

# Attack-Related Life Disruption and Child Psychopathology in New York City Public Schoolchildren 6-Months Post-9/11

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In the aftermath of disasters, understanding relationships between disaster-related life disruption and children's functioning is key to informing future postdisaster intervention efforts. The present study examined attack-related life disruptions and psychopathology in a representative sample ( $N=8,236$ ) of New York City public schoolchildren (Grades 4–12) surveyed 6 months after September 11, 2001. One in 5 youth reported a family member lost their job because of the attacks, and 1 in 3 reported their parents restricted their postattack travel. These forms of disruption were, in turn, associated with elevated rates of probable posttraumatic stress disorder and other anxiety disorders (and major depressive disorder in the case of restricted travel). Results indicate that adverse disaster-related experiences extend beyond traumatic exposure and include the prolonged ripple of postdisaster life disruption and economic hardship.

Future postdisaster efforts must, in addition to ensuring the availability of mental health services for proximally exposed youth, maintain a focus on youth burdened by disaster-related life disruption.

Destructive occurrences that disrupt and overwhelm entire communities at once confront every society and collectively affect as many as 33 million individuals worldwide in a given year (International Federation of Red Cross and Red Crescent Societies, 1998). When such disasters strike, a great many youth are in close proximity and are vulnerable to directly witnessing massive destruction, seeing dead or injured, being involved in a school evacuation or removal to shelter, losing a loved one, or viewing physical damage or ruins. Research consistently links such direct disaster-related exposure to a wide array of clinical needs, including elevated traumatic stress symptoms, functional impairments, posttraumatic stress disorder (PTSD), and host of other mental disorders (Comer & Kendall, 2007; Hensley & Varela, 2008; Hoven et al., 2005; Hsu, Chong, Yang, & Yen, 2002; La Greca, Silverman, Vernberg, & Prinstein, 1996; March, Amaya-Jackson, Terry, & Costanzo, 1997; Pfefferbaum et al., 1999; Weems & Overstreet, 2008). Much of the postdisaster literature documents a dose-response relationship between direct exposure and adverse youth outcomes, in which the prevalence of mental disorders increases with increased exposure to disaster events (e.g., La Greca, Silverman, & Wasserstein, 1998; Weems et al., 2007).

Of importance, in the aftermath of disasters, substantial numbers of youth not proximally exposed to disaster-related traumatic stress also exhibit elevated rates of psychopathology and functional impairments (Comer & Kendall, 2007; Hoven et al., 2005; Lengua, Long, Smith, & Meltzoff, 2005; Pfefferbaum et al., 2003; Schlenger et al., 2002). To understand the full impact of disasters on the psychiatric functioning of youth, it is critical to also examine the subsequently changed ecology of child development. Unlike many adversities encountered during childhood, mass disasters may directly impact and disrupt a wide array of contexts in which child adaptation and maladaptation unfold (e.g., family, schools, neighborhood cohesion). In the aftermath of disasters, jobs are lost, schools are forced to close, freedom to travel is restricted, and families are forced to relocate.

Weems and Overstreet's (2008) contextual-ecological model of postdisaster influences on child adaptation offers a useful framework for understanding the impacts of disaster-related life disruptions on youth. This model extends Bronfenbrenner's (1979) ecological model of human development to emphasize the multiple levels of influence on child adaptation in the aftermath of

disaster. Specifically, postdisaster adaptation is believed to unfold within a series of disaster-affected contexts varying in proximity to the child. Contexts proximal to the child (e.g., family) are embedded within distal contexts (e.g., community, society). The macrosystem refers to the most distal contexts and includes cultural values and beliefs that may indirectly affect children's postdisaster adaptation (e.g., prejudice and discrimination in the aftermath of Hurricane Katrina; Weems, Watts, et al., 2007). The exosystem includes contexts in which the child does not actively participate but in which disaster-related disruptions can nonetheless exert considerable indirect influence (e.g., postdisaster financial strain at a parent's place of work, which can in turn greatly affect family stress). The microsystem refers to proximal contexts of development (e.g., family, school), and the mesosystem refers to linkages among various microsystems (e.g., links between family and school). The ontogenic level constitutes factors within the individual (e.g., biology, coping style) that influence postdisaster adaptation.

Understanding the impact of disaster-related life disruptions on child psychopathology within an ecological framework is critical, yet only a limited number of studies have systematically evaluated such life disruptions after accounting for traumatic exposure to disaster events (e.g., Assanangkornchai, Tangboonngam, & Edwards, 2004; Bokszanin, 2002; La Greca et al., 1996). For example, La Greca and colleagues found considerable numbers of surveyed youth reported disaster-related life disruption 7 months after Hurricane Andrew (e.g., roughly one third reported that damages to their home remained unfixed), and such disruptions accounted for 5% of the variance in PTSD symptoms after accounting for traumatic exposure. Of importance, research has failed to sufficiently address disaster-related life disruptions using population-based sampling and structured diagnostic interview methods. Samples of youth studied in the aftermath of disasters have typically been limited in size and distribution of exposure, precluding population-based consideration of the impact of disaster-related life disruptions beyond the impact associated with direct child exposure or exposure of family members. Moreover, as noted elsewhere (e.g., Comer & Kendall, 2007; La Greca, 2007), there is a shortage of quality research examining postdisaster life disruptions as they relate to youth outcomes beyond PTSD.

