Developmental Psychology

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Online First Publication, June 18, 2012. doi: 10.1037/a0028916

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0012-1649/12/$12.00 DOI: 10.1037/a0028916

A Lifespan Perspective on Terrorism: Age Differences in Trajectories of Response to 9/11

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A terrorist attack is an adverse event characterized by both an event-specific stressor and concern about future threats. Little is known about age differences in responses to terrorism. This longitudinal study examined generalized distress, posttraumatic stress responses, and fear of future attacks following the September 11, 2001 (9/11) terrorist attacks among a large U.S. national sample of adults (N = 2,240) aged 18–101 years. Individuals completed Web-based surveys up to 6 times over 3 years post 9/11. Multilevel models revealed different age-related patterns for distress, posttraumatic stress, and ongoing fear of future attacks. Specifically, older age was associated with lower overall levels of general distress, a steeper decline in posttraumatic stress over time, and less change in fear of future terrorist attacks over the 3 years. Understanding age differences in response to the stress of terrorism adds to the growing body of work on age differences in reactions to adversity.

Keywords: lifespan, terrorism, distress, posttraumatic stress, fear

The September 11, 2001 (9/11) terrorist attacks were a shared national trauma that initiated two wars and a period of broader concern about the future. Over the years, thousands of articles have examined the aftermath of the attacks in an effort to understand their psychological consequences (Silver, 2011). Researchers have found marked geographic (e.g., Schlenger et al., 2002) and temporal (e.g., Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002) diversity in individuals' response to 9/11. Gender and ethnic differences have also been identified in response to the attacks (Chu, Seery, Ence, Holman, & Silver, 2006; Galea et al., 2002; Schlenger et al., 2002). Perhaps surprisingly, despite the possible differences in potential impact of the attacks in individuals across the lifespan, there has been limited attention paid to age differences in response to the attacks immediately or over time. Moreover, while a large body of research has explored the effects of the attacks on youths in the United States (see Eisenberg & Silver, 2011, for a review), there has been relatively little attention paid to the impact of the attacks in the elderly (see Lamet, Szuchman, Perkel, & Walsh, 2009; Monahan & Lurie, 2007; Tracy & Galea, 2006, for exceptions). In addition, no research has examined the differential immediate and enduring impact of 9/11 across the full range of the adult lifespan.

Lifespan Developmental Considerations

There are strong theoretical reasons to expect age differences in response to a collective stressor such as 9/11. As individuals age, they become increasingly motivated to regulate their emotions (Urry & Gross, 2010) and do so by focusing more on positive emotional experiences and less on negative ones (Charles, Mather, & Carstensen, 2003) and by having positive, meaningful social interactions (Blanchard-Fields, 1998; Carstensen, 1995; Folkman, Lazarus, Pimley, & Novacek, 1987; Schulz & Heckhausen, 1998; Wrosch, Heckhausen, & Lachman, 2000). As a result, younger people have been found to be more emotionally labile and prone to negative affect (Mroczek & Kolarz, 1998; Thomsen, Mehlsen, Viidik, Sommerlund, & Zachariae, 2005), and older adults are thought to be more emotionally stable (Löckenhoff & Carstensen, 2004). In addition, age may be associated with responses to collective stressors because such events can have different implica-

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Stacey B. Scott's work was supported by a National Institute of Mental Health Special Topics in Aging Research Training: Mental Health (START-MH) fellowship; an earlier version was presented at the START-MH conference. Project funding was provided by National Science Foundation Grants BCS-9910223, BCS-0211039, and BCS-0215937 to Roxane Cohen Silver.

We thank E. Alison Holman, Daniel McIntosh, Virginia Gil-Rivas, and Judith Andersen for their assistance with the study design and data collection; Scott Maxwell, Joseph Rausch, and Martin Sliwinski for statistical advice; and the Knowledge Networks Government, Academic, and Non-Profit Research team of J. Michael Dennis, William McCready, Kathy Dykeman, Rick Li, and Vicki Pineau for providing access to data collected on Knowledge Networks panelists, for preparing the Web-based versions of our surveys, for creating the data files, for general guidance on their methodology, and for their survey research and sampling expertise.

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tions for different cohorts (Baltes & Nesselroade, 1984; Baltes, Reese, & Lipsitt, 1980). A classic example is Elder's (1979) finding that men born just before the 1930s were more adversely affected by the Great Depression, with these effects enduring through middle age, than their peers who were born 10 years before them.

Despite theoretical reasons for expecting age differences in response to collective stressors, previous empirical work has yielded inconsistent findings (see Shenk, Ramos, Kalaw, & Tufan, 2009, for review). Some researchers have found older adults to be less vulnerable to and show better recovery from disasters than younger adults across a variety of outcomes, including anxiety and physical distress (Bell, 1978; Bolin & Klenow, 1982); acute stress disorder (Cohen, 2008); feelings of relative deprivation (Huerta & Horton, 1978); and sleep disturbances, depression, and irritability (Kato, Asukai, Miyake, Minakawa, & Nishiyama, 1996). Additionally, following Hurricane Katrina, older adults who returned to New Orleans reported less psychological distress and worry about the future than younger respondents (Day & Jencik, 2010). Within a sample of older people, Phifer (1990) found the old-old to be relatively resilient with respect to psychological distress following a natural disaster when compared with younger-old respondents. In contrast, other researchers have reported no age-related differences in symptoms of posttraumatic stress (PTS; i.e., intrusion, avoidance, and hyperarousal) and depression following disasters (Goenjian et al., 1994; Knight, Gatz, Heller, & Bengston, 2000; Livingston, Livingston, Brooks, & McKinlay, 1992). Still other investigators have found older adults to report higher overall levels of PTS symptoms in response to a natural disaster (Ticehurst, Webster, Carr, & Lewin, 1996). In their extensive review of 160 samples of disaster victims, Norris et al. reported that the effects of age depended on the country studied and concluded that "there was no consistent effect of age; rather, it depended upon the social, economic, cultural, and historical context of the disaster-stricken setting" (Norris et al., 2002, p. 235). Further, across these studies, when compared with younger and older persons, middle-aged adults appeared to be the most adversely affected.

