

Special Report

A NATIONAL SURVEY OF STRESS REACTIONS AFTER THE SEPTEMBER 11, 2001, TERRORIST ATTACKS

MARK A. SCHUSTER, M.D., PH.D., BRADLEY D. STEIN, M.D., M.P.H., LISA H. JAYCOX, PH.D., REBECCA L. COLLINS, PH.D., GRANT N. MARSHALL, PH.D., MARC N. ELLIOTT, PH.D., ANNIE J. ZHOU, M.S., DAVID E. KANOUSE, PH.D., JANINA L. MORRISON, A.B., AND SANDRA H. BERRY, M.A.

ABSTRACT

Background People who are not present at a traumatic event may experience stress reactions. We assessed the immediate mental health effects of the terrorist attacks on September 11, 2001.

Methods Using random-digit dialing three to five days after September 11, we interviewed a nationally representative sample of 560 U.S. adults about their reactions to the terrorist attacks and their perceptions of their children's reactions.

Results Forty-four percent of the adults reported one or more substantial symptoms of stress; 90 percent had one or more symptoms to at least some degree. Respondents throughout the country reported stress symptoms. They coped by talking with others (98 percent), turning to religion (90 percent), participating in group activities (60 percent), and making donations (36 percent). Eighty-four percent of parents reported that they or other adults in the household had talked to their children about the attacks for an hour or more; 34 percent restricted their children's television viewing. Thirty-five percent of children had one or more stress symptoms, and 47 percent were worried about their own safety or the safety of loved ones.

Conclusions After the September 11 terrorist attacks, Americans across the country, including children, had substantial symptoms of stress. Even clinicians who practice in regions that are far from the recent attacks should be prepared to assist people with trauma-related symptoms of stress. (N Engl J Med 2001;345:1507-12.)

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THE terrorist attacks against the United States on September 11, 2001, shook the nation. Television coverage was immediate, graphic, and pervasive.¹⁻³ Newscasts included remarkable video footage showing two airplanes crashing into the World Trade Center and the aftermath of four airplane crashes.^{2,3} People who are present at a traumatic event often have symptoms of stress, but there is evidence that adults and children need not be present to have stress symptoms,⁴⁻⁶ especially if they consider themselves similar to the victims.⁴ The events on Sep-

tember 11 were widely described as attacks on America, and most or all Americans may have identified with the victims or perceived the attacks as directed at themselves as well.

The immediate mental health effects of a national catastrophe experienced from afar — especially one that carries the threat of further attacks — have rarely been examined. We surveyed a nationally representative U.S. sample to determine the immediate reactions of adults to the attacks and their perceptions of their children's reactions.

METHODS**Data Collection**

We used random-digit dialing within the United States. The interview period was three to five days after the attack — from Friday evening, September 14, at the end of the national day of mourning declared by President George W. Bush, through Sunday evening, September 16, just before the start of the workweek, when the president encouraged Americans to return to their normal activities.⁷ Trained interviewers conducted computer-assisted telephone interviews in English; the median duration of the interviews was 28 minutes. RAND's institutional review board approved the study procedures.

Sample

Adults (persons 19 years of age or older) who were at home when we called were eligible for the study; if two or more adults were at home, we randomly selected one to interview. We spoke with a total of 768 selected adults. Of these persons, 73 percent (560) were interviewed, 24 percent refused to be interviewed, and 3 percent agreed to be interviewed later in the weekend but the interview did not take place. Because of the extremely short time for this survey, we could not establish how many of the 3505 telephone numbers we called might eventually have yielded an eligible person or been established as ineligible. At the end of the interview period, 683 telephone numbers were determined to be nonworking or business numbers; 182 were cell phones, pagers, fax machines, or other such ineligible numbers; 495 were unanswered after several attempts.

As compared with the U.S. population represented in the March 2001 Current Population Survey,⁸ our sample slightly overrepresented women, non-Hispanic whites, and persons with higher levels of education and household income, which is typical of sam-

From RAND, Santa Monica, Calif. (M.A.S., B.D.S., L.H.J., R.L.C., G.N.M., M.N.E., A.J.Z., D.E.K., S.H.B.); and the Departments of Pediatrics (M.A.S., J.L.M.), Health Services (M.A.S.), and Medicine (M.N.E.), University of California, Los Angeles. Address reprint requests to Dr. Schuster at RAND, 1700 Main St., Santa Monica, CA 90407-2138, or at schuster@rand.org.

ples selected by means of random-digit dialing.^{9,10} As a sensitivity analysis, we repeated all analyses after weighting the sample to resemble the population estimates from the Current Population Survey, which neither reduced the total sampling error nor substantially altered the results.

