Exposure to the World Trade Center Attack and the Use of Cigarettes and Alcohol Among New York City Public High-School Students

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We examined exposure to the World Trade Center attack and changes in cigarette smoking and drinking among 2731 New York City public high-school students evaluated 6 months after the attack. Increased drinking was associated with direct exposure to the World Trade Center attack ($P<.05$). Increased smoking was not directly associated with exposure to the World Trade Center attack but was marginally significantly associated with posttraumatic stress disorder ($P=.06$). Our findings suggest that targeted substance-use interventions for youths may be warranted after large-scale disasters. (*Am J Public Health*. 2006;96:804–807. doi: 10.2105/AJPH.2004.058925)

Millions of Americans, especially those living in New York City, were affected, many of them traumatically, by the World Trade Center (WTC) attack on September 11, 2001. Studies of adults have documented elevated rates of posttraumatic stress disorder (PTSD),[1] psychological stress,[2,3] and substance use immediately after the attack.[4–6] The immediate effect on children and adolescents of the WTC attack was not assessed as intensively as it was on adults.[7–9] Studies have shown increases in substance use in relation to exposure to trauma and PTSD, suggesting that substance use may develop as one attempts to relieve traumatic memories, sleep disturbances, and other PTSD symptoms.[10–13] To our knowledge, no studies have been published assessing exposure to the WTC attack and changes in cigarette smoking and alcohol use among adolescents. We sought to understand (1) how different types of exposure to the WTC attack contributed to an increase in smoking and/or drinking among New York City adolescents, and (2) whether PTSD related to the WTC attack can explain increases in use of cigarettes and alcohol among New York City adolescents.

METHODS

Our analyses were based on self-reported[14] data from 2731 high-school students who participated in a New York City Board of Education–sponsored post–September 11 needs assessment and were asked about smoking and drinking after September 11, 2001 (response rate=79%). Details of the study's methodology and a description of the total sample (N=8236) of students in grades 4 to 12 are given elsewhere.[9,15,16] Participation was anonymous with parental notification. The study was carried out in full compliance with institutional review board requirements.

The survey was conducted 6 months after the WTC attack. Adolescents were asked questions about changes in smoking and drinking after September 11. Adolescents who reported that they "started to smoke cigarettes" or "smoked more cigarettes" after September 2001 were considered to have increased smoking. Adolescents who reported that they "drank more alcohol" after September 2001 were considered to have increased alcohol consumption.

We collected information on different types of exposure to the WTC attack: (1) direct exposure, (2) family exposure, (3) media exposure, and (4) attendance at a school in the Ground Zero area. We also obtained information about previous exposure to traumatic situations, such as having had a severe injury in violent circumstances or having lived through war or another pre–September 11, 2001, disaster. Detailed definitions of these exposure categories can be found elsewhere.[9]

We assessed PTSD related to the WTC attack using the Diagnostic Interview Schedule

for Children Predictive Scales.[17,18] We considered a student to have probable PTSD if he or she had positive screening results for 5 of 8 PTSD symptoms and reported significant impairment. Sociodemographic information also was obtained.

Initially, we examined bivariate associations between 2 dichotomous outcome variables (increased smoking and increased drinking) and independent variables of interest. We used logistic regression analysis to assess the association between an outcome variable and each independent variable, after we adjusted for other risk factors. We used SUDAAN software (Research Triangle Institute, Research Triangle Park, NC) to account for the complex sampling design and to obtain correct variance estimates.

RESULTS

Table 1 shows that 5.4% of the students reported increased cigarette use or having started smoking after the WTC attack, and 10.9% reported increased drinking. Among all types of exposure, only direct exposure was significantly associated with increased drinking (odds ratio [OR]=1.8; $P<.05$). Increased smoking was significantly associated with prior trauma (OR=2.0; $P<.05$) and PTSD (OR=3.1; $P<.05$). Older age was associated with increased drinking (OR=1.5; $P<.05$) but not smoking. Non-White students, especially Black and Hispanic students, were less likely to report increased smoking or drinking than were non-Hispanic White students.

Table 2 shows the results from the logistic regression analyses when all factors were considered simultaneously. Most associations that were significant in bivariate analyses remained significant in the multiple logistic regression analyses. However, the adjusted odds ratio for the association between increased smoking and PTSD decreased to 2.5 ($P=.06$).

TABLE 1—Bivariate Associations of Sociodemographic Factors, Exposures to the World Trade Center Attack, and Probable Posttraumatic Stress Disorder (PTSD) With Increased Cigarette Smoking and Alcohol Consumption Among 2731 New York City Public High-School Students

