

## Television Images and Psychological Symptoms after the September 11 Terrorist Attacks

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Exposure to graphic television images may exacerbate psychological symptoms in disaster situations. We tested the hypotheses that (1) more frequent viewing of television images of the September 11 terrorist attacks was associated with posttraumatic stress disorder (PTSD) and depression, and that (2) direct exposure to disaster events had an interactive effect with media viewing. We recruited 1,008 adult residents of the borough of Manhattan in New York City through a random-digit-dial telephone survey conducted between October 16 and November 15, 2001. Respondents who repeatedly saw "people falling or jumping from the towers of the World Trade Center" had higher prevalence of PTSD (17.4%) and depression (14.7%) than those who did not (6.2% and 5.3%, respectively). Among respondents who were directly affected by the attacks (e.g., had a friend killed), those who watched this television image frequently were more likely to have PTSD and depression than those who did not. Among respondents not directly affected by the attacks, prevalence of PTSD and depression was not associated with frequency of television image viewing. Specific disaster-related television images were associated with PTSD and depression among persons who were directly exposed to a disaster. Future research should address causal directionality of this association.

From the first moments of the September 11 terrorist attacks in New York City, television coverage provided a major means of communication about the development of

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events in the city and elsewhere. The television broadcasts of all major networks featured live and recurring images of the September 11 attacks, from the initial impact of the airplanes colliding with the World Trade Center (WTC) towers to their ultimate collapse.

Although media coverage plays an essential role of communication in disaster situations, it also has the potential to powerfully affect those viewing (Holloway, Norwood, Fullerton, Engel, and Ursano 1997). Little is known about the impact of media viewing on mental health after major disasters. After the 1995 Oklahoma City bombing, children who watched extensive television coverage of terrorist attacks had more posttraumatic stress symptoms in both shorter- and longer term assessments (Pfefferbaum et al. 1999; Pfefferbaum, Nixon, et al. 1999; Pfefferbaum, Gurwitch, et al. 2000; Pfefferbaum, Seale, et al. 2000; Pfefferbaum et al. 2001). Other studies of children suggest that media coverage affects their mental health after traumatic experiences (Nader, Pynoos, Fairbands, Al-Ajeel, and Al-Asfour 1993; Terr et al. 1999). Although data about the effects of television coverage after a terrorist attack on the mental health of adults are sparse, research suggests that media is a common trigger of suppressed traumatic memories, reactivation of posttraumatic stress disorder (PTSD) in veterans, and a cause of immediate physiological arousal, particularly among adults who have experienced various kinds of individual traumatic events such as an assault or a motor vehicle accident (Elliott 1997; Kinzie et al. 1998; Long, Chamberlain, and Vincent 1994; Moyers 1996).

We hypothesized an association between exposure to media images after the September 11 attacks and psychopathology in adults. In particular, we hypothesized that (1) more frequent viewing of different images regarding the September 11 attacks would be associated with PTSD and depression, and that (2) direct exposure to the events of September 11 would have an interactive effect with media viewing and be associated with PTSD and depression. We tested these hypotheses through a random-digit-dial survey of Manhattan residents.

## METHOD

We conducted a telephone survey between October 16 and November 15, 2001, with residents of the borough of Manhattan in New York City living south of 110th Street. Using random-digit-dial methods, households were contacted and then screened for eligibility by location. In geographically eligible households an adult was randomly selected for interview based on most recent birthday. The interview took approximately 35 minutes and the cooperation rate was 64.3%. The study protocol was approved by the New York Academy of Medicine Institutional Review Board.

Respondents answered questions about demographic characteristics including age, race/ethnicity, sex, income, and education. We collected information on background factors such as major stressors experienced in the previous 12 months (including recent mental or emotional problems), amount of social support available in the previous 6 months, and location where the respondent lived before the September 11 attacks. The survey included questions on event-experiences related to the attacks, which included report of a friend or family member killed in the attacks, witnessing the attacks in person, postevent loss of a job, loss of possessions, displacement from home for at least one night, and participation in the rescue efforts. For the purposes of this analysis we created an "any event experience" question. Event experiences were combined into one measure of any direct event exposure or involvement (any of the preceding items reported or none), which focused on people who were exposed in any way to the September 11 attacks or their aftermath.