Mirroring the literature on age differences on the psychological impact of disasters in general, studies conducted in the early aftermath of the 9/11 attacks found inconsistent results across age groups. In three successive samples of adults living near New York City surveyed between October and December 2011, individuals older than 65 reported greater mental health than did younger individuals (Ford, Adams, & Dailey, 2007). In contrast, nationwide phone surveys 3 to 5 days after the attacks found no age differences in PTS symptoms (Schuster et al., 2001). Similarly, phone surveys conducted among Manhattan residents in October and November 2011 found no age differences in PTS or depressive symptoms (Galea et al., 2002). However, in a nationally representative study sampled in the same period, age was inversely related to PTS symptoms but unrelated to generalized psychological distress (Schlenger et al., 2002). In one of the few studies conducted 2 to 3 years after the attacks, risk for PTS symptoms increased with age among residents who lived in the area south of Canal Street on 9/11 and was greatest among adults 45–64 years (DiGrande et al., 2008).

Possible Explanations for Inconsistent Findings

Despite predictions of age differences in emotion regulation and in responses to large-scale stressors, theories have been relatively silent on the situations in which age differences might be seen or the specific emotional outcomes that might be affected. Moreover, theories do not specify the time period over which this regulation would occur following event exposure, nor do they address whether one might see different trajectories of emotional response by age cohorts over time. Further, variability in the age distribution and exposure levels among samples in prior research may obscure whatever response patterns theories might predict. For example, several contextual factors relevant for responses to collective stressors (e.g., proximity to the collective stressor, time since the event) have been inconsistent across studies and may explain the inconsistent age effects in the empirical work reviewed above. Moreover, age differences in initial or ongoing response could arise from individuals' social contexts at the time of the event (e.g., exposure to 9/11), as well as their life histories (e.g., lifetime exposure to stressful events).

Change Over Time

It is important to note that, in general, most of the disaster literature—including the research conducted on 9/11 specifically—does not involve repeated measurements of the outcomes on the same individuals. Although early data, which many studies collected in the immediate aftermath of the attacks, are critical to understanding initial reactions to disaster, they do not provide information about long-term trends in these responses (Neria, DiGrande, & Adams, 2011). It is necessary to have both early and ongoing data collection to understand how these responses unfold over time (North & Pfefferbaum, 2002; Silver et al., 2006). Individuals could be very similar in their trajectories; on the other hand, certain subgroups could initially appear very similar, but their trajectories could diverge from each other over time. These different change patterns cannot be determined from the majority of research conducted after 9/11. Further, as Kato et al. (1996) pointed out, the effect of age on disaster response may itself change over time.

Two substantive questions direct studies of change (Singer & Willett, 2003). First, individual patterns of change are of central interest to trauma and developmental researchers. The focus here is describing the shape of within-person change on the outcome over time. That is, does a particular response (e.g., distress) generally increase, decrease, or take a more complex form in the wake of a trauma? Second, in addition to describing the shape of individual trajectories, understanding between-person characteristics that predict different patterns of change is key. The focus here is on determining if different people show different trajectories and if these differences in initial levels or patterns of change can be predicted by some other attribute (e.g., age). Longitudinal data are necessary to examine these important but complex questions. Neither cross-sectional nor pre-post-designs are sufficient to address change fully. At least three waves of data are necessary to model linear change; additional measurements are needed to explore more complex patterns.

Temporal Focus of Response

While research on responses to any type of trauma or adversity should address patterns of adjustment over time, these patterns are likely to be especially complex in the case of terrorism, as terrorism engenders distress with respect not only to past events but also to possible future events. PTS symptoms and posttraumatic stress disorder (PTSD) involve recurrent thoughts and feelings related to a traumatic event in the past (American Psychiatric Association, 1994). The "terror" of terrorism, however, also consists of anxiety over whether further acts of violence may affect oneself, close others, or one's country (Marshall et al., 2007). For older adults, in particular, adjustment to terrorism may present unique challenges because past- and present-focused emotion management strategies (e.g., positively biased memory and attention; Charles et al., 2003) may not address this future threat. Finally, it is possible that how individuals currently feel about their everyday lives, that is, how generally distressed they report feeling, may also change over time (Sliwinski, Almeida, Smyth, & Stawski, 2009) because of changing daily demands such as health problems or caregiving commitments. It is important to examine age-related trends in overall distress levels in order to identify trends that may be due to demands common to a developmental period, as opposed to effects related to an historical event to which individuals across all ages are exposed.

The Present Study

In order to understand possible age-related differences in response to the 9/11 attacks, we sought to examine responses to 9/11 in people across the lifespan, over time, and with outcomes reflecting past-, present-, and future-related distress. Thus, we explored 9/11-specific (past-focused) PTS responses, overall levels of current distress, and fears of future terrorism in a large national sample of Americans approximately 2, 6, 12, 18, 24, and 36 months after the attacks. These repeated measures produced a hierarchical or nested data structure in which observations were nested within individuals. We supplemented early, short-term measurements of outcomes by following respondents over 3 years, including assessments at hypothesized important dates such as the anniversaries of the attacks. Three specific questions were examined: (a) What, if any, is the association between age and early psychological responses to 9/11? (b) How did these responses change over the 3 years following 9/11? And (c) what kind of trajectories of response did Americans of different ages experience? We also examined the role of other characteristics of the individuals themselves (e.g., gender, mental health history), their prior life experiences (e.g., lifetime stressful events), as well as their context at the time of the event (e.g., degree of 9/11-related exposure), which have all been found to be important predictors of psychological outcomes in previous trauma research (Norris et al., 2002). In order to pursue these research questions, we systematically examined different possible trajectories and how these individual characteristics might moderate these trends over time using multilevel modeling (MLM), a technique well-suited to longitudinal data in which repeated observations are nested in persons and with provisions to address the missing data common to longitudinal studies.

It was hypothesized that older people's past- and present-focused emotional responses (as assessed by PTS symptoms and current levels of distress) would be less negative, in general, than those of younger age groups but that this pattern might not hold for distress about future events (as assessed by fears of future terrorism). To address the dearth of research on the shape of trajectories of response beyond short term follow-ups, we first describe the general pattern for each outcome across the years. We then examine how age may serve as a moderator of these average trajectories. Based on previous theory and research, we expected that there might be age differences in the intercepts and rates of change, but we did not have a strong basis for expecting qualitatively different patterns of change in a sample representing the United States as a whole.

