Psychopathology Among New York City Public School Children 6 Months After September 11

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Context: Children exposed to a traumatic event may be at higher risk for developing mental disorders. The prevalence of child psychopathology, however, has not been assessed in a population-based sample exposed to different levels of mass trauma or across a range of disorders.

Objective: To determine prevalence and correlates of probable mental disorders among New York City, NY, public school students 6 months following the September 11, 2001, World Trade Center attack.

Design: Survey.

Setting: New York City public schools.

Participants: A citywide, random, representative sample of 8236 students in grades 4 through 12, including oversampling in closest proximity to the World Trade Center site (ground zero) and other high-risk areas.

Main Outcome Measure: Children were screened for probable mental disorders with the Diagnostic Interview Schedule for Children Predictive Scales.

Results: One or more of 6 probable anxiety/depressive disorders were identified in 28.6% of all children. The most prevalent were probable agoraphobia (14.8%), probable separation anxiety (12.3%), and probable posttraumatic stress disorder (10.6%). Higher levels of exposure correspond to higher prevalence for all probable anxiety/depressive disorders. Girls and children in grades 4 and 5 were the most affected. In logistic regression analyses, child's exposure (adjusted odds ratio, 1.62), exposure of a child's family member (adjusted odds ratio, 1.80), and the child's prior trauma (adjusted odds ratio, 2.01) were related to increased likelihood of probable anxiety/depressive disorders. Results were adjusted for different types of exposure, sociodemographic characteristics, and child mental health service use.

Conclusions: A high proportion of New York City public school children had a probable mental disorder 6 months after September 11, 2001. The data suggest that there is a relationship between level of exposure to trauma and likelihood of child anxiety/depressive disorders in the community. The results support the need to apply wide-area epidemiological approaches to mental health assessment after any large-scale disaster.

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I T HAS BEEN PROPOSED THAT THE terror itself that results from a terrorist attack elicits what is perhaps one of the attack's more profound consequences: a direct assault on the population's mental health.[1] Prior research suggests that in the context of a mass disaster, children may be an especially vulnerable group.[2-5]

Previous research has shown that direct exposure to different types of mass traumatic events is associated with an increase in posttraumatic stress symptoms among children.[6-8] Postdisaster studies have also reported elevated prevalence of physical symptoms,[3] anxiety, and depression,[4,7] which are frequently comorbid with posttraumatic stress reactions among youth.[5] Previous studies examining the results of mass trauma on child mental health have included selected or volunteer samples at the trauma site. Studies to date have not examined population-based samples; therefore, the extent to which results generalize to youth in the community, or to different levels of exposure, is not known. Moreover, previous studies have focused mainly on posttraumatic stress disorder (PTSD), and have not assessed a range of mental disorders.

Several publications have documented the impact of September 11 on adults' mental health[9-11]; studies published to date have not yet directly assessed children, although some did elicit parental reports.[10-12] This article reports the results of the New York City, NY, Department of Education (formerly the New York City Board of Education) study, which examined the prevalence of 8 prob-