Exposure to television was measured with a series of questions about several specific images that were broadcast repeatedly. Respondents were asked whether or not they saw these images on television, and if they had, how many times they saw them in the 7 days following September 11. The images included "an airplane hitting the WTC," "buildings collapsing," "people running away from a cloud of smoke," and "people falling or jump-

achieved sample is representative of the underlying population.

Most respondents reported that they saw television images of the disaster more than daily during the first week after September 11. The image of "an airplane hitting the WTC" was never seen by only 3.5% of respondents, while 87% saw this image more than 7 times in the 7 days after the September 11 attacks. This image was viewed a median of 36 times. The images of the "buildings collapsing" and of "people running away from a cloud of smoke" were never seen by 5.1% and 4.5% of respondents, respectively, and were seen by 83.1% and 82.9% of respondents, respectively, more than daily. The "buildings collapsing" was seen a median of 29 times and "people running away from a cloud of smoke" was seen a median of 25 times. Respondents reported seeing "people falling or jumping from the towers of the WTC" far less frequently than the other images. Of the sample, 39.5% never saw this image and only 19.5% saw this more than 7 times. This image was seen a median of 2 times.

Figures 1 and 2 show the percentages of PTSD and depression, respectively, among respondents who reported seeing each of the images with different frequencies in the 7 days following September 11. For the images of "an airplane hitting the WTC," "people running away from a cloud of smoke," and "people falling or jumping from the towers of the WTC," these figures suggest a trend between increased frequency of viewing the images and both PTSD and depression prevalences. The strongest association in both cases is for the image of people falling or jumping; 14.7% of those who reported seeing this image more than 7 times had PTSD and 17.4% had depression. The image of "buildings collapsing" was not associated with either PTSD or depression.

Table 1 shows percentages and crude odds ratios for the relation between the frequency of viewing each image and PTSD and depression. PTSD was more common in those who reported seeing the image of people falling or jumping more than 7 times than in those who did not see this image ( $OR = 3.1$ ,  $p <$

.001). Depression was more common among those who reported seeing the image of people falling or jumping more than 7 times compared to those who did not ( $OR = 3.2$ ;  $p < .001$ ), as was the case with the image of an airplane hitting the WTC ( $OR = 5.1$ ;  $p = .01$ ).

To examine if television images had a different effect on people who had been more directly affected by or involved with the September 11 attacks or their aftermath, we focused on the image of "people falling or jumping from the towers of the WTC." This was the image most consistently associated with both PTSD and depression. Table 2 shows adjusted logistic regression models for the association between the image of people falling or jumping and PTSD. First, the background and demographic variables gender, race/ethnicity, income, location of residence before September 11, social support, and stressors in the prior 12 months were considered for the multivariable model; likelihood ratio comparisons were used to determine which variables were retained. Second, the variable for having been directly exposed to the attacks was added to the regression. Different theoretically driven combinations of exposure variables were used to categorize "direct" exposure; all combinations yielded similar results, and results using one combination of variables are presented here. Finally, an interaction term between viewing the image of people falling or jumping and direct exposure to the attacks was added. The image of people falling or jumping was still associated with PTSD after full adjustment ( $OR$  for  $>7$  times = 2.5;  $p = .009$ ). The addition of an interaction term showed that those who were directly exposed and saw the image more than 7 times had a higher odds of PTSD ( $p = .08$ ). Table 3 shows equivalent logistic regression models with depression as the outcome. The background and demographic factors gender, race, income, education, social support and stressors in the prior 12 months were considered for the multivariable model and likelihood ratio comparisons were used to determine which variables to retain. The variable for direct exposure to the attacks and finally an interaction term were added, as in the PTSD models. The image of

ing from the towers of the WTC." For the purpose of these analyses we categorized the number of times people had seen each of these images on television into three categories: 0 times, 1–7 times, and more than 7 times. These categories were chosen because they represent potentially meaningful differences between routine television viewing and persons who watched television for prolonged periods during the week after September 11.

