

## ORIGINAL CONTRIBUTIONS

### Increased Use of Cigarettes, Alcohol, and Marijuana among Manhattan, New York, Residents after the September 11th Terrorist Attacks

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The September 11, 2001, terrorist attacks were the largest human-made disaster in the United States since the Civil War. Studies after earlier disasters have reported rates of psychological disorders in the acute postdisaster period. However, data on postdisaster increases in substance use are sparse. A random digit dial telephone survey was conducted to estimate the prevalence of increased cigarette smoking, alcohol consumption, and marijuana use among residents of Manhattan, New York City, 5–8 weeks after the attacks. Among 988 persons included, 28.8% reported an increase in use of any of these three substances, 9.7% reported an increase in smoking, 24.6% reported an increase in alcohol consumption, and 3.2% reported an increase in marijuana use. Persons who increased smoking of cigarettes and marijuana were more likely to experience posttraumatic stress disorder than were those who did not (24.2% vs. 5.6% posttraumatic stress disorder for cigarettes; 36.0% vs. 6.6% for marijuana). Depression was more common among those who increased than for those who did not increase cigarette smoking (22.1 vs 8.2%), alcohol consumption (15.5 vs. 8.3%), and marijuana smoking (22.3 vs. 9.4%). The results of this study suggest a substantial increase in substance use in the acute postdisaster period after the September 11th attacks. Increase in use of different substances may be associated with the presence of different comorbid psychiatric conditions. *Am J Epidemiol* 2002;155:988–96.

alcohol drinking; disasters; marijuana smoking; smoking; stress disorders, posttraumatic; substance-related disorders

The terrorist attacks of September 11, 2001, produced the largest death toll of any disaster on US soil. In New York City alone, more than 3,000 people died, and a large area of lower Manhattan was destroyed. The attacks have had a significant social and economic impact on New York City, with increased unemployment, disruption of transportation, and the ongoing threat of further terrorist assaults. Early studies of the acute psychological effects after the September 11th attacks suggest a high prevalence

of stress, posttraumatic stress disorder (PTSD), and depression throughout the United States and in Manhattan, in particular (1, 2).

Several studies demonstrate that the survivors of disasters bear a substantial burden of psychiatric disorders (3). PTSD, depression, anxiety, and panic disorders are the most frequently documented psychological sequelae of disasters and mass trauma (4, 5). Although substance use is a well-documented comorbid factor accompanying PTSD and other psychological disorders (6–8), few investigations have specifically documented the prevalence of increased substance use after major disasters. Most of the research that has examined substance use after disasters has focused on direct survivors of the disaster, that is, people who were in some way directly affected by the event (9–12). Different measures of substance use and postdisaster time frames make generalization of results difficult. In addition, persons in the same community may be affected to different degrees by the disaster event, that is, by being present at the disaster site, through relationships with victims, by disruption of personal routines, or by repeated exposure to the event through the media. More precise measurement of the population effects of disasters is needed for more targeted public health planning.

To estimate prevalence and correlates of cigarette smoking, alcohol consumption, and marijuana use after the attacks, we used data from a random digit dial telephone survey of Manhattan residents below 110th Street conducted

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Abbreviations: OR, odds ratio; PTSD, posttraumatic stress disorder; WTC, World Trade Center.

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5–8 weeks after September 11th. We had three a priori hypotheses: 1) there would be an increase of cigarette smoking, alcohol consumption, and marijuana use after the attacks; 2) increased substance use would cooccur with an increase in PTSD and depression after the disaster; and 3) there would be an association between different event exposures and increased substance use.

