

Television Images and Probable Posttraumatic Stress Disorder After September 11

The Role of Background Characteristics, Event Exposures, and Perievent Panic

Jennifer Ahern, MPH,* Sandro Galea, MD, DrPH,*† Heidi Resnick, PhD,‡ and David Vlahov, PhD*†

Abstract: Television viewing has been associated with posttraumatic stress disorder (PTSD) symptoms after disasters and traumas; we examined characteristics that may explain this association among New Yorkers after September 11, 2001. Among 2001 respondents to a random-digit dial telephone survey conducted 4 months after September 11, people who viewed more television images in the 7 days after September 11 had more probable PTSD. People in the highest third of viewing had a 2.32 times greater odds of probable PTSD after September 11 compared with people in the lowest third of viewing; after adjustment for explanatory variables, the relative odds of probable PTSD were 1.66. Adjustment for perievent panic accounted for 44% of the reduction in association between television and probable PTSD, suggesting that perievent emotional reactions may play an important role in the television and psychopathology association. Television may merit consideration as a potential exposure to a traumatic event.

(*J Nerv Ment Dis* 2004;192: 217–226)

The relation between television viewing and psychopathology in the context of major traumatic events is controversial, with most extant research conducted among children and adolescents. In the aftermath of the Oklahoma City bombing, studies showed that television viewing related to the bombing was associated with symptoms of posttraumatic stress disorder (PTSD) among local children with close connections (geographically and emotionally) to the bombing

and those more removed from the bombing. (Pfefferbaum et al., 1999a; Pfefferbaum et al., 1999b; Pfefferbaum et al., 1999c; Pfefferbaum et al., 2000a; Pfefferbaum et al., 2000b; Pfefferbaum et al., 2001; Pfefferbaum, 2001). After the Iraqi invasion of Kuwait in 1990, one study showed that viewing graphic television images related to the conflict was associated with PTSD symptoms among Kuwaiti children (Nader et al., 1993). There have been fewer studies addressing the potential association between television viewing and psychopathology in adults. Among adults who have previously been traumatized (e.g., veterans and refugees), symptoms of PTSD can be exacerbated by violent television images, particularly those related to the original trauma (Elliott, 1997; Kinzie et al., 1998; Kinzie et al., 2002; Long et al., 1994; Moyers, 1996; Pittman et al., 1987). For example, in a study of veterans and refugees with and without PTSD, Cambodian refugees with PTSD experienced the greatest increased heart rate and were most disturbed by viewing footage from the aftermath of the Cambodian massacre (Kinzie et al., 1998). Many of these refugees continued to report psychological distress at least a week after the viewing (Kinzie et al., 1998). In the general population of the United States, among people who experienced a serious trauma and had delayed recall of the trauma, the most commonly reported trigger of memory recall was a media presentation (television or movie) with some similarity to the original trauma (Elliott, 1997).

In the aftermath of the September 11 terrorist attacks in New York City (NYC) and Washington, DC, four studies that assessed mental health in the general population demonstrated associations between viewing television coverage of the attacks and symptoms of PTSD (Ahern et al., 2002; Schlenger et al., 2002; Schuster et al., 2001; Silver et al., 2002). The first study published, a nationwide telephone survey conducted 3 to 5 days after September 11, found that hours of viewing coverage of the attacks on September 11 was associated with a substantial stress reaction, based on five posttraumatic stress symptoms (Schuster et al., 2001). A

*New York Academy of Medicine, Center for Urban Epidemiologic Studies, New York, NY; †Division of Epidemiology, Columbia University Mailman School of Public Health, New York, NY; and ‡National Crime Victims' Research and Treatment Center, Medical University of South Carolina, Charleston, SC.

Send reprint requests to Dr. Sandro Galea, Center for Urban Epidemiologic Studies, Room 556, New York Academy of Medicine, 1216 Fifth Avenue, New York, NY 10029-5283.

Copyright © 2004 by Lippincott Williams & Wilkins

ISSN: 0022-3018/04/19203-0217

DOI: 10.1097/01.nmd.0000116465.99830.ca

telephone survey of Manhattan residents conducted 1 month after the attacks found associations between viewing the image of people falling or jumping from the World Trade Center (WTC) and probable PTSD in adjusted models (Ahern et al., 2002). This effect was strongest in people who were directly affected by the attacks (Ahern et al., 2002). A web-based survey, conducted 1 to 2 months after September 11 in the NYC metropolitan area, found that viewing television coverage of the attacks was one of four characteristics associated with PTSD symptom levels, adjusting for background characteristics and event experiences (Schlenger et al., 2002). In a national Web-based survey, watching the attacks live on television was associated with elevated post-traumatic stress symptoms during the 6 months after the attacks, although the effect was no longer significant after adjustment for coping behavior after September 11 (Silver et al., 2002).