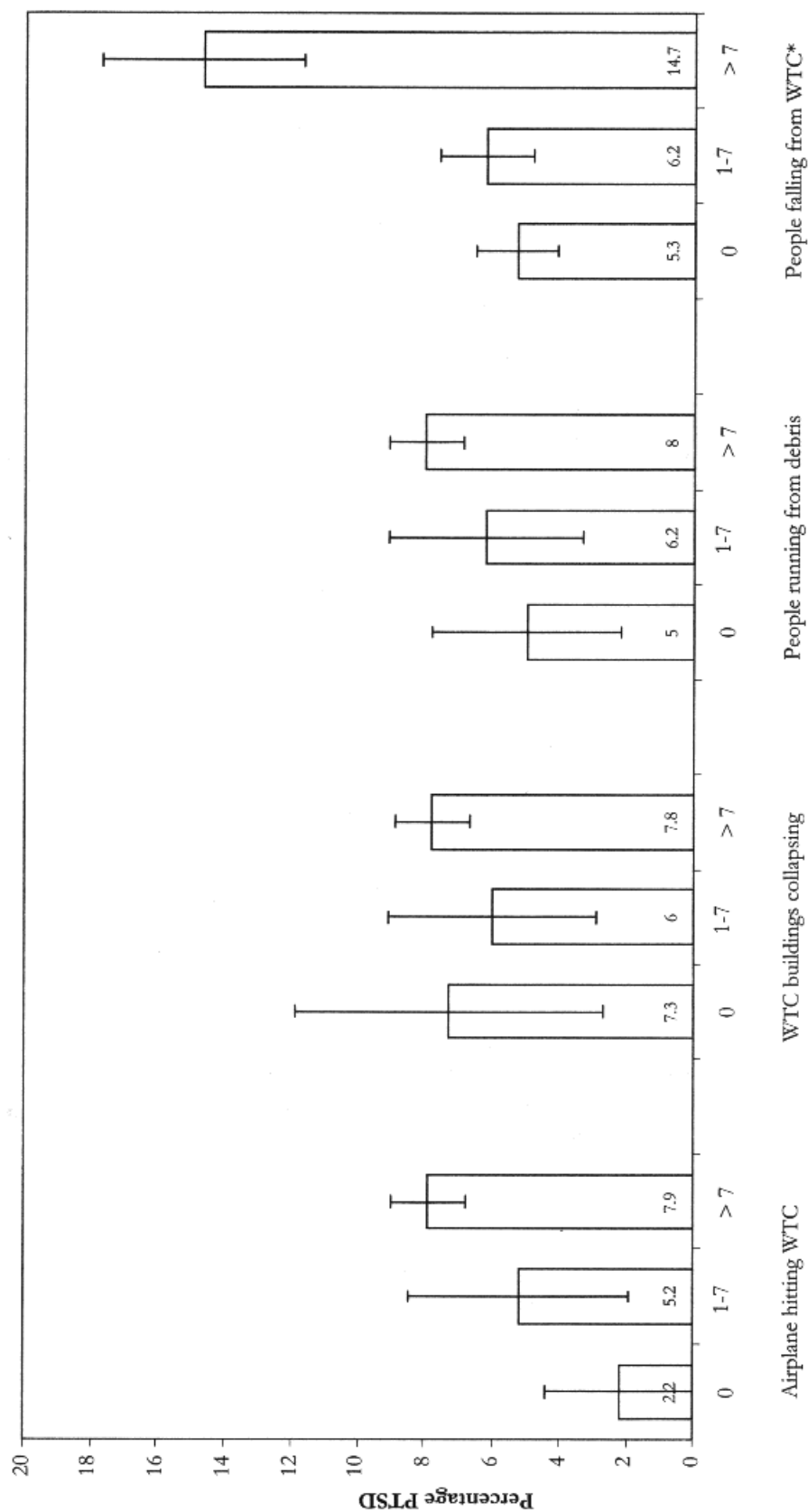
We examined two mental health outcome measures: PTSD and depression. The PTSD measure used was the National Women's Study (NWS) measure of PTSD. The NWS PTSD measure is a structured interview that captures symptoms consistent with the *Diagnostic and Statistical Manual of Mental Disorder, 4th edition (DSM-IV)* criteria (American Psychiatric Association, 1994) and has a coefficient of agreement with a clinician-administered interview of 0.71 for current PTSD (Kilpatrick et al. 1998; Resnick, Kilpatrick, Dansky, Saunders, and Best 1993). It includes questions on each of the three PTSD criterion groups, B (reexperiencing), C (avoidance), and D (arousal). For event-specific questions (e.g., unwanted distressing memories), the response contributed to the measure of current PTSD if it was related specifically to the September 11 attacks. Current PTSD was based on all symptoms reported within past 30 days. One B item, three C items, and two D items were required for classification as having symptoms consistent with PTSD. Depression was measured with the NWS depression module, a validated measure that captures symptoms consistent with DSM-IV criteria (Kilpatrick, Saunders, and Smith 2001). To meet the criteria for depression, respondents had to report four or more symptoms for a period of at least 2 weeks, one of which included depressed mood or loss of pleasure or interest. Current depression was based on required symptoms reported within the past 30 days.