The terrorist attacks of September 11, 2001, offer a unique opportunity to examine important relationships

between disaster-related life disruption and children's psychiatric functioning and can inform future postdisaster intervention efforts within a contextual-ecological framework. The tremendous human loss at the site of the World Trade Center (WTC) attacks was followed by a prolonged ripple of economic hardship and disrupted infrastructure throughout the entire New York City (NYC) region (Bram, Orr, & Rapaport, 2002), affecting the ecology of child development at multiple levels. Exosystem influences for NYC youth include the profoundly affected local labor market. Approximately 18,000 businesses were dislocated, disrupted, or destroyed. In the 3 months following the attacks, layoffs directly and indirectly attributable to the attacks reached record highs, with New York families suffering approximately 430,000 job losses and \$2.8 billion in lost wages (Makinen, 2002). Micro- and mesosystem influences include strains and disruptions in the family, school, and travel. At the time of the attacks, approximately 750,000 public schoolchildren were reliant on daily public transportation (Hoven, 2003). Damaged subway lines, collapsed subway tunnels, and the destruction of a key subway hub in Lower Manhattan substantially disrupted the speed and facility with which individuals were able to travel throughout the city. Fears of additional attacks led to further restriction of travel. All NYC public schools closed on the day of the attacks, and numerous schools, housing thousands of students, were forced to close for extended periods.

The present analysis examines links between attack-related life disruption and child psychopathology in a large representative sample of New York City public schoolchildren 6 months following the terrorist attacks of September 11, 2001. A previous analysis of data from this sample (Hoven et al., 2005) showed that 6 months following the 9/11 attacks, probable PTSD was identified in roughly 11% of NYC schoolchildren, probable depression was identified in roughly 8%, and probable conduct disorder was identified in roughly 13%. Of importance, this previous analysis did not evaluate associations between postdisaster ecological disruptions and child psychopathology. In the present analysis, we examined five forms of WTC attack-related life disruptions at three ecological levels of child development. Specifically, at the exosystem level of influence, we examined family job loss; at the mesosystem level of influence, we examined restricted travel; and at the microsystem level of influence, we examined family relocation, school closure, and school relocation. We examined relationships between these five forms of postattack life disruptions and probable PTSD, other anxiety disorders, major depression, and conduct disorder. It was hypothesized that attack-related life disruptions at the exo-, meso-, and microsystem levels

of influence would be highly prevalent in NYC public schoolchildren 6 months following the 9/11 attacks and that each form of attack-related life disruption would in turn be associated with elevated rates of probable PTSD, other anxiety disorders, major depression, and conduct disorder, even after accounting for direct and family-based exposure to the attacks.

Secondary analyses evaluated the potential role of gender in moderating associations between life disruptions and child psychopathology. Previous postdisaster work shows girls are at greater risk for internalizing disorders, whereas boys are at greater risk for externalizing disorders (e.g., Hoven et al., 2005). Accordingly, we hypothesized that associations between attack-related life disruptions and probable anxiety and mood disorders would be higher among girls and that associations between attack-related life disruptions and probable conduct disorder would be higher among boys.

## METHOD

### Participants

At the time of the attacks, more than 1.1 million students were enrolled in the NYC public school system across 1,193 schools, with an estimated 716,189 enrolled in Grades 4 through 12. Data are drawn from Hoven and colleagues' (2005) representative sample of the NYC public school student population enrolled in Grades 4 through 12 (excluding those attending special education schools) 6 months after September 11, 2001. Details of the sampling frame, developed in collaboration with the Centers for Disease Control (CDC), are fully specified elsewhere (Hoven et al., 2005). A total of 102 representative schools were targeted and 94 schools participated. All students in selected classrooms were solicited for participation. By grade group, participation rates among those in school on the day of the survey ranged from 69.0% (fourth to fifth graders) to 95.8% (sixth to eighth graders). The final sample consisted of 8,236 students aged 9 to 21 years.

### Measures

The WTC Questionnaire (Hoven et al., 2002) was used to assess attack-related life disruption. Respondents were asked whether they experienced any of the following: (a) family relocation ("After the attack did you have to move out of your home?"); (b) family job loss ("Because of the attack on the WTC, has anyone in your family lost her/his job?"); (c) restricted travel ("Since September 11th, have your parents cut down on your freedom to travel around the city?"); (d) school closure ("Did you have to attend another school because your

school was closed due to the WTC attack?"); and (e) school relocation ("Have your parents moved you to a different school because of the WTC attacks?").

The Diagnostic Interview Schedule for Children (DISC) Predictive Scales (DPS; Lucas et al., 2001) was used to assess probable *Diagnosis and Statistical Manual of Mental Disorders* (4th ed. [DSM-IV]; American Psychiatric Association, 1994) mental disorders. The DPS is a self-report youth screening measure derived from the National Institute of Mental Health DISC Version IV (Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000) and includes those DISC items that are most predictive of DSM-IV DISC diagnoses (Lucas et al., 2001). For the present purposes, items in the probable PTSD module were worded to refer to the WTC attack as the anchoring traumatic event. In addition to probable PTSD, the present analyses examined probable major depressive disorder (MDD), probable conduct disorder (CD), as well as probable anxiety disorders, aside from PTSD (Other AD): separation anxiety disorder, generalized anxiety disorder, panic disorder, and/or agoraphobia.