## MATERIALS AND METHODS

### Sample

All English- and Spanish-speaking adults (over age 17 years) who lived in Manhattan south of 110th Street in households with telephones at the time of the study were potential study participants. We chose to sample only Manhattan south of 110th Street because it is the demographically homogenous area most proximal to the World Trade Center (WTC). The sample was selected by using random digit dialing for households with telephones between October 16 and November 15, 2001. When we reached a person at a residential telephone number, we obtained verbal consent and then determined the area of residence in Manhattan (screening out those north of 110th Street). The number of adults in each household was determined, and one adult per household was randomly selected for interview. Weighting techniques were applied to correct potential biases related to the number of household telephones and the number of persons in the household. The overall response rate to the survey was 64.3 percent.

### Data collection

Interviews were conducted by experienced interviewers using a computer-assisted telephone interviewing system. Both English- and back-translated Spanish-language versions of the questionnaire were available for the interviews. A protocol was in place to provide assistance to participants who requested mental health counseling. The mean duration of the interviews was 35 minutes. The Institutional Review Board of the New York Academy of Medicine reviewed and approved the study protocols.

We inquired about participants' cigarette smoking, alcohol drinking, and marijuana smoking. For each of the three substances, we asked the following series of questions. First, we asked whether the participant had ever used the substance (e.g., "Have you ever smoked cigarettes?"). Participants who answered yes to this question were asked how many cigarettes they had smoked during the week before September 11th. We also inquired about the number of drinks consumed and the number of times marijuana was smoked. We then asked the number of times participants had used each substance during the week before the survey was conducted. Therefore, we obtained measures of pre- and post-September 11th substance use. For the analyses, we studied the increase in use of any of these substances and in each of these substances individually. We also examined persons who reported a new use of any of these substances.

We asked questions about demographic variables, including age, race/ethnicity, gender, yearly household income, edu-

cation, and marital status. We collected information regarding the intersections closest to two addresses—where the respondent was living prior to September 11th and where the respondent was upon hearing about the September 11th attacks. For the analyses, we used geographic information system coding to locate the intersections and grouped the locations in four zones, progressively further away from the WTC within the sampling frame below and including Canal Street (i.e., the area closest to the WTC); above Canal Street and below and including 14th Street; above 14th Street and below and including 60th Street; and above 60th Street and below and including 110th Street (i.e., the area farthest from the WTC in this sampling frame). These zones represent distinctions between groups of neighborhoods in Manhattan.

We asked about a list of eight traumatic events (e.g., the death of a spouse) that the respondent could have experienced in the year before the events of September 11th. For the analyses, we divided responses into groups of zero, one, or two or more previous-year stressors (13). We assessed September 11th event experiences, including whether the respondent had directly witnessed the attacks of September 11th, whether he or she was afraid for her/his life during the attacks, whether friends or relatives were killed during the attacks, whether the respondent was displaced from home, whether he or she was involved in the rescue efforts, and whether he or she lost a job or possessions as a result of the September 11th attacks. We asked questions regarding the type and quantity of media exposure, including inquires about how many times each of five specific images were seen on television in the 7 days after September 11th. For the analyses, we created thirds of the sum of images viewed; the groups from lowest to highest frequency viewing are referred to as low, medium, or high media exposure. We measured perievent panic attack using a modified version of the Diagnostic Interview Schedule measure for panic attack (phrased to assess symptoms that occurred during or shortly after the terrorist attacks) (14). We asked about panic symptomatology specifically in the "first few hours after" the events of September 11th; the presence of four or more symptoms contributed to a diagnosis of a perievent panic attack.

We used two measures of mental health status: PTSD and major depression. The PTSD measure was a modified version of the Diagnostic Interview Schedule measure, based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (15). The PTSD scale used has a coefficient of agreement with clinician-administered structured clinical interviews of 0.71 for current PTSD (16, 17). We measured current PTSD related to the September 11th attacks. Current PTSD was based on prevalence of necessary PTSD criterion B, C, and D symptoms within the previous 30 days. All reexperience symptoms (criterion B) and all content-specific (e.g., avoidance of thoughts or feelings) avoidance symptoms (criterion C) were required to be related to the September 11th attacks to qualify as current PTSD symptoms. A subset of avoidance symptoms and all of the arousal symptoms (criterion D) could not be linked directly to the attacks except by time frame (occurrence within the previous 30 days, hence, since the attacks).