All analyses were weighted by number of telephones and adults in the household to account for the probability of selection and performed using SUDAAN to properly adjust statistical tests for a weighted sample. We

present the number of times each image was viewed in the 7 days after the attacks. Percentages, odds ratios (OR), 95% confidence intervals (CI), and *p*-values are presented for each image by PTSD and depression. Using multiple logistic regression, the relations between the image of "people falling or jumping from the towers of the World Trade Center" (the image most consistently associated with both outcomes) and PTSD and depression were first adjusted by background and demographic factors associated with each outcome in bivariate associations, presented in earlier analyses (Galea et al. 2002). Second, we accounted for traumatic event experiences by adjusting for those who had experienced direct event exposure (any or none) related to the attacks. Third, we added an interaction term between the frequency of viewing the image of people falling or jumping and being directly exposed. This permitted the assessment of multiplicative interaction between image viewing frequency and event-exposure. To fully test the hypothesis that those who were directly involved in or affected by the attacks would be more affected by seeing television images, we also assessed the data for the presence of additive interactions. To allow for assessment of additive interaction, we stratified the association of television image frequency with PTSD and depression by direct event exposure (any or none). We used a two-tailed chi-square test to assess the relation between television image frequency and each psychological outcome within the two strata.

## RESULTS

Of 1,008 completed interviews, 20 participants were excluded in analysis due to missing weight values. Mean age was 42 years old, 52% were female, 71% were white and 14.3% were Hispanic. The distribution of location of residence (e.g., 5.2% south of Canal Street) and the demographic characteristics match closely with demographic estimates from the 2000 U.S. Census for the area south of 110th Street in Manhattan, suggesting that the