The WTC Questionnaire was also used to collect sociodemographic data and to assess exposure to the attacks. Among other information, the WTC Questionnaire assessed (a) direct exposure—defined as two or more of the following: personally witnessed the attack, hurt in the attack, in or near the cloud of dust and smoke, evacuated to safety, or extremely worried about the safety of a loved one at time of attack; and (b) family exposure—defined as having a family member killed or injured in the attack, or escaped unharmed. Consistent with Hoven et al. (2005) direct and family exposures were combined to define levels of exposure: (a) severe exposure—defined as the presence of two or more direct and/or one or more family exposures; (b) moderate exposure—defined as the presence of one direct and no family exposure; and (c) mild exposure—defined as neither direct nor family exposure. The WTC Questionnaire also measured prior trauma, assessing exposure to six potentially traumatic stressors, such as having had a serious injury in violent circumstances or having lived through war or another major pre-9/11 disaster.

### Procedure

Study procedures were conducted under the approval of and in full compliance with the Institutional Review Boards of Columbia University–New York State Psychiatric Institute, the NYC Department of Education, and the New York State Office of Mental Health Committee for WTC-Related Research (Albany). As reported previously (Hoven et al., 2005), the sampling plan targeted the population (excluding special education schools) of New York City public school students enrolled in Grades 4 through 12

(estimated to be approximately 716,189 youth when the sampling plan was carried out) 6 months after September 11, 2001. Each of the 1,193 public schools was first assigned to one of three sampling strata.

Stratum 1, the ground zero area, comprised 15 elementary, middle, and high schools located in the immediate vicinity of the WTC. Stratum 2, high-risk areas, included schools whose students could be at elevated risk because of family exposure, geography, or other events. This stratum consisted of other schools in Manhattan below 14th Street; schools in Brooklyn along the East River facing the WTC; schools in Staten Island where a disproportionate number of police, fire, and emergency workers live; schools in Belle Harbor, Queens, where American Airlines flight 587 to the Dominican Republic crashed on November 12, 2001; and schools in Washington Heights, where more than 85,500 Dominican Republic expatriates reside, as well as the relatives of many of those who died on Flight 587. Stratum 3 comprised the schools in all other New York City areas.

Schools were sampled separately in each of the three strata. In the ground zero area strata, all eligible schools were invited to participate. In the high-risk (over-sampled) and other areas, each school was weighted according to the number of eligible students, and schools were then selected with probability proportional to size. A total of 102 schools were targeted: 15 ground zero area, 28 high risk, and 59 other area. A total of 94 schools participated. In Strata 2 and 3, three classrooms were randomly selected in each school, whereas in the ground zero area all eligible schools were selected and the method was simple random selection of classrooms. In each stratum, all students in selected classrooms were solicited for recruitment. Of 10,469 eligible students, 11% were absent on the day of the survey, a rate identical to that reported by the NYC Department of Education among 4th through 12th graders in 2001–2002. The final sample consisted of 8,236 students aged 9 to 21 years.

Active parental consent was required for participation of 4th and 5th graders, and parental notification was required for 6th through 12th graders. Students completed questionnaires within one class period. The questionnaire was read aloud for 4th and 5th graders by survey personnel as students filled in their responses. The 6th through 12th graders read and completed their own questionnaires. Prior to fielding, the questionnaire was piloted in three nonselected New York City public schools.

### Data Analysis

Frequencies of five forms of attack-related life disruption (attack-related family relocation, family job loss,

restricted travel, school closure, and school relocation) were determined. Respondents endorsing each form of attack-related life disruption were examined with respect to demographic characteristics (grade, sex, race/ethnicity), exposure to the attacks (moderate or severe), and prior trauma. In addition, frequencies of four categories of probable mental disorders (PTSD, Other AD, MDD, and CD) by were calculated for each form of attack-related life disruption. Logistic regression examined associations between attack-related life disruption and probable mental disorders, adjusting for sociodemographic characteristics, exposure to the attacks, and prior trauma. Analyses of gender moderation evaluated attack-related life disruptions by gender interactions in the prediction of probable mental disorders, after accounting for variance due to the main effects of gender and life disruptions. Due to the complex sampling of the survey, all analytic procedures were conducted using SUDAAN (Research Triangle Institute, 2004).

## RESULTS

## Prevalence of Attack-Related Life Disruption and Demographic Correlates

Among NYC public schoolchildren the prevalence of any of the five forms of attack-related life disruption 6 months post-9/11 was 40.5%. Prevalence estimates of the five forms of attack-related life disruption ranged from approximately 1% to almost 30% (family relocation = 0.72; school relocation = 1.04; school closure = 1.65; restricted travel = 17.31; family job loss = 28.86). The distribution of sociodemographic and trauma-related factors associated with five forms of attack-related life disruption are presented in Table 1. Girls were more likely than boys to report that their parents restricted their travel because of the attacks (roughly 34% vs. 23%),  $\chi^2 = 19.30$ ,  $p < .001$ , and that someone in their family lost his or her job because of the attacks (roughly 20% vs. 15%),  $\chi^2 = 7.91$ ,  $p < .01$ .

