2009.** Beginning at the end of December, 2006, surveys were administered annually, for 3 years, to a second, distinct cohort of individuals who had been on the KN panel for less than 6 months and were aged 18 years and older. This subsample of adults was selected from the KN panel using a stratified random sampling design. As compensation for completing each wave of the survey, KN panel members were given 5,000 points (\$5 USD). If panelists did not initially respond to survey requests, they were phoned and sent email reminders by KN in order to encourage participation and minimize nonresponse. Participants who left the panel during the study were contacted by postal mail and email and asked to take the remaining surveys online using a link provided.

Among Cohort 2, Wave 1 surveys were administered between December 28, 2006 and January 18, 2007; in total, 2,142 panelists were invited to participate, and 1,613 individuals completed the Wave 1 survey (a 75.3% participation rate). All Wave 1 participants were invited to participate in Waves 2 and 3, conducted more than 6 and 7 years after the 9/11 attacks, respectively. Participants were considered ineligible for subsequent waves if they either left the KN panel and requested that they not be contacted for any future surveys, or if they could not be reached due to an invalid postal or email address. Wave 2 surveys were administered between December 28, 2007 and February 19, 2008, and were completed by 1,157 panelists (a 71.7% retention rate from Wave 1 and a 76.8% participation rate from eligible Wave 1 panelists). Wave 3 surveys were administered between December 31, 2008 and February 9, 2009. A total of 975 panelists completed the survey, which was a 72.0% participation rate for eligible panelists.

Multiple logistic regression analyses indicated that Wave 1 participants tended to be older (age,  $M = 45.95$  years,  $SD = 15.88$ ) than nonparticipants (age,  $M = 40.90$  years,  $SD = 15.3$ ), odds ratio [ $OR$ ] = 1.02,  $p < .001$ ; and African Americans were less likely to participate compared with Caucasians,  $OR = 0.59$ ,  $p = .001$ . We used Stata 15 (Stata Corp, College Station, TX) xtlogit module (a multilevel application, appropriate for longitudinal data with dichotomous outcomes) to examine participation at Waves 2 to 3, with participation at Wave 2 (yes/no) and 3 (yes/no) as the time-varying dependent variable. Nonparticipants were more likely to have a lower income,  $OR = 0.94$ ,  $p = .003$ ; to have experienced more negative life events,  $OR = 1.02$ ,  $p = .024$ ; and more likely to be African American,  $OR = 3.17$ ,  $p < .001$  than Caucasian. All procedures for both cohorts were reviewed and approved by the Institutional Review Board of the University of California, Irvine.

## Measures

### Cohorts 1 and 2.

**Demographics.** During panel enrollment, KN collected basic demographic information from all panelists. We obtained age, gender, marital status, ethnicity, education, employment status, region of residency, and home ownership status for all participants in Cohorts 1 and 2.

**9/11-related posttraumatic stress symptomatology.** This information was collected during all waves for Cohort 1, and during Waves 1 and 2 for Cohort 2. The Posttraumatic Stress Disorder Checklist (PCL) is a well-validated 17-item self-report measure used to assess probable PTSD (Weathers, Litz, Herman, Huska, & Keane, 1993). The PCL assesses symptoms for *DSM-IV* (APA, 1994) PTSD diagnostic Criterion B (reexperiencing), Criterion C (avoidance), and Criterion D (hyperarousal). Participants rated how distressed or bothered they were by 9/11-related PTS symptoms in the past month; response choices ranged from 1 (*not at all*) to 5 (*extremely*). The PCL can be used to assess both PTSD and PTS (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). It can also be scored as a continuous measure by summing the responses to create a total PTS score ranging from 17 to 85, or coded by symptom clusters. We used the PCL as a continuous measure for inferential statistics and via the symptom-cluster scoring method for presentation of descriptive statistics. In the symptom-cluster scoring method, items endorsed as “moderately” (3) or more were counted as present (National Center for PTSD, 2017). The *DSM-IV* (APA, 1994) diagnostic criteria were current at time of survey administration and were implemented (i.e., endorsement of at least one intrusion or reexperiencing item, at least three avoidance items, and at least two hyperarousal items). As most participants did not meet Criterion A for direct trauma exposure, they were not assumed to have PTSD. Internal consistency was excellent in Cohort 2 at Waves 1 (Cronbach’s  $\alpha = .93$ ) and 2 (Cronbach’s  $\alpha = .95$ ).