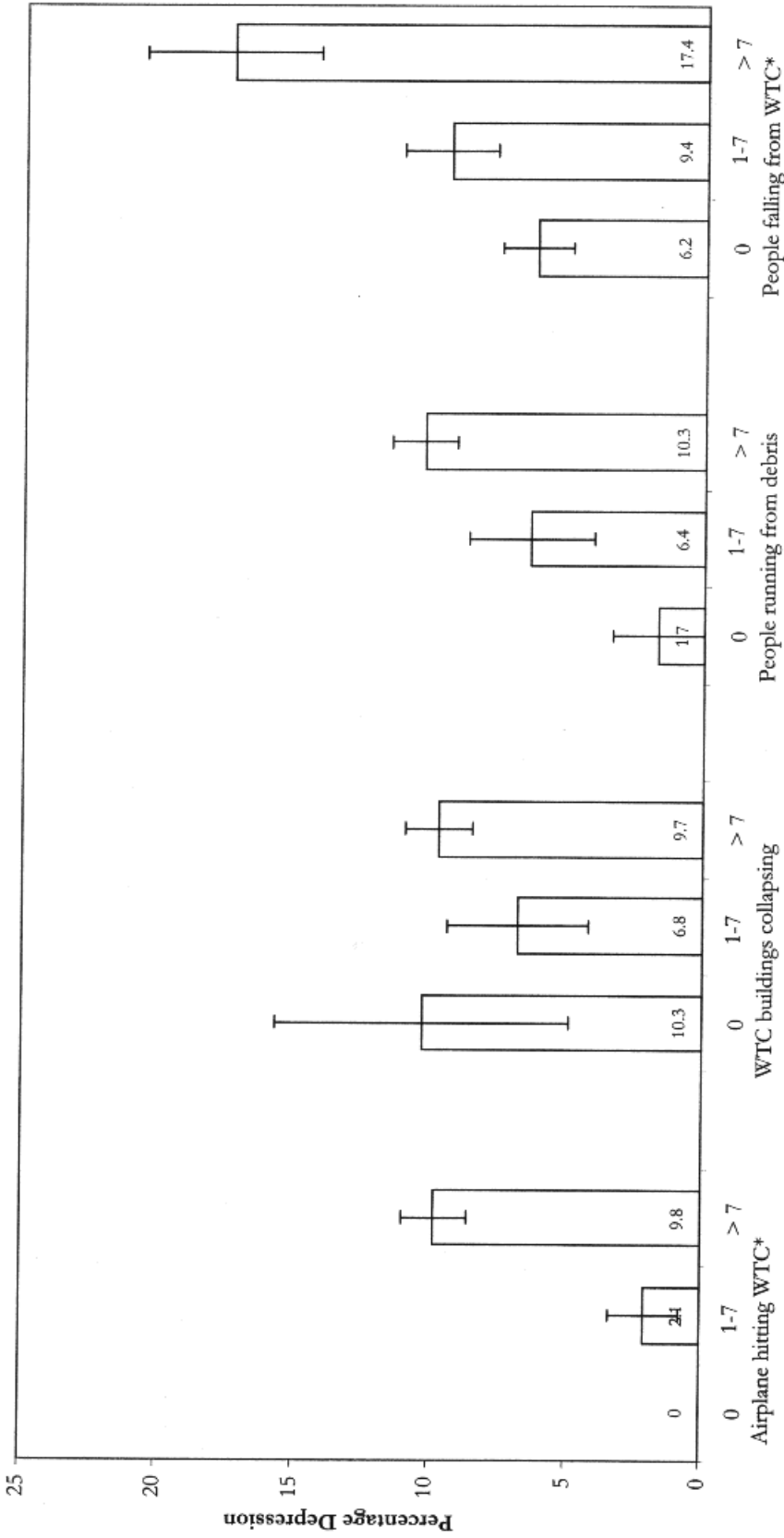


Number of Times Images Viewed.

Figure 1.

Percentage of posttraumatic stress disorder by number of times specific images viewed on television in the 7 days after the World Trade Center disaster.

\*Wald adjusted  $F$ -test  $p < .05$ .



Number of Times Images Viewed.

Figure 2.

Percentage of depression by number of times specific images viewed on television in the 7 days after the World Trade Center disaster.

\*Wald adjusted F-test  $p < .05$ .

**TABLE 1**  
*Bivariate Relation between Frequency of Viewing Television Images and PTSD and Depression*

Television Image	Number of Times Seen <sup>a</sup>	N	% PTSD <sup>b</sup>				% Depression <sup>b</sup>				
			OR	95% CI	p-value	OR	95% CI	p-value			
Airplanes hitting WTC	0	36	2.2	1.0	—	—	0.0	n/a	—	—	
	1-7	84	5.2	2.4	0.2-26.6	0.47	2.1	1.0	—	—	
	>7	763	7.9	3.8	0.5-28.2	0.20	9.8	5.1	1.5-17.5	0.01	
WTC buildings collapsing	0	47	7.3	1.0	—	—	10.3	1.0	—	—	
	1-7	102	6.0	0.8	0.2-4.5	0.82	6.8	0.6	0.2-2.5	0.52	
	>7	747	7.8	1.1	0.3-4.3	0.91	9.7	0.9	0.3-3.0	0.91	
People running from debris	0	47	5.0	1.0	—	—	1.7	1.0	—	—	
	1-7	109	6.2	1.3	0.3-5.9	0.76	6.4	4.0	0.5-33.7	0.20	
	>7	749	8.0	1.7	0.5-5.6	0.41	10.3	6.7	0.9-50.0	0.06	
People falling from WTC	0	375	5.3	1.0	—	—	6.2	1.0	—	—	
	1-7	380	6.2	1.2	0.6-2.3	0.64	9.4	1.6	0.9-2.8	0.13	
	>7	186	14.7	3.1	1.6-6.0	<0.001	17.4	3.2	1.7-5.8	<0.001	