Respondents living with a child 5 to 18 years old were asked questions about the child (or about a randomly selected child if there were two or more children at home); information was obtained for a total of 170 children. Although we did not ask whether the respondent was the child's parent, we use the term "parent" because data from the Current Population Survey suggest that most adults in households with children are their parents.

Instrument and Key Measures

To assess reactions to the September 11 attacks, we selected and developed questionnaire items on the basis of prior research and current media reports. Except as otherwise noted, the questions specified a time frame of "since Tuesday"; questions about television viewing specified "on Tuesday." To assess exposure to the attacks through television viewing, we asked respondents the amount of time (in hours, or in minutes if less than one hour) on September 11 that they and their children watched television coverage of the attacks.

To assess stress in adults, we modified 5 questions about symptoms from the 17-question Posttraumatic Stress Disorder Checklist¹¹ (Table 1). The symptoms were selected from those reported by 50 percent or more of the survivors of the Oklahoma City bombing.¹² For the analysis, we defined a substantial stress symptom as one of the two highest of the five response options¹³ ("quite a bit" or "extremely"). A substantial stress reaction was defined as one or more substantial stress symptoms. For children, we modified five items from the Diagnostic Interview Schedule for Children, Version IV (parent's version)¹⁴ (Table 1). A stress reaction was defined as an affirmative response to at least one of the items.

To determine the distance of the respondents from all three

crash sites, as well as from the takeoff and destination sites of the flights, we performed a geographic information system analysis, coding the location as the longitude and latitude for the center of the ZIP Code area (or of the telephone-exchange area for the 8 percent of respondents who provided no ZIP Code). We assessed the relation between stress in adults and the distances from individual sites, as well as the relation between stress and the distance from the nearest crash site and from the nearest of any of the sites. The strongest association was with the distance from the World Trade Center. Therefore, that is the association we report in this article. We also examined population density, a characteristic of location that we believed might be associated with differences in the perceived risk of terrorism and with reported stress.

Statistical Analysis

We report the results of univariate analyses (means and percentages) and bivariate analyses (Pearson's and Spearman's tests of correlation, t-tests, and chi-square tests of homogeneity). Where applicable, transformations of variables were used to satisfy the assumptions of these tests. Data have been weighted to account for multiple telephone lines in a household; our question about the number of telephone lines did not exclude inactive and data-transfer lines, so the results of significance tests may be conservative. We used the linearization method to estimate standard errors and to correct statistical tests for weights.¹⁵ The 95 percent sampling error for reported percentages was no more than 4.3 percentage points for adults and no more than 7.7 percentage points for children. No imputation of missing values was performed.

RESULTS

Adults

Forty-four percent of the U.S. adults we surveyed reported at least one of five substantial stress symp-

TABLE 1. ADULTS WITH SUBSTANTIAL STRESS SYMPTOMS AND CHILDREN WITH STRESS SYMPTOMS AND WORRIES.

QUESTION	NO. OF RESPONDENTS	Substantial Stress*
		%
Adults		
Since Tuesday, have you been bothered by:		
Feeling very upset when something reminds you of what happened?	554	30
Repeated, disturbing memories, thoughts, or dreams about what happened?	557	16
Having difficulty concentrating?	558	14
Trouble falling or staying asleep?	555	11
Feeling irritable or having angry outbursts?	558	9
At least one of the above†	560	44
Children		
Since Tuesday, has your child been:		
Avoiding talking or hearing about what happened?	167	18
Having trouble keeping his or her mind on things and concentrating?	167	12
Having trouble falling asleep or staying asleep?	167	10
Losing his or her temper or being irritable?	167	10
Having nightmares?	167	6
At least one of the above	167	35
Since Tuesday, has your child been worrying about his or her safety or the safety of loved ones?	167	47

*For adults, substantial stress was defined as an answer of "quite a bit" or "extremely" on a five-point scale ("not at all," "a little bit," "moderately," "quite a bit," and "extremely"). For children, stress was defined as an answer of "yes" on a two-point scale ("yes," "no").

