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Health status and health care utilization following collective trauma: A 3-year national study of the 9/11 terrorist attacks in the United States

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ABSTRACT

The September 11, 2001 terrorist attacks (9/11) presented a unique opportunity to assess the physical health impact of collective stress in the United States. This study prospectively examined rates of physical ailments and predictors of health care utilization in a U.S. nationally representative sample over three years following the attacks. A sample of adults ($N = 2592$) completed a survey before 9/11/01 that assessed MD-diagnosed physical and mental health ailments. Follow-up surveys were administered at one ($N = 1923$), two ($N = 1576$), and three ($N = 1950$) years post-9/11 to assess MD-diagnosed physical health ailments (e.g., cardiovascular, endocrine) and health care utilization. Reports of physical ailments increased 18% over three years following 9/11. 9/11-related exposure, lifetime and post-9/11 stress, MD-diagnosed depression/anxiety, smoking status, age, and female gender predicted increased incidence of post-9/11 ailments, after controlling for pre-9/11 health. After adjusting for covariates (demographics, somatization, smoking status, pre-9/11 mental and physical health, lifetime and post-9/11 stress, and degree of 9/11-related exposure), increases in MD-diagnosed cardiovascular, endocrine, gastrointestinal, and hematology-oncology ailments predicted greater utilization of health care services over two years. After the collective stress of 9/11, rates of physical ailments increased and predicted greater health care utilization in a U.S. national sample.

In the wake of the September 11th terrorist attacks (9/11), several studies documented short- and long-term mental health consequences in the directly impacted communities of New York City and Washington, DC (Galea et al., 2002; Neria, Gross, Marshall, & Susser, 2006; Schlenger et al., 2002). Physical health outcomes received substantially less attention, although some research found that survivors and rescue workers in New York reported many physician-diagnosed physical health problems both immediately (Feng, Lenihan, Johnson, & Reddy, 2006; Lampert, Baron, McPherson, & Lee, 2002; Steinberg et al., 2004) and as long as 5 years after 9/11 (Brackbill et al., 2006; Wheeler et al., 2007). Indeed, a growing body of research suggests extremely stressful events may trigger biological processes that increase an individual's risk of developing various health ailments (e.g., gastrointestinal, musculoskeletal, neurological; McEwen, 1998; Pizarro, Silver, & Prause, 2006; Schnurr & Green, 2004).

The 9/11 attacks were more than an isolated, individual trauma experienced by people in New York and Washington, however. The attacks were *both* a directly-experienced, individual trauma for a small proportion of Americans as well as a collective cultural upheaval for the American population as a whole (cf. Conejero & Etxebarria, 2007; Wayment, 2004). As such, their impact on mental health was seen around the country, outside the directly affected communities (Schlenger et al., 2002; Schuster et al., 2001; Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002; Silver et al., 2006). In addition, stress responses among indirectly exposed individuals mirrored the psychological responses typically exhibited by individuals who are directly exposed to a traumatic event (Suvak, Maguen, Litz, Silver, & Holman, 2008). Elsewhere we have reported that acute stress response to the attacks in a national sample predicted an increase in reports of physician-diagnosed cardiovascular ailments over 3-years following 9/11 (Holman et al., 2008). These findings suggest that collective stress may influence more than just mental health; physical health may also suffer following these highly stressful experiences (see also Shedd et al., 2004). The present research was designed to test whether

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a collective stress such as 9/11 might have had a broader impact on physical health and health care utilization beyond directly exposed survivors.

Linking psychological stress and physical health

There are several theories that may help explain how events like the 9/11 attacks might lead to physical ailments. Early physiologic stress responses (e.g., increased heart rate) have been linked to the development of psychological ailments (e.g., Posttraumatic Stress Disorder, PTSD; Ozer, Best, Lipsey, & Weiss, 2003), which have been associated with a variety of medical ailments (Schnurr & Green, 2004) and increased utilization of health care services (Boscarino, 2004; Fagan, Galea, Ahern, Bonner, & Vlahov, 2003). However, stress-related physiologic arousal may also produce unexplained physical symptoms that lead people to seek care from health professionals (Barsky, Orav, & Bates, 2005).

Moreover, with growing evidence identifying various biological pathways by which stress may influence disease states (e.g., Epel et al., 2004; McEwen, 1998; Miller, Cohen, & Ritchey, 2002), development of a mental illness is not necessary for the development of stress-related illness, or for increases in health care utilization that may result from these illnesses. Extreme stress triggers a neurohormonal cascade of events that supports coping in the short run, but threatens health if it does not abate after the event has passed. If these stress-related physiologic responses persist over time, it is very likely that they will be detrimental for long-term physical health (McEwen, 1998, 2008). In addition, many illnesses linked to stress-related processes are chronic in nature (e.g., McEwen, 1998), and as such, will likely impact health care utilization over a protracted period of time.