Participants were required to report at least one reexperiencing symptom specific to the attack, at least three avoidance symptoms (content specific when relevant or in the previous 30 days), and two arousal symptoms (in the previous 30 days). For presence of depression overall and by recency (i.e., previous 30 days), we used a validated modified version of the Structured Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders Fourth Edition*, major depressive episode questions (18, 19).

### Statistical analyses

We report baseline prevalence of the combined and then separate use of cigarettes, alcohol, and marijuana both before and after the September 11th attacks. Two-tailed chi-square tests were used to determine the association between increase in substance use (increased cigarette smoking, alcohol consumption, and marijuana use), current PTSD, and current depression. The prevalence of increased cigarette smoking, alcohol drinking, and marijuana use was cross-tabulated by each of the other covariates of interest. Crude odds ratios and 95 percent confidence intervals were calculated for all bivariate associations. Multiple logistic regression was used to examine associations separately for increases in cigarette smoking, alcohol drinking, and marijuana smoking. Variables that were associated with increased substance use ( $p < 0.1$ ) in bivariate analyses were included in the final multivariable models, allowing us to assess for putative confounders and to examine interaction. All calculated  $p$  values were two-tailed, and 95 percent confidence intervals were used to guide interpretation. We used SUDAAN for all analyses to estimate standard errors and to correct statistical tests for weighting (20).

### RESULTS

Among 1,008 adults surveyed, 20 were excluded in analysis because of missing weight variables. Overall, 52.0 percent of the sample were women, mean age was 42 years

(standard deviation, 15.4 years), and 71.6 percent were White. Age, gender, race, and residence distributions in our sample were comparable with estimates obtained by the 2000 US Census (21) for our sampling frame.

Table 1 shows that 22.6 percent of the participants reported smoking cigarettes, 59.1 percent reported drinking alcohol, and 4.4 percent using marijuana during the week prior to September 11th. After September 11th, 23.4 percent reported smoking cigarettes, 64.4 drinking alcohol, and 5.7 percent smoking marijuana. Among those who smoked cigarettes before September 11th, 41.2 percent increased frequency of smoking. Among those who increased smoking, 8.2 percent smoked at least an extra pack of cigarettes a week. Among those who drank alcohol before September 11th, 41.7 percent increased frequency of drinking after the attacks. Among those who increased drinking, 20.8 percent reported at least one extra drink a day. Overall, increase in substance use was 9.7 percent for cigarette smoking, 24.6 percent for alcohol consumption, and 3.2 percent for marijuana smoking. Overall increase in use of cigarettes, alcohol, or marijuana was 28.8 percent.

Table 2 shows the association between PTSD and depression by substance use. Current PTSD was more frequent in those who increased use than those who did not for cigarettes (24.2 vs. 5.6 percent,  $p < 0.001$ ) and for marijuana use (36.0 vs. 6.6 percent,  $p = 0.05$ ). However, rates of PTSD were statistically similar for persons who increased alcohol consumption and those who did not (8.8 vs. 7.8 percent,  $p = 0.65$ ). Current depression was more frequent for those who increased use than for those who did not for cigarette smoking (22.1 vs. 8.2 percent,  $p = 0.004$ ), alcohol use (15.5 vs. 8.3 percent,  $p = 0.01$ ), and marijuana use (22.3 vs. 9.4 percent,  $p = 0.05$ ).

Table 3 shows overall and individual substance bivariate associations for increase in use. The covariates associated with an increase in cigarette smoking in bivariate logistic regression models were: greater than age 65 years (odds ratio (OR) = 0.2 vs. ages 18–24 years,  $p = 0.008$ ); household income \$75,000–\$99,000 per year (OR = 2.3 vs.

