Exposure and Peritraumatic Response as Predictors of Posttraumatic Stress in Children Following the 1995 Oklahoma City Bombing

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ABSTRACT *Studies have demonstrated a positive relationship between exposure and posttraumatic stress, but one's subjective appraisal of danger and threat at the time of exposure may be a better predictor of posttraumatic stress than more objective measures of exposure. We examined the role of peritraumatic response in posttraumatic stress reactions in over 2,000 middle school children 7 weeks after the 1995 Oklahoma City, Oklahoma, bombing. While many children reported hearing and feeling the blast and knowing direct victims, most were in school at the time of the explosion and therefore were not in direct physical proximity to the incident. Physical, interpersonal, and television exposure accounted for 12% of the total variance in our measure of posttraumatic stress when peritraumatic response was ignored. Peritraumatic response and television exposure accounted for 25% of the total variance, and physical and interpersonal exposure were not significant in this context. These findings suggest the importance of peritraumatic response in children's reactions to terrorism. These early responses can be used to help determine which children may experience difficulty over time.*

KEYWORDS *Children, Disaster, Posttraumatic Stress, Terrorism, Trauma.*

INTRODUCTION

Childhood exposure to traumatic events and situations is increasingly common, especially in some environments. Giaconia and colleagues¹ found that, by the age of 18 years, more than two fifths of youths in a community sample of predominantly working-class or lower-middle-class households met criteria for at least one *Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition (DSM-III-R)*² trauma, and over 6% met criteria for a lifetime diagnosis of posttraumatic stress disorder (PTSD). Rates of PTSD in populations exposed to severe trauma are even higher.³⁻⁸ PTSD often has a chronic course, and symptoms may be disabling.¹

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Exposure to a traumatic stressor is essential to the diagnosis of PTSD. Diagnostic criteria require that the victim experience, witness, or confront the traumatic event.⁹ Research has demonstrated the role of physical proximity^{10–13} and interpersonal exposure^{14–16} in symptom development in children. Television coverage has also been implicated.^{16–20} Combined forms of exposure may increase risk. For example, March and colleagues¹¹ found that posttraumatic stress symptomatology resulted from direct visual exposure and from indirect exposure through nonwitnessed harm to relatives and/or close friends in children 9 months after exposure to an industrial fire. Those with combined direct and indirect exposure were at greatest risk.

A number of studies have examined the relative impact of various forms of exposure—physical, interpersonal, and media.^{11,12,14–18,21–23} Nader and colleagues¹⁷ found that PTSD symptomatology in Kuwaiti children following the Gulf War correlated positively with direct exposure through witnessing and with indirect exposure through television coverage, but not with indirect exposure through interpersonal relationships. On the other hand, in a study of the impact of various forms of trauma, illness or death of someone close to the child posed the greatest risk for the development of PTSD,¹⁴ and interpersonal exposure was more important than physical exposure in adolescents who witnessed a school bus accident involving their peers.¹⁴

Pfefferbaum and colleagues¹⁹ described bomb-related PTSD reactions in children residing 100 miles from Oklahoma City, Oklahoma, 2 years after the incident. Over one third of the parents surveyed in a telephone interview reported PTSD symptoms in their children following the September 11th attacks on the World Trade Center and Pentagon.²⁴ The impact of events such as these on children is of great concern as we recognize our vulnerability to additional terrorist attacks in the future. With potential exposure through indirect means, it is essential that we identify children at greatest risk early so that we can monitor and intervene as needed.

Research suggests the importance of the child's subjective appraisal of danger in reaction to trauma.^{25–29} In a study of children after a school shooting, Schwarz and Kowalski²⁹ recommended that initial physiologic and emotional response be considered an aspect of exposure. Vernberg and colleagues³⁰ included perceived life threat in their measure of exposure in children following Hurricane Andrew; the exposure variable, in combination with other factors, was highly predictive of later PTSD symptoms. These studies examined samples in which most children were directly exposed to the traumatic event. Less is known about the importance of the child's subjective experiences in samples for which exposure is less direct.