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

<sup>a</sup>Number of times specific image was viewed on television in the week after the September 11 attacks.

<sup>b</sup>Symptoms consistent with posttraumatic stress disorder or depression within the previous 30 days.

people falling or jumping was associated with depression after full adjustment (OR for >7 times = 2.9; *p* = .002). The addition of an interaction term in this model did not show multiplicative interaction (*p* = .38).

Table 4 shows the association between the image of people falling or jumping and PTSD and depression, stratified by direct involvement to assess additive interaction. There was an association between viewing the image of people falling or jumping and the prevalence of PTSD and depression among those who were directly exposed (*p* = .006, *p* = .005 respectively), but not among those who were not directly exposed (*p* = .51, *p* = .45, respectively). The prevalence of PTSD was highest among respondents who were directly exposed and saw the image more than 7 times (22.5%), while it was much lower among those not directly affected who reported seeing the image more than 7 times (3.6%), suggesting additive interaction. Similarly, the prevalence of depression was highest among respondents who were directly involved and saw the image more than 7 times (21.3%), and much lower among those not directly affected

who reported seeing the image more than 7 times (11.7%), suggesting additive interaction.

**DISCUSSION**

In this representative survey of Manhattan residents conducted 5-8 weeks after September 11, we found that most people were exposed to multiple television images related to the WTC attacks in the first week after they occurred. This finding is consistent with the impression that New Yorkers were intensely following the news coverage in the days following the attacks, particularly as many were at home due to a virtual shutdown of the city below 14th Street, disruption in phone service, and the difficulties of transportation to work throughout the city (Kennedy 2001a, 2001b).

The different relations between each of the four images and both PTSD and depression suggest that certain images may be more disturbing to people and contribute more to postdisaster psychopathology. In particular,

**TABLE 2**  
*Logistic Regression Models Predicting PTSD, Adjusting for Confounders and Examining Interaction<sup>a</sup>*

Characteristic	beta	OR	p-value	beta	OR	p-value	beta	OR	p-value
Times saw people falling from WTC									
0	0.0	1.0	—	0.0	1.0	—	0.0	1.0	—
1-7	0.33	1.4	0.36	0.40	1.5	0.27	0.76	n/a <sup>b</sup>	0.22
>7	0.94	2.6	0.008	0.93	2.5	0.009	-0.28	n/a <sup>b</sup>	0.72
Gender									
Male	0.0	1.0	—	0.0	1.0	—	0.0	1.0	—
Female	0.71	2.0	0.03	0.72	2.1	0.03	0.70	2.0	0.04
Race									
White	0.0	1.0	—	0.0	1.0	—	0.0	1.0	—
African American	0.04	1.0	0.94	0.26	1.3	0.62	0.34	1.4	0.53
Asian	-0.88	0.4	0.15	-0.84	0.4	0.18	-0.90	0.4	0.16
Hispanic	0.66	1.9	0.05	0.74	2.1	0.03	0.76	2.1	0.03
Other	1.26	3.5	0.10	1.17	3.2	0.12	1.22	3.4	0.09
Where lived before September 11									
110th St. to Canal St.	0.0	1.0	—	0.0	1.0	—	0.0	1.0	—
Below Canal St.	1.41	4.1	0.002	1.3	3.6	0.007	1.27	3.6	0.008
Life stressors 12 months before September 11									
0	0.0	1.0	—	0.0	1.0	—	0.0	1.0	—
1	0.61	1.8	0.12	0.59	1.8	0.13	0.60	1.8	0.13
≥2	1.76	5.8	<0.001	1.74	5.7	<0.001	1.78	5.9	<0.001
Direct event exposure <sup>c</sup>									
No				0.0	1.0	—	0.0	1.0	—
Yes				0.75	2.1	0.02	0.64	n/a <sup>b</sup>	0.28
Interactions									
Direct exposure × image 1-7							-0.68	n/a <sup>b</sup>	0.38
Direct exposure × image > 7							1.56	n/a <sup>b</sup>	0.08