### Cohort 2.

**Prior mental health status.** Mental health history was assessed separately by KN prior to Wave 1; participants reported having a history of any physician-diagnosed anxiety or depressive disorder. We constructed a three-level continuous variable, with participants coded either 0 (no history of anxiety or depressive disorder), 1 (prior physician diagnosis of either anxiety or depressive disorder), or 2 (prior history of physician diagnosis of both anxiety and depressive disorder).

**Prior negative life events.** At Wave 1, we assessed lifetime exposure to 37 negative events using a measure previously implemented in survey research (Seery, Holman, & Silver, 2010) that was modified from the Diagnostic Interview Schedule (DIS) trauma section (Robins, Helzer, Croughan, & Ratcliff, 1981) and expanded based on primary care patients’ reports

of exposure to stressful events (Holman, Silver, & Waitzkin, 2000). Participants could report up to four instances of each negative event; examples included loved one’s death, combat experience, and natural disaster exposure. Participants endorsed *yes* (1) or *no* (0); a simple count variable representing total number of pre-2006 stressful events was calculated ( $M = 11.06$ ,  $SD = 8.13$ , range: 0 to 106).

**9/11 exposure.** At Wave 1, participants reported their degree of exposure to the 9/11 attacks, reporting whether they had been directly exposed (i.e., being in the World Trade Center or Pentagon, seeing or hearing the attacks in person, or having a close relationship with someone in the targeted buildings or airplanes), exposed via live media (i.e., watching the attacks live on television as they occurred), or having no live exposure (i.e., not having any direct firsthand experience of the attacks as they occurred). This three-level nominal variable was dummy-coded in analyses, with “no live exposure” serving as the reference group.

**Ongoing fear and worry about terrorism.** Fears of future terrorism were measured at Waves 2 and 3 with a two-item measure that had been used in prior 9/11 research (e.g., Holman et al., 2008): “How often in the past week have you had fears about the possibility of another terrorist attack (e.g., bioterrorism, hijacking, etc.)” and “I worry that an act of terrorism (e.g., bioterrorism, hijacking, etc.) will personally affect me or someone in my family in the future.” Response options ranged from 1 (*never*) to 5 (*all the time*); responses were averaged. Internal consistency was good at Waves 2 (Cronbach’s  $\alpha = .81$ ) and 3 (Cronbach’s  $\alpha = .82$ ).

## Data Analysis

We conducted statistical analyses using Stata 15 (Stata-Corp, College Station, TX). Data were weighted to allow for stronger population-based inferences; weights adjusted for different probabilities of selection, nonresponse, sampling variability, and other forms of error. Cells were adjusted according to gender, age (18 to 29, 30 to 44, 45 to 59,  $\geq 60$  years), race/ethnicity, education (less than high school, high school, some college, bachelor’s degree and beyond), region, metropolitan area (yes/no), Internet access (yes/no), and income level (high/low). Iterative proportional fitting (raking) was implemented since individual cells were too small for complete cross-tabulation (Speed, 2005). Poststratification weights were then determined by an iterative process that uses probability estimates to match the demographic distribution of the final sample to the U.S. Census benchmarks. A poststratification weight was calculated for each wave of data, based on the number of respondents from that wave.

A repeated-measures approach using generalized estimating equations (GEE; Ballinger, 2004) was implemented to assess, in Cohort 2, predictors of 9/11-related PCL at Waves 1 and 2 and ongoing fears and worry about future terrorism at Waves 2

Table 1  
*Posttraumatic Stress Related to the September 11, 2001 Terrorist Attacks*

Variable	1 year post-9/11 Cohort 1 N = 2,054		2 years post-9/11 Cohort 1 N = 1,510		3 years post-9/11 Cohort 1 N = 1,873		5 years post-9/11 Cohort 2 N = 1,613		6 years post-9/11 Cohort 2 N = 1,157	
	n	%	n	%	n	%	n	%	n	%
Total PTS dx	108	5.2	68	4.5	84	4.4	58	3.6	49	4.2
Hyperarousal	207	9.9	158	10.3	219	11.5	109	6.7	95	8.2
Intrusion	513	24.6	377	24.7	431	22.5	431	26.7	217	18.8
Avoidance	167	8.0	110	7.2	127	6.6	98	6.0	71	6.1