Although these studies have shown associations between television viewing and the likelihood of PTSD symptoms, we are not aware of any study that has systematically explored the factors that may explain the observed television–psychopathology relation. A systematic examination of the variables that may explain the association between television viewing related to September 11 and probable PTSD may help elucidate some of the factors that contribute to the observed associations between television and symptoms of PTSD and guide the current debate (Eth, 2002; Michels, 2002; North and Pfefferbaum, 2002; Pfefferbaum et al., 2002; Putnam, 2002) about the potential role of television viewing as a traumatic event exposure. In this analysis, we assessed the role that demographic and background characteristics, event exposures, and perievent emotional reactions played in explaining the association between television viewing and probable PTSD among residents of NYC in the aftermath of the September 11 attacks.

METHODS

We conducted a random-digit dial telephone survey of NYC residents in January and February 2002. All people at least 18 years old and living in NYC on September 11, 2001, were eligible to participate. We called each number as many as 10 times in an effort to contact the residents and interviewed one person in each household contacted, using a most recent birthday selection method. The interview was approximately 35 minutes in length. All five boroughs of NYC were included in the survey, with an oversample in Manhattan south of 110th Street for comparison with a previous survey. All participants gave informed consent, and the cooperation rate (completed interviews and screen-outs as a percentage of completed interviews, screen-outs, refusals, and premature terminations) was 63.5%. The study protocol was approved

TABLE 1. Demographic comparison of sample with US Census estimates

Characteristic	Weighted percentage from sample	Percentage from 2000 US Census	<i>p</i> -value
Age, yr			
18–24	15.2	13.2	.705
25–34	25.6	22.5	
35–44	22.2	20.8	
45–54	16.9	16.7	
55–64	10.2	11.3	
≥65	9.8	15.5	
Sex			
Male	46.5	46.2	.952
Female	53.5	53.8	
Race			
White	40.5	38.7	.625
African American	25.7	23.0	
Asian	5.4	10.1	
Hispanic	25.0	24.7	
Other	3.3	3.6	

by the Institutional Review Board of the New York Academy of Medicine.

Respondents were asked for demographic information including age, race or ethnicity, sex, education, income, and marital status. We assessed lifetime traumatic event experiences and past-year stressors before September 11. Social support was measured with three questions from the Medical Outcomes Study social support scale, including instrumental, emotional, and appraisal support (Sherbourne and Stewart, 1991). Location of residence and location at the time of the September 11 attacks were assessed by zip code. We asked respondents about their experiences related to the attacks on September 11, including seeing the attacks on the WTC in person; being afraid of injury or death; having relatives, friends, or acquaintances who were killed or injured in the attacks; having possessions lost or damaged in the attacks; being involved in the rescue efforts; and losing a job after the attacks. We assessed television viewing by asking how many times respondents had seen the images of an airplane hitting the WTC, buildings collapsing, people running away from a cloud of smoke or debris, and people falling or jumping from the towers of the WTC in the 7 days after the attacks. Perievent panic attack was measured using a modified version of the Diagnostic Interview Schedule measure for panic attack (Centers for Disease Control, 1989). The presence of four or more symptoms occurring in the first few hours after the events of September 11 contributed to a diagnosis of a perievent panic attack.

TABLE 2. Characteristics of survey respondents, NYC 2002

	N	%
Total income	2001	100.0
≥100,000	272	14.2
\$75,000–\$99,999	146	9.6
\$50,000–\$74,999	253	15.8
\$40,000–\$49,999	162	10.5
\$30,000–\$39,999	219	14.0
\$20,000–\$29,999	221	14.9
<\$20,000	317	21.1
Education		
Graduate degree	290	10.8
College degree	663	30.4
Some college	414	22.1
High school graduate/General Educational Development	427	25.3
<High school graduate	191	11.5
Marital status		
Married	768	44.9
Divorced	200	7.6
Separated	79	3.6
Widowed	139	5.4
Never married	736	35.3
Unmarried couple	67	3.2
Social support		
High	593	31.9
Medium	694	37.4
Low	553	30.7
Lifetime traumatic events before September 11 ^a		
0	570	30.3
1	461	23.5
2–3	559	27.1
≥4	411	19.2
Past year stressors before September 11 ^b		
0	1094	55.8
1	569	28.1
≥2	338	16.1
Were below Canal St.		
No	1872	95.7
Yes	87	4.3
Live below 14th St.		
No	1862	96.3
Yes	139	3.7
Saw September 11 attacks in person		
No	1462	75.4
Yes	523	24.6
Fear of personal injury or death		
No	1434	72.0
Yes	480	28.0

(Table Continues)

TABLE 2. (continued)

	N	%
Perievent panic attack		
No	1676	83.3
Yes	325	16.7
Friend or relative killed		
No	1745	87.9
Yes	256	12.1
Lost possessions		
No	1939	97.1
Yes	62	2.9
Involved in rescue effort		
No	1792	91.2
Yes	205	8.8
Lost job because of September 11		
No	1875	94.1
Yes	116	5.9
Media exposure		
Low	640	33.6
Medium	641	33.1
High	643	33.3

^aLifetime traumatic events include, *e.g.*, being attacked, serious accident, seeing someone injured or killed.

