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Short communication

Exposure to mass disaster and probable panic disorder among children in New York City

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ABSTRACT

While both direct and indirect exposure to mass trauma are increasing in the United States, relatively little is known about the potential link between mass trauma and risk of panic disorder early in life. It is also unclear whether history of prior individual trauma increases risk of panic disorder even further among those with exposure to mass trauma. The current study investigated the association between exposure to a mass trauma event (the World Trade Center (WTC) attack) and risk of panic disorder among children, how panic disorder varies by exposure severity and sociodemographic characteristics, and whether there is an interaction between individual and mass trauma exposure in the risk of panic disorder. Data were from an epidemiologic study of probable mental disorders among New York City schoolchildren exposed to the WTC terrorist attack. Severe (adjusted odds ratio [AOR] = 2.0 (1.1, 3.7)) exposure to the WTC disaster was associated with increased odds of probable panic disorder, relative to mild exposure. The prevalence of panic disorder increased with higher level of WTC exposure among all sociodemographic strata. Prior individual trauma exposure was associated with increased odds of panic disorder (AOR = 2.4 (1.6, 3.5)), but there was no evidence of interaction between prior individual trauma exposure and exposure to the WTC disaster. Preventive measures to address the widespread nature of mass disaster exposure at increasingly earlier ages and via media could mitigate the potential impact on mental health.

1. Introduction

Panic disorder is associated with significant impairment and distress (Kinley et al., 2009), increased risk of the onset of a wide range of mental and substance use disorders (Goodwin and Gotlib, 2004; Goodwin and Hamilton, 2002), as well as a more severe course of psychotic (Goodwin and Davidson, 2002; Goodwin et al., 2002; Goodwin et al., 2003), substance use (Goodwin et al., 2002), personality (Goodwin et al., 2005a), anxiety and mood disorders (Bittner et al., 2004; Goodwin et al., 2004a, 2004b). Panic disorder tends to have a fairly early onset, and several studies suggest that early treatment can decrease the risk of subsequent anxiety and mood disorders (Goodwin and Olfson, 2001; Goodwin and Gorman, 2002). As such, efforts to identify those at higher risk of panic disorder early in life have substantial prevention and treatment implications for at-risk youth.

There has been growing interest in the possible links between exposure to individual traumatic life events and the risk of panic disorder (Asselmann et al., 2016; Beesdo et al., 2010; Friedman et al., 2002; Goodwin et al., 2005a; Reifels et al., 2019). Data from clinical and community samples of adults with panic disorder find high rates of retrospective reporting of traumatic life experiences dating back to early childhood (Asselmann et al., 2016; Bandelow et al., 2002; Biederman

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et al., 2005; Friedman et al., 2002; Leskin and Sheikh, 2002). A number of community-based longitudinal studies following individuals from childhood to adulthood have shown that traumatic experiences early in life are associated with increased risk of panic disorder onset and severity later in life (e.g., Goodwin et al., 2005b).

While studies of adults have linked individual trauma exposure, including retrospective reports of childhood trauma exposure, to risk of panic disorder, few studies have examined whether and to what degree exposure to mass disaster may increase the risk of panic disorder among children and adolescents. Among adolescents in China, direct witnessing of "tragic scenes" related to an earthquake was associated with panic disorder (Geng et al., 2018). Other than witnessing, little is known about different types of trauma exposure, including indirect exposure, and their association with panic disorder. An example of indirect exposure to a mass disaster would be a child who is more than 15 miles from Ground Zero during the World Trade Center (WTC) terrorist attacks on September 11, 2001 hearing about the attacks and realizing that a loved one was at the scene of the disaster.

Given that individual trauma history is associated with increased risk of panic disorder, it is conceivable that those with both exposures may have a differential risk (greater or lower) than those without prior exposure, and that there could be an interaction between prior and mass trauma exposure in the risk of panic disorder. Prior exposure could protect against risk of panic disorder in the context of exposure to mass trauma, potentially via habituation (i.e., previous trauma exposures leading to lower response to later collective traumas (Andersen et al., 2013; Cheetham-Blake et al., 2019)), making the individual more prepared to cope with mass trauma. For example, children who reported past stress had lower anticipatory cortisol response to a laboratory stress test than children without past stress (Cheetham-Blake et al., 2019). Alternatively, prior trauma could lead to greater vulnerability if trauma has a purely cumulative effect in relation to panic disorder. For example, prior exposure to collective trauma events (e.g., WTC terrorist attacks, Sandy Hook school shooting) is associated with greater acute stress responses to later collective trauma events among adults (Garfin et al., 2015, 2020). It is also conceivable that this effect may differ by sociodemographic characteristics (e.g., gender, school grade). Given that young persons are potentially increasingly directly and indirectly exposed to mass disaster and trauma, especially through instant messaging and social media, understanding the impact of mass trauma, prior trauma, and the potential interaction between the two on panic disorder in youth is increasingly relevant for prevention and early mental health intervention planning.