**TABLE 1. Prevalence of substance use and changes in substance use before and after September 11th, 2001, for 988 Manhattan, New York City, residents**

Substance	% using substance before September 11th*,†	95% confidence interval	% using substance after September 11th‡,§	95% confidence interval	% reporting increased use of substance after September 11th‡,§	95% confidence interval
Cigarettes	22.6	19.7, 25.5	23.4	20.4, 26.3	9.7	7.9, 11.4
Alcohol	59.1	55.5, 62.8	64.4	61.0, 67.9	24.6	21.5, 27.8
Marijuana	4.4	2.9, 5.8	5.7	4.0, 7.3	3.2	1.9, 4.6

\* Percentage of respondents who were using a substance (cigarettes, alcohol, or marijuana) during the week before September 11th, 2001.

† Sample weighted to account for the number of residents in the household and the number of telephones.

‡ Percentage of respondents who were using a substance during the week before the survey was administered, i.e., 4–7 weeks after September 11th, 2001.

§ Percentage of respondents who increased substance use in the week prior to survey administration compared with the week before September 11th, 2001. This percentage includes respondents who used the substance the week before September 11th and increased their frequency of use during the week prior to the survey and those who were not using the substance during the week before September 11th and were using it the week prior to the survey.

**TABLE 2. Associations between increase in substance use and prevalence of current posttraumatic stress disorder and current depression, Manhattan, New York City, 2001.**

Substance	No.	% with current* PTSD†	$\chi^2‡$	<i>p</i> value	% with current* depression†	$\chi^2‡$	<i>p</i> value
Total	988	7.5			9.7		
Increase in cigarettes							
No	886	5.6	12.9	<0.001	8.2	8.4	0.004
Yes	90	24.2			22.1		
Increase in alcohol							
No	675	7.8	0.2	0.65	8.3	6.3	0.01
Yes	223	8.8			15.5		
Increase in marijuana							
No	939	6.6	7.2	0.008	9.4	3.9	0.05
Yes	32	36.0			22.3		

\* "Current" denotes symptoms consistent with a diagnosis of posttraumatic stress disorder (PTSD) or depression within the 30 days prior to the interview.

† Sample weighted to account for the number of residents and the number of telephones in the household.

‡ Two-tailed chi-square test.

\$100,000 per year,  $p = 0.03$ ); living between Canal Street and 14th Street at the time of the attacks (OR = 2.3 vs. living between 60th Street and 110th Street,  $p = 0.005$ ); having had life stressors in the year before September 11th (OR = 2.5 for one vs. no life stressors,  $p = 0.003$ ; OR = 4.0 for more than two vs. no life stressors,  $p < 0.001$ ); fear of personal injury or death during the attacks (OR = 1.8 vs. no fear of personal injury or death,  $p = 0.03$ ); perievent panic attack (OR = 4.6 vs. no panic attack,  $p < 0.001$ ); having lost a job as a result of the September 11th attacks (OR = 2.5 vs. not having lost a job,  $p < 0.02$ ); and high media exposure (OR = 1.8 vs. low media exposure,  $p = 0.05$ ).

The covariates associated with an increase in alcohol drinking in bivariate logistic regression models were: greater than age 65 years (OR = 0.3 vs. ages 18–24 years,  $p = 0.02$ ); household income less than \$20,000 per year (OR = 0.4 vs. \$100,000 per year;  $p = 0.007$ ); marital status (OR = 0.4 for divorced, separated, or widowed vs. married,  $p = 0.009$ ; OR = 1.9 for member of an unmarried couple vs. married,  $p = 0.03$ ); one life stressor in the previous 12 months (OR = 1.7 vs. no life stressors,  $p = 0.007$ ); fear of personal injury or death during the attacks (OR = 1.7 vs. no fear of personal injury or death,  $p = 0.02$ ); perievent panic attack (OR = 1.7 vs. no panic attack,  $p = 0.03$ ); and high media exposure (OR = 2.4 vs. low media exposure,  $p < 0.001$ ).