^bPast year stressors include, *e.g.*, family problems, marriage, divorce, separation, death of a family member.

We used the National Women’s Study (NWS) PTSD module to measure PTSD symptoms. The NWS PTSD module was validated in a field trial against the PTSD module of the Structured Clinical Interview for DSM-III-R (SCID; Spitzer et al., 1992) administered by mental health professionals (Kilpatrick et al., 1998). In the field trial, interrater Kappa coefficients were 0.85 for the diagnosis of lifetime PTSD and 0.86 for the diagnosis of current PTSD. Comparing the NWS PTSD module with the SCID, the Kappa coefficient of the NWS PTSD module with SCID diagnosis of PTSD was 0.77 for lifetime PTSD and 0.71 for current PTSD (Kilpatrick et al., 1998). Instrument sensitivity was 99% and specificity was 79% when compared with SCID diagnosis (Kilpatrick et al., 1998; Resnick et al., 1993).

The NWS PTSD module assesses the presence of criteria B, C, and D symptoms and determines content for content-specific PTSD symptoms (*e.g.*, content of dreams or nightmares). We assessed probable PTSD since September 11 based on the presence of necessary PTSD criteria B, C, and D symptoms during that period. To measure probable PTSD related to the September 11 attacks, all re-experiencing 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 11 attacks. A

subset of avoidance symptoms and all the arousal symptoms (criterion D, e.g., being easily startled or jumpy) were linked to the attacks by time frame (occurrence since September 11).

All analyses were conducted in SUDAAN (Research Triangle Institute, Research Triangle Park, NC) with weighting to account for the probability of selection for an interview based on the number of people and telephone lines in the household and the Manhattan oversample (Shah et al., 1997). We assessed the television images viewed as categorical predictors of probable PTSD. The specific television images and a combined sum of all images were divided into thirds, creating low, medium, and high categories of frequency of viewing. Relations between the television categories and probable PTSD were assessed in cross-tabulations with two-tailed chi-square tests.

We assessed the bivariate associations of demographic and background characteristics, event exposures, and perievent emotional reactions with probable PTSD and with categories of television viewing. Characteristics associated ($p < .10$) with both probable PTSD and categories of television viewing were considered variables that might explain some of the association between television and probable PTSD. We built stepwise logistic regression models, adding potential explanatory variables one at a time. We started with demographic characteristics, followed by lifetime traumatic events and social support as of September 11, then event exposures and perievent emotional reactions in their likely chronological order. Respondents with missing values for any of the potential explanatory variables were excluded from all models to assure comparability among the models.

RESULTS

Of 2011 respondents to the survey, 2001 provided information required to calculate weights (number of people in the household and number of telephone lines) and could be included in the analysis. The demographic characteristics of the respondents were very similar to those of the 2000 US Census, suggesting that our sample was representative of NYC residents (Table 1). Mean age was 41 years, 53.3% were female, and the racial and ethnic composition was 40.5% white, 5.4% Asian, 25.7% African American, 25.0% Hispanic, and 3.3% other race or ethnicity. In terms of income and education, 21.1% earned less than \$20,000, 14.2% earned at least \$100,000 in the past year, 11.5% had less than a high school education, and 10.8% had some graduate education. Event exposures were common: 24.6% saw the attacks on the WTC in person, 28.0% were afraid of injury or death, 12.1% had a friend or relative killed, 8.8% were involved in the rescue efforts, and 5.9% lost a job after the attacks. A full description of the sample can be found in Table 2.

The image of an airplane hitting the WTC was viewed relatively frequently in the 7 days after September 11 (mean,

41.1; median, 30), as were the images of the buildings collapsing (mean, 36.9; median, 20) and people running from a cloud of smoke (mean, 36.7; median, 21). The image of people falling or jumping was seen less frequently (mean, 11.9; median, 2).

Respondents who reported viewing television images of the attacks on the WTC more frequently had a higher prevalence of probable PTSD (Table 3). Among those who saw an airplane hitting the WTC most frequently, 10.3% had probable PTSD, whereas among those who saw it least frequently, 4.5% had probable PTSD ($p = .003$). Similar associations were present for the images of buildings collapsing and people running. For the image of people falling or jumping, there was more probable PTSD among those who saw the image most frequently, but the difference was not statistically significant ($p = .272$). Because all four images had similar patterns of association with probable PTSD, we created a measure of combined images. For those who saw the most combined images, the prevalence of probable PTSD was 11.2%, and among those who were in the middle and lowest categories of combined images, the prevalences of probable PTSD were 4.5% and 5.5%, respectively ($p < .001$).