TABLE 1  
Weighted Percentages of Five Forms of World Trade Center Attack-Related Life Disruption Associated With Demographic Characteristics in 8,236 New York City Public School Children, 6 Months Post-9/11

	No. of Respondents (Weighted)	Family Relocation <sup>a</sup> % (SE)	School Closure <sup>b</sup> % (SE)	School Relocation <sup>c</sup> % (SE)	Restricted Travel <sup>d</sup> % (SE)	Family Job Loss <sup>e</sup> % (SE)
Grade Group						
4-5	2,085	0.76 (0.61)	1.23 (0.65)	0.89 (0.44)	34.49 (5.49)	17.95 (2.11)
6-8	2,774	0.90 (0.46)	0.48 (0.23)	1.82 (0.52)	30.52 (2.32)	17.20 (1.72)
9-12	3,377	0.53 (0.25)	2.86 (0.76)	0.48 (0.33)	24.04 (1.98)	17.00 (1.59)
Sex						
Female	4,374	0.50 (0.23)	1.45 (0.42)	0.94 (0.34)	33.67 (2.01)	19.72 (1.24)
Male	3,862	0.96 (0.35)	1.86 (0.39)	1.15 (0.46)	23.40 (2.25)	14.55 (1.41)
Race/Ethnicity						
African American	2,302	0.74 (0.39)	0.89 (0.42)	1.02 (0.60)	26.09 (3.40)	17.57 (1.77)
Latino	3,302	0.60 (0.34)	1.44 (0.56)	1.02 (0.42)	29.87 (2.01)	18.82 (1.26)
White	1,102	0.88 (0.50)	2.28 (0.54)	1.17 (0.71)	29.55 (2.80)	14.61 (2.48)
Asian	1,058	0.80 (0.64)	3.34 (1.14)	0.85 (0.55)	30.39 (3.27)	13.50 (2.08)
Mixed/Other	472	0.83 (0.70)	1.51 (0.92)	1.33 (1.18)	30.18 (5.75)	20.35 (4.65)
Living With Both Biological Parents						
Yes	5,040	0.58 (0.28)	1.95 (0.45)	0.96 (0.30)	29.99 (2.34)	16.43 (1.21)
No	3,196	0.93 (0.36)	1.17 (0.35)	1.16 (0.46)	27.06 (2.10)	18.72 (1.49)
Maternal Education						
<12 years	1,404	0.60 (0.36)	1.89 (0.89)	0.96 (0.71)	29.12 (2.54)	19.67 (2.33)
>12 years	6,831	0.74 (0.28)	1.59 (0.29)	1.05 (0.32)	28.80 (2.02)	16.82 (1.28)
Attack Exposure						
Moderate or Severe	5,490	0.87 (0.32)	2.16 (0.36)	1.15 (0.32)	33.05 (2.21)	20.55 (1.21)
Mild or None	2,746	0.41 (0.25)	0.62 (0.47)	0.81 (0.40)	20.39 (1.90)	10.87 (1.40)
Prior Trauma						
Yes	2,520	1.04 (0.47)	1.28 (0.35)	1.01 (0.48)	31.69 (2.26)	22.25 (2.02)
No	5,716	0.57 (0.20)	1.81 (0.44)	1.05 (0.30)	27.59 (2.09)	15.14 (1.15)

Note: Weighted data; % refer to row percentages.

<sup>a</sup>N = 58.

<sup>b</sup>N = 135.

<sup>c</sup>N = 79.

<sup>d</sup>N = 2,291.

<sup>e</sup>N = 1,391.

TABLE 2  
 Frequency of Probable Child Mental Disorders by Five Forms of Attack-Related Life Disruption in 8,236 New York City Public School Children, 6 Months Post-9/11

	No. of Respondents (Weighted)	Probable PTSD <sup>a</sup> % (SE)	Probable Other AD <sup>b</sup> % (SE)	Probable MDD <sup>c</sup> % (SE)	Probable CD <sup>d</sup> % (SE)
Family Relocation					
Yes	58	19.73 (10.30)	33.55 (14.58)	7.92 (7.96)	12.02 (9.21)
No	8,110	10.47 (1.51)	25.30 (1.36)	8.02 (0.96)	12.79 (1.33)
School Closure					
Yes	135	17.43 (5.97)	32.37 (6.23)	13.20 (5.59)	15.23 (6.22)
No	8,055	10.43 (1.50)	25.25 (1.36)	7.97 (0.97)	12.71 (1.28)
School Relocation					
Yes	79	18.56 (9.22)	41.10 (11.54)	13.73 (10.14)	8.77 (7.79)
No	7,512	10.63 (1.57)	25.21 (1.43)	7.94 (1.02)	12.71 (1.28)
Restricted Travel					
Yes	2,291	21.36 (2.94)	39.90 (2.98)	12.95 (1.91)	14.66 (2.05)
No	5,648	6.27 (1.03)	19.78 (1.14)	6.34 (0.90)	12.04 (1.34)
Family Job Loss					
Yes	1,391	17.47 (2.87)	36.36 (2.94)	11.47 (1.97)	16.05 (2.15)
No	6,645	9.00 (1.44)	22.95 (1.49)	7.43 (1.03)	12.03 (1.31)

Note: Weighted sample sizes and frequencies; % refer to row percentages. PTSD = posttraumatic stress disorder; Other AD = separation anxiety disorder, generalized anxiety disorder, panic disorder, and/or agoraphobia; MDD = major depressive disorder; CD = conduct disorder.

<sup>a</sup>N = 870.