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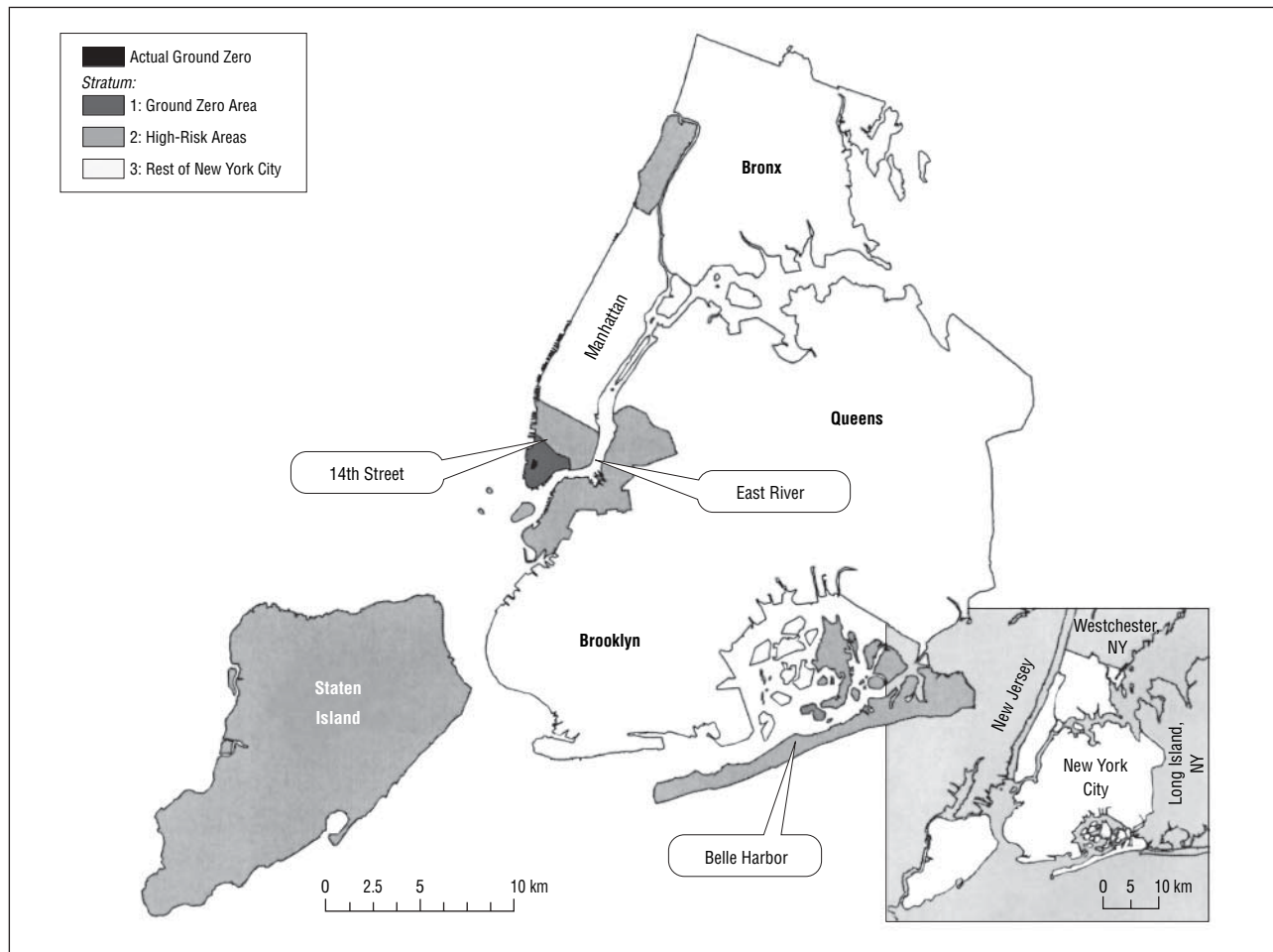
Figure 1. New York City Department of Education Survey Strata. Created by George J. Musa, Child Psychiatric Epidemiology Group, Mailman School of Public Health, Columbia University, March 1, 2003. Projection: New York–Long Island state plane (NAD83). Sources: New York City Department of City Planning and New York City Department of Education.

able mental disorders and their relationship to levels of exposure to the World Trade Center (WTC) attack in a large representative sample of New York City public school children 6 months following this disaster.

METHODS

SAMPLE

More than 1.1 million students in grades kindergarten through 12 are enrolled in New York City public schools. The sampling plan targeted the universe (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 1193 public schools was first assigned to 1 of 3 sampling strata (**Figure 1**). 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. Mainstreamed special education students were eligible for selection.

Schools were sampled separately in each of the 3 strata (**Figure 2**). In the ground zero area stratum, all eligible schools were invited to participate. In the high-risk (oversampled) and other areas strata, 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. Six refusals were in ground zero area schools (most not wanting to perpetuate a focus on September 11). Participating and nonparticipating ground zero area schools did not differ in proximity to the WTC, but all of the schools with large enrollments participated. Nonparticipating schools enrolled younger elementary school–aged students.

Participating ground zero area schools (primarily high schools) drew most (82%) of their student bodies from outside the immediate geographical area, whereas the nonparticipating ground zero area schools (primarily elementary schools) enrolled local populations. In strata 2 and 3, 3 classrooms were randomly selected in each school, while in the ground zero area

all eligible schools were selected and the method was simple random selection of classrooms (Figure 2).

In each stratum, all students in selected classrooms were solicited for recruitment. Among 10 469 eligible students, 667 parents or students refused participation prior to data collection and an additional 217 students refused participation on the day of data collection. Of the 10 469 eligible students, 1326 (11%) were absent on the day of the survey, a rate identical to that reported by the New York City Department of Education among 4th through 12th graders in 2001-2002.[13] By grade, compliance ranged from 69.02% among 4th and 5th graders (64.97%, including absentees) to 95.83% among 6th through 8th graders (87.24%, including absentees). The lowest compliance rate by both stratum and grade was 59.05% among 4th and 5th graders in the ground zero area stratum (57.94%, including absentees). The final sample consisted of 8236 students aged 9 to 21 years.