		Increased Cigarette Smoking			Increased Alcohol Consumption		
	No. of Respondents (Weighted)	%	OR (95% CI)	*P*	%	OR (95% CI)	*P*
Total	2731	5.4			10.9		
Gender							
Male	1312	5.1	1.0		10.8	1.0	
Female	1419	5.6	1.1 (0.7, 1.8)	.69	11.0	1.0 (0.7, 1.4)	.87
Age, y							
≤16	1783	4.8	1.0		9.6	1.0	
≥17	948	6.3	1.3 (0.8, 12.2)	.26	13.4	1.5 (1.1, 2.0)	.03
Ethnicity							
White	427	9.9	1.0		17.8	1.0	
Black	789	3.4	0.3 (0.1, 0.7)	.007	7.6	0.4 (0.2, 0.7)	.006
Hispanic	1050	4.3	0.4 (0.2, 0.8)	.010	10.7	0.6 (0.3, 0.9)	.03
Asian	345	7.1	0.7 (0.3, 1.6)	.36	9.3	0.5 (0.3, 0.9)	.02
Other/Mixed	119	6.1	0.6 (0.2, 1.8)	.33	15.3	0.8 (0.3, 2.6)	.75
Mother did not finish high school							
No	2084	5.3	1.0		11.2	1.0	
Yes	647	5.7	1.1 (0.6, 1.8)	.78	10.1	0.9 (0.5, 1.5)	.68
Not living with both biological parents							
No	1550	5.5	1.0		11.2	1.0	
Yes	1181	5.2	1.0 (0.6, 1.5)	.83	10.5	0.9 (0.6, 1.4)	.72
Direct exposure							
No	2176	5.3	1.0		9.7	1.0	
Yes	555	5.6	1.1 (0.6, 1.9)	.83	15.9	1.8 (1.1, 2.8)	.01
Family exposure							
No	2484	5.2	1.0		10.7	1.0	
Yes	247	6.9	1.3 (0.6, 2.8)	.42	13.3	1.3 (0.7, 2.4)	.41
Media exposure							
No	812	4.8	1.0		9.7	1.0	
Yes	1919	5.6	1.2 (0.7, 2.1)	.56	11.4	1.2 (0.8, 1.9)	.44
Attended Ground Zero schools							
No	2661	5.4	1.0		10.9	1.0	
Yes	67	5.7	1.1 (0.8, 1.5)	.67	12.8	1.2 (0.9, 1.5)	.11
Prior trauma							
No	1751	4.1	1.0		9.6	1.0	
Yes	980	7.7	2.0 (1.2, 3.4)	.01	13.2	1.4 (0.9, 2.2)	.11
Probable PTSD							
No	2576	4.9	1.0		10.8	1.0	
Yes	155	13.6	3.1 (1.3, 7.3)	.01	13.2	1.3 (0.6, 2.6)	.52

Note. OR = odds ratio; CI = confidence interval.

DISCUSSION

As in studies of adults,[4,5] our study identified an association between exposure to the events of September 11, 2001, and alcohol use in adolescents. Different factors were associated with increases in cigarette smoking and alcohol consumption after September 11, 2001, suggesting distinct underlying mechanisms. We found a significant association between direct exposure to the WTC attack and increased alcohol consumption, which suggests that alcohol was used as a way of coping with the immediate effect of the attack. We found a marginally significant association between PTSD and cigarette smoking and no

TABLE 2—Increased Smoking and Drinking Among 2731 New York City Public High-School Students, by Demographics, Exposure to the World Trade Center Attack, and Probable Posttraumatic Stress Disorder (PTSD): Results of Multiple Logistic Regression Analyses

	Increased Smoking Adjusted OR (95% CI)	Increased Alcohol Consumption Adjusted OR (95% CI)
Sociodemographics		
Girl	1.1 (0.7, 1.9)	1.1 (0.8, 1.5)
Age ≥ 17 y	1.3 (0.8, 2.2)	1.5* (1.0, 2.1)
Race/Ethnicity (reference group = White)		
Black	0.3** (0.1, 0.6)	0.4** (0.2, 0.7)
Hispanic	0.4** (0.2, 0.7)	0.5* (0.3, 0.9)
Asian	0.7 (0.3, 1.6)	0.5* (0.2, 1.0)
Other/Mixed	0.5 (0.2, 1.6)	0.8 (0.3, 2.6)
Low maternal education	1.1 (0.7, 1.9)	0.9 (0.5, 1.5)
Not living with both biological parents	1.2 (0.7, 1.9)	1.1 (0.7, 1.6)
Exposure		
Direct	1.0 (0.5, 1.9)	1.8* (1.1, 2.9)
Family	1.1 (0.6, 2.3)	1.1 (0.6, 2.0)
Media	1.0 (0.6, 1.6)	1.0 (0.6, 1.6)
Ground zero	1.0 (0.6, 1.8)	0.8 (0.5, 1.3)
Previous trauma	2.0* (1.1, 3.6)	1.4 (0.9, 2.3)
Psychiatric disorder		
Probable PTSD	2.5*** (1.0, 6.6)	1.0 (0.5, 2.1)

Note. OR = odds ratio; CI = confidence interval.
*P < .05; **P < .01; ***P = .06.

direct association between any form of exposure to the WTC attack and smoking, which may indicate that youths used nicotine as a self-medication strategy to obtain relief from their PTSD symptoms related to the WTC attack. We found that prior trauma increased youth vulnerability to an adverse behavior change (increased smoking), after exposure to the WTC attacks, which parallels findings reported elsewhere of increased vulnerability to psychiatric symptoms.[9]

Our study was limited by its cross-sectional design, retrospective survey method, and lack of detailed information on changes in smoking and drinking behaviors, which may have affected the interpretation of the findings. However, these findings have important clinical and policy relevance, especially in preparation for other possible large-scale traumatic events. Appropriate and targeted prevention and intervention programs are needed to help youths better respond to such crises. ■

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Contributors

P. Wu conceptualized and designed this study of a subsample of the data from the New York City Post-9/11 School Survey, performed data analyses, and wrote the brief. C.S. Duarte contributed to the study design, questionnaire preparation, data imputation, and interpretation of the results. D.J. Mandell contributed to the study design, questionnaire preparation, and interpretation of the results. B. Fan was the data manager and was involved in data imputation. X. Liu provided statistical advice and was involved in data analyses. C.J. Fuller was involved in writing the literature review. G. Musa was involved in designing the study and preparing the questionnaires. M. Cohen managed the data collection process. P. Cohen was involved in designing the study and provided advice on data imputation and analysis. C.W. Hoven was the principal investigator of the World Trade Center–Board of Education Study of the Psychological Effects on New York Public School Students and was involved in all aspects of the study.

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Human Participant Protection

The study was approved by the institutional review board of the New York State Psychiatric Institute.

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