Method

Design and Procedure

The present project was part of a larger longitudinal study examining mental and physical health in the United States following the 9/11 attacks (Silver et al., 2006), conducted in collaboration with Knowledge Networks, Inc. (KN), a Web-based survey research company that maintains a nationally representative Web-enabled research panel of potential respondents. The KN panel was developed using traditional methods for creating national survey samples and at the initiation of the study, panelists were recruited using stratified random-digit-dial (RDD) telephone sampling. RDD provides a known nonzero probability of selection for every U.S. household with a telephone. KN provided panel households with WebTV in order to support participation by population segments without personal computers or Internet access. Panel members received an Internet connection and the necessary equipment to access the Internet using the television as a monitor. In exchange for free Internet access, members participated in surveys three to four times a month. Provision of WebTV and Internet access were not contingent on the completion of any particular survey. The KN panel closely tracks the distribution of census counts for the U.S. population on age, race, Hispanic ethnicity, geographical region, employment status, income, and education. Compared with "naïve" survey respondents, the panel does not respond to surveys significantly differently over time (Dennis, 2001).

Six Web-based surveys were administered over 3 years following September 11, 2001. Specifically, responses to the 9/11 attacks were assessed at approximately 2, 6, 12, 18, 24, and 36 months post-September 11, 2001.[1] Due to funding limitations inherent in mobilizing resources to study an unfolding disaster, individuals were brought into the study at two different time points. A portion (N = 1,020) of the sample was invited to complete the 2 months post 9/11 survey, which served as the first wave of data collection for the outcomes in the current study; these individuals were also invited to complete additional surveys over the next 3 years. The balance (N = 1,220) of the participants were invited to participate in the 12-month survey, as well as the remaining surveys over the next 2 years. No participants joined the sample after the 12-month survey. (See Silver et al., 2006, for detail on the sample at each

[1] An earlier survey that did not include the variables of interest here was administered to most of our sample between September 20 and October 4, 2001.

wave.) In sum, participants in this analysis entered the study at either the 2-month or 12-month survey and could provide between one and six waves of data.

Respondents received notification in password-protected e-mail accounts when they were assigned a survey. They could access a survey at any time for a designated period but could complete it only once. Surveys were self-administered and confidential, with identifying information never revealed to the researchers by KN without respondent approval. Longitudinal surveys were linked over time with an identification code provided by KN.

Participants

The sample for this article drew from a nationally representative sample from the KN panel outside of New York City (N = 2,136) and a representative sample from the KN panel of New York City residents (N = 104). The sample included adults from across the lifespan, ranging in age from 18 to 101 years. From the overall sample collected across 3 years, 2,240 participants were included in the analyses described below. The age distribution of the participants was as follows: 330 participants were 18–29 years of age, 636 were 30–44 years, 675 were 45–59 years, 446 were 60–74 years, and 153 were 75–101 years. More than 80% of the sample completed three or more waves of data; 153 (7%) participated in one wave, 290 (13%) participated in two waves, 303 (14%) participated in three waves, 836 participated in four waves (37%), 172 (8%) participated in five waves, and 486 (22%) participated in all six waves of the study. Additionally, although participants had different patterns of missingness, most provided data in both the first year and the end of the study (e.g., 78% participants completed the 3-year survey).

Measures

Demographics. A demographic questionnaire assessed gender, age, ethnicity, educational status, and household income. Missing values for income were imputed by KN using the mean income score for each respondent's census block (i.e., the smallest geographic area for which the Bureau of the Census collects and tabulates data, see http://www.census.gov).

9/11-related exposure. Participants' experiences on 9/11/01 were assessed. Individuals were grouped into three different categories of exposure: *direct exposure* (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 during the attacks), *live media exposure* (watching the attacks unfold live on television), and *no live exposure* (only seeing or learning of the attacks after they had occurred).

Lifetime stressful events. Within the first year after 9/11, participants completed a checklist of 38 stressful events they may have experienced in their lifetimes (e.g., natural disaster, death of family member, child abuse) and reported at what age the events occurred. The measure was based on open-ended coding of lifetime stressors in a primary care community sample (Holman, Silver, & Waitzkin, 2000) and provides rates of specific events that match epidemiologic surveys of other representative community samples (e.g., Breslau et al., 1998). Individuals' total number of stressful life events was calculated from their responses to the checklist.

Mental health history. Participant reports of having been diagnosed with no prior mental illness, diagnosed with either depression or an anxiety disorder, or diagnosed with both depression and an anxiety disorder prior to 9/11/01 were assessed.

Posttraumatic stress symptoms. September 11-related PTS symptoms were measured at Waves 1 and 2 using the Impact of Events Scale—Revised (IES-R; Weiss & Marmar, 1997). The IES-R is a widely used scale with good reliability and validity that measures the extent to which participants were bothered by PTS symptoms resulting from the 9/11 attacks. Reliability for this measure was excellent in this sample (α = .94); the mean score was used as an index of PTS symptoms. To enable direct comparison to methodology employed in other national investigations of the 9/11 attacks (e.g., Schlenger et al., 2002), the PTSD Checklist (PCL; Weathers, Litz, Herman, Huska, & Keane, 1993) was used for the duration of the study. Both the IES-R and PCL utilize overlapping items and constructs. The PCL has been shown to have excellent psychometric properties and also had very good reliability in this sample (α = .92–.94). In order to ensure compatibility between the scales, all IES-R values were recoded from a 0–4 scale to a 1–5 scale, consistent with the PCL.

Distress. General distress was assessed at Wave 1 using the Hopkins Symptom Checklist (HSCL-25; Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974), a standardized scale of psychological symptomatology with response options ranging from 0–3. At subsequent waves, distress was assessed with the 18-item Brief Symptom Inventory (BSI-18; Derogatis & Savitz, 2000), a related standardized scale that has substantial methodological and conceptual overlap (i.e., shared items) with the HSCL. Both measures assess the degree to which respondents are distressed by symptoms of depression, anxiety, and somatization, and both measures had excellent reliability in this sample (HSCL α = .95; BSI-18 α = .92–.93). In order to ensure compatibility between the scales, HSCL scores were multiplied by 4/3 to shift them to a 0–4 scale, consistent with the BSI.