Notes. All percentages and *N/n* values are weighted to adjust for sampling design and error and deviation from U.S. census benchmarks. 9/11 = September 11, 2001 terrorist attacks; PTS dx = Probable posttraumatic stress symptoms (PTS; i.e., meets *DSM-IV* [APA, 1994] criteria for hyperarousal, intrusion, and avoidance symptoms).

and 3. We constructed two separate GEE models (one for PTS and one for ongoing fears and worry) using a hierarchical variable entry strategy. This approach accounts for correlations between time points, and GEE adjusts standard errors accordingly. Because GEE focuses on marginal, population-averaged (i.e., covariate-adjusted mean) effects over time, coefficients can be interpreted analogously to the fixed effects estimates from ordinary least squares regression. Robust standard errors are presented, as appropriate for complex survey data (Rabe-Hesketh & Skrondal, 2006).

Variables were screened for inclusion in models via GEE, in theoretically relevant blocks (listed below). Significant variables were added in these conceptually constructed blocks using a hierarchical variable entry strategy (Cohen, Cohen, West, & Aiken, 2003). Demographics and wave (if significant) were entered in Model 1; prior mental health and lifetime negative life events were entered in Model 2; and 9/11-related variables were entered in Model 3. Variables not statistically significant at  $p < .05$  were not included in models. Due to the low levels of missing data in our analyses (less than 1% of any item), in accordance with prior research (Schafer, 1999), a mean of the respondent's available data was utilized if one item from the PCL was missing; listwise deletion was implemented for respondents missing more than one item from the PCL or any other measure.

To examine past-month 9/11-related PTS using PCL scores in Waves 1 and 2, the following variables were tested for inclusion in the GEE models: (1) time, (2) demographics, (3) prior mental health diagnosis, (4) prior negative life events, and (5) exposure to the 9/11 terrorist attacks. To examine ongoing fear and worry about terrorism in Waves 2 and 3, the following variables were tested for inclusion in the GEE models: (1) time, (2) demographics, (3) prior mental health diagnosis, (4) prior negative life events, (5) exposure to the 9/11 terrorist attacks, and (6) 9/11-related PCL at Wave 1 (assessed approximately 5 years after 9/11).

Because the distribution in time-lagged PTS was skewed, we replicated our analyses using natural-log transformed

continuous PCL scores; the pattern of results did not change. For ease of interpretation, we present the untransformed coefficients.

## Results

### Description of the Sample (Cohort 2)

The sample, both weighted and unweighted, closely matched the demographic composition of the September 2006 Current Population Benchmarks compiled by the U.S. Census (U.S. Census, 2006; detailed comparisons provided upon request). In terms of having a mental health diagnosis, 9.8% of the sample reported having been diagnosed with either an anxiety or depressive disorder prior to 2006, and 5.5% reported having been diagnosed with both. A small minority ( $n = 69$ , 4.3%) reported direct exposure to 9/11, 71.3% ( $n = 1,151$ ) witnessed the attacks live on television, and 375 (23.2%) reported neither direct nor live media-based exposure.

### National Rates of PTS Symptoms Across the Post-9/11 Decade (Cohorts 1 and 2)

Using the symptom-cluster scoring method, a consistent minority of U.S. residents endorsed moderate to high levels of 9/11-related PTS symptoms between the first and sixth anniversaries after 9/11 (see Table 1). Approximately 60% of participants who met criteria for high PTS did not report prior mental health diagnoses.

### Predictors of Long-Term 9/11-Related PTS (Cohort 2)

Time was not a significant predictor of 9/11 PTS between Waves 1 and 2, suggesting little change in PTS over the years measured. Several demographic characteristics (less education, minority ethnicity, and lower income) were associated with higher levels of PTS 5 to 6 years post 9/11 in initial variable screening (see Table 2, Model 1). After we controlled for demographic factors, having a prior mental health diagnosis



and having experienced more negative life events were both associated with increased PTS (see Table 2, Model 2). In the final model, both direct and media-based exposure to 9/11 remained significant predictors of long-term 9/11-related PTS (see Table 2, Model 3).