†Respondents who answered some but not all of the questions about stress are included.

toms since September 11, 2001 (Table 1); 68 percent experienced at least one symptom “moderately” and 90 percent experienced at least one symptom “a little bit.” Stress reactions varied significantly according to sex, race or ethnic group, presence or absence of prior emotional or mental health problems, distance from the World Trade Center, and region of the country (Table 2).

On September 11, adult respondents watched television coverage of the attacks for a mean of 8.1 hours;

2 percent of respondents watched for less than 1 hour, 15 percent for 1 to 3 hours, 34 percent for 4 to 7 hours, 31 percent for 8 to 12 hours, and 18 percent for 13 hours or more. Extensive television viewing was associated with a substantial stress reaction (Table 2).

Adults responded to the attacks in various ways (Table 3). People with a substantial stress reaction were more likely than others to have talked at least “a medium amount” about their feelings (91 percent

TABLE 2. STRESS REACTIONS ACCORDING TO THE CHARACTERISTICS OF THE RESPONDENTS.*

CHARACTERISTIC OF RESPONDENT	ADULTS			CHILDREN		
	NO. OF RESPONDENTS	STRESS REACTION	P VALUE†	NO. OF RESPONDENTS	STRESS REACTION	P VALUE
		%			%	
Total	560	44		167	35	
Sex			0.006			0.05
Female	298	50		96	41	
Male	226	37		64	25	
Race or ethnic group			<0.001			0.41
White (non-Hispanic)	413	41		125	33	
Nonwhite	106	62		35	41	
Prior emotional or mental health problems‡			0.05			0.10
Yes	66	56		16	53	
No	489	42		150	32	
Distance from World Trade Center			<0.001			0.23
≤100 mi	44	61		13	52	
101–1000 mi	274	48		93	26	
≥1001 mi	242	36		61	44	
Region§			0.05			0.17
Northeast	93	55		30	43	
South	169	46		54	30	
Midwest	154	42		48	25	
West	144	36		35	47	
Population density			0.17			0.21
≤100 persons/mi ²	122	39		35	26	
101–300 persons/mi ²	107	48		30	38	
301–1000 persons/mi ²	144	38		43	33	
1001–2000 persons/mi ²	105	47		30	34	
≥2001 persons/mi ²	82	52		29	46	
Hours of television viewing on September 11 about the attacks¶			0.001			
0–3 hr	94	37		—	—	
4–7 hr	185	39		—	—	
8–12 hr	175	46		—	—	
≥13 hr	102	58		—	—	

*For adults, substantial stress was defined as an answer of “quite a bit” or “extremely” to one or more of five questions about stress on a five-point scale (“not at all,” “a little bit,” “moderately,” “quite a bit,” and “extremely”). For children, stress was defined as an answer of “yes” to one or more of five questions about stress. P values were calculated with the use of Spearman’s tests of correlation for ordered categories (population density, miles from World Trade Center, and hours of television viewing) and chi-square tests of homogeneity for unordered categories. Variables not included in the table were not significant at the P<0.05 level (respondent’s age, respondent’s level of education, number of children 5 to 18 years old, household income, sex of child, child’s age, and number of hours of television viewing by child on September 11 about the attacks). To convert miles to kilometers, multiply by 1.609344; to convert square miles to square kilometers, multiply by 2.589988.

†In a multivariate model that included all characteristics with significant bivariate associations (P<0.10), all variables other than region and prior emotional or mental health problems were significantly associated with adult stress (P<0.05).

‡Respondents were asked whether they had needed help for emotional or mental health problems, such as feeling sad, blue, anxious, or nervous, during the 12 months before the attacks.¹⁶

§Regions were defined according to U.S. Census regions.

¶The percentages were almost identical when adults who avoided television and other reminders of the attack were omitted from the analysis (P=0.003).