Large-scale collective events like 9/11 often set in motion a series of events, such as personal loss, economic hardship, and fears about the future (Holman et al., 2008), that may prolong and exacerbate the stress response for many people. Under these circumstances, "allostatic load" on the body increases, placing physical health at risk (McEwen, 1998, 2008). For example, persistent exposure to cortisol and other stress hormones can negatively affect bone density, increase blood pressure, promote atherosclerotic changes in arteries, and increase the risk of myocardial infarction (Brown, Varghese, & McEwen, 2004). Musculoskeletal ailments have also been associated with another form of allostatic load—HPA axis hyporesponsiveness—wherein low cortisol responses to stress allow increased secretion of inflammatory cytokines that promote autoimmune and other inflammatory diseases, many of which affect the musculoskeletal system (Boscarino, 2004; McEwen, 1998). Although a growing body of animal and human studies provides evidence consistent with the allostatic load theory (Lupien, McEwen, Gunnar, & Heim, 2009), alternative models have also been proposed (e.g., Romero, Dickens, & Cyr, 2009), in part due to the difficulty in measuring allostatic load directly (see Smith, Maloney, Falkenberg, Dimulescu, & Rajeevan, 2009). Despite theoretical differences regarding the specific mechanisms by which stress influences disease, the stress-disease relationship is widely accepted.

The present study

To date, most research addressing the health impact of stressful life events has not included pre-event measures of mental or physical health, and few studies have been longitudinal. We sought to address these limitations and explore prospectively how collective stress might be related to physical health status and health care utilization in a national sample of American adults following the 9/11 attacks. Moreover, as allostatic load affects all bodily systems, we sought to extend the link between collective stress and health beyond simply cardiovascular ailments (cf. Holman et al., 2008; Shedd et al., 2004). Based on prior theory and research that has linked extreme stress to physical health ailments and utilization (e.g., Boscarino, 2004; Schnurr & Green, 2004), we hypothesized that: (a) overall rates of physical ailments would increase from before to after the 9/11 attacks, (b) higher levels of 9/11-related exposure would predict increases in physical health problems, and (c) changes in physical ailments following 9/11 would be associated with health care utilization in the years following the attacks. Finally, we examined whether specific categories of physical ailments would be associated with higher utilization.

Method

Overview

Starting in September, 2001, our research team conducted a longitudinal study of mental and physical health following the 9/11 attacks among a national probability sample of the U.S. population (Silver et al., 2006), in collaboration with Knowledge Networks, Inc. (KN), a Web-based survey research company. KN recruits, maintains, and conducts surveys with a nationally representative Web-enabled panel using anonymous Web-based methodology.

The KN panel was developed using traditional probability methods for creating national survey samples and recruited using stratified random-digit-dial (RDD) telephone sampling. RDD provides a known non-zero probability of selection for every household having a telephone. To ensure representation of population segments that would not otherwise have Internet access, KN provides non-Web-enabled panel households with Internet connections and appliances that use televisions as monitors (Web TV). Panel members participate in surveys 3–4 times monthly in exchange for free Internet access or other compensation (e.g., bonus points used to obtain merchandise) if the household is already Web-enabled. The KN panel closely tracks the distribution of census counts for the U.S. population on age, race, Hispanic ethnicity, education, income, geographical region, and employment status (Dennis & Krotki, 2001). To correct for possible non-response bias from panel recruitment and attrition, representative samples are selected for panel surveys using post-stratification weights that weight panel distributions to match benchmarks from the most recent government statistics for gender, age, race, ethnicity, education, and geographic region. Distributions for panel samples resemble, within sampling error, U.S. population distributions for key demographic variables.

Panel members are notified in password-protected e-mail accounts that an assigned survey is available. Surveys are confidential, self-administered and accessible any time for a designated period; participants can complete a survey only once. Members may leave the panel at any time, and receipt of the Web TV and Internet access is not contingent upon completion of any particular survey. Comparison of KN panelists' demographic, attitudinal, and behavioral responses to newly recruited RDD samples strongly suggests they do not respond as "professional" respondents (Krosnick & Chang, 2001).

KN provided demographic data for all respondents and updated these data annually. Physical health and health care utilization were assessed prior to 9/11/01; physical ailments and health care utilization were assessed annually following 9/11/01. Specifically, between October 10 and December 6, 2002, 1923 of 2281 available respondents completed the first post-9/11 health survey online (84% of those fielded; 74% of the 2592 respondents who completed