



## Childhood maltreatment, 9/11 exposure, and latent dimensions of psychopathology: A test of stress sensitization



Jacquelyn L. Meyers<sup>a</sup>, Sarah R. Lowe<sup>a</sup>, Nicholas R. Eaton<sup>b</sup>, Robert Krueger<sup>c</sup>,  
Bridget F. Grant<sup>d</sup>, Deborah Hasin<sup>a, e, f, \*</sup>

<sup>a</sup> Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY 10032, USA

<sup>b</sup> Department of Psychology, Stony Brook University, Stony Brook, NY 11794, USA

<sup>c</sup> Department of Psychology, University of Minnesota, Minneapolis, MN 55455, USA

<sup>d</sup> Laboratory of Epidemiology and Biometry, National Institute on Alcohol Abuse and Alcoholism, Bethesda, MD 20892, USA

<sup>e</sup> Department of Psychiatry, College of Physicians and Surgeons, Columbia University, New York, NY 10032, USA

<sup>f</sup> New York State Psychiatric Institute, New York, NY 10032, USA

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### ABSTRACT

On September 11, 2001, a terrorist attack occurred in the U.S. (9/11). Research on 9/11 and psychiatric outcomes has focused on individual disorders rather than the broader internalizing (INT) and externalizing (EXT) domains of psychopathology, leaving unknown whether direct and indirect 9/11 exposure differentially impacted these domains rather than individual disorders. Further, whether such effects were exacerbated by earlier childhood maltreatment (i.e. *stress sensitization*) is unknown. 18,713 participants from a U.S. national sample with no history of psychiatric disorders prior to 9/11 were assessed using a structured in-person interview. Structural equation modeling conducted in a sample who endorsed no psychiatric history prior to 9/11, indicated that *indirect* exposure to 9/11 (i.e. media, friends/family) was related to both EXT (alcohol, nicotine, and cannabis dependence, and antisocial personality disorder) and INT (major depression, generalized anxiety, and post-traumatic stress disorder (PTSD)) dimensions of psychopathology (EXT:  $\beta = 0.10$ ,  $p < 0.001$ ; INT:  $\beta = 0.11$ ,  $p < 0.001$ ) whereas *direct* exposure was associated with the INT dimension only ( $\beta = 0.11$ ,  $p < 0.001$ ). For individuals who had experienced childhood maltreatment, the risk for EXT and INT dimensions associated with 9/11 was exacerbated (Interactions:  $\beta = 0.06$ ,  $p < 0.01$ ;  $\beta = 0.07$ ,  $p < 0.001$ , respectively). These findings indicate that 9/11 impacted latent liability to broad domains of psychopathology in the US general population rather than specific disorders with the exception of PTSD, which had independent effects beyond INT (as indicated by a significant ( $p < 0.05$ ) improvement in modification indices). Findings also indicated that childhood maltreatment increases the risk associated with adult trauma exposure, providing further evidence for the concept of *stress sensitization*.

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### 1. Introduction

On September 11, 2001, a large-scale terrorist attack occurred in New York City (9/11) (Galea et al., 2002). Since then, studies have linked 9/11 exposure to adverse psychological outcomes, including depression, anxiety, and substance use disorders (Breslau et al., 2010; Henriksen et al., 2010; Neria et al., 2011; Perlman et al.,

2011; Lucchini et al., 2012). Individuals directly impacted by 9/11 have been studied in depth (Welch et al., 2012). However, most of the US population experienced 9/11 indirectly, through relatives, friends, or media exposure, e.g., television news (Dougall et al., 2005). Such indirect 9/11 exposures were also associated with depression, anxiety, and problem drinking, particularly in vulnerable groups, such as those with prior psychiatric disorders (Lengua et al., 2005; Pollack et al., 2006; Otto et al., 2007; Holman et al., 2011; Barnes et al., 2012; Pietrzak et al., 2012). However, many aspects of the associations between 9/11 exposures and psychological outcomes remain unknown. Outstanding issues involve the relationships between direct and indirect 9/11 exposure, their

\* Corresponding author. Columbia University College of Physicians and Surgeons, Department of Psychiatry, 1051 Riverside Drive #123, New York, NY 10032, USA. Tel.: +1 212 543 5035; fax: +1 212 543 5913.

E-mail address: [dsh2@columbia.edu](mailto:dsh2@columbia.edu) (D. Hasin).

impact on broad underlying dimensions of psychopathology rather than specific individual disorders, and whether such relationships are altered by prior exposure to other well-documented risk factors such as childhood maltreatment or a history of parental mental illness.

Risk factors for one disorder tend to predispose individuals to other disorders (Kendler et al., 2003; Carr et al., 2013). The high comorbidity of substance and psychiatric disorders (Kessler et al., 1994; Compton et al., 2007; Hasin et al., 2007b) has been conceptualized as forming a meta-structure of broader internalizing and externalizing latent dimensions (Krueger et al., 2002; Kendler et al., 2003; Eaton et al., 2012; Krueger and Markon, 2014). In a US national sample, childhood maltreatment affected the risk for specific adult mood, anxiety, personality, and substance use disorders primarily through the broader internalizing and externalizing dimensions rather than impacting the risk for specific individual psychiatric disorders (Keyes et al., 2012). Further, in another US national sample, familial aggregation of mood, personality, and substance use disorders was explained by underlying vulnerabilities to internalizing and externalizing dimensions transmitted across generations (Kendler et al., 1997). However, up to now, 9/11 research has focused on individual disorders rather than the broader internalizing and externalizing dimensions, leaving unknown whether 9/11 effects are primarily through these domains, whether such effects differ between the internalizing or externalizing domains, and whether additional effects would be found for specific individual disorders. Further, differential effects on the internalizing and externalizing dimensions among those directly or indirectly exposed to 9/11 remain unknown. Addressing such questions is important not only to understanding 9/11 effects, but to building broader knowledge about the effects of large-scale traumatic events that affect major segments of the general population.