MEASURES

Mental Disorder

To assess probable mental disorder, we used the Diagnostic Interview Schedule for Children (DISC) Predictive Scales (DPS),[14] a screening measure derived from the National Institute of Mental Health's DISC Version IV,[15] a structured diagnostic interview. The DPS includes only the DISC items that are most predictive of *DSM-IV*[16] DISC diagnoses. Eight probable mental disorders were assessed: PTSD, major depression, generalized anxiety disorder, separation anxiety disorder, panic, agoraphobia, conduct disorder, and alcohol problems (abuse/dependence). The decision of which disorders to include was based, in part, on postdisaster literature and expert opinion. There was particular interest in internalizing disorders. It was also based on an understanding of the unique features of New York City and the principal investigator's conjectures about the potential September 11 consequences on children's mental health. For example, agoraphobia was assessed because approximately 750 000 public school children were known to take public transportation on a daily basis, including subways, boats, and buses, passing over bridges and waterways and through tunnels.

Psychometrics of the DPS were determined by the Stamford Schools Study (C.P.L., S. Greenwald, PhD, A. Matteo, PhD, and Miller Brotman, PhD, unpublished data, 2000-2003), a 2-stage community survey using the DPS and the DISC. The DPS scales were administered as a self-report telephone questionnaire to parents and adolescents in a nonreferred community sample. These individuals subsequently participated in a face-to-face interview based on the DISC Version IV. Sensitivity of the DPS ranged from 60% to 83.3% and specificity from 79.9% to 88.1% for probable separation anxiety, agoraphobia, generalized anxiety disorder, and alcohol abuse or dependence, regardless of impairment.[17] Three scales required modification for this study; the psychometric performance of 2 of them was also ascertained using data from the Stamford Schools Study: probable major depression (with questions substituted for suicidality) (sensitivity, 90%; specificity, 93%) and probable conduct disorder (with questions substituted for criminal behavior) (sensitivity, 63%; specificity, 95%). For probable PTSD, a sample from Boystown, Juvenile Detention (Omaha, Neb) and San Diego Services (San Diego, Calif) (N = 2173) provided psychometric information (sensitivity, 85%; specificity, 98.4%). The probable PTSD questions were worded to refer to the WTC attack as the anchoring traumatic event.

Exposure

To assess exposure to the WTC attack, we designed specific questions[18] (WTC Questionnaire, available on request) to mea-
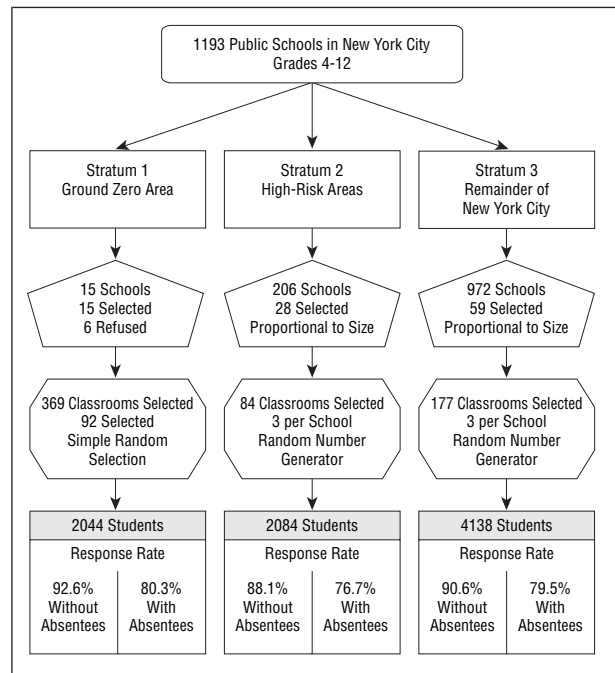

Figure 2. Study sampling methods.

sure: (1) attendance in a ground zero area school; (2) direct exposure, defined as 2 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 being extremely worried about the safety of a loved one; (3) family exposure, defined as having a family member (mother, father, stepmother, stepfather, foster mother, foster father, sister, brother, grandmother, grandfather, aunt, uncle, or other family member) killed or injured in the attack, or witnessing the attack but escaping unharmed.

Direct and family exposures were combined to define levels of exposure: severe exposure, defined as the presence of 2 or more direct and/or 1 or more family exposures; moderate exposure consisted of 1 direct and no family exposure; and mild exposure as neither direct nor family exposure. Media exposure was measured, with high media exposure defined as having spent "a lot of time" watching television coverage of the attack.