TABLE 3. COPING BEHAVIOR AND OTHER REACTIONS BY ADULTS.*

QUESTION	TOTAL NO. OF RESPONDENTS	RESPONSE			
		NOT AT ALL	A LITTLE BIT	A MEDIUM AMOUNT	A LOT
		percent			
How much have you talked with someone about your thoughts and feelings about what happened?	556	2	12	30	57
How much have you turned to prayer, religion, or spiritual feelings?	556	10	15	31	44
How much have you participated in a public or group activity in recognition of what happened?	559	40	26	23	11
How much have you avoided activities such as watching TV because they remind you of what happened?	555	61	20	14	5
		YES			
		percent			
Have you donated blood or money or done any volunteer work?	559			36	
Have you gotten any extra food, gas, cash, or other supplies you might need?	557			18	
Have you checked the safety of immediate family members and friends?	556			75	
Have you checked on someone you thought might be hurt or missing?	556			32	

*Each question referred to the interval between September 11 and the date of the interview (September 14, 15, or 16). Because of rounding, not all percentages total 100.

vs. 83 percent, $P=0.008$), turned to religion (84 percent vs. 69 percent, $P<0.001$), made donations (42 percent vs. 31 percent, $P=0.01$), and checked on the safety of family members and friends (83 percent vs. 69 percent, $P<0.001$).

Thirty-six percent of adults thought that terrorism was a "very serious" or "somewhat serious" problem in the area where they live and work. Forty-four percent thought terrorism would increase over the next five years, and 21 percent thought it would remain at the current level.

Children

Thirty-five percent of parents reported that their children had at least one of five stress symptoms; 47 percent reported that their children had been worrying about their own safety or the safety of loved ones (Table 1). Parents with a substantial stress reaction were more likely than others to report that their

children had symptoms of stress (50 percent vs. 22 percent, $P<0.001$).

Children watched television coverage of the attacks for a mean of 3.0 hours on September 11; 8 percent did not watch any of the coverage, 33 percent watched for 1 hour or less, 36 percent watched for 2 to 4 hours, and 23 percent watched for 5 hours or more. Older children watched more (Pearson's $r=0.52$, $P<0.001$); for example, 73 percent of children who were 5 to 8 years old watched for one hour or less, whereas 51 percent of those who were 17 or 18 years old watched for five hours or more. Thirty-four percent of parents tried to restrict (limit or prevent) their children's viewing of the televised coverage of the attacks; in this subgroup, the children watched an average of 2.3 hours of coverage, as compared with 3.4 hours for other children ($P=0.005$). Parents were more likely to try to limit television viewing by younger children than by older children (Spearman's $r=0.39$, $P<0.001$). Parents who reported that their children were stressed were more likely than others to restrict their children's television viewing (45 percent vs. 29 percent, $P=0.05$); among children whose parents did not try to restrict television viewing, there was an association between the number of hours of television viewing and the number of reported stress symptoms (Pearson's $r=0.27$, $P=0.02$). The response to the question about whether the child worried about his or her safety or the safety of others was not significantly associated with whether parents tried to restrict television viewing or with the number of hours of television viewing by children whose parents did not try to restrict viewing.

One percent of parents reported that they (or other adults in the household) did not speak with their children about the attacks; 15 percent discussed the attacks for less than one hour, 48 percent for one to three hours, 22 percent for four to eight hours, and 14 percent for nine hours or more. The number of hours of discussion was higher for older children than for younger children (Pearson's $r=0.27$, $P=0.001$) and was associated with the number of hours of television viewing (Pearson's $r=0.40$, $P<0.001$). There was no significant association between the extent of communication and the degree of stress symptoms on the part of parents or children.

DISCUSSION

A few days after the September 11 terrorist attacks, 44 percent of a nationally representative sample of adults reported that they had had at least one of five substantial stress symptoms since the attacks, and 90 percent reported at least low levels of stress symptoms. Children also experienced stress: 35 percent had at least one of five stress symptoms after the attacks. Although the rates of stress reactions were highest among subgroups previously found to have

relatively high rates of trauma-related stress symptoms after disasters (e.g., women, nonwhites, and people with preexisting psychological problems^{17,18}), we found high rates of substantial stress reactions in all subgroups.