Against this background, the current study will begin to fill this gap with three main objectives. First, the study will examine the relationship between exposure to mass trauma and panic disorder in children by investigating whether level of direct and indirect exposure to the WTC mass trauma is associated with vulnerability to panic disorder. Second, the study will examine whether there is an interaction between prior trauma and mass trauma exposure in the odds of panic disorder. Third, the study will examine whether the impact of mass trauma exposure on vulnerability to panic disorder varies by sociodemographic characteristics.

2. Methods

Data were drawn from students (N = 6991) grades 6–12 who participated in a New York City Board of Education post-September 11 needs assessment study. Details of the study's methodology and a description of the total sample (N = 8236) of students in grades 4–12 are given elsewhere (Hoven et al., 2005). The survey was conducted six months after the WTC attacks in New York City (NYC) on September 11, 2001 at school. Questionnaires included items related to WTC exposure, mental disorders, history of trauma, sociodemographic characteristics, family composition, and use of mental health services. Participation was anonymous. This study was conducted in full compliance with the institutional review boards of Columbia University–New York State Psychiatric Institute (NYC) and the New York City Department of Education and the New York State Office of Mental Health Committee for WTC-Related Research (Albany). This study was also carried out in accordance with the latest version of the Declaration of Helsinki, and informed consent of the parents and assent of the children were obtained after the nature of the study had been fully explained.

2.1. WTC mass trauma exposure

To assess exposure to the WTC attack, we defined three exposure variables. The primary measure of exposure was a three-level variable (severe, moderate, mild) combining direct and indirect exposures. "Direct Exposure" was defined as the following experiences: having personally witnessed the attack, been hurt in the attack, been in or near the cloud of dust and smoke, been evacuated to safety, or been extremely worried about the safety of a loved one. "Indirect Exposure" was defined as having a family member killed or injured in the attack, or a family member witnessing the attack but escaping unharmed. Each exposure was reported independently. A participant's level of WTC exposure was then classified as severe if they experienced two or more direct and/or one or more indirect exposures, moderate if they experienced only one direct and no indirect exposure, and mild if they experienced neither direct nor indirect exposure (Hoven et al., 2005). Two additional categories of exposure to the WTC attack were assessed: "Media Exposure" was defined as having spent "a lot of time" watching coverage of the attack, and "School Attended" was defined by attendance at a school in the Ground Zero area.

2.2. Panic disorder

Past-month probable panic disorder was assessed using the Diagnostic Interview Schedule for Children Predictive Scales (DPS) (Lucas et al., 2001). The DPS includes Diagnostic Interview Schedule for Children (DISC-IV) items most predictive of Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV) DISC diagnoses (Shaffer et al., 2000). The panic disorder items were introduced with a description of a panic attack, followed by questions about experiences in the last four weeks: "Have you had a feeling when, all of a sudden, you felt very afraid or in a panic … even though there was nothing around to frighten you?" (yes/no), "Have you had a time when you suddenly felt that you were suffocating or you couldn't breathe?" (yes/no). A student was considered to have probable panic disorder if they had positive screening results for either of the two panic symptoms. The term "panic disorder" is used throughout for ease of language.

2.3. Individual trauma history

Prior individual trauma exposure was assessed using the University of California, Los Angeles (UCLA) Adolescent Trauma Exposure Schedule (Saltzman et al., 1999), and included history of severe injury in violent circumstance, having lived through war, and additional items specific to then-recent events in NYC (e.g., AA flight 587 crash two months after September 11). Because the survey included students in grades 4–12 (only grades 6–12 reported here), the New York City Board of Education requested that the sexual trauma question be omitted.

Table 1
Probable panic disorder and sociodemographic factors among New York City public school students (Grades 6–12, N = 6991).