In addition, exposure to trauma not related to September 11 was assessed. Included was previous exposure to traumatic situations, defined as having had a severe injury in violent circumstances or having lived through war or another major pre–September 11 disaster.[19] Exposure to the American Airlines flight 587 crash, 2 months after September 11 (defined as having a relative who died on the flight or living in the Belle Harbor crash site area of New York City), was also assessed.

Other Measures

The demographic information included grade, sex, and ethnicity. Children reported if their mother had completed high school and their family composition.

The variable "mental health service use" was considered as having occurred if a child reported that she or he had talked about the September 11 attack with a mental health professional in the school environment (school guidance counselor or school social worker) or outside the school environment (a health professional outside of school, like a doctor, therapist, social worker, psychologist, psychiatrist, nurse, or other professional).

PROCEDURES

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 1 class period. The questionnaire was slightly shorter for 4th and 5th graders and was read aloud to them 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 3 nonselected New York City public schools.

To maximize the range of information obtained while not exceeding the allotted administration time, a planned missing data 3-form design[20,21] was used. Each questionnaire consisted of a core, as well as 2 of 3 possible noncore sections. Hence, each student received the core and two thirds of the noncore questionnaire.

This study was conducted in full compliance with the institutional review boards of Columbia University–New York State Psychiatric Institute (New York City) and the New York City Department of Education and the New York State Office of Mental Health Committee for WTC-Related Research (Albany).

STATISTICAL ANALYSIS

Individual respondent weights were used, reflecting the sampling design for grade level and stratum. Individually omitted items (unplanned missings) were imputed from other data (items on scales, write-ins, demographics, or school variables) or by using multiple imputation in the case of sex, maternal education, family composition, and probable psychiatric disorders (SAS MI procedure[22]). Multiple imputation was also used for variables that were not part of the core section of the questionnaire (planned missings). Approximately 12 variables, conceptually and empirically correlated with each variable with missing information, were used for imputation (planned and unplanned missings). For probable disorders, where needed, each symptom was individually imputed, and recommended symptom-count cutoffs were applied to determine probable disorder. Unplanned missing values ranged from 1% to 5.3%, and planned missing values ranged from 5.4% (for major depressive disorder and generalized anxiety disorder, which were noncore only for 4th-5th graders) to 34.3%, including the remaining 4 disorders, which were noncore for the entire sample. To verify the impact of imputation on the results, parameter estimates and standard errors were calculated for the original (unimputed) and fully imputed data (unplanned and planned missing values imputed) and compared; considering the individual disorders that were part of the main outcome variable (any anxious/depressive disorder), after full imputation, parameter estimates never varied more than 0.6% compared with the original, unimputed values. Variations in the estimated odds ratio and adjusted odds ratio (AOR), measuring the association between demographics and exposure with "any anxious/depressive disorder," were never more than 0.22. We assessed the association between dose of exposure and prevalence of 8 probable disorders. To further evaluate this association, 6 of the disorders were grouped as probable anxiety/depressive disorders, representing reactions common to mass traumatic events but which are more likely to go undetected. Logistic regression analyses were conducted to determine the association of covariates of interest with probability of having a depressive/anxious disorder. The covariates included in the model were demographic and exposure variables, as well as an indicator of mental health service use. These variables were selected based on their theoretical association with the outcome of interest. The logistic regression analyses were restricted to 6th through 12th graders because 4th and 5th graders differed on the number of questions asked, consent procedure, administration mode, and compliance rate. These analyses were conducted using the statistical software SUDAAN Version 8.0[23] to account for clustering of the data due to sampling design.

ROLE OF THE FUNDING SOURCE

The US Department of Education School Emergency Response to Violence Project funded the data collection but had no other role in the study. The Epidemiology Department, Mailman School of Public Health, Columbia University; the New York State Psychiatric Institute; and the Centers for Disease Control and Prevention (Atlanta, Ga) provided personnel and material support pro bono.

RESULTS

Table 1 presents the selected sociodemographic characteristics of the sample. The sex and ethnic distribution closely reflected the New York City public school population, grades 4 through 12,[13] at the time of the survey. Latino children were the largest group (40.1%), followed by African American children (27.9%). Table 1 also displays data on exposure to the WTC attack. Ground zero area children had more direct exposure than did children in the rest of the city (80.8% vs 23.8%; $\chi_1^2 = 543.81$; $P<.001$, not shown). However, they had less family exposure (8.6% vs 12.6%; $\chi_1^2 = 16.77$; $P<.001$). They also had less prior exposure to traumatic events (22.1% vs 30.6%; $\chi_1^2 = 15.55$; $P<.001$).