Note. OR, odds ratio.

<sup>a</sup>Models predicting symptoms consistent with posttraumatic stress disorder within previous 30 days.

<sup>b</sup>Odds ratios must be calculated to include parameters for both main effects and interaction terms. For example, the odds ratio for PTSD in respondents who reported seeing the image >7 times and who had direct event exposure (compared to respondents who did not see the image and who did not have event exposure as referent) =  $\exp(-0.28 + 0.64 + 1.56) = 6.8$ .

<sup>c</sup>Direct exposure included respondents who met any of the following criteria: saw any part of the World Trade Center disaster while it was happening in person, had a friend or relative killed, moved out of their home for at least one night, lost possessions or had possessions damaged, were involved in the rescue or recovery efforts, or lost their job.

frequent viewing of the image of people falling or jumping from the towers of the WTC was strongly related to PTSD and depression. This association was exacerbated among respondents who had experienced or been directly affected by the events.

The strong relation between image frequency and both PTSD and depression

among those directly involved in, or affected by, the attacks, and the lack of such a relation in other respondents has not been previously documented among adults. A study among children after the Oklahoma City bombing showed that although television viewing time was positively associated with posttraumatic stress symptoms, there was no interaction be-



TABLE 3

*Logistic Regression Models Predicting Depression, Adjusting for Confounders and Examining Interaction<sup>a</sup>*

Characteristic	beta	OR	p-value	beta	OR	p-value	beta	OR	p-value
Times saw people falling from WTC									
0	0.0	1.0	—	0.0	1.0	—	0.0	1.0	—
1-7	0.59	1.8	0.06	0.65	1.9	0.04	0.23	n/a <sup>b</sup>	0.64
>7	1.09	3.0	0.001	1.08	2.9	0.002	0.65	n/a <sup>b</sup>	0.28
Social Support									
High	0.0	1.0	—	0.0	1.0	—	0.0	1.0	—
Medium	0.35	1.4	0.40	0.36	1.4	0.39	0.39	1.5	0.34
Low	1.22	3.4	<0.001	1.21	3.4	<0.001	1.22	3.4	<0.001
Life stressors 12 months before September 11									
0	0.0	1.0	—	0.0	1.0	—	0.0	1.0	—
1	0.47	1.6	0.17	0.46	1.6	0.18	0.47	1.6	0.17
≥2	1.39	4.0	<0.001	1.39	4.0	<0.001	1.42	4.1	<0.001
Direct event exposure <sup>c</sup>									
No				0.0	1.0	—	0.0	1.0	—
Yes				0.65	1.9	0.02	0.18	n/a <sup>b</sup>	0.70
Interactions									
Direct exposure × image 1-7							0.66	n/a <sup>b</sup>	0.30
Direct exposure × image > 7							0.65	n/a <sup>b</sup>	0.38

Note. OR, odds ratio.

<sup>a</sup>Models predicting symptoms consistent with depression within previous 30 days.

<sup>b</sup>Odds ratios must be calculated to include parameters for both main effects and interaction terms. For example, the odds ratio for depression in respondents who reported seeing the image >7 times and who had direct event exposure (compared to respondents who did not see the image and who did not have event exposure as referent) =  $\exp(0.65 + 0.18 + 0.65) = 4.4$ .