We examined the associations of demographic, background, event exposure, and perievent emotional reaction characteristics with probable PTSD and with categories of

TABLE 3. Associations between thirds of television image viewing and probable PTSD, NYC 2002

	<i>N</i>	%	<i>N</i> PTSD	% PTSD	<i>p</i> -value
Airplane hitting towers					
Low	545	34.0	23	4.5	.003
Medium	441	26.1	31	5.6	
High	665	39.9	70	10.3	
Buildings collapsing					
Low	556	34.3	23	4.8	.001
Medium	527	30.9	34	5.2	
High	609	34.8	67	10.6	
People running					
Low	557	33.5	22	4.5	<.001
Medium	555	32.5	32	4.8	
High	597	34.1	70	11.1	
People falling/jumping					
Low	708	36.6	37	5.5	.272
Medium	593	32.2	47	7.4	
High	543	31.2	52	8.1	
Images combined					
Low	640	33.6	33	5.5	<.001
Medium	641	33.1	37	4.5	
High	643	33.3	74	11.2	

television viewing to identify potential explanatory variables for the association between television and probable PTSD. Characteristics associated with both television viewing and probable PTSD ($p < .01$) are presented in Table 4. Age, race or ethnicity, social support, lifetime traumatic events, seeing the attacks in person, experiencing a perievent panic attack, having a friend or relative killed, and participating in the

rescue effort were all associated with both television viewing and probable PTSD ($p < .10$).

Table 5 presents logistic regression models of the association between categories of television images and probable PTSD; the explanatory variables were added sequentially to each model. The unadjusted odds ratio (OR) for the highest category of media images (compared with the lowest)

TABLE 4. Bivariate associations between explanatory variables, probable PTSD, and television viewing

	Probable PTSD			Television viewing					<i>p</i> -value	
	<i>N</i>	%	<i>p</i> -value	<i>N</i> Low	% Low	<i>N</i> Medium	% Medium	<i>N</i> High		% High
Age, yr										
18–24	15	5.5	.005	69	14.41	74	16.03	64	15.83	<.001
25–34	39	8.7		126	21.65	175	28.3	180	27.74	
35–44	52	11.0		125	20.28	149	22.04	177	24.64	
45–54	20	4.2		98	15.79	114	16.57	120	18.18	
55–64	12	4.2		75	11.78	61	9.95	55	8.45	
≥65	10	4.7		122	16.09	57	7.12	42	5.16	
Race/ethnicity										
White	54	5.6	.014	270	38.05	326	42.89	308	41.78	.084
Asian	4	3.0		36	7.32	30	5.1	23	3.92	
African American	33	6.3		177	28.57	142	26.48	140	23	
Hispanic	50	11.0		125	23.01	110	21.4	145	28.46	
Other	5	4.5		20	3.05	22	4.13	15	2.85	
Social support										
High	30	4.5	.005	202	34.2	174	31.21	152	25.94	.013
Medium	56	7.6		220	39.23	229	36.99	223	36.89	
Low	57	9.9		156	26.57	197	31.8	220	37.17	
Lifetime traumatic events before September 11 ^a										
0	21	4.2	<.001	232	37.24	164	28.21	152	25.14	<.001
1	26	4.9		154	24.36	142	21.38	147	24.3	
2–3	47	7.8		154	24.07	200	30.77	185	27.26	
≥4	54	12.6		100	14.32	135	19.64	159	23.29	
Saw September 11 attacks in person										
No	83	5.7	.002	494	80.34	450	72.26	456	73.1	.008
Yes	64	10.9		139	19.66	189	27.74	181	26.9	
Fear of personal injury or death										
No	65	4.3	<.001	475	75.14	469	72.98	439	67.98	.067
Yes	78	13.7		133	24.86	150	27.02	177	32.02	
Perievent panic attack										
No	66	3.7	<.001	564	87.58	558	85.99	492	76.67	<.001
Yes	82	23.2		76	12.42	83	14.01	151	23.33	
Friend or relative killed										
No	114	6.1	.004	565	88.84	578	90.42	539	84.84	.023
Yes	34	13.6		75	11.16	63	9.58	104	15.16	
Involved in rescue effort										
No	121	6.4	.024	596	94.96	571	90.3	559	89	.002
Yes	27	13.3		42	5.04	69	9.7	83	11	

^aLifetime traumatic events include, *e.g.*, being attacked, serious accident, seeing someone injured or killed.

TABLE 5. Multivariable models of television viewing predicting probable PTSD, sequentially adjusted for potential explanatory variables