The covariates associated with an increase in marijuana smoking in bivariate logistic regression models were: age (OR = 0.3 for ages 25–34 years vs. ages 18–24 years,  $p = 0.05$ ; OR = 0.2 for ages 55–64 vs. ages 18–24 years,  $p = 0.04$ ), marital status (OR = 7.8 for divorced, separated, or widowed, OR = 10.6 for never married, and OR = 15.8 for member of an unmarried couple all vs. married,  $p = 0.05$ , 0.007, and 0.004 respectively), and perievent panic attack (OR = 3.4 vs. no panic attack,  $p = 0.005$ ).

Table 4 shows the final multivariable models predicting increases in substance use. The adjusted covariates associated with an increase in cigarette smoking were: living between

Canal Street and 14th Street (OR = 2.4 vs. living between 60th Street and 110th Street,  $p = 0.007$ ); life stressors in the 12 months prior to September 11th (OR = 2.0 for one life stressor and OR = 2.6 for two or more life stressors vs. no life stressors,  $p = 0.03$  and 0.004, respectively), and perievent panic attack (OR = 3.6 vs. no panic attack,  $p < 0.001$ ). For the model of increase in alcohol consumption, only high media exposure (OR = 1.8 vs. low media exposure,  $p = 0.03$ ) was observed. The adjusted covariates associated with an increase in marijuana smoking were: ages 35–44 years (OR = 0.2 vs. ages 18–24 years,  $p = 0.05$ ); household income less than \$20,000 per year (OR = 0.1 vs. \$100,000 per year,  $p = 0.01$ ); marital status (OR = 11.0 for divorced, separated, or widowed, OR = 7.6 for never married, and OR = 8.7 for member of an unmarried couple all vs. married,  $p = 0.03$ , 0.02, and 0.03 respectively); and perievent panic attack (OR = 3.0 vs. no panic attack,  $p = 0.02$ ).

## DISCUSSION

Our results suggest that there was a substantial increase in substance use (cigarette smoking, alcohol consumption, or marijuana use) in Manhattan after the September 11th, 2001, terrorist attacks. Persons who reported an increase in substance use also had a higher prevalence of current PTSD and of current depression than did persons who did not increase their use of these substances. Overall, 28.8 percent of those in our sampling frame reported an increase in use of any substance; this corresponds to 265,000 persons (95 percent confidence interval: 236,000, 294,000) living in Manhattan below 110th Street. Persons who reported an increase in cigarette smoking or marijuana use were also more likely to have both PTSD and depression, while those who reported an increase in alcohol consumption were more likely to have depression only. Thus, our results suggest that increased substance use may be a significant problem in the immediate aftermath of a disaster and that it may frequently co-occur with PTSD and depression.

**TABLE 3. Bivariate relations between demographic and event exposure covariates and increase in cigarette smoking, alcohol consumption, and marijuana use, Manhattan, New York City, 2001\***