<sup>c</sup>Direct exposure included respondents who met any of the following criteria: saw any part of the World Trade Center disaster while it was happening in person, had a friend or relative killed, moved out of their home for at least one night, lost possessions or had possessions damaged, were involved in the rescue or recovery efforts, or lost their job.

tween physical and emotional exposure to the bombing and television viewing time in relation to this outcome (Pfefferbaum et al. 2001). However, in other analyses of these children, those who lost an acquaintance, friend, or family member had more difficulty calming down after watching bomb-related television coverage 7 weeks after the attack (Pfefferbaum, Moore, et al. 1999; Pfefferbaum, Nixon, et al. 1999). In adult veterans, it has been shown that not having a sense of control over events increases the risk of PTSD, and that among veterans with PTSD, imagery of the precipitating event can revive these feelings of a lack of control (Hendin and Haas 1984; Pittman, Orr, Fergue, DeJong, and Claiborn

1987). While New Yorkers did not have control over the events of September 11, those who were impacted directly may have felt the lack of control more acutely than others. Extensive media exposure in this group may have activated these feelings over a longer period of time and increased their risk of psychological symptomatology.

The image of people falling or jumping from the towers of the WTC is a particularly vivid and disturbing image. It has been documented in this and other studies that exposure to event experiences increases the risk of psychopathology in disaster situations (Green et al. 1990; North et al. 1999). Repeated viewing of an image so unusual and upsetting may have

TABLE 4

*Relation Between Television Image of "People Falling or Jumping from the WTC" and PTSD and Depression, Stratified by Direct Exposure to the Events and Aftermath of September 11*

Subgroup	Times Viewed People Falling from WTC <sup>a</sup>	N	Weighted % <sup>b</sup>	% PTSD	P-value	% Depression	P-value <sup>c</sup>
Directly involved in or affected by Sept 11 attacks <sup>d</sup>							
Yes	Total	502		9.9		12.0	
	0	211	40.9	6.7	0.006	6.5	0.005
	1-7	184	37.6	6.1		12.7	
	> 7	107	21.5	22.5		21.3	
No	Total	439		4.8		7.1	
	0	164	28.6	3.6	0.51	5.9	0.45
	1-7	196	58.7	6.3		6.4	
	> 7	79	12.7	3.6		11.7	

<sup>a</sup>Number of times respondents saw the image of people falling or jumping from the World Trade Center towers on television in the week after the September 11 attacks.

<sup>b</sup>Sample weighted to account for number of residents in household and number of telephones.

<sup>c</sup>Two-sided chi-square test.

<sup>d</sup>Direct involvement included respondents who met any of the following criteria: saw any part of the World Trade Center disaster while it was happening in person, had a friend or relative killed, moved out of their home for at least one night, lost possessions or had possessions damaged, were involved in the rescue or recovery efforts, or lost their job.

been an additional indirect exposure to the disaster among those who were already affected by or involved in the disaster. This particular image was shown on television only on the first few days after the event, which may explain its less frequent viewing. It is difficult to speculate on the potential effect prolonged broadcasting of this image may have had on mental health.

The current study has several limitations. We examined media exposure in the 7 days after the disaster and PTSD and depression 5-8 weeks after September 11. However, we cannot know if people who began to develop psychological symptoms soon after the attacks watched more television as a result of these symptoms or if the television viewing contributed to these symptoms. It is plausible that in many cases each was contributing to the other. The different associations of qualitatively different images with PTSD and depression do suggest that there may be an exacerbation of psychological symptoms by more

disturbing images. However, prospective assessment would be necessary to establish the temporal association between these factors. In addition, people with PTSD or depression may have recalled seeing the television images more frequently in retrospect because they may have felt more affected by the events, and people with preexisting anxiety disorders may have been more likely both to watch television and to develop PTSD (Breslau, Davis, Andreski, Peterson, and Schultz 1997). Almost ubiquitous viewing of many television images may have led to imprecise estimates and limited our ability to examine potential interactive effects of viewing those images and direct exposure to the September 11 attacks.

Notwithstanding these limitations, there are two practical implications of the observed association between frequency of viewing disaster images and mental health. In future postdisaster conditions, clinicians who encounter people directly affected by the disaster may recommend a reduction in exposure to

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