	Beta	OR	Wald <i>p</i> -value	Beta	OR	Wald <i>p</i> -value	Beta	OR	Wald <i>p</i> -value	Beta	OR	Wald <i>p</i> -value	Beta	OR
Media exposure														
Low	0	1.00	<.001	0	1.00	.0005	0	1.00	<.001	0	1.00	<.001	0	1.00
Medium	-0.05715	0.94		-0.12035	0.89		-0.10136	0.90		-0.09597	0.91		-0.20666	0.81
High	0.84021	2.32		0.76249	2.14		0.74391	2.10		0.82333	2.28		0.70264	2.02
Age, yr														
18–24				0	1.00	.015	0	1.00	.012	0	1.00	.012	0	1.00
25–34				0.39476	1.48		0.54566	1.73		0.49406	1.64		0.48673	1.63
35–44				0.73165	2.08		0.88828	2.43		0.84762	2.33		0.77237	2.16
45–54				-0.21515	0.81		-0.03111	0.97		-0.07397	0.93		-0.16416	0.85
55–64				-0.09041	0.91		0.06189	1.06		-0.00795	0.99		-0.11339	0.89
≥65				-0.43504	0.65		-0.26654	0.77		-0.3606	0.70		-0.35236	0.70
Race/ethnicity														
White							0	1.00	.018	0	1.00	.032	0	1.00
Asian							-0.055967	0.57		-0.75883	0.47		-0.52549	0.59
African American							-0.01442	0.99		-0.18441	0.83		-0.16005	0.85
Hispanic							0.72491	2.06		0.57497	1.78		0.65144	1.92
Other							0.08619	1.09		-0.01478	0.99		-0.02062	0.98
Social support														
High										0	1.00	.009	0	1.00
Medium										0.55327	1.74		0.5569	1.75
Lifetime traumatic events before September 11 ^a														
0													0	1.00
1													0.39814	1.49
2–3													0.83698	2.31
≥4													1.24184	3.46
Saw September 11 attacks in person														
No														
Yes														
Fear of personal injury or death														
No														
Yes														
Perievent panic attack														
No														
Yes														
Friend or relative killed														
No														
Yes														
Involved in rescue effort														
No														
Yes														

^aLifetime traumatic events include, *e.g.*, being attacked, serious accident, seeing someone injured or killed.

TABLE 5. continued

Wald <i>p</i> -value	Beta	OR	Wald <i>p</i> -value	Beta	OR	Wald <i>p</i> -value	Beta	OR	Wald <i>p</i> -value	Beta	OR	Wald <i>p</i> -value	Beta	OR	Wald <i>p</i> -value
<.001	0	1.00	<.001	0	1.00	.001	0	1.00	.020	0	1.00	.022	0	1.00	.026
	-0.22423	0.80		-0.20311	0.82		-0.21911	0.80		-0.22923	0.80		-0.2545	0.78	
	0.69652	2.01		0.70086	2.02		0.55522	1.74		0.54242	1.72		0.50675	1.66	
.016	0	1.00	.043	0	1.00	.113	0	1.00	.079	0	1.00	.145	0	1.00	.084
	0.47582	1.61		0.42543	1.53		0.24732	1.28		0.21629	1.24		0.17957	1.20	
	0.75808	2.13		0.67506	1.96		0.48733	1.63		0.41915	1.52		0.38045	1.46	
	-0.10273	0.90		-0.13178	0.88		-0.52041	0.59		-0.61169	0.54		-0.65196	0.52	
	-0.04753	0.95		0.0295	1.03		-0.17879	0.84		-0.23845	0.79		-0.27141	0.76	
	-0.25532	0.77		-0.24711	0.78		-0.24913	0.78		-0.24959	0.78		-0.24617	0.78	
.029	0	1.00	.034	0	1.00	.111	0	1.00	.070	0	1.00	.082	0	1.00	.078
	-0.42793	0.65		-0.54142	0.58		-0.70833	0.49		-0.56843	0.57		-0.57284	0.56	
	-0.10375	0.90		-0.1202	0.89		-0.29741	0.74		-0.24988	0.78		-0.25927	0.77	
	0.68451	1.98		0.52869	1.70		0.48757	1.63		0.52327	1.69		0.52505	1.69	
	-0.01007	0.99		-0.16174	0.85		-0.53404	0.59		-0.46443	0.63		-0.42706	0.65	
				0	1.00	.034	0	1.00	.038	0	1.00	.025	0	1.00	.027
.008	0	1.00	.012	0.53591	1.71		0.58692	1.80		0.65524	1.93		0.64379	1.90	
	0.52799	1.70		0.79909	2.22		0.85438	2.35		0.89484	2.45		0.89244	2.44	
.002	0	1.00	.007	0	1.00	.003	0	1.00	.008	0	1.00	.012	0	1.00	.015
	0.37392	1.45		0.38324	1.47		0.429	1.54		0.39678	1.49		0.39661	1.49	
	0.79633	2.22		0.83299	2.30		0.88185	2.42		0.83624	2.31		0.83994	2.32	
	1.14025	3.13		1.22259	3.40		1.16694	3.21		1.10715	3.03		1.08555	2.96	
	0	1.00	.023	0	1.00	.053	0	1.00	.106	0	1.00	.113	0	1.00	.158
	0.5288	1.70		0.45301	1.57		0.40019	1.49		0.39022	1.48		0.35083	1.42	
				0	1.00	<.001	0	1.00	.023	0	1.00	.027	0	1.00	.031
				0.91835	2.51		0.57466	1.78		0.5558	1.74		0.54312	1.72	
							0	1.00	<.001	0	1.00	<.001	0	1.00	<.001
							1.92336	6.84		1.86711	6.47		1.85342	6.38	
										0	1.00	.010	0	1.00	.016
										0.6758	1.97		0.6316	1.88	
													0	1.00	.145
													0.4659	1.59	

was 2.32. After adjustment for the demographic characteristics age and race or ethnicity, the OR was reduced to 2.10. After adjusting for social support and lifetime traumatic events, the OR was further reduced to 2.02. Adjusting for the event exposures of seeing the disaster in person and fear of injury or death did not markedly change the OR. Adjusting for perievent panic attack reduced the OR substantially to 1.74. Adding the death of a friend or relative did not affect the OR, but adjusting for involvement in the rescue effort further reduced the OR to 1.66. Overall, the reduction in the effect (based on parameter estimates) was 40%. The reduction from adjustment for perievent panic attack accounted for 44% of this reduction and constituted a 17% overall reduction in the association between high levels of television image viewing and probable PTSD.