As presented in **Table 2**, 28.6% of all children had 1 or more of the 6 probable anxiety/depressive disorders. The most prevalent were probable agoraphobia (14.8%), probable separation anxiety (12.3%), and probable PTSD (10.6%). Additionally, 12.8% had probable conduct disorder and 4.5% of those in grades 6 through 12 had probable alcohol problems (abuse/dependence).

Table 2 also presents the prevalence of probable disorder by level of exposure to the WTC attack. Each probable anxiety/depressive disorder had a higher prevalence at higher levels of exposure (dose-response). Probable conduct disorder and probable alcohol abuse/dependence exhibited the same, though weaker, pattern. Further evidence for a dose-response pattern is provided by statistically significant linear relationships between number of symptoms and exposure level (P values for linear trend $\leq .008$, Cochran Mantel-Haenszel χ^2 test; test values not shown in tables).

Also in Table 2 are comparison rates of probable psychiatric disorders in children from pre-WTC community studies from available studies in New York State and surrounding areas, as well as Puerto Rico. In our study, among those with mild exposure, prevalence was within the range of pre-WTC non-New York City community rates, except for probable agoraphobia and probable alcohol abuse/dependence.

Table 3 presents prevalence of probable disorders and exposure by sex and grade level. The probable anxiety/depressive disorders were more frequent in girls. Rates of probable PTSD, probable separation anxiety, and probable agoraphobia were higher in younger children (4th-5th graders). As might be expected, probable conduct dis-

Table 1. Sociodemographics and Exposures for 8236 Sample Children: New York City School Survey Post–September 11th, Grades 4 Through 12

	Sample Size (Unweighted)	Unweighted Percentage (SE)	Weighted Percentage (SE)	New York City Public School Students Grades 4-12 (2001-2002), %*
Grade group				
4-5	1245	15.1 (4.7)	25.3 (9.6)	24.0
6-8	2924	35.5 (6.9)	33.7 (9.1)	34.4
9-12	4067	49.4 (6.6)	41.0 (10.0)	41.5
Female	4316	52.4 (1.8)	53.1 (2.8)	50.6
Race/ethnicity†				
African American	1855	22.5 (3.3)	27.9 (5.3)	34.6
Latino	2936	35.6 (3.3)	40.1 (4.4)	36.3
White	1489	18.1 (3.0)	13.4 (3.3)	15.8
Asian	1552	18.8 (2.2)	12.8 (3.2)	13.0
Mixed/other	404	4.9 (0.5)	5.7 (0.8)	0.3
Exposure				
Attendance in ground zero area school	2042	24.8 (1.3)	1.3 (0.1)	
Direct exposure (≥2)	3226	39.2 (1.9)	24.6 (2.3)	
Any family exposure	957	11.6 (0.6)	12.5 (1.0)	
Prior exposure (≥2)	2376	28.8 (1.2)	30.6 (2.1)	
High media exposure	5292	64.2 (1.3)	63.3 (2.5)	
Belle Harbor plane crash	258	3.1 (0.7)	2.9 (0.6)	
Mental health service use	1586	19.3 (0.9)	18.8 (1.2)	

*Source: New York City Department of Education.[24]

†The New York City Department of Education used US census 1990 race/ethnicity categories that do not include "mixed race." The "other" group reported by the Department of Education is Native American (0.3%). The study reported herein used US census 2000 race/ethnicity categories and allows for mixed race.

Table 2. 6 Months' Post-September 11 Prevalence of Probable Mental Disorder by Exposure Level, Compared With Pre–September 11 US Community Rates, for 8236 New York City Public School Children in Grades 4-12*