Fear of future attacks. Fear about future terrorist attacks was assessed at each wave with two items modified from Vaughan's perceived risk scale (Vaughan & Wong, 2002). Using a 1–5 scale, respondents reported how often in the past week they had fears about the possibility of another terrorist attack (e.g., bioterrorism, hijacking) or whether they worried that an act of terrorism would personally affect them or a family member in the future. This scale has demonstrated high internal consistency across diverse community populations (e.g., elderly poor, ethnic minorities), high test–retest reliability, and acceptable discriminant validity (see Silver et al., 2002). Together, the items had good reliability (α = .82–.88).

Overview of Analyses

MLM were conducted using the SAS PROC MIXED procedure, which employs full-information maximum-likelihood estimation to use all available data in estimating the models. Therefore, participants were not excluded because of missing data. In order to investigate bias due to nonrandom missingness, we conducted sensitivity analyses to examine whether our results were sensitive to differential participation across the sample over time. We categorized the participants by entrance into the study (e.g., 2 or 12 months), number of follow-ups (e.g., one to six waves), and timing of dropout (e.g., post 2, 6, 12, 18, or 24 months or completed final

survey). In separate pattern mixture models (Hedeker & Gibbins, 1997; Sliwinski & Buschke, 1999), we used these as predictors of baseline scores and patterns of change in the outcomes and determined whether the results for the predictors of interest were affected. The pattern of results for PTS symptoms, general distress, and fear of future terrorism held when entrance, number of follow-ups, and dropout were included as predictors. Therefore, we report the results of models without these controls in the tables below.

MLM was used to examine trajectories of PTS symptoms, distress, and fear of future attacks in the 3 years following 9/11. Analyses for each outcome were conducted separately. Level 1 models were used to identify the sample average intercept and trend (e.g., intercept: how much a typical person reported worrying about future terrorist attacks 2 months post 9/11; trend: on average, what shape best described the pattern of fear of future attacks across the 3 years). When significant variation among individuals was found in the components of the trajectories (i.e., intercepts and patterns of change), age and other person-characteristics (i.e., gender, mental health history, lifetime stressful events, degree of 9/11-related exposure) were used at Level 2 to predict these differences. These analyses focus on moderators (e.g., how age interacts with the rate of change in PTS symptoms across the study). As the literature on responses to disaster and terrorism has not yet clearly documented the nature of change in PTS symptoms, distress, or fear over time, curvilinear relationships were also explored. Examining the descriptive plots of the means at each wave (see Figures 1, 2, and 3), and that of fear in particular, further prompted consideration of higher order trends. To investigate the degree of curvature in each trajectory, quadratic (i.e., $time^2$), cubic (i.e., $time^3$), and quartic (i.e., $time^4$) terms were added. In our exploratory work plotting the data, we separated the sample into smaller age groups in order to examine whether there were descriptive differences in the means over time. In our actual analyses, however, age was used as a continuous predictor. Intercepts and linear slopes were specified as random—that is, allowed to vary between individuals—in all models. Model-fitting began by specifying simple models that were then used as comparisons for the higher order models. Such higher order trends were important to provide a good fit to the data, as indicated in Figures 1–3, as well as the indices of model fit (Akaike information criterion [AIC], Bayesian information criterion [BIC]).[2]

Because our questions were about age differences in the patterns of change over time in these outcomes, it was necessary to separate cross-sectional age differences from longitudinal age changes (Sliwinski, Hoffman, & Hofer, 2010), which would have been conflated if we simply used age as our nesting variable. Therefore, the repeated observations were included at Level 1, indexed by wave (i.e., months since 9/11), and individuals' age at baseline was entered at Level 2 as a predictor of individual differences in intercepts and change over time. In our models, we used continuous age as a predictor rather than creating arbitrary age groups. However, for illustrative purposes, age-group-based means are displayed in the figures for the patterns of each of the outcomes across time.

In the main analyses reported in Tables 1, 3, and 4, time was centered at 2 months in order to avoid extrapolating backward to time points prior to the data collection (i.e., 9/11). As age differences in both level as well as change were of interest, results for age predicting the intercept at each wave are reported in Table 2 in order to highlight at which time points age differences existed. Thus, the analytic models were of exactly the same form and used the same predictors across centerings. In order to manage the extremely small coefficients and standard errors that result from the use of higher order factors, the linear, quadratic, cubic and quartic terms were rescaled as follows: the linear trend was specified by dividing time by 10, quadratic by dividing time by 1,000, cubic by dividing time by 10,000, and quartic by dividing time by 1,000,000. Given the large sample size, a more conservative significance cutoff of 0.01 or less was set. The complexity of the models (higher order trends, rescaling of trends) suggests that examination of the t values and significance may be more informative than sole reliance on the parameter estimates themselves. As most MLM software does not provide standardized regression coefficients—in part because an agreed upon method for accurately calculating standardized MLM results does not exist and common strategies such as standardizing based on the between-person standard deviation give misleading estimates of the within-person effects—unstandardized regression coefficients are reported.

Results

Posttraumatic Stress Symptoms

As depicted in the means by wave in Figure 1, PTS symptoms decreased over the first year and remained fairly stable over the 18, 24, and 36-month assessments. As seen in Table 1, the quadratic model (with random intercept, and linear and quadratic slopes) best described the data. Income, lifetime stressful events, 9/11-related exposure, and mental health history were unrelated to the linear or quadratic trends. Thus, these interactions were excluded from the final model; however, these variables did predict differences in PTS symptoms at 2 months. Specifically, higher income was related to lower PTS symptoms at 2 months, while greater exposure to stressors across one's lifetime, prior mental health difficulties, and more direct exposure to 9/11 were associated with higher PTS symptoms at Wave 1. Older age was associated with a steeper decline in linear slope and slightly more (quadratic) curvature. Women reported higher initial PTS symptoms and displayed more (quadratic) curvature in their trajectories. Recentering time to examine age differences at each wave, older age was related to lower PTS symptoms at 24 months post-9/11, but age differences were not apparent at 2, 6, 12, or 36 months (see Table 2).

Distress

As depicted in the means by wave in Figure 2, general distress showed a small amount of change over the course of the study. The linear and quadratic slopes of distress were significant (see Table 3). Although the intercept term was significantly different from

[2] When evidence for meaningful differences between people in the higher order trends was found, results of these models with random polynomials are reported. In cases in which the models could not converge with random higher order polynomials, the more parsimonious random intercept and linear slope models (with meaningful fixed, average, polynomial trends) are reported.