DISCUSSION

In this analysis, viewing more television images in the week after September 11 was associated with a higher likelihood of having symptoms of probable PTSD in the aftermath of the September 11 attacks in NYC. The association between television viewing and probable PTSD was reduced after adjustment for potential explanatory variables, but people who viewed the most television still had a 66% greater likelihood of having probable PTSD than those who viewed the least television in fully adjusted models. Experience of a perievent panic attack accounted for a large proportion of the reduction in association between television viewing and probable PTSD.

Consistent with previous research on television viewing and symptoms of PTSD after September 11, this analysis demonstrated an association between television images and PTSD (Ahern et al., 2002; Schlenger et al., 2002; Schuster et al., 2001; Silver et al., 2002). However, there is a paucity of research on factors that may explain the observed relations between television viewing and PTSD. One analysis of television viewing and PTSD in the general US population found that the association between television viewing and PTSD symptoms was dramatically reduced by adjusting for early postdisaster coping strategies, particularly active coping (Silver et al., 2002). This finding suggests that television viewing may be a part of or may go along with ineffective coping responses. In our study, experiencing a perievent panic attack was responsible for the largest reduction (almost half of the total reduction) in the association between television viewing and probable PTSD. This finding indicates both that there is a strong association between watching more television images and having experienced a perievent panic attack and that those who experienced a panic attack around the time of the September 11 attacks were more likely to develop probable PTSD. Research suggests that severe traumatic events may instigate a panic attack when they occur, that those panic symptoms themselves may be re-experienced as part of

PTSD, and that panic attacks may continue to occur among those with PTSD (Deering et al., 1996; Falsetti and Resnick, 1997). Other research indicates that panic reactions predict the development of PTSD after exposure to traumatic events (Bryant and Panasetis, 2001). The connections between these two experiences suggest the importance of considering a perievent panic attack a strong risk factor for later development of PTSD. It cannot be determined from our analysis whether those who experienced a panic attack viewed more television afterward or whether watching more television increased the risk of experiencing a panic attack. Experimental research among patients with PTSD suggests that viewing television images of distressing events can cause physiologic arousal, suggesting that television images may contribute to the development of a panic attack (Kinzie et al., 1998). Our analysis suggests that television viewing and panic are both associated with posttraumatic stress symptoms after experiencing a traumatic event. However, future research will need to examine the potential etiologic mechanisms that can only be hinted at by these data.

Other factors that contributed to the reduction in the association between television viewing and probable PTSD included demographic characteristics, supports and previous traumatic experiences, and some event exposures. These characteristics have been shown to be associated with PTSD in previous research (Brewin et al., 2000; Galea et al., 2002; Ozer et al., 2003). The association between television viewing and probable PTSD remains even after adjustment for these characteristics, suggesting that television viewing and symptoms of PTSD are interrelated and independent of other predictors of probable PTSD. However, the causal direction of this association needs to be explored further.

There are two possible primary explanations for the observed independent association between television viewing and probable PTSD. First, in NYC, the impact of the attacks on all residents was substantial. Whether residents knew someone who was killed in the collapse of the towers, saw the towers on fire, watched workers and residents streaming uptown and over the bridges covered in ash, experienced a rain of office papers and photographs in their neighborhood, watched on television and worried about other planes the networks said were unaccounted for in the air, or were caught in the subway during one of many bomb scares during the weeks after September 11, all were affected by the attacks in some way. Broader exposure in a disaster of this magnitude may explain why television was associated with posttraumatic stress symptoms among those who would not traditionally be considered exposed in the aftermath of a disaster. Second, it is also possible that viewing constant and ubiquitous television coverage of these unanticipated and unprecedented dramatic events was sufficient to constitute exposure to the attacks among residents of NYC. Previous research demonstrating associations between television viewing re-

lated to September 11 and symptoms of PTSD (Ahern et al., 2002; Schlenger et al., 2002; Schuster et al., 2001; Silver et al., 2002) has generated discussion about whether television viewing may constitute exposure to a traumatic event (Eth, 2002; Michels, 2002; North and Pfefferbaum, 2002; Pfefferbaum et al., 2002; Putnam, 2002). Television viewing has not been included specifically as an example of exposure to a traumatic event, which is required as criterion A for a diagnosis of PTSD (DSM-IV). These findings, taken together, suggest that television viewing as a traumatic exposure may deserve further research and potential reconsideration. It is important to note that the impact of television viewing in this context may be substantially different than the impact of other broadcasts of disturbing images that may be distant or of a smaller scale (e.g., images of a war in a foreign country). The terrorist attacks of September 11 were unprecedented in the United States, and it is difficult to generalize findings about the role of television viewing after these attacks to the potential role of television viewing in other contexts. However, in a new era of live and constant news coverage across the globe and increasing concerns about terrorism, this is an issue that merits further consideration. At the least, these findings indicate that heavy television viewing is an indicator for risk of developing symptoms of posttraumatic stress in the months after a large-scale manmade disaster.