### Predictors of Ongoing Fear and Worry About Terrorism (Cohort 2)

Several demographic characteristics were associated with ongoing worry about future terrorism (see Table 3, Model 1). After we controlled for demographic predictors, pre-2006 mental health history and having experienced more negative life events were associated with ongoing worry about terrorism (see Table 3, Model 2), but not after we accounted for 9/11-related exposure and Wave 1 9/11-related PTS (see Table 3, Model 3). Both direct and media-based exposure to the 9/11 attacks predicted ongoing fear and worry about terrorism in initial variable screening: live media-based exposure,  $B = 0.13$ ,  $SE = 0.06$ , 95% CI [0.01, 0.25],  $p = .038$ ; direct exposure:  $B = 0.49$ ,  $SE = 0.16$ , 95% CI [0.18, 0.80],  $p = .002$ . However, these variables were no longer significant once 9/11-related PTS reported at Wave 1 was added to the model (see Table 3, Model 3). In the final covariate-adjusted model, 9/11-related PTS reported assessed 5 years after 9/11 was a significant predictor of ongoing worry about future terrorism 6 to 7 years after the attacks.

## Discussion

The 9/11 terrorist attacks were a major tragedy that impacted residents across the United States. We are not aware of any previous research that examined the national psychological effects of this event after 5 years post-9/11 (see Neria et al., 2011, for a similar conclusion). The present study hypothesized that 9/11 would have measurable long-term psychological impacts on residents of the United States. We expected that a small minority of U.S. residents would continue to experience elevated levels of PTS, that predictors previously shown to explain short- and medium-term responses could partially account for this PTS, and that 9/11-related PTS would be associated with ongoing anxiety about future terrorism. Our results suggested that the true impact of 9/11 in the years after the attacks was manifested not only in elevated levels of PTS about the attacks themselves, but also in ongoing fears and worry about future acts of terrorism. This may be due to a high level of media-based, rather than direct, exposure to the event.

Our results partially supported the hypothesis that the common predictors of 9/11-related PTS in the short and medium term would also explain 9/11-related PTS in the longer term. Individuals exposed to the attacks both directly and via live television reported significantly more symptoms of PTS 5 to 6 years after the attacks compared with those who learned of the attacks after they occurred. Having a history of previously diagnosed mental health difficulties predicted PTS

5 to 6 years post 9/11, yet the majority of participants who met criteria for high PTS did not have previously diagnosed mental health difficulties. However, not all predictors that were associated with short- and medium-term reactions were associated with long-term reactions (e.g., age), which warrants further investigation.

After we adjusted for potential confounds, anxiety regarding future terrorist attacks that was present between 6 and 7 years post-9/11 was predicted by PTS reported 5 years post-9/11. One potential implication of long-term reactions to 9/11 may have been a continued influence on U.S. residents' lifestyles and behaviors. Torabi and Seo (2004) showed a link between anxiety about terrorism and both choices related to travel behaviors and the decision to limit ones' outside activities. Ongoing anxiety about terrorism might also influence policy preferences and political outcomes; fear of future terrorism has been linked to a willingness to give up civil liberties, vote for a specific candidate, or endorse military action against other nations (e.g., Huddy et al., 2005). Additionally, fear of terrorism is associated with political intolerance of others who differ in political beliefs (Skitka, Bauman, & Mullen, 2004). The significant association between time and ongoing fear and worry about terrorism suggests that anxiety over terrorism did decrease over time. Remaining anxiety may be due to persistent 9/11-related media coverage and imagery, or more broadly, to terrorism's salience in the post-9/11 political sphere (Rothe & Muzzatti, 2004). This may have influenced public awareness and perceptions of risk, as well as ongoing anxiety and worry (see Huddy & Feldman, 2011).