	NYC-DOE WTC School Survey						
			Exposure Level†				
Probable Disorders‡	Estimated No. of Students	Total Sample (N = 8236)	Severe (n = 2650 [32.2%])	Moderate (n = 2840 [34.5%])	Mild (n = 2746 [33.3%])	P Value§	US Community Studies (Ages 9-17), Pre–September 11, %
PTSD	75 916	10.6 (1.50)	18.4 (2.3)	10.0 (1.7)	3.6 (1.1)	<.001	3.3‖
Major depression	58 011	8.1 (0.98)	11.0 (1.6)	8.0 (1.4)	5.4 (1.3)	.007	2.1-5.9‖¶#**
Generalized anxiety	73 767	10.3 (0.98)	14.1 (1.7)	9.8 (1.5)	7.2 (1.0)	.002	3.4-5.5‖**
Separation anxiety	88 091	12.3 (1.39)	20.1 (2.0)	11.8 (1.7)	5.4 (1.2)	<.001	1.7-7.7‖¶#**
Panic disorder	62 308	8.7 (0.83)	13.0 (1.7)	8.4 (1.3)	4.9 (0.9)	<.001	0.6-4.1‖**
Agoraphobia	105 996	14.8 (1.58)	21.8 (2.7)	15.4 (1.9)	7.6 (1.5)	<.001	1.3-4.5‖¶
Any anxiety/depressive disorder††	204 829	28.6 (1.47)	38.9 (2.8)	29.1 (2.2)	18.2 (1.8)	<.001	
Conduct disorder	91 672	12.8 (1.29)	14.3 (1.8)	12.5 (1.7)	11.6 (1.8)	.43	3.9-11.2‖#**
Alcohol abuse/dependence (grades 6-12)	24 461	4.5 (0.81)	6.0 (1.4)	4.2 (1.2)	3.6 (0.8)	.28	0.9-2.2‖¶**

Abbreviations: DISC, Diagnostic Interview Schedule for Children; DPS, Diagnostic Interview Schedule for Children Predictive Scales; NYC-DOE, New York City Department of Education; PTSD, posttraumatic stress disorder; WTC, World Trade Center.

*Weighted data. Values are expressed as percentage (standard error) unless otherwise indicated.

†Severe exposure = 2 or more direct and/or at least 1 family exposure; moderate exposure = 1 direct and no family exposure; and mild exposure = no direct or family exposure.

‡Reported rates are with impairment, except for alcohol abuse/dependence and conduct disorder.

§Overall χ^2 test. Results of paired χ^2 tests on exposure level. All comparisons are significant at $P<.05$, except for conduct disorder and alcohol abuse/dependence, major depressive disorder (moderate vs mild and moderate vs severe), and generalized anxiety disorder (moderate vs mild).

‖Lucas CP, 2002, DPS validation report; *DSM-IV;* 9 to 17 y; DPS (N = 687); DISC Version IV (N = 191) (unpublished data, 2002).

¶Bird et al[25]; *DSM-III;* 4 to 16 years; DISC Version 2.0 (2-stage sampling design; first stage [N = 777]; second stage [N = 386]).

#Cohen et al[26]; *DSM-III-R;* 9 to 18 years; DISC Version 1.0 (N = 776).

**Shaffer et al[27]; *DSM-III-R;* 9 to 17 years; DISC Version 2.3 (N = 356).

††"Any" is limited to PTSD, major depression, generalized anxiety, separation anxiety, panic, and agoraphobia.

order was more frequent in boys and in older children. Direct and family exposure were more frequent in younger children (4th-5th graders). Older children (9th-12th grad-

ers) were more likely to attend ground zero area schools and to have had prior exposures compared with the younger age groups.

Table 3. Prevalence of Probable Mental Disorders and Exposure by Sex and Grade Group for 8236 New York City Public School Children 6 Months After September 11*

	Sex			Grade Group			
	Girls	Boys	P Value	4-5	6-8	9-12	P Value†
Probable disorders							
PTSD	13.3 (1.9)	7.4 (1.3)	<.001	20.1 (3.9)	9.1 (1.3)	5.9 (1.1)	.004
Major depression	10.4 (1.3)	5.5 (0.9)	<.001	7.3 (2.2)	6.8 (0.9)	9.6 (1.6)	.32
Generalized anxiety	12.8 (1.4)	7.5 (0.9)	<.001	10.9 (3.1)	9.2 (1.0)	10.8 (1.2)	.60
Separation anxiety	16.0 (1.7)	8.2 (1.3)	<.001	20.2 (3.4)	12.1 (1.2)	7.6 (1.4)	.003
Panic disorder	11.6 (1.2)	5.4 (0.9)	<.001	10.9 (2.5)	8.2 (0.8)	7.8 (1.1)	.51
Agoraphobia	20.0 (2.0)	9.0 (1.3)	<.001	24.1 (4.2)	12.7 (1.5)	10.9 (1.5)	.02
Any anxious/depressive‡	34.7 (1.9)	21.8 (1.6)	<.001	34.1 (4.4)	27.8 (1.6)	26.0 (2.0)	.20
Conduct disorder	10.6 (1.3)	15.3 (1.7)	.004	9.6 (3.0)	12.4 (1.0)	15.1 (2.0)	.32
Alcohol abuse/dependence (grades 6-12)	4.3 (1.0)	4.8 (1.0)	.67	NA	1.8 (0.5)	6.8 (1.0)	<.001
Exposure							
Attendance ground zero area school	1.2 (0.1)	1.4 (0.1)	.33	0.7 (0.4)	0.2 (0.1)	2.5 (0.6)	<.001
Direct exposure (≥2)	26.3 (2.6)	22.6 (2.6)	.15	34.5 (5.9)	22.9 (2.8)	19.8 (3.0)	.03
Any family exposure	14.1 (1.4)	10.7 (1.4)	.12	17.6 (1.3)	12.1 (1.3)	9.7 (0.9)	.003
Prior trauma (≥2)	29.6 (2.3)	31.7 (2.5)	.31	21.8 (3.2)	29.5 (2.2)	36.9 (2.3)	.01
High media exposure	64.3 (3.1)	62.3 (2.4)	.46	52.4 (4.4)	65.7 (2.0)	68.2 (2.3)	.13