There are other considerations relevant to the interpretation of this analysis. The associations observed between television and probable PTSD do not demonstrate causality. Extensive television viewing may be a marker of early psychopathology, or the viewing may contribute to symptoms of psychopathology. Longitudinal assessment that determined the timing of the development of symptoms in relation to television viewing would help address the question of causality. Although we accounted for factors in this study that may have explained the association between television viewing and probable PTSD, there may be unmeasured characteristics that could have accounted for the association between television viewing and probable PTSD. In addition, we have previously reported that the relation between television viewing and probable PTSD is stronger among people directly affected by the attacks (Ahern et al., 2002). It is possible that the association between television viewing and PTSD is complex and differs by exposure groups. Also, the images associated more strongly with probable PTSD in this analysis were different from the images we reported in our previous research conducted on a sample of Manhattan residents 1 month after the September 11 attacks (Ahern et al., 2002). These differences may reflect changes in recall of the numbers of times images were seen given the different time points at which the surveys were administered, or may reflect geographic differences in the two populations sampled (residents of Manhattan versus residents of NYC as a whole).

CONCLUSION

This analysis contributes further evidence to the recent studies that have shown an association between television viewing and posttraumatic psychopathology. It also suggests that a greater understanding of the mechanisms behind the observed associations between television viewing and posttraumatic stress may help us understand and better prepare for the effects of such disasters in the future. Perievent panic attacks may be particularly important in the relation between television viewing and psychopathology and may be a critical avenue for possible postevent intervention (Resnick et al., In press). The concept of exposure to a traumatic event and the potential effects of television coverage of disasters, terrorist attacks, and wars merit further research, consideration, and discussion.

ACKNOWLEDGMENTS

This study was supported by grants from the United Way of New York City, the New York Community Trust, the Commonwealth Fund, the National Institute on Drug Abuse, and the National Institute of Mental Health of the National Institutes of Health.

REFERENCES

- Ahern J, Galea S, Resnick H, Kilpatrick D, Bucuvalas M, Gold J, Vlahov D (2002) Television images and psychological symptoms after the September 11 terrorist attacks. *Psychiatry*. 65:289–300.
- Brewin C, Andrews B, Valentine J (2000) Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *J Consult Clin Psychol*. 68:746–766.
- Bryant R, Panasetti P (2001) Panic symptoms during trauma and acute stress disorder. *Behav Res Ther*. 39:961–966.
- Centers for Disease Control (1989) Diagnostic interview schedule (DIS). In *Health status of Vietnam veterans, supplement C: Medical and psychological procedure manuals and forms* (pp 405–499). Atlanta, GA.
- Deering CG, Glover SG, Ready D, Eddleman HC, Alarcon RD (1996) Unique patterns of comorbidity in posttraumatic stress disorder from different sources of trauma. *Compr Psychiatry*. 37:336–346.
- Elliott DM (1997) Traumatic events: Prevalence and delayed recall in the general population. *J Consult Clin Psychol*. 65:811–820.
- Eth S (2002) Television viewing as risk factor. *Psychiatry*. 65:301–303.
- Falsetti SA, Resnick H (1997) Frequency and severity of panic attack symptoms in a treatment seeking sample of trauma victims. *J Trauma Stress*. 10:683–689.
- Galea S, Ahern J, Resnick H, Kilpatrick D, Bucuvalas M, Gold J, Vlahov D (2002) Psychological sequelae of the September 11 terrorist attacks in Manhattan, New York City. *N Engl J Med*. 346:982–987.
- Kilpatrick D, Resnick H, Freedy J, Pelcovitz D, Resnick P, Roth S, van der Kolk B (1998) The posttraumatic stress disorder field trial: Evaluation of the PTSD construct—criteria A through E. In TA Widiger, AJ Frances, HA Pincus, et al. (Eds), *DSM-IV sourcebook* (Vol 4, pp 803–844). Washington, DC: American Psychiatric Association Press.
- Kinzie JD, Boehnlein J, Riley C, Sparr L (2002) The effects of September 11 on traumatized refugees: Reactivation of posttraumatic stress disorder. *J Nerv Ment Dis*. 190:437–441.
- Kinzie JD, Denney D, Riley C, Boehnlein J, McFarland B, Leung P (1998) A cross-cultural study of reactivation of posttraumatic stress disorder symptoms. *J Nerv Ment Dis*. 186:670–676.
- Long N, Chamberlain K, Vincent C (1994) Effect of the Gulf War on reactivation of adverse combat-related memories in Vietnam veterans. *J Clin Psychol*. 50:138–144.