	No. of respondents†	Increase in cigarette smoking			Increase in alcohol consumption			Increase in marijuana use		
		% increase‡	OR§	p value	% increase	OR	p value	% increase	OR	p value
Total	988	9.7			24.6			3.2		
Age (years)										
18–24	70	17.4	1.0		28.6	1.0		9.3	1.0	
25–34	294	10.1	0.5	0.12	31.1	1.1	0.72	3.1	0.3	0.05
35–44	193	8.4	0.4	0.07	32.5	1.2	0.61	2.4	0.2	0.08
45–54	187	10.0	0.5	0.15	15.6	0.5	0.05	3.2	0.3	0.06
55–64	122	9.0	0.5	0.14	17.3	0.5	0.13	2.0	0.2	0.04
≥65	106	3.1	0.2	0.008	11.1	0.3	0.02	1.5	0.2	0.09
Income (dollars)										
≥\$100,000	308	9.7	1.0		28.8	1.0		2.8	1.0	
\$75,000–\$99,999	96	20.0	2.3	0.03	28.5	1.0	0.96	7.0	2.6	0.15
\$40,000–\$74,999	178	11.6	1.2	0.54	27.2	0.9	0.75	3.2	1.2	0.84
\$20,000–\$39,999	135	10.0	1.0	0.91	30.2	1.1	0.80	5.8	2.1	0.17
<\$20,000	93	7.2	0.7	0.51	12.5	0.4	0.007	0.3	0.1	0.05
Marital status										
Married	302	7.5	1.0		24.4	1.0		0.5	1.0	
Divorced, separated, or widowed	165	10.1	1.4	0.40	12.0	0.4	0.009	3.6	7.8	0.05
Never married	443	10.6	1.5	0.18	26.4	1.1	0.59	4.8	10.6	0.007
Unmarried couple	70	14.5	2.1	0.09	38.2	1.9	0.03	7.1	15.8	0.004
Location of residence before September 11th										
60th St. to 110th St.	471	7.8	1.0		25.4	1.0		3.4	1.0	
14th St. to 60th St.	283	8.3	1.1	0.83	25.2	1.0	0.97	2.0	0.6	0.27
Canal St. to 14th St.	184	16.3	2.3	0.005	24.5	1.0	0.84	5.5	1.7	0.31
Below Canal St.	50	8.1	1.0	0.94	15.6	0.5	0.18	0.0	NA	
Life stressors 12 months before September 11th										
0	554	5.5	1.0		21.0	1.0		2.1	1.0	
1	251	12.6	2.5	0.003	31.5	1.7	0.007	5.0	2.5	0.07
≥2	183	19.0	4.0	<0.001	26.4	1.4	0.19	4.4	2.2	0.13
Fear of personal injury or death										
No	812	8.7	1.0		23.2	1.0		3.2	1.0	
Yes	162	14.9	1.8	0.03	33.5	1.7	0.02	3.5	1.1	0.88
Panic attack¶										
No	864	7.3	1.0		23.3	1.0		2.5	1.0	
Yes	124	26.3	4.6	<0.001	33.7	1.7	0.03	8.1	3.4	0.005
Lost job due to the September 11th attacks										
No	924	9.0	1.0		24.5	1.0		3.2	1.0	
Yes	64	19.7	2.5	0.02	26.1	1.1	0.81	4.0	1.3	0.75
Media exposure#										
Low	325	7.7	1.0		17.2	1.0		2.5	1.0	
Medium	319	8.6	1.1	0.70	23.7	1.5	0.08	3.9	1.6	0.42
High	327	13.1	1.8	0.05	32.9	2.4	<0.001	3.5	1.4	0.53

\* Only covariates significantly associated with one of the outcome variables in two-tailed chi-square tests are included in table.

† Number of respondents in the covariate category. Numbers may not add up to 988 because of missing values.

‡ Sample weighted to account for the number of residents and the number of telephones in the household.

§ OR, odds ratio.

¶ Symptoms consistent with a panic attack in the first few hours after the September 11th attacks.

# Total number of times respondents saw five specific images on television in the 7 days after September 11th, divided into thirds.

**TABLE 4. Multivariable models predicting an increase in cigarette smoking, alcohol consumption, and marijuana use, Manhattan, New York City, 2001**