There are few data with which to compare our findings. Although the prevalence of trauma-related psychiatric disorders has been examined in community-based samples,¹⁹⁻²⁴ few studies have reported the prevalence of trauma-related symptoms of stress in people who do not necessarily meet criteria for a psychiatric disorder. One such study described a representative sample of adults in St. Louis in which 16 percent of respondents reported a lifetime history of at least 1 of 14 symptoms of stress related to a frightening event.^{24,25} Although methodologic differences complicate the comparison, this rate is much lower than the rate of event-related stress in our study.

Catastrophes can have a pronounced effect on adults who are not physically present.⁴ The effect may be greatest when a loved one or acquaintance is harmed, but others who may personalize the event and think of themselves as potential victims can also have stress symptoms.⁴ Children exposed to a catastrophe largely through television coverage can also be affected, as after the Challenger explosion,⁵ the Gulf War,⁶ and the Oklahoma City bombing,^{26,27} with symptoms of trauma-related stress persisting for as long as two years.²⁶ The potential for personalizing the September 11 attacks was large, even for those who were thousands of miles away at the time. Although the people we surveyed who were closest to New York had the highest rate of substantial stress reactions, others throughout the country, in large and small communities, also reported substantial stress reactions.

The level of stress was associated with the extent of television viewing. There are several possible explanations for this finding. The meaning and magnitude of the events were uncertain, and television provided information about what to do and whether the situation posed a personal threat; it may therefore have served as a method of coping for some people, an interpretation that is consistent with threat-appraisal models of coping and stress.^{28,29} For others, particularly children,^{30,31} watching television may have exacerbated or caused stress, especially with repeated viewing of terrifying images. Some unmeasured characteristics of the respondents (e.g., weak social support) may also have resulted in both increased television viewing and increased stress reactions.

Our survey indicates that Americans responded to the attacks in various ways. Most turned to religion, and also to one another for social support. They checked on the safety of those they cared about, talked about their thoughts and feelings, and participated in activities such as vigils, which can provide a sense of community. They also made donations. Efforts to

help people far away, which have been reported after other tragedies,³² may have been means of coping in the aftermath of the attacks — trying to take constructive action in a time of uncertainty and helplessness. Some people avoided activities, such as watching television, that reminded them of the attacks. Although it has been postulated that avoidance interferes with the emotional processing necessary to recover fully from trauma,³³ the unusual circumstances and continuous coverage of the September 11 attacks may have made avoidance in the short term a healthy response.

Professional organizations recommend that parents restrict their children's television viewing during a crisis and discuss the event with them.³⁴⁻³⁶ We found that parents did try to limit their children's television viewing, particularly in the case of younger children and those who were stressed, and parents also talked with their children, often at length, about the attacks.

Although stress symptoms in parents are associated with stress symptoms in their children, we cannot determine from our data whether parental stress causes stress in children or whether children develop their parents' styles of reacting to a crisis. Parents who are experiencing stress may perceive stress in their children, whether or not it is present. However, many of the parents in our survey who reported stress reactions did not report such reactions in their children, suggesting that the parents did not assume that their children reacted as they did. Indeed, underreporting of children's stress seems more likely than overreporting. We selected symptoms we thought parents would know about, but prior research has shown that parents underestimate the stress that media images cause in their children.³⁷

Our study has important implications for health. Although studies of prior disasters suggest that stress reactions diminish over time in the vast majority of people who have had indirect exposure, the September 11 attacks, the shocking televised images, and the profound ramifications are unprecedented. It remains to be seen whether stress reactions in people throughout the country will indeed diminish, especially with recurrent triggers from ongoing threats and further attacks. By intervening as soon as symptoms appear, physicians, psychologists, and other clinicians may be able to help people identify normal stress reactions and take steps to cope effectively. Clinicians can also tell parents what signs to look for in their children and how to respond to their needs.

The psychological effects of the recent terrorism are unlikely to disappear soon. Many of the respondents in our survey said that they anticipated further attacks and that they thought the attacks could be local. Concern about future attacks could heighten anxiety. Ongoing media coverage may serve as a traumatic reminder, resulting in persistent symptoms. When people are anticipating disaster, their fears can

worsen existing symptoms and cause new ones.^{38,39} The events of September 11 made Americans realize that the United States is vulnerable to attack on a scale that few had thought possible. If there are further attacks, clinicians should anticipate that even people far from the attacks will have trauma-related symptoms of stress.

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