- Michels R (2002) Exposure to traumatic images: Symptom or cause? *Psychiatry*. 65:304–305.
- Moyers F (1996) Oklahoma City bombing: Exacerbation of symptoms in veterans with PTSD. *Arch Psychiatr Nurs*. 10:55–59.
- Nader KO, Pynoos RS, Fairbanks LA, Al-Ajeel M, Al-Asfour A (1993) A preliminary study of PTSD and grief among the children of Kuwait following the gulf crisis. *Br J Clin Psychol*. 32:407–416.
- North CS, Pfefferbaum B (2002) Research on the mental health effects of terrorism. *JAMA*. 288:633–636.
- Ozer E, Best C, Lipsey J, Weiss D (2003) Predictors of post traumatic stress disorder: A metaanalysis. *Psychol Bull*. 129:52–73.
- Pfefferbaum B (2001) The impact of the Oklahoma City bombing on children in the community. *Mil Med*. 166:49–50.
- Pfefferbaum B, Gurwitch RH, McDonald NB, Leftwich MJT, Sconzo GM, Messenbaugh AK, Schultz RA (2000a) Posttraumatic stress among young children after the death of a friend or acquaintance in a terrorist bombing. *Psychiatr Serv*. 52:386–388.
- Pfefferbaum B, Moore VL, McDonald NB, Maynard BT, Gurwitch RH, Nixon SJ (1999a) The role of exposure in posttraumatic stress in youths following the 1995 bombing. *J Okla State Med Assoc*. 92:164–167.
- Pfefferbaum B, Nixon SJ, Tivis RD, Moore VL, Brown JM, Pynoos RS, Foy DW, Gurwitch RH (1999b) Clinical needs assessment of middle and high school students following the 1995 Oklahoma City bombing. *Am J Psychiatry*. 156:1069–1074.
- Pfefferbaum B, Nixon SJ, Tivis RD, Doughty DE, Pynoos RS, Gurwitch RH, Foy DW (2001) Television exposure in children after a terrorist incident. *Psychiatry*. 64:202–211.
- Pfefferbaum B, Nixon SJ, Tucker PM, Tivis RD, Moore VL, Gurwitch RH, Pynoos RS, Geis HK (1999c) Posttraumatic stress responses in bereaved children after the Oklahoma City bombing. *J Am Acad Child Adolesc Psychiatry*. 38:1372–1379.
- Pfefferbaum B, Pfefferbaum RL, North CS, Neas BR (2002) Does television viewing satisfy criteria for exposure in posttraumatic stress disorder? *Psychiatry*. 65:306–309.
- Pfefferbaum B, Seale TW, McDonald NB, Brandt EN, Rainwater SM, Maynard BT, Meierhoefer B, Miller PD (2000b) Posttraumatic stress two years after the Oklahoma City bombing in youths geographically distant from the explosion. *Psychiatry*. 63:358–370.
- Pittman RK, Orr SP, Forgue DF, deJong J, Claiborn JM (1987) Psychophysiological assessment of posttraumatic stress disorder imagery in Vietnam combat veterans. *Arch Gen Psychiatry*. 44:970–975.
- Putnam FW (2002) Televised trauma and viewer PTSD: Implications for prevention. *Psychiatry*. 65:310–312.
- Resick P, Acierno R, Stafford J, Minhinnett R (In press) Early intervention strategies applied following rape. In R Orner, U Schnyder (Eds), *Reconstructing early interventions following trauma*. London: Oxford University Press.
- Resnick HS, Kilpatrick DG, Dansky BS, Saunders BE, Best C (1993) Prevalence of civilian trauma and posttraumatic stress disorder in a representative national survey of women. *J Consult Clin Psychol*. 61:984–991.
- Schlenger WE, Caddell JM, Ebert L, Jordan BK, Rourke KM, Wilson D, Thalji L, Dennis JM, Fairbank JA, Kulka RA (2002) Psychological reactions to terrorist attacks: Findings from the national study of Americans' reactions to September 11. *JAMA*. 288:581–588.
- Schuster MA, Stein BD, Jaycox LH, Collins RL, Marshall GN, Elliott MN, Zhou AJ, Kanouse DE, Morrison JL, Berry SH (2001) A national survey of stress reactions after the September 11, 2001, terrorist attacks. *N Engl J Med*. 345:1507–1512.
- Shah B, Barnewell B, Bieler G (1997) *SUDAAN user's manual, release 7.5*. Research Triangle Park, NC: Research Triangle Institute.
- Sherbourne CD, Stewart AL (1991) The MOS Social Support Survey. *Soc Sci Med*. 32:705–714.
- Silver RC, Holman EA, McIntosh DN, Poulin M, Gil-Rivas V (2002) Nationwide longitudinal study of psychological responses to September 11. *JAMA*. 288:1235–1244.
- Spitzer R, Williams J, Gibbon M, First M (1992) The Structural Clinical Interview for DSM-III-R (SCID), I: History, rationale and description. *Arch Gen Psychiatry*. 49:624–629.