<sup>b</sup>N = 2,089.

<sup>c</sup>N = 666.

<sup>d</sup>N = 1,052.

Distributions for respondents who experienced school closure differed from respondents who did not with regard to grade,  $\chi^2 = 8.35, p < .05$ , and race/ethnicity,  $\chi^2 = 10.11, p < .05$ . As compared to respondents who did not experience school closure, higher proportions of 9th to 12th graders and Asian students, and lower proportions of African American students, reported that they had to attend another school because of attack-related school closures. Distributions for respondents who experienced restricted travel differed from respondents who did not with regard to grade,  $\chi^2 = 6.40, p < .05$ , with higher proportions of fourth and fifth graders reporting that since the attacks their parents restricted their freedom to travel. Those reporting moderate or severe exposure to the attacks were more likely than those reporting mild or no exposure to report school closure (roughly 2% vs. 1%),  $\chi^2 = 12.62, p < .001$ ; restricted travel (roughly 33% vs. 20%),  $\chi^2 = 20.13, p < .001$ ; and family job loss (roughly 21% vs. 11%),  $\chi^2 = 24.51, p < .001$ . In addition, those with prior trauma histories were more likely than those without prior trauma histories to report family job loss (roughly 22% vs. 15%),  $\chi^2 = 8.18, p < .001$ .

Child Psychopathology and Attack-Related Life Disruption

Probable PTSD, Other AD, MDD, and CD were respectively identified in 10.6%, 25.4%, 8.1%, and

12.8% of NYC public school children (previously reported in Hoven et al., 2005). Frequencies of these probable mental disorders, as associated with the five forms of attack-related life disruption, are presented in Table 2. Respondents reporting that their parents restricted their travel following the attacks exhibited significantly higher rates of probable PTSD ( $\chi^2 = 26.28, p < .001$ ), Other AD ( $\chi^2 = 33.19, p < .001$ ), and MDD ( $\chi^2 = 12.96, p < .001$ ) than respondents who did not report restricted travel. Among youth reporting restricted travel, the prevalence of probable PTSD was roughly three times greater, and the rates of probable Other AD and probable MDD were roughly two times greater, than in youth whose travel was not restricted. Respondents reporting that someone in their family lost their job because of the WTC attacks exhibited significantly higher rates of probable PTSD ( $\chi^2 = 11.64, p < .001$ ), Other AD ( $\chi^2 = 19.88, p < .001$ ), and MDD ( $\chi^2 = 4.35, p < .05$ ) than respondents who did not report family job loss.

Logistic regression analyses examined associations between probable mental disorders and attack-related life disruption after adjusting for sociodemographic characteristics, exposure to the attacks, and prior trauma (unadjusted and adjusted associations presented in Table 3). After adjusting for sociodemographic characteristics, exposure to the attacks, and prior trauma, significant associations were retained for probable PTSD, Other AD, and MDD. Youth whose parents

TABLE 3  
Unadjusted and Adjusted Associations Between Attack-Related Life Disruption and Probable Child Mental Disorders in 8,236 New York City Public School Children, 6 Months Post-9/11

	Probable Disorder											
	PTSD			Other AD			MDD			CD		
	OR <sup>a</sup> (95% CI)	AOR <sup>b</sup> (95% CI)	OR <sup>a</sup> (95% CI)	AOR <sup>b</sup> (95% CI)	OR <sup>a</sup> (95% CI)	AOR <sup>b</sup> (95% CI)	OR <sup>a</sup> (95% CI)	AOR <sup>b</sup> (95% CI)	OR <sup>a</sup> (95% CI)	AOR <sup>b</sup> (95% CI)	OR <sup>a</sup> (95% CI)	AOR <sup>b</sup> (95% CI)
Family Relocation	2.10 (0.55,7.97)	1.58 (0.39,6.46)	1.49 (0.41,5.36)	1.26 (0.35,4.59)	0.99 (0.12,8.38)	0.90 (0.10,8.08)	0.93 (0.16,5.48)	0.75 (0.13,4.46)	1.23 (0.49,3.08)	1.38 (0.44,4.29)	1.25 (0.93,1.69)	1.16 (0.41,3.28)
School Closure	1.81 (0.80,4.11)	1.81 (0.74,4.41)	1.42 (0.83,2.43)	1.36 (0.75,2.47)	1.76 (0.67,4.63)	1.76 (0.67,4.63)	1.76 (0.67,4.63)	1.76 (0.67,4.63)	1.76 (0.67,4.63)	1.76 (0.67,4.63)	1.76 (0.67,4.63)	1.76 (0.67,4.63)
School Relocation	1.92 (0.55,6.69)	1.53 (0.41,5.77)	2.07 (0.80,5.35)	1.96 (0.70,5.48)	1.85 (0.34,9.93)	2.05 (0.37,11.34)	0.66 (0.10,4.58)	0.64 (0.08,4.82)	2.05 (0.37,11.34)	2.05 (0.37,11.34)	2.05 (0.37,11.34)	2.05 (0.37,11.34)
Restricted Travel	4.06*** (2.87,5.73)	3.19*** (2.18,4.68)	2.69*** (2.07,3.50)	2.27*** (1.73,2.97)	2.20*** (1.54,3.14)	1.90** (1.30,2.77)	1.25 (0.93,1.69)	1.30 (0.95,1.79)	2.20*** (1.54,3.14)	2.20*** (1.54,3.14)	2.20*** (1.54,3.14)	2.20*** (1.54,3.14)
Family Job Loss	2.14*** (1.48,3.10)	1.64* (1.10,2.46)	1.92*** (1.42,2.59)	1.52** (1.12,2.07)	1.61* (1.05,2.47)	1.25 (0.81,1.95)	1.40* (1.02,1.92)	1.29 (0.94,1.77)	1.61* (1.05,2.47)	1.61* (1.05,2.47)	1.61* (1.05,2.47)	1.61* (1.05,2.47)