Abbreviations: NA, not applicable; PTSD, posttraumatic stress disorder.
*Weighted data. Values are expressed as percentage (standard error) unless otherwise indicated.
†χ^2 test.
‡"Any" is limited to PTSD, major depression, generalized anxiety, separation anxiety, panic, and agoraphobia.

Table 4. Logistic Regression Models Predicting Any Probable Anxious/Depressive Disorder, in 6991 New York City Public School Children, 6 Months After September 11, Grades 6-12

	Any Probable Depressive/Anxious Disorder*	
	OR (95% CI)	AOR (95% CI)
Girls	1.91 (1.55-2.36)	1.90 (1.52-2.36)
Age†	0.97 (0.92-1.03)	0.96 (0.90-1.01)
Ethnicity (reference = white)		
African American	1.27 (0.95-1.71)	1.24 (0.92-1.67)
Latino	1.31 (1.00-1.71)	1.15 (0.85-1.54)
Asian	1.20 (0.79-1.84)	1.44 (0.89-2.34)
Mixed/other	1.40 (0.78-2.53)	1.34 (0.75-2.40)
Low maternal education (<high school)	1.40 (1.10-1.78)	1.42 (1.06-1.89)
Don't live with both parents	1.13 (0.92-1.40)	1.05 (0.85-1.30)
Attendance in ground zero area school	0.80 (0.69-0.94)	0.66 (0.51-0.85)
Direct exposure (≥2)	1.88 (1.45-2.44)	1.62 (1.24-2.11)
Any family exposure	2.09 (1.52-2.88)	1.80 (1.28-2.55)
Prior trauma (≥2)	2.07 (1.61-2.66)	2.01 (1.55-2.62)
High media exposure	1.64 (1.30-2.09)	1.58 (1.23-2.03)
Belle Harbor plane crash	1.49 (0.95-2.35)	1.34 (0.81-2.22)
Mental health service use	1.86 (1.48-2.35)	1.64 (1.30-2.07)

Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; OR, unadjusted odds ratio; PTSD, posttraumatic stress disorder.
*Weighted data. "Any probable anxious/depressive disorder" is at least 1 of PTSD, major depression, generalized anxiety, separation anxiety, panic, or agoraphobia.
†Continuous variable.

Table 4 reports the results of logistic regression analyses of the outcome "probable anxiety/depressive disorder." After adjustment for other characteristics, the AORs and 95% confidence intervals (CIs) were AOR, 1.62 (95% CI, 1.24-2.11) for having 2 or more direct exposures and AOR, 1.80 (95% CI, 1.28-2.55) for having had at least 1 family member exposed. High media exposure to the WTC attack was also associated with increased risk. Attending a ground zero area school was associated with decreased risk (AOR, 0.66 [95% CI, 0.51-0.85]). Prior exposure to traumatic events (2 or more) was also associated with increased risk of probable anxiety/depressive disorder (AOR, 2.01 [95% CI, 1.55-2.62]). Other factors associated with any anxiety/depressive disorder were being a girl, low maternal education, and child mental health service use.