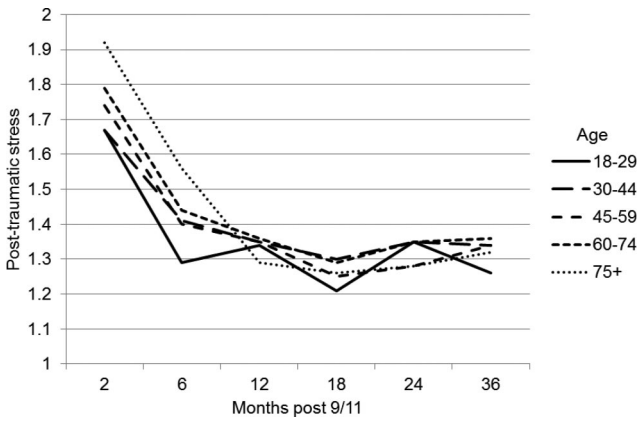

Figure 1. Mean levels of posttraumatic stress symptoms by age group over 3 years following 9/11.

zero, it was quite low given that scores could range between 0 and 4. The average level of distress across the 3 years of measurement was also low ($M = 0.33$, $SD = 0.49$). Younger adults showed higher initial levels of distress than older adults. Women and those with lower incomes, more lifetime stressful events, more direct 9/11 exposure, and prior mental health difficulties reported higher initial levels of distress. Although the other Level 2 predictors tended to have larger coefficients for intercept, age had a small but significant role in predicting differences in distress. Only gender explained differences in the trends over time, with women reporting steeper linear slopes and more curvature in their distress across 3 years.

Fear of Future Terrorist Attacks

As depicted in the means by wave in Figure 3, the average trajectory of fear decreased over the 3 years following 9/11 but peaked again at approximately 18 months. Table 4 shows the trend in fear was best described by a quartic function.[3] In this model, average fear at 2 months post 9/11 was 3.31, representing worrying about terrorism "sometimes" within the prior week. The linear, quadratic, cubic, and quartic trends were significant. Small but significant interactions between age and the linear, quadratic, cubic, and quartic trends appeared. Interactions between gender and time trends were also apparent, in which women reported higher levels of fear initially and more steep curvature across time. 9/11-related exposure, lifetime stressful events, prior mental health diagnoses, and income did not predict differences in the trends and were excluded from the final model.

It is difficult to describe interactions between covariates and higher order trends meaningfully. Therefore, age differences were explored further by recentering time (see Table 2). Age differences in fear of future terrorist attacks were not apparent at 2 months post-9/11. As Table 2 and Figure 3 describe, however, considerable variability appeared in the fear responses of individuals across the lifespan over time. Rather than a consistent effect, levels of fear for individuals across the lifespan depended upon the time of measurement. At 6 months, age significantly predicted differences in levels of fear, with older adults reporting higher levels of fear of terrorism. At the 1-year anniversary and 18 months post 9/11, however, age differences were not apparent. Age was related to fear of future terrorist attacks at both the 2- and 3-year anniversaries, again with older individuals reporting higher levels of fear (see Table 2).

Discussion

The current study followed a geographically, sociodemographically, and ethnically diverse U.S. national sample of young, middle, and older adults for 3 years following the 9/11 attacks. As the largest study to date examining age differences in response to 9/11, it represents the only study with both early and longitudinal data on an adult lifespan sample. This study also contributes to the broader disaster and 9/11-specific literature that rarely considers age beyond a control variable. The longitudinal analyses presented here indicate that the role of age in shaping responses to terrorism is more complex than single-time-point cross-sectional studies can reveal. The long-term pattern of response to 9/11 depended upon the variable examined; differing patterns of change over time were found for PTS symptoms, general distress, and fears of terrorism. Additionally, age predicted level and trajectories of change in different ways for these three variables.

Most previous research on age and adjustment to stressors has failed to distinguish among historical, cohort, and developmental influences reflected in age differences in patterns of response. However, contemporary lifespan work considers alternate metrics of time to disentangle age differences from other influences (e.g., life satisfaction and distance to death, Gerstorf, Ram, Rocke, Lindenberger, & Smith, 2008; disability and time-as-resources, Ram, Gerstorf, Fauth, Zarit, & Malmberg, 2010). Following this trend, we use time since event—a commonly used metric in life stress research—to examine age differences in patterns of change across time following 9/11. Further, lifetime stress exposure, another predictor that we include in our models, offers an alternative to chronological age. Lifetime event counts provide information on the prior experiences individuals carry with them that may moderate their responses to a disaster. In this study, special attention was paid to separating age differences in longitudinal change following an historical event from the uninterpretable mix of developmental and time-related effects in previous cross-sectional studies. Below, we discuss both general and age-related change in responses to 9/11 and propose possible explanations for these differences.

Trajectories of Response to 9/11

Distress and posttraumatic stress symptoms. Both distress and PTS symptoms were generally lower at the end of the study than they were shortly after 9/11. However, their trajectories were not the same. Levels of distress were relatively low across the 3

[3] The final model for fear allowed for random intercept and linear slope but only fixed quadratic, cubic, or quartic trends. Although the AIC and BIC declined slightly in the completely random effects model, an examination of the covariance parameter estimates of these higher order trends indicated that between-person differences in these trends were nonsignificant. In both the completely random effects model and the final model, the significance of the fixed effects were $p < 0.001$; the t value estimates were, in most cases, the same to the first decimal place.