Note: Weighted data. PTSD = posttraumatic stress disorder; Other AD = separation anxiety disorder, generalized anxiety disorder, panic disorder, and/or agoraphobia; MDD = major depressive disorder; CD = conduct disorder.

<sup>a</sup>Unadjusted odds ratio.

<sup>b</sup>Odds ratio adjusted for demographic variables (age, sex, ethnicity/race, living arrangement, and maternal education), prior trauma, and exposure (moderate or severe).

\**p* < .05. \*\**p* < .01. \*\*\**p* < .001.

restricted their travel since the attacks remained roughly three times as likely to evidence probable PTSD, and were roughly twice as likely to evidence probable Other AD and MDD, than youth whose parents did not impose such restrictions. After adjustment, youth reporting family job loss remained almost twice as likely to evidence probable PTSD and Other AD. Gender did not moderate any of the associations between attack-related life disruptions and probable mental disorders ( $p > .05$ ).

## DISCUSSION

The present findings add to a growing literature documenting the heavy psychological toll that disasters impose on youth (Comer & Kendall, 2007; Hensley & Varela, 2008; Hsu et al., 2002; La Greca et al., 1996; Pfefferbaum et al., 1999; Weems & Overstreet, 2008) and suggest that adverse disaster-related experiences extend far beyond proximal contact and traumatic exposure. Using population-based sampling to survey NYC public school children 6 months after the 9/11 terrorist attacks we found that the prolonged ripple of life disruption and economic hardship that followed the attacks was strongly associated with children's mental health. Disruptions at the exo- and mesosystem levels of influences were prevalent and were associated with increased rates of child psychopathology. Roughly one in five youth reported that someone in their family had lost their job because of the attacks, and roughly one in three youth reported that their parents restricted their travel throughout the city since the attacks. These forms of life disruption were, in turn, associated with considerably elevated rates of probable PTSD and other anxiety disorders (and MDD in the case of restricted travel), even after accounting for exposures to the attacks, prior trauma, and sociodemographic characteristics.

As disasters are typically sudden and characterized by low predictability, these findings underscore the importance of consistency and routine for children in the aftermath of disasters. Disruptions in a family's economic stability, as would be expected in the event of parental job loss, may prolong the unpredictability of a child's postdisaster world, undermining their sense of safety and security. Children affected by disaster-related job loss may also be exposed to increased family stress, conflict about finances, compromised parenting practices, and parent psychopathology, each of which in turn is associated with increased psychiatric morbidity in children (Conger, Ge, Elder, Lorenz, & Simmons, 1994; McLoyd, Jayaratne, Ceballo, & Borquez, 1994; Pilowsky, Wickramaratne, Nomura, & Weissman, 2006; Solantaus, Leinonen, & Punamaki,

2004). Future work is needed to examine how key variables, such as parent stress and family functioning, moderate the direction, magnitude, and nature of associations between ecological disruptions at the micro- and mesosystem levels and children's mental health. Future work is also needed to examine the role of protective factors, such as economic resource and neighborhood cohesion, and the availability of social support, that may reduce the risk of developing mental disorders.

Transportation plays an important role in linking key microsystem levels of influence (e.g., family, school, peers). One third of the children surveyed reported that after the attacks their parents restricted their freedom to travel throughout the city, which in turn was associated with twice the likelihood of developing a probable mood or anxiety disorder. These findings are consistent with research finding children who develop an anxiety disorder are more likely to have parents who promote and encourage avoidant behavior (Barrett, Rapee, Dadds, & Ryan, 1996; Dadds, Barrett, & Rapee, 1996). Preventing children from freely moving about may deny them important corrective emotional experiences that can attenuate inflated perceptions of personal risk and general negative affect. In addition, disrupting children's normal activities may encourage social withdrawal and isolation, both associated with increased risk for the development of internalizing symptoms (Boivin, Hymel, & Bukowski, 1995; Rubin, Chen, McDougall, Bowker, & McKinnon, 1995). Moreover, parental restriction of children's travel may reflect parental fears and anxiety, and thus the present findings may reflect the transactional relationship between parent and child adjustment following a disaster.

Several forms of life disruption assessed in the WTC Questionnaire (i.e., family relocation, school closure, and school relocation) were not associated with increased rates of probable mental disorders. As compared to restricted travel and family job loss, these forms of life disruption were relatively rare among NYC public school children (~1%). Whereas the physical destruction of the 9/11 attacks was confined to the WTC area, it is possible that in the aftermath of other disasters (e.g., earthquakes, floods, hurricanes) school closures and family relocation are more prevalent, and therefore associations between these forms of life disruption and children's postdisaster adjustment may be easier to detect.