Dwarfed now by the events of September 11, 2001, the 1995 Oklahoma City bombing was a horrifying event and, at the time, the deadliest act of domestic terrorism in the history of the United States. The bombing left many casualties—167 died in the blast, 1 nurse responder died in the rescue effort, and hundreds more were injured. Exposure was extensive. Over 60% of the youths sampled in a school survey heard and/or felt the explosion, and more than one third knew someone killed and/or injured.¹⁶ Television coverage began immediately and remained extensive for weeks. Pfefferbaum and colleagues¹⁸ described the relative importance of three forms of exposure—physical, interpersonal, and media—in middle school students 7 weeks after the incident. In this study, we examined the association of peritraumatic response to the bombing with PTSD reactions, while controlling for various forms of exposure and concerns about safety. We hypothesized that peri-

traumatic response, as well as physical, interpersonal, and television exposure, and ongoing safety concerns would predict posttraumatic stress reactions.

METHODS

Participants and Procedure

Participants for this study were recruited from Oklahoma City middle schools. The Oklahoma City public schools (OCPS) had an enrollment of approximately 7,200 students in grades six through eight. Approximately one third ($n = 2,381$) of the students, representing all 11 middle schools in the district, participated in the study. There were 949 (40%) sixth graders, 746 (31%) seventh graders, and 686 (29%) eighth graders. Girls ($n = 1,336$, 56%) outnumbered boys ($n = 1,003$, 42%); gender was not reported by 42 (2%) of the sample. Most OCPS students were minorities, with families of lower socioeconomic status predominating. The ethnic distribution of the sample roughly paralleled that of the school district, with 1,005 (42%) self-reporting as African American, 848 (36%) as Caucasian, 263 (11%) as Hispanic, 111 (5%) as American Indian, and 112 (5%) as other; 42 (2%) surveys had missing responses.

Two days before the summer recess, approximately 7 weeks after the bombing, the OCPS administration distributed the assessment instrument to principals in all schools. Principals who agreed to the participation of their schools in turn distributed it to the teachers in their schools. The decision regarding classroom participation rested with individual teachers. Students also could decline participation. Although we intended wide distribution, we did not expect universal response because of curricular priorities and high absenteeism, thought to be due to the bombing and the approaching summer recess. All participating students completed the assessment on the same day.

Informed consent was obtained in accordance with OCPS policy for passive consent. This involved sending a letter home to the parents of students; the letter advised the parents to notify their child's principal if they did not want their child to participate. The protocol was approved by the University of Oklahoma Health Sciences Center Institutional Review Board.

Assessment Instrument

The survey included 56 items addressing physical, interpersonal, and television exposure and current safety concerns, worry, and posttraumatic stress reactions.

Physical exposure was established by asking participants if they heard ("did not hear," "loud," "very loud," and "hurt my ears") and/or felt ("did not feel," "some," "strong," and "terrible") the explosion. The two items were summed, and the possible range of scores was 2 to 8, with higher scores indicating greater exposure. Interpersonal exposure was calculated by assigning a score of 1 to participants who knew someone killed and/or injured in the bombing and a score of 0 to those who knew no one killed or injured. A single-item querying amount of bomb-related television viewing in the aftermath of the explosion had five response options ("none," "very little," "some," "most of my TV time," and "all of my TV time") and constituted the television exposure variable. The possible range of scores was 1 to 5, with higher scores reflecting greater exposure.

The peritraumatic response scale, adapted from scales developed by Freedy and

colleagues³¹ and by Wang and colleagues,³² included 12 items addressing the participants' peritraumatic responses of fear, arousal, and dissociation at the time of the incident. Each item was rated on a scale with five response categories ("strongly disagree," "disagree," "neither," "agree," "strongly agree"). The items were summed, and the possible range of scores was 12 to 60, with higher scores indicating stronger peritraumatic response. Cronbach α was .85 for this sample.

Current concern about safety and worry that something would happen to self or family (WORRY) was assessed by summing scores for two items, each measured on a scale from 1 to 4: "I feel safe now" ("a lot," "some," "a little," "not at all") and "I worry that something will happen to me or my family" ("none," "a little," "some," "a lot"). The range of possible scores was 2 to 8, with higher scores indicating greater concern about safety and worry.

The Posttraumatic Stress Scale