Table 1
Predictors of Posttraumatic Stress Symptoms Over Time

Variable	Estimate	*SE*	*t*	*p*
Intercept (2-month status)	1.78	0.06	32.07	<.0001
Age	<0.01	<0.01	2.23	.0262
Female	0.16	0.03	5.21	<.0001
Income	−0.02	<0.01	−5.28	<.0001
Lifetime stressful events	0.01	<0.01	7.40	<.0001
9/11 exposure				
None	−0.33	0.04	−7.07	<.0001
Live TV	−0.25	0.04	−5.52	<.0001
Direct	Reference group	Reference group	Reference group	Reference group
Mental health diagnosis				
Neither	−0.28	0.04	−6.57	<.0001
Anxiety or depression	−0.17	0.04	−3.36	.0008
Both	Reference group	Reference group	Reference group	Reference group
Time (linear term)	−0.29	0.07	−14.14	<.0001
Age	<−0.01	<0.01	−3.63	<.0001
Female	−0.11	0.03	−3.78	<.0001
$Time^2$ (quadratic term)	0.67	0.05	13.62	<.0001
Age	<0.01	<0.01	3.34	.0002
Female	0.23	0.07	3.29	<.0001

Note. $N = 2{,}420$. Final model for trajectory of posttraumatic stress symptoms. Time was centered at 2 months post 9/11. Age and lifetime stressful events were grand mean centered. Income, lifetime stressful events, 9/11 exposure, and mental health diagnoses were not significant predictors of the linear or quadratic trends and were excluded from the final model.

years but showed a small amount of linear and quadratic change, particularly within the first 6 months after the attacks. PTS symptoms followed a quadratic pattern, decreasing rapidly over the first year and changing little over the following 2 years. Why did these trajectories differ? Gilboa-Schechtman and Foa (2001) hypothesized that PTS reactions to trauma increase from the time of exposure to a peak, followed by an exponential decay. Levels of the outcomes examined in the present study were not available prior to 2 months after 9/11, but with more frequent measurements the trend may have appeared more like the hypothesized smooth decay with time. Overall levels of distress, on the other hand, displayed only a small amount of change across the study. This contrast may reflect both the sample and the phenomenon studied. While the study included a subsample of New York City residents, it reflected the country as a whole and, thus, was for the most part not directly exposed to the attacks. Thus, although participants reported thinking about the attacks and worrying about future acts of terrorism, they appeared able to maintain their general emotional well-being across the period of the study. These results point to the specificity in different operationalizations of stress. Examining the trajectories of multiple outcomes can provide a more complete picture of the continuum of responses to collective traumas.

Fear of future terrorist attacks. In contrast to our findings for distress and PTS symptoms, fear showed a complex change pattern and was not obviously lower at the end of our study than it was at the beginning. Fear was best described by a quartic pattern, with both rate and direction of the trend both changing—

Table 2
Average Levels and Age Effects in Posttraumatic Stress Symptoms and Fear of Future Terrorism Over Time

	Months post 9/11					
Variable	2	6	12	18	24	36
Posttraumatic stress	Intercept = 2.13, age < 0.01 (t = 2.45, p = .01)	Intercept = 1.67, age < 0.01 (t = 1.26, p = .21)	Intercept = 1.55, age < −0.01 (t = −0.78, p = .44)	Intercept = 1.48, age < −0.01 (t = −2.18, p = .03)	Intercept = 1.46, **age < −0.01 (t = −2.61, p < .01)**	Intercept = 1.56, age < −0.01 (t = −0.95, p = .34)
Fear of future terrorism	Intercept = 3.31, age < −0.01 (t = 0.56, p = .57)	Intercept = 2.90, **age < 0.01 (t = 4.17, p < .01)**	Intercept = 2.88, age < 0.01 (t = 2.90, p = .03)	Intercept = 2.89, age < −0.01 (t = 0.33, p = .74)	Intercept = 2.64, **age < 0.01 (t = 4.55, p < .01)**	Intercept = 2.72, **age < 0.01 (t = 4.51, p < .01)**

Note. $N = 2{,}420$. Sample average levels (i.e., intercepts) of posttraumatic stress symptoms and fear of future terrorism were significantly different from zero at all waves at the $p < .0001$ level; intercept and age estimates at each wave are reported. Unstandardized coefficients, t values, and significance of the influence of age on the intercept are reported for each wave. Significant age differences in level of posttraumatic stress symptoms and fear of future terrorism at the .01 level are displayed in bold. Levels of general distress did not show significant change across the study and therefore were omitted from table; age differences in distress are displayed in the Table 1 age effect on the intercept. Aside from recentering of time, models are exactly the same as those described in Tables 1 and 4.

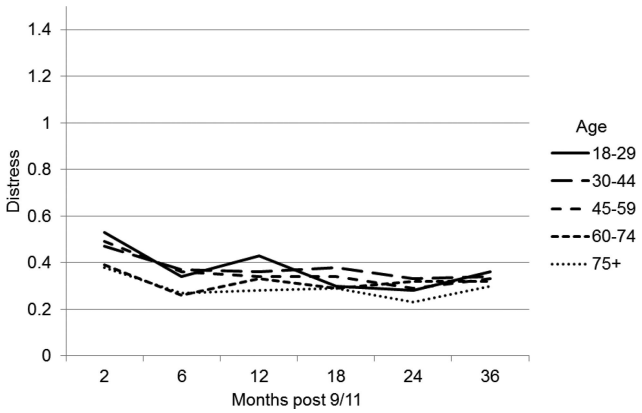

Figure 2. Mean levels of distress by age group over 3 years following 9/11.

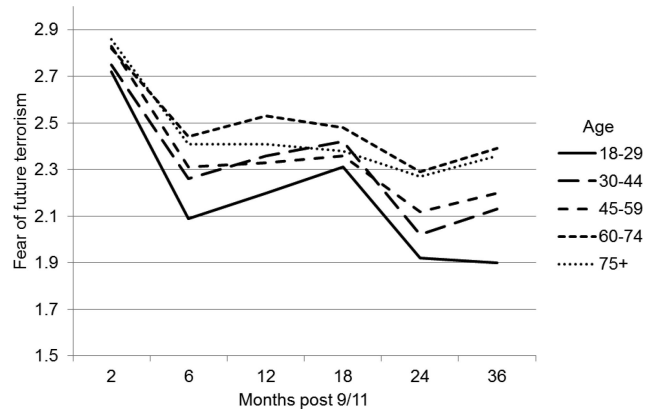

Figure 3. Mean levels of fear of future terrorist attacks by age group over 3 years following 9/11.

that is, there were peaks and valleys in fear levels over the 3 years. The explanation for this finding most likely has to do more with the aftermath of and national reaction to 9/11 than solely with the attacks themselves. Our results indicated that levels of fear were highest around specific fear-provoking events–shortly (2 months) after the original attacks, the 1-year anniversary, and the lead-up to the Iraq War (the 18-month survey was conducted around the start of the 2003 invasion of Iraq). Notably, the later anniversaries of 9/11 were not related to substantial increases in fear of terrorism. These findings suggest the importance of historical context for understanding responses to terrorism and potentially other collective traumas. Moreover, these unexpected findings point to the importance of conceptualizing response to collective traumas in a dynamic way.