	Increase in cigarette smoking		Increase in alcohol consumption		Increase in marijuana smoking	
	OR*	<i>p</i> value	OR	<i>p</i> value	OR	<i>p</i> value
<b>Age (years)</b>						
18–24	1.0		1.0		1.0	
25–34	0.5	0.11	1.0	0.99	0.3	0.08
35–44	0.4	0.07	1.2	0.63	0.2	0.05
45–54	0.5	0.18	0.6	0.16	0.4	0.22
55–64	0.7	0.43	0.5	0.19	0.3	0.24
≥65	0.3	0.13	0.4	0.13	0.3	0.29
<b>Income (dollars)</b>						
≥\$100,000	1.0		1.0		1.0	
\$75,000–\$99,999	1.6	0.21	1.1	0.77	2.0	0.32
\$40,000–\$74,999	1.0	0.96	1.0	0.98	0.8	0.72
\$20,000–\$39,999	0.8	0.55	1.4	0.26	1.2	0.81
<\$20,000	0.4	0.06	0.5	0.13	0.1	0.01
<b>Marital status</b>						
Married			1.0		1.0	
Divorced, separated, or widowed			0.7	0.28	11.0	0.03
Never married			0.9	0.65	7.6	0.02
Unmarried couple			1.5	0.25	8.7	0.03
<b>Location of residence before September 11th</b>						
60th St. to 110th St.	1.0					
14th St. to 60th St.	1.0	0.86				
Canal St. to 14th St.	2.4	0.007				
Below Canal St.	1.1	0.84				
<b>Life stressors 12 months before September 11th</b>						
0	1.0		1.0			
1	2.0	0.03	1.5	0.06		
≥2	2.6	0.004	1.1	0.74		
<b>Fear of personal injury or death</b>						
No	1.0		1.0			
Yes	1.1	0.77	1.4	0.16		
<b>Panic attack†</b>						
No	1.0		1.0		1.0	
Yes	3.6	<0.001	1.5	0.20	3.0	0.02
<b>Lost job due to the September 11th attacks</b>						
No	1.0					
Yes	1.4	0.44				
<b>Media exposure‡</b>						
Low	1.0		1.0			
Medium	1.0	0.88	1.3	0.37		
High	1.3	0.49	1.8	0.03		

\* OR, odds ratio.

† Symptoms consistent with a panic attack in the first few hours after the September 11th attacks.

‡ Total number of times respondents saw five specific images on television in the 7 days after September 11th, divided into thirds.

Several research groups have identified substance use as a significant problem after disasters and traumatic events (9–12, 22). For example, using methodology comparable with our study, a national survey of women found that 38.7

percent of women with a history of assault were smokers compared with 23.6 percent of women with no history of assault (8). However, different time frames for assessment, different measures of substance use, and a predominant

focus on direct survivors make it difficult to compare the observed increase in substance use in our study with these previous studies.

We documented an association between increases in cigarette and marijuana smoking and current PTSD and one between alcohol consumption, cigarette smoking, and depression. The estimates of increased substance use among persons with PTSD and depression in our sample are consistent with the documented comorbidity of substance use and PTSD in other samples. For example, among survivors of the Oklahoma City bombing, 32.4 percent of subjects with PTSD and a comorbid diagnosis drank alcohol (22).

In our data, PTSD was not associated with increased risk of alcohol consumption but was associated with increased risk of marijuana use and smoking. This finding is consistent with data from one national survey (23) but runs counter to observations from other surveys (24). It is possible that the absence of an association between PTSD and alcohol consumption is a result of the time frame used in this study. We focused our analysis on current PTSD and the increase in alcohol consumption in the previous week compared with baseline. Since increased alcohol consumption was relatively more common during the period of the study, it may reflect a short-term normative adaptation. Alcohol may play a more important role as a factor that maintains and/or is maintained by PTSD in the medium to long term (25), and associations between alcohol consumption and PTSD at longer postdisaster intervals may provide a clearer picture of more problematic and persistent changes in postevent alcohol consumption.

Rates of smoking in veterans with PTSD have been reported to be higher than those observed in the general population (26). Although smoking in persons suffering from depressive and anxiety disorders has been conceptualized as a coping strategy (8), there are very few estimates available of the cooccurrence of increased smoking and PTSD or depression after disasters. In the general population, depression frequently cooccurs with nicotine dependence (27). In a national survey of women, those with a lifetime history of depression were twice as likely to smoke as those who did not have a depressive history, although current depression was not associated with increased cigarette smoking, contrary to the findings of our study (8). The limited evidence on the relation between psychiatric morbidity and marijuana use suggests that increased marijuana use accompanies PTSD after different types of trauma (28), an observation consistent with the findings of this study.