Gender did not moderate any of the associations between attack-related life disruptions and probable mental disorders. Whereas postdisaster research finds girls at greater risk for internalizing disorders and boys at greater risk for externalizing disorders (e.g., Hoven et al., 2005), our findings suggest that the strength of association between postdisaster ecological disruptions and child psychopathology is equal across boys and girls.

Several limitations warrant comment. The cross-sectional observational design does not permit causal inferences. Future work in the aftermath of disasters should conduct multiple waves of postdisaster data collection, affording prospective examination of issues related to temporal precedence and the impact of disaster-related disruption over time. In addition, associations between reported life disruption and probable mental disorders could have been inflated by shared method variance (e.g., self-report data). Moreover, the diagnostic assessment measure used, the DPS, was designed for screening purposes. Consequently the prevalence rates reported herein refer to probable, not definite, cases.

### Implications for Research, Policy, and Practice

Governmental agencies and private foundations, recognizing the needs of youth in the aftermath of disasters, provide substantial resources for child services following disasters. To ensure that the mental health needs of youth are afforded ample and appropriate attention, postdisaster resource allocation must be based in data drawn from previous disasters. Whereas traditional mental health models of disaster link mental health consequences with physical proximity to disaster (i.e., bull's eye models; Marshall et al., 2007), increasing evidence portrays a more complicated picture in which considerably elevated rates of postdisaster mental disorders are found in populations lacking direct contact with disaster events (Galea et al., 2002; Galea & Resnick, 2005; Hoven et al., 2005; Marshall et al., 2007; Neria et al., 2006; Pfefferbaum et al., 2003; Schlenger et al., 2002). The present findings suggest that in NYC in the aftermath of the 9/11 attacks, subsequent life disruptions explain substantial variance in children's psychopathology not attributable to traumatic exposure. Future efforts launched in the aftermath of disasters must, in addition to ensuring the availability of mental health services for proximally exposed youth, maintain a broad focus of identifying and treating early signs of mental disorder, and reducing barriers to effective mental health care, in youth burdened by disaster-related life disruption.

### REFERENCES

- Assanangkornchai, S., Tangboonngam, S., & Edwards, J. G. (2004). The flooding of Hat Yai: Predictors of adverse emotional responses to a natural disaster. *Stress and Health, 20*, 81-89.
- Barrett, P. M., Rapee, R. M., Dadds, M. R., & Ryan, S. M. (1996). Family enhancement of cognitive style in anxious and aggressive children. *Journal of Abnormal Child Psychology, 24*, 187-203.
- Bokszanin, A. (2002). Long-term negative psychological effects of a flood on adolescents. *Polish Psychological Bulletin, 33*, 55-61.
- Boivin, M., Hymel, S., & Bukowski, W. (1995). The roles of social withdrawal, peer rejection, and victimization by peers in predicting loneliness and depressed mood in childhood. *Development and Psychopathology, 7*, 765-785.
- Bram, J., Orr, J., & Rapaport, C. (2002). Measuring the effects of the September 11 attack on New York City. *Economic Policy Review, 8*, 5-20.
- Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.
- Comer, J. S., & Kendall, P. C. (2007). Terrorism: The psychological impact on youth. *Clinical Psychology: Science and Practice, 14*, 179-212.
- Conger, R. D., Ge, X., Elder, G. H. J., Lorenz, F. O., & Simmons, R. L. (1994). Economic stress, coercive family process, and developmental problems of adolescents. *Child Development, 65*, 541-561.
- Dadds, M. R., Barrett, P. M., & Rapee, R. M. (1996). Family process and child anxiety and aggression: An observational analysis. *Journal of Abnormal Child Psychology, 24*, 715-734.
- Galea, S., Ahern, J., Resnick, H., Kilpatrick, D., Bucuvalas, M., Gold, J., et al. (2002). Psychological sequelae of the September 11 terrorist attacks in New York City. *New England Journal of Medicine, 346*, 982-987.
- Galea, S., & Resnick, H. (2005). Posttraumatic stress disorder in the general population after mass terrorist incidents: Considerations about the nature of exposure. *CNS Spectrums, 10*, 107-115.
- Hensley, L., & Varela, R. E. (2008). PTSD symptoms and somatic complaints following Hurricane Katrina: The roles of trait anxiety and anxiety sensitivity. *Journal of Clinical Child and Adolescent Psychology, 37*, 542-552.
- Hoven, C. W. (2003). *Testimony to United States Senate, Hearing Before the Committee on Health, Education, Labor, and Pensions, Children of September 11: The Need for Mental Health Services, June 10, 2002*. New York: U.S. Government Printing Office.
- Hoven, C. W., Duarte, C. S., Mandell, D., Musa, G., Wicks, J., Wu, P., et al. (2002). *WTC-NYC Child and Adolescent Questionnaire*. New York: Columbia-University-New York State Psychiatric Institute.
- Hoven, C. W., Duarte, C. S., Lucas, C. P., Wu, P., Mandell, R. D., Goodwin, R. D., et al. (2005). Psychopathology among New York City public school children 6 months after September 11. *Archives of General Psychiatry, 62*, 545-552.
- Hsu, C. C., Chong, M. Y., Yang, P., & Yen, C. F. (2002). Post-traumatic stress disorder among adolescent earthquake victims in Taiwan. *Journal of the American Academy of Child and Adolescent Psychiatry, 41*, 875-881.
- International Federation of Red Cross and Red Crescent Societies. (1998). *World disasters report*. Oxford, England: Oxford University Press.
- La Greca, A. M. (2007). Understanding the psychological impact of terrorism on youth: Moving beyond posttraumatic stress disorder. *Clinical Psychology: Science and Practice, 14*, 219-223.
- La Greca, A. M., Silverman, W. K., Vernberg, E. M., & Prinstein, M. J. (1996). Symptoms of posttraumatic stress in children after Hurricane Andrew: A prospective study. *Journal of Consulting and Clinical Psychology, 64*, 712-723.
- La Greca, A. M., Silverman, W. K., & Wasserstein, S. B. (1998). Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *Journal of Consulting and Clinical Psychology, 66*, 883-892.
- Lengua, L. J., Long, A. C., Smith, K. I., & Meltzoff, A. N. (2005). Pre-attack symptomatology and temperament as predictors of children's responses to the September 11 terrorist attacks. *Journal of Child Psychology and Psychiatry, 46*, 631-645.
- Lucas, C. P., Zhang, H., Fisher, P. W., Shaffer, D., Regier, D. A., Narrow, W. E., et al. (2001). The DISC Predictive Scales (DPS).