Age and Trajectories of Response

The ways in which age predicted trajectories differed markedly across outcomes. Specifically, older adults showed lower levels of general distress and decreased more in their PTS symptoms, but they stayed more fearful over time. These findings suggest that older adults may experience event-specific anxiety or worry but that this does not necessarily spill over into their general emotional life.

This specificity is an important finding as existing theory does not yet articulate the timing or the particular emotional responses for which age differences may appear. The distress results fit with previous research indicating that older adults report less negative affect than do younger adults (Löckenhoff & Carstensen, 2004; Mroczek & Kolarz, 1998). The results for PTS symptoms, however, do not mirror this general trend but may be explained by the recently proposed Strength and Vulnerability Integration model (SAVI; Charles, 2010). This theory incorporates both age-related increases in strategies for avoiding or reducing exposure to negative experiences (e.g., strengths) as well as age-related reductions in physiological flexibility to respond to unavoidable high-arousal situations (e.g., vulnerabilities). Specifically, it posits that in the

Table 3
Predictors of General Distress Over Time

Variable	Estimate	*SE*	*t*	*p*
Intercept (2-month status)	1.06	0.06	17.23	<.0001
Age	<−0.01	<0.01	−4.88	<.0001
Female	0.14	0.02	5.55	<.0001
Income	−0.01	<0.01	−5.84	<.0001
Lifetime stressful events	0.01	<0.01	10.39	<.0001
9/11 exposure				
None	−0.25	0.04	−5.91	<.0001
Live TV	−0.21	0.04	−5.10	<.0001
Direct	Reference group	Reference group	Reference group	Reference group
Mental health diagnosis				
Neither	−0.51	0.04	−13.10	<.0001
Anxiety or depression	−0.29	0.04	−6.52	<.0001
Both	Reference group	Reference group	Reference group	Reference group
Time (linear term)	−0.06	0.02	−3.10	<.0001
Female	−0.11	0.03	−4.17	<.0020
$Time^2$ (quadratic term)	0.11	0.05	2.49	.0129
Female	0.26	0.06	3.99	<.0001

Note. $N = 2{,}420$. Final model for trajectory of distress. Time was centered at 2 months post 9/11. Age and lifetime stressful events were grand mean centered. Age, income, 9/11 exposure, lifetime stressful events, and mental health diagnosis were not significant predictors of the trends and were excluded from the final model.

Table 4
Predictors of Fear of Future Terrorism Over Time

Variable	Estimate	*SE*	*t*	*p*
Intercept (2-month status)	3.31	0.12	26.84	<.0001
Age	<−0.01	<0.01	0.56	.5745
Female	0.27	0.05	5.33	<.0001
Income	−0.01	<0.01	−2.25	.0248
Lifetime stressful events	0.02	<0.01	6.62	<.0001
9/11 exposure				
None	−0.44	0.08	−5.29	<.0001
Live TV	−0.29	0.08	−3.51	.0005
Direct	Reference group	Reference group	Reference group	Reference group
Mental health				
Neither	−0.38	0.08	−4.97	<.0001
Depression or anxiety	−0.20	0.09	−2.24	.0255
Both	Reference group	Reference group	Reference group	Reference group
Time (linear term)	−1.77	0.15	−11.43	<.0001
Age	0.03	<0.01	4.14	<.0001
Female	−0.63	0.22	−2.92	.0036
$Time^2$ (quadratic term)	22.56	2.34	9.64	<.0001
Age	−0.47	0.10	−4.59	<.0001
Female	10.26	3.29	3.12	.0018
$Time^3$ (cubic term)	−10.87	1.17	−9.29	<.0001
Age	0.24	0.05	4.77	<.0001
Female	−5.20	1.64	−3.17	.0016
$Time^4$ (quartic term)	16.50	1.80	9.17	<.0001
Age	−0.38	0.08	−4.81	<.0001
Female	7.98	2.37	3.16	.0016

Note. $N = 2{,}420$. Final model for trajectory of fear of future terrorism. Time was centered at 2 months post 9/11. Age and lifetime stressful events were grand mean centered. Income, 9/11 exposure, lifetime stressful events, and mental health diagnosis were not significant predictors of the trends and were excluded from the final model.

absence of a negative event, age should be positively associated with well-being. During an unavoidable negative event, however, age should be weakly or unrelated to well-being, as older adults' avoidance- or disengagement-focused strategies may be irrelevant and physiological limitations in regulation may lead older persons to appear as upset or even more so than younger persons. Given time to employ strategies such as cognitive appraisal after an event, older age should again be associated with higher well-being as the negative event unfolds. Although it provides more specific predictions about the conditions under which age differences in emotional responses will or will not be present, SAVI draws primarily from lab-based and daily diary research and so has not yet been applied to major events such as 9/11. Nonetheless, consistent with its hypotheses, older age was related to higher levels of PTS symptomatology 2 months after the attacks. Moreover, at later time points, age was either unrelated to or predicted lower reports of PTS symptoms. It may be that with sufficient time to engage their coping skills, older adults suffered less from reliving the experience of 9/11 over time.

Even though age may be associated with longitudinal benefits in terms of distress and PTS symptoms, it does not appear that older adults were simply putting the attacks out of their minds. In the context of specific fear-provoking events (e.g., soon after the attacks, at the 1 year anniversary, and during the build-up to the Iraq War), older adults did not differ from younger people in their fear of terrorism. These time points overlapped with times during which the Homeland Security Advisory System's threat level increased for the nation overall (U.S. Department of Homeland Security, 2011) and may have been especially salient because of increased media attention. During more "ordinary" times (e.g., 6 months, second and third anniversaries), however, older age was related to reporting being more concerned about future terrorist attacks.