Sociodemographic factors, weighted %	Panic disorder, row % (n = 522, 8.0%)	OR (95% CI)
Gender		
Male (47.3%)	5.4	Ref
Female (52.7%)	10.3	2.0 (1.4, 3.0)
Grade		
Grades 9–12 (54.9%)	7.8	1.0 (0.7, 1.4)
Grades 6–8 (45.1%)	8.2	Ref
Race/Ethnicity		
White (15.9%)	7.2	Ref
Black (27.4%)	8.0	1.1 (0.6, 2.0)
Hispanic (38.7%)	9.2	1.3 (0.8, 2.1)
Asian (13.0%)	5.4	0.7 (0.4, 1.4)
Other/Mixed (4.9%)	7.9	1.1 (0.4, 2.9)
Maternal Education		
Less than high school (19.2%)	9.4	1.3 (0.8, 2.1)
High school graduate or greater (80.8%)	7.7	Ref
Lives with Both Biological Parents		
Yes (58.0%)	7.3	Ref
No (42.0%)	8.9	1.2 (0.8, 1.9)

Key: CI, confidence interval; NYC, New York City; OR, odds ratio.

2.4. Sociodemographic variables

Sociodemographic variables assessed included gender, grade in school, race/ethnicity, maternal education, and whether the child was currently living with both biological parents.

2.5. Data analysis

Prevalence of probable panic disorder was tabulated by sociodemographic factors (gender, grade level, race/ethnicity, maternal education, and living with both biological parents) and exposures (level of WTC exposure, high media exposure, attending a Ground Zero area school, and prior trauma). The association of each sociodemographic and exposure variable with probable panic disorder was tested with unadjusted logistic regression analysis. An adjusted logistic regression model including all exposures and sociodemographic factors tested the independent association of each exposure variable with probable panic disorder, adjusted for potential confounding by the sociodemographic factors. To determine whether the impact of WTC exposure level on risk of probable panic disorder varies by sociodemographic or other exposure variables, interaction product terms between level of WTC exposure and each sociodemographic variable, media exposure, attending a Ground Zero area school, and prior trauma were added to adjusted models. Stratum-specific odds ratios (ORs) and 95% confidence intervals (CIs) were computed, and statistical significance was assessed based on the p-value for the interaction term ($p<0.05$). All descriptive statistics and statistical analyses were conducted in SUDAAN version 11.0.1, taking into account the sampling strategy (strata, clustering, joint probability of selection, sampling weights, and the subpopulation of the current analysis).

3. Results

3.1. Sample characteristics

The characteristics of the sample and their exposures are shown in the first column of Table 1 (characteristics) and 2 (exposures). The proportion of the weighted sample in school grades 6–8 was 45.1%, and in grades 9–12 was 54.9%. The sex and race/ethnicity distributions were comparable to the NYC public school population at the time of the survey. The proportion of the weighted sample with severe, moderate, and mild level of WTC exposure were 28.2%, 34.5%, and 37.3% respectively (See Table 2). Only 1.5% of the weighted sample attended a Ground Zero Area school, and 67.1% of the sample had high media exposure to the event.

3.2. Prevalence of probable panic disorder

Over seven percent (n = 522) of young persons in the analytic sample met criteria for probable panic disorder. Probable panic disorder was more common among females than males (10.3% vs. 5.4%, OR = 2.0 (1.4, 3.0)); there were no other significant sociodemographic differences between youth with and without probable panic disorder (See Table 1).

3.3. WTC exposure and panic disorder

Severe (AOR = 2.0 (1.1, 3.7)) WTC exposure, relative to mild WTC exposure, was associated with increased probable panic disorder (See Table 2). Moderate WTC exposure was statistically significant only in the unadjusted model (AOR = 1.5 (1.0, 2.5); OR = 1.7 (1.1, 2.8)). High media exposure relative to low media exposure was also associated with increased odds of probable panic disorder (AOR = 1.5 (1.0, 2.3)), whereas there was no association between attendance at a Ground Zero school and probable panic disorder.

3.4. Interaction between prior trauma and WTC exposure

Prior trauma relative to no prior trauma was associated with increased odds of probable panic disorder (12.8% vs. 5.6%, AOR = 2.4

Table 2
Exposure to WTC and probable panic disorder among New York City public school students (Grades 6–12, N = 6991).