Our results contribute to the ongoing debate about the nature and presentation of PTS, PTSD, and related symptomatology. Although not eligible for clinical diagnoses, PTS responses can occur in response to nontraumatic events (Robinson & Larson, 2010) and may occur throughout the population after community-based traumatic events. The present study assessed a small minority of people who were directly exposed to the 9/11 terrorist attacks, with the majority of participants having been exposed via television. These indirectly exposed individuals do not meet diagnostic *DSM-IV* Criterion A1 (one's own or a loved one's direct exposure to a trauma) for PTSD diagnosis. Indeed, several researchers have questioned the utility of Criterion A in adequately capturing the continuum of PTS responses. Brewin, Lanius, Novac, Schnyder, and Galea (2009) summarized criticisms of Criterion A on several major dimensions, including: (a) it pathologizes normal responses to stressful events, and (b) it may be both too narrow and too broad in its definition of trauma. As such, examining low-level PTS in a directly exposed and/or media-exposed population can elucidate individuals' adjustment processes to stressful events along the continuum of posttrauma adaptation (see Suvak et al., 2008). Acknowledging the potential for distress response both in people exposed directly and those exposed via the media is important, especially given the measurable physical health problems associated with national acute PTS responses to 9/11 (Holman et al., 2008).



Our results also expand on past work that examined national responses to collective traumas, demonstrating that the theories and principles applicable to short- and medium-term responses may be consistent with those characterizing longer-term reactions. Findings regarding the impact of prior stressful life events, degree of exposure, and duration of symptomatology contribute to the existing literature on the long-term progression of stress responses following community disasters (Norris et al., 2002). Our findings are consistent with previous studies that have suggested the number of prior stressors to which an individual is exposed is linked to increased distress following a subsequent trauma (Seery et al., 2010). People exposed to events via the media may also be affected, with measurable impacts evident for many years.

Clinicians, researchers, and media professionals should be aware that responses to violent traumas and chronic stressors may be long-lasting for some individuals and may not follow a simple dose-response formula. Long-term longitudinal assessments are critical. Clinicians and health care providers should not pathologize normal responses, but provide access to appropriate treatments if symptoms persist, particularly among populations at risk for long-term difficulties, and be aware that collective trauma may exacerbate preexisting conditions. Additionally, extensive media coverage of negative events, particularly reports that present repeated graphic images, may have lasting deleterious consequences (Silver et al., 2013). Reporters and media professionals should consider the potential negative impact of repeated, alarming media reports of traumatic events on both physical and mental health (see Holman et al., 2008) and present information sensitively.

### Limitations and Future Directions

The overarching hypothesis, that 9/11 continued to have an impact on residents of the United States several years after the attacks, was supported. Nonetheless, we acknowledge some caveats. First, a very small minority of individuals continued to experience elevated rates of PTSD-like distress. While many endorsed some symptoms of 9/11-related PTS, their clinical and practical significance (e.g., impacts on cardiovascular illness or decisions to avoid travel) requires further examination. Second, assessment of specific exposure to the 9/11 attacks was necessarily collected retrospectively, thus subject to bias. Third, systematic rates of attrition existed, although sample weighting corrected for bias in sample demographic composition. Fourth, two different cohorts, consisting of different individuals, were used to illustrate rates of PTS over the decade. Since both cohorts were nationally representative, results presented a snapshot of how U.S. residents in general responded to 9/11 over time. Nonetheless, it is impossible to identify delayed-onset reactions, and we could not control for acute responses to 9/11 in longitudinal analyses. Fifth, the correlational design precluded causal statements regarding directionality, although longitudinal assessments controlled for preexisting mental health diagnoses, and the temporal ordering of surveys supports

inferences about adjustment over time. Sixth, while the Wave 3 participation rate for Cohort 2 respondents who were available to complete the survey was relatively high (72.0%), only 60.4% of Wave 1 participants were retained by the final wave. Nevertheless, given that some predictors of this attrition (e.g., minority status) have been linked with increased distress (e.g., DiGrande et al., 2010; Silver et al., 2002), analyses may have conservatively reported 9/11's long-term impact. Finally, due to constraints in this interdisciplinary project, we were unable to assess 9/11-related PTS among Cohort 2 participants at Wave 3, although it would have been ideal to do so.

Despite these limitations, our study responded to a void in the extant literature regarding long-term psychological responses to 9/11. Our findings suggest that 9/11, a graphic and violent community trauma, left a mark on many individuals across America. Bearing witness to the destruction of fellow countrymen and revered symbols of national pride was associated with ongoing concerns about terrorism. Our study demonstrated that, indeed, 9/11 is a tragedy that U.S. residents did not, and likely will not soon, forget.

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