Although a few studies have shown that the degree of event exposure is associated with greater substance use after disasters (29, 30), problems with uniformly measuring disaster exposure make it difficult to draw conclusions about relative increase in substance use within exposure gradients. Studies of uniformed personnel who have significant exposure to disasters and traumatic events show rates of alcohol consumption that are higher than those in the general population (31). In our data, persons who were living closer to the site of the September 11th attacks were more likely to increase their cigarette smoking when other covariates were controlled for. However, other event exposure measures,

including being displaced from home, losing possessions during the attacks, and being involved in the rescue efforts, were not consistently associated with increased substance use.

Perievent panic attack was consistently associated with an increase in use of all substances in bivariate analyses and with an increase in marijuana and cigarette smoking in adjusted models. This finding is intriguing. Previous work has shown that acute emotional responses are associated with the development of PTSD and depression after disasters (32). Epidemiologic investigations that have explored the relation between panic attacks and smoking suggest that smoking may contribute to subsequent panic attacks (33). This raises the possibility that substance use may mediate the relation between perievent autonomic stimulation and longer-term panic disorders and PTSD (34). Further longitudinal posttrauma research should explore this potential pathway.

Epidemiologic evidence suggests that men are more likely to have lifetime diagnoses of substance use dependence than are women (35). However, there is little convincing evidence that changes in substance use after disasters are different between men and women (36). We did not document a consistent relation between gender and increase in any of the substances studied. The relative importance of sociodemographic covariates (such as income and marital status) suggests that demographic characteristics other than gender play a critical role in subsequent substance use and cooccurring psychopathology. Similarly, although data suggest that race/ethnicity may be related to the likelihood of posttrauma psychopathology (37), there is little evidence for a relation between differential rates of substance use in racial/ethnic groups postdisaster. One study that documented a higher level of PTSD and alcohol abuse-dependence in a group of Hispanic Vietnam combat veterans did not include veterans of other races (38). Although we have previously demonstrated that in this sample Hispanics were more likely to have symptoms consistent with PTSD and depression when other important covariates are controlled for (2), we did not find a racial/ethnic difference in rates of increased substance use after the September 11th attacks.

The observations we draw from this study must be interpreted with caution. At the time of the study, residents of New York City were on heightened alert because of the discovery of anthrax in the city and concern about possible further terrorist attacks. In addition, the concomitant evolving economic recession added to stressors faced by New York City at the time. This may mean that a degree of the observed increase in substance use was associated with other stressors in addition to the events of September 11th. Rates of increase in substance use in more circumscribed disasters may be expected to be lower than those observed in this study. We collected data by using anonymous telephone interviews, raising the possibility of the underreporting of substances used. It is also possible that respondents' recall may have been less accurate when they were asked about substance use before September 11th than it was when they were asked about substance use in the week prior to the survey. Baseline prevalence of cigarette smoking, alcohol

drinking, and marijuana use are, however, comparable with national estimates (39), providing some basis of comparison. We note that the population of Manhattan below 110th Street is largely White, affluent, and well-educated. It is difficult to generalize these results to more sociodemographically diverse groups. This study was carried out 5–8 weeks after September 11th, too early to allow the introduction of a measure of substance use dependence. We were interested instead in documenting an increase in substance use as a way of informing public health intervention. The substantial increase in substance use that we documented soon after the September 11th attacks, along with the cooccurrence with mental health problems, suggests that public health practitioners in the postdisaster period may consider raising awareness of these issues among the general public and, among clinicians, in the early postdisaster period. Future research should explore the relations between event exposure, psychopathology, and substance use and dependence.

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