Exposure, weighted %	Panic disorder, row % (n = 522, 8.0%)	OR (95% CI)	AOR[a] (95% CI)
Level of WTC Exposure			
Severe (28.2%)	11.4	2.4 (1.4, 4.2)	2.0 (1.1, 3.7)
Moderate (34.5%)	8.4	1.7 (1.1, 2.8)	1.5 (1.0, 2.5)
Mild (37.3%)	5.0	Ref	Ref
High Media Exposure			
Yes (67.1%)	9.1	1.7 (1.1, 2.5)	1.5 (1.0, 2.3)
No (32.9%)	5.7	Ref	Ref
School Attended			
Ground Zero area school (1.5%)	6.8	0.8 (0.6, 1.1)	0.8 (0.5, 1.3)
Rest of NYC (98.5%)	8.0	Ref	Ref
Prior Trauma (≥2 items)			
Yes (33.6%)	12.8	2.5 (1.8, 3.6)	2.4 (1.6, 3.5)
No (66.4%)	5.6	Ref	Ref

Key: AOR, adjusted odds ratio; CI, confidence interval; NYC, New York City; OR, odds ratio; WTC, World Trade Center.
[a] Adjusted for gender, grade, race/ethnicity, maternal education, lives with both biological parents and all other exposures listed in the table.

(1.6, 3.5)) (See Table 2). However, there was no evidence of statistical interaction between prior trauma exposure and WTC exposure in predicting probable panic disorder. Within all sociodemographic and exposure strata, the prevalence of probable panic disorder increased with higher level of WTC exposure.

4. Discussion

The present study is among the first to examine the association between exposure to a mass trauma (i.e., exposure to September 11) and probable panic disorder in a representative sample of youth in NYC. First, we found that severe exposure and high media exposure to WTC were associated with increased odds of probable panic disorder among school children in NYC six months after the event. Second, prior trauma exposure was associated with increased odds of probable panic disorder, but there was no evidence of statistical interaction between prior trauma and WTC exposure in vulnerability to probable panic disorder following the WTC attack. While a known link exists between mass trauma exposure and post-traumatic stress disorder among youth, these are the first data to show a link between a history of mass trauma and increased likelihood of panic disorder in a representative sample of children. Below, we discuss the findings in greater detail and their potential implications.

Previous studies have examined the relationship between individual traumatic events and the risk of panic attack and panic disorder in subsequent years (Asselmann et al., 2016; Beesdo et al., 2010; Copeland et al., 2013; Goodwin et al., 2005a). The vast majority of studies looking at the links between traumatic experiences and panic disorder have examined individual trauma experiences (i.e., child abuse and victimization), rather than exposure to a mass/community-based trauma event. The results of this study suggest evidence for a sensitization model of the impact of past trauma on reactions to current trauma (Garfin et al., 2015, 2020), such that previous traumatic events are associated with greater risk of panic disorder among children. As exposure to mass disaster events has risen in recent years, understanding the potential impact of these exposures (including media exposure, which may cause continuous acute stress (Holman et al., 2014; Pfefferbaum 2020)) on youth is urgently needed for service planning and mitigation of secondary effects of trauma exposure.

It is important to note methodologic limitations of this work when considering implications of these findings. First, while the measure of panic disorder is well validated, we can only be confident of the level of a "probable diagnosis". Second, in the absence of baseline assessment prior to September 11 and data on pre-existing mental health conditions, no causal conclusions can be drawn about the link between exposure and subsequent mental health problems. Third, while an examination of the relationship of panic disorder and post-traumatic stress disorder would be meaningful given symptom overlap, this paper was not able to address this topic. Fourth, although we collected information on a wide range of correlates, it is conceivable that there are factors contributing to the association we observed that were not assessed (e.g., family history of panic disorder).

5. Conclusion

Findings of this study have clear implications for clinical work and research concerning the associations between mass trauma and panic disorder. From a clinical perspective, these data suggest that children exposed to mass trauma are at increased risk for development of panic disorder, and those with a history of trauma are particularly vulnerable. Since there are effective treatments for panic disorder (James et al., 2015), it may be clinically appropriate to focus on panic disorder among children in psychological evaluations and care in the aftermath of a massive traumatic event. Given the increase in both direct and indirect exposure to mass traumas (e.g., media exposure) and the association of panic disorder with subsequent psychiatric problems among youth, successful intervention may have long-term implications.

Contributions

Renee D. Goodwin: conceptualization, writing - original draft; Keely Cheslack-Postava: conceptualization, data curation, formal analysis; George J. Musa: data curation, investigation, project administration; Ruth Eisenberg: data curation, formal analysis; Michaeline Bresnahan: writing – original draft; Judith Wicks: investigation; Andrea H. Weinberger: writing – revising/editing; Bin Fan: data curation, formal analysis; Christina W. Hoven: conceptualization, funding acquisition, investigation, project administration, writing – revising/editing

Declarations of interest

None.

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