Although this persistent worry associated with older age may not be consistent with the theoretical explanations reviewed above, an age-related increase in levels of generativity as a sense of concern for the legacy of future generations is one possible explanation. Unlike the distress and PTS questions, the fear items were not solely about the individual her- or himself. One of the questions pertained to how much respondents worried that a terrorist attack would affect themselves or their families. Older adults may have reported consistently elevated levels of fear because they were concerned about their children's and grandchildren's lives. Although typically conceptualized as a central concern of midlife, McAdams, de St. Aubin, and Logan (1993) found that older adults showed surprisingly high scores representing generative commitment (described as strivings for the next generation, care for others, and creative contributions to society). Future studies should examine if aspects of generativity are actually intensified by the experience of crisis. In addition, although a generative orientation may help to explain the present findings, it will be important to attend to issues of historical and developmental time in future studies. Recent work has identified generational differences among Baby Boomers', GenXers', and Millenials' rankings of affiliation and community goals while in early adulthood (Twenge, Campbell, & Freeman, 2012). Thus, it is not clear whether today's young adults would show a similar level or pattern of fear as older adults.

We found older age related to less change and higher levels of fear of future attacks at specific waves. In contrast, Day and Jencik (2010) found that older adults reported less overall worry about the future. There are several possible reasons for this inconsistency: The studies differed in stressor type (e.g., localized natural disaster vs. deliberate attack on key national landmarks), measurement of worry (e.g., general worry about the future vs. specific worries related to future terrorist attacks), and design (e.g., cross-sectional surveys at three time points vs. six waves of longitudinal data across 3 years). In a cross-sectional study of coping responses to 9/11 about 1–2 months after the attacks in a sample of adolescents, young, and middle-aged adults indirectly exposed to the attacks via mass media, Wadsworth et al. (2004) found rumination decreased with age but that adolescents and middle-aged adults reported more intrusive thoughts than young adults. The measures of rumination and intrusive thoughts were from a general coping and response to stress questionnaire, as opposed to the 9/11-specific questions used in the present study. In a study that specifically asked about thoughts related to a collective stressor, Knight et al. (2000) found older age to be related to lower earthquake-specific ruminations in their sample of middle aged, young-old, and old-old adults.

What might explain the consistently high reports of fear of future terrorism among older adults in the present study, in contrast to other studies' findings of increased age related to lower levels of worrying about the future, ruminating about past events, and being bothered by intrusive thoughts? Aside from the measurement and design differences mentioned above, it may be that terrorist attacks represent a qualitatively different kind of stressor than a natural disaster. Both have the possibility of unexpected recurrence; however, terrorist attacks also may influence enduring and broad changes in society (e.g., laws, political rhetoric) as a whole beyond the repair of the damage to the specific impact sites. Because of their generative orientation, older adults in the present study may be displaying their concerns about how these changes may affect their descendants. Another possibility is that the oldest members of this sample are drawing from their experiences with the long-term repercussions of superficially similar events (e.g., Pearl Harbor) in rating their concerns for future attacks. Finally, the issues of selection and survival effects are always present as possible explanations of age differences. The younger portions of the sample include both participants who will live to old age as well as participants who will die before reaching later life, whereas the older participants have successfully lived to old age. These remaining older adults may differ from the more heterogeneous mix of younger participants because of selection (e.g., the physically healthiest members of a given birth cohort live into old age) as well as survival (e.g., the people who were most successful at coping and other life skills live into old age).

Other Predictors of Trajectories of Response

Although the goal of this investigation was to examine age differences in immediate levels and trajectories of response, other possible predictors (e.g., pre-existing mental health difficulties; demographics, including gender and income; degree of exposure) were also included in our models. We included lifetime stressful experiences as another possible way of investigating developmental influences on these responses separate from chronological age. While several of these predictors were useful in explaining differences in distress, PTS symptoms, and fear of future attacks at the first wave of the study, gender was the only predictor aside from age that interacted with the patterns of change over time. Our findings are consistent with prior epidemiological research that has demonstrated that women report higher levels of depression (see Kessler, 2003, for review), PTSD (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), and anxiety (Kessler et al., 1994).

Limitations and Future Directions

The use of longitudinal data and a large, national sample are strengths of our study. Nonetheless, several limitations should also be noted. First, pre-9/11 data on our outcome variables of interest (e.g., general distress, PTS, fears of terrorism) were not available; therefore, it is impossible to discuss these trends prior to the 2-month post-9/11 mark. Second, we did not maintain our full sample over the course of our multiwave longitudinal study. Nonetheless, we conducted sensitivity analyses to determine the impact of differences in entry to the study, pattern of missingness, and dropout on the intercepts and slopes for all three outcomes and found that the pattern of results were unaffected. Third, the measures of distress and PTS symptoms we used were not consistent across all waves of the study. Thus, it is not possible to completely rule out method effects as the introduction of different measures occurred at times in the study when change might be expected. However, careful consideration of the measures and data support confidence in the longitudinal results. For example, the instruments we employed (the IES-R and PCL for PTS; the HSCL-25 and BSI-18 for distress) had overlapping items and were designed to tap the same respective theoretical constructs. Indeed, Suvak et al. (2008) used these measures to examine the structure of PTS symptoms across the first year after 9/11 in this sample and found evidence for measurement invariance in this construct. In addition, the general trends of both outcomes followed a reasonable pattern. Distress showed small change and PTS symptoms continued to decline, albeit less sharply, as would be expected as length of time from the traumatic event increased.

Future studies of disaster, and terrorism specifically, should examine the long-term trajectories of multiple indicators of adjustment and attend to the effects of age and other characteristics in shaping between-person differences in these trends. Hurricane Katrina, the London subway and bus bombings, the Asian tsunami, and the Japanese earthquake and subsequent nuclear crisis are unfortunate events that could inform theory on human response to disaster. Previous experiences, such as having lived through wars and national turmoil, may influence different cohorts' responses to terrorism and other collective events. In addition, experiences that occur in the period following the trauma, such as military deployment of loved ones or increased security measures, could augment or defuse an individual's fear, distress, or PTS symptoms. For example, prolonged concern for a family member in the armed services could have enhanced a person's general distress, whereas enhanced security features in their own communities may assure other people and leave them less fearful of possible future attacks.

By examining trajectories over time, this study offers a detailed understanding of the diversity and variation in re-

sponses to a national trauma from individuals across the lifespan. It may be that the events of 9/11 fit the definition of a normative history-graded determinant of development, as an event that "occurs for most members of a given cohort (generation) in similar ways, although the events may differ for different age cohorts living at the same time" (Baltes et al., 1980, p. 75). Research in the coming years will reveal whether the lifespan differences in response to 9/11 are unique or whether they will be replicated following other disasters.

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Received August 24, 2011
Revision received February 16, 2012
Accepted April 20, 2012 ■