- Journal of the American Academy of Child and Adolescent Psychiatry*, 40, 443-449.
- Kinien, G. (2002). *The economic effects of 9/11: A retrospective assessment*. Washington, DC: Library of Congress.
- Leach, J. S., Amaya-Jackson, L., Terry, R., & Costanzo, P. (1997). Posttraumatic symptomatology in children and adolescents after an industrial fire. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36, 1080-1088.
- Marshall, R. D., Bryant, R. A., Amsel, L., Suh, E. J., Cook, J. M., & Veria, Y. (2007). The psychology of ongoing threat: Relative risk appraisal, the September 11 attacks, and terrorism-related fears. *American Psychologist*, 62, 304-316.
- Lloyd, V. C., Jayaratne, T. E., Ceballo, R., & Borquez, J. (1994). Unemployment and work interruption among African-American single mothers: Effects on parenting and adolescent socioemotional functioning. *Child Development*, 65, 362-389.
- Maria, Y., Gross, R., Olfson, M., Gameroff, M., Wickramaratne, P., Das, A., et al. (2006). Posttraumatic stress disorder in primary care one year after the 9/11 attacks. *General Hospital Psychiatry*, 28, 213-222.
- Milowsky, D. J., Wickramaratne, P., Nomura, Y., & Weissman, M. M. (2006). Family discord, parental depression, and psychopathology in offspring: 20-year follow-up. *Journal of the American Academy of Child and Adolescent Psychiatry*, 45, 452-460.
- Pfefferbaum, B., Nixon, S., Krug, R., Tivis, R., Moore, V., Brown, J., et al. (1999). Clinical needs assessment of middle and high school students following the 1995 Oklahoma City bombing. *American Journal of Psychiatry*, 156, 1069-1074.
- Pfefferbaum, B., Seale, T. W., Brandt, E. N., Pfefferbaum, R. L., Doughty, D. E., Rainwater, S. M., et al. (2003). Media exposure in children one hundred miles from a terrorist bombing. *Annals of Clinical Psychiatry*, 15, 1-8.
- Research Triangle Institute. (2004). *Software for survey data analyses (Version 9.01)*. Research Triangle Park, NC: Author.
- Rubin, K., Chen, X., McDougall, P., Bowker, A., & McKinnon, J. (1995). The Waterloo Longitudinal Project: Predicting adolescent internalizing and externalizing problems from early and mid-childhood. *Development and Psychopathology*, 7, 751-764.
- Schlenger, W. E., Caddell, J. M., Ebert, L., Jordan, B. K., Rourke, K. M., Wilson, D., et al. (2002). Psychological reactions to terrorist attacks: Findings from the Nation Study of Americans' Reactions to September 11. *Journal of the American Medical Association*, 288, 581-588.
- Shaffer, D., Fisher, P., Lucas, C. P., Dulcan, M. K., & Schwab-Stone, M. E. (2000). NIMH Diagnostic Interview Schedule for Children Version I (NIMH DISC-IV). *Journal of the American Academy of Child and Adolescent Psychiatry*, 39, 28-38.
- Solantaus, T., Leinonen, J., & Punamaki, R. L. (2004). Children's mental health in times of economic recession: Replication and extension of the family economic stress model in Finland. *Developmental Psychology*, 40, 412-429.
- Weems, C. F., & Overstreet, S. (2008). Child and adolescent mental health research in the context of Hurricane Katrina: An ecological needs-based perspective and introduction to the special section. *Journal of Clinical Child and Adolescent Psychology*, 37, 487-494.
- Weems, C. F., Pina, A. A., Costa, N. M., Watts, S. E., Taylor, L. K., & Cannon, M. F. (2007). Predisaster trait anxiety and negative affect predict posttraumatic stress in youths after Hurricane Katrina. *Journal of Consulting and Clinical Psychology*, 75, 154-159.
- Weems, C. F., Watts, S. E., Marsee, M. A., Taylor, L. K., Costa, N. M., Cannon, M. F., et al. (2007). The psychosocial impact of Hurricane Katrina: Contextual differences in psychological symptoms, social support, and discrimination. *Behaviour Research and Therapy*, 45, 2295-2306.