Incorporation of prior risk factors including negative childhood events (e.g., childhood maltreatment, parental psychopathology) can aid in building this understanding. Studies indicate that individuals who experience an earlier negative life event may be more sensitized to the effects of a subsequent trauma, and therefore more likely to develop mental health problems. This process has been termed *stress sensitization* (Van Winkel et al., 2008; Heim and Nemeroff, 2009; Pratchett and Yehuda, 2011). For example, several studies found that childhood maltreatment moderates the association between an adult traumatic event and adult psychopathology, such that those who experienced childhood maltreatment have more severe symptoms after later trauma than those who did not experience maltreatment (Keyes et al., 2014; Pratchett and Yehuda, 2011; Young-Wolff et al., 2012; van Winkel et al., 2013). However, stress sensitization has not been examined in the context of an unanticipated, mass traumatic event such as 9/11. Evidence that negative childhood experiences moderate risk associated with direct and indirect exposure to events such as 9/11 would assist in the identification of individuals at risk of adverse psychological outcomes, and provide further insight into the concept of stress sensitization.

We therefore investigated two research questions related to 9/11 exposure and subsequent psychiatric disorders in a sample of household residents in the US, the National Epidemiologic Study on Alcohol Related Conditions (NESARC). Our first goal was to examine the association between direct and indirect 9/11 exposure and post-9/11 onsets of psychopathology in the internalizing and externalizing dimensions of psychiatric and substance use disorders, prior to and after accounting for childhood maltreatment and/or parental history of mental illness (depression, alcohol or drug dependence, antisocial behavior). Our second goal was to investigate whether the experience of childhood

maltreatment increased risk for externalizing and internalizing disorders associated with greater exposure to 9/11 (i.e. stress sensitization).

## 2. Methods

### 2.1. Study design and sample

NESARC is a survey of non-institutionalized US adults residing in homes or group quarters. NESARC data were collected at two time points: Wave 1 (2001–2002) with 43,093 participants and Wave 2 (2004–2005) with 34,653 of the original participants (cumulative Wave 2 response rate, 70.2%). Young, Black and Hispanic individuals were oversampled. Data were weighted to reflect the demographic characteristics of the US population based on the 2000 census (Grant et al., 2004; Grant et al., 2005). The research protocol, including written informed consent, received approval from the US Census Bureau and the US Office of Management and Budget. Further study details are described elsewhere (Grant et al., 2004; Grant et al., 2005; Ruan et al., 2008).

The present study included Wave 2 participants, as the Wave 2 interview included all relevant variables. Of the 34,653 participants assessed at Wave 2, 46.0% ( $N = 15,940$ ) had a prior psychiatric diagnosis (lifetime), and were excluded from the present analyses. This was done so that we can specifically examine the lifetime onset of psychiatric symptoms following 9/11 exposure, versus the reoccurrence of prior lifetime psychiatric symptoms. The present analyses included 18,713 participants with no history of psychiatric disorders prior to 9/11. As shown in Table 1, participants were 58% female with an age range of 21–90 (Mean = 49.1, Standard Deviation (SD) = 17.3). White participants comprised 58.2% of the sample, African Americans 19.0%, Hispanics 18.4%, Asian or Pacific Islanders 2.8% and American Indians and Alaska Natives 1.7%.

### 2.2. Measures

Participants were interviewed in person with the Alcohol Use Disorder and Associated Disabilities Interview Schedule, DSM-IV version (AUDADIS-IV), a fully structured instrument designed for lay interviewers.

#### 2.2.1. Outcomes

**2.2.1.1. Psychiatric disorders.** Psychiatric disorders were defined using the DSM-IV criteria (American Psychological Association, 2000), as assessed by the AUDADIS-IV (Grant et al., 2003), including alcohol dependence (AD), cannabis dependence (CD), nicotine dependence (ND), and antisocial personality disorders (ASPD), major depressive disorder (MDD), generalized anxiety disorder (GAD), and post-traumatic stress disorder (PTSD), as described elsewhere (Compton et al., 2005; Grant et al., 2005; Hasin et al., 2006). AUDADIS diagnoses have fair to excellent test–retest reliability ( $k = 0.42–0.84$ ) in clinical and general population samples (Hasin et al., 2007, 2012), and good to excellent validity in US (Hasin et al., 1994, 1997b; Hasin and Paykin, 1999; Canino et al., 1999; Grant et al., 2003; Ruan et al., 2008) populations. We analyzed disorders with lifetime initial onset after 9/11.

#### 2.2.2. Predictors

**2.2.2.1. 9/11 Exposure.** Questions on 9/11 included the type of exposure to the attacks. From these, we used an ordinal NESARC 9/11 variable with four exposure levels, as described elsewhere (Henriksen et al., 2010): (1) No exposure; (2) Indirect exposure through media, news, etc.; (3) Had a close friend or family member injured or killed; and (4) Direct exposure (respondent at the scene

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