COMMENT

This study has 6 main findings. First, 6 months after the WTC attack, a high proportion of New York City public school children had a probable mental disorder. A projected 205 000 students (28.6%) in grades 4 through 12 had 1 or more of the 6 probable anxiety/depressive disorders. The validity of these prevalence findings are supported, in part, by being consistent with observations from other studies as to the sex and age distribution of those with mental disorders in the general population.[25,27] Studies conducted after disasters have the major limitation of not having assessed representative samples of a given population but rather having concentrated on subgroups subjected to specific exposures of interest. Consequently, comparing rates across studies can be misleading. A recent literature review[28] revealed that after natural disasters, PTSD-related syndromes varied from 3% in children exposed to a tornado[29] to 90% in children after exposure to a hurricane.[7]

The second main finding is that the severity of exposure to September 11 was related to the likelihood of hav-

ing 1 or more of the 8 probable disorders assessed. Generally, among children with neither direct nor family exposure to the WTC attack, the prevalence of these probable disorders was not elevated and appeared quite similar in magnitude to previous community studies. Based on the association between increased prevalence and greater exposure, it appears that the elevated prevalence of probable PTSD, as well as the other probable anxiety and depressive disorders, is related to exposure to the WTC attack. This observation must be made with caution, as pre-event prevalence in the same population is not available. However, when our study prevalence is compared with another urban population study (Stamford, Conn), conducted just prior to September 11, based on the same measure of probable psychopathology and targeting the same age group, the prevalence of probable anxiety/depressive disorders in Stamford was only slightly lower than that in New York City's children with mild exposure.[17] The higher prevalence of probable alcohol abuse/dependence and conduct disorder among the most severely exposed compared with those less exposed may also be related to the WTC attack. However, because these probable disorders do not exhibit as clear an association with dose of exposure, the present study cannot be considered as providing strong evidence for such a relationship.

The third main finding was that a wide range of probable mental disorders was elevated, in addition to PTSD. Because children with the types of mental disorders identified herein are not likely to be easily identified without active screening, nor likely to seek treatment,[30] the variety of probable disorders identified by this survey highlights the importance of comprehensive population-based screening for psychiatric problems in children after a major disaster[31] so that interventions can be properly targeted.

The fourth main finding was that family exposure to the WTC attack was associated with probable mental disorder, even more strongly than direct exposure. This suggests that some children may experience greater emotional impact from having a family member exposed than from being directly exposed themselves. The mechanism of this association is not known. This result may alert primary care professionals, first responders, school counselors, and other public health authorities of the potential that parental traumatization may in itself have an effect on child mental health. For children, postdisaster intervention may need to be broadly focused, including parental/family experience and loss.

The fifth main finding was that going to a school near the place of the attack was associated with lower rates of probable mental disorder. This somewhat surprising finding may possibly be explained by a combination of factors, such as worldwide attention to their situation, increased social support, and the fact that students in the ground zero area schools were the recipients of significant mental health intervention immediately after September 11, 2001. Although the following characteristics did not explain lower risk of psychopathology when added to multiple logistic regression models, students sampled from the ground zero area schools were more likely to be Asian, on average older, more likely to have received mental health services, and to live in households with 2 parents than were New York City students in general. While the complete explanation remains unclear, the broad geographic distribution of children with probable mental disorders throughout New York City indicates that those in need of mental health intervention after this disaster were not confined to the immediate area of the attack. Consequently, future postdisaster interventions should probably not be confined exclusively to children in close proximity to a disaster but should incorporate the disaster's reach, both physically and psychologically.

The sixth main finding was that exposure to trauma prior to the WTC attack was a major risk factor for a post–September 11 probable mental disorder. Thinking prospectively, this finding is of considerable public health significance since a significant proportion of New York City children have now experienced a major trauma (September 11), rendering them more vulnerable to mental disorders in the future, especially following any new disaster. Interventions to mitigate the effects of prior trauma, including September 11, have now, therefore, become substantially more important.

The findings presented herein should be considered in light of the study's limitations. The diagnostic assessment measure used, the DPS, was designed for screening, not diagnosis; therefore, the prevalence reported herein refers to probable, not definite, cases. Because this was an urgent assessment, following a unique situation, many of the measures of exposure used were not previously validated. Regarding the assessment of media exposure, more detailed information might have proven particularly useful in understanding the results. The mode of survey administration for the 2 grade groups differed, and individual compliance for those in grades 4 and 5 was less than for those in grades 6 through 12, which may have influenced these findings. While we approximated a representative sample of New York City public school children in grades 4 through 12, we did not include children attending parochial and private schools and were also unable to assess grades kindergarten through 3 and separate special education schools. The seemingly anomalous results related to ground zero area students might be associated with information not measured in the current study, such as specific types of postdisaster interventions received (including mental health services). Finally, it may be inappropriate to generalize from the widely dispersed effects found in this study to children affected by some other traumatic events. The elevated probable mental disorder prevalence identified throughout New York City after the WTC attack may, in fact, be due in part to the high visibility of this particular event, directly witnessed by millions of New Yorkers, indeed the world, as well as to the subsequent threats (eg, anthrax) and the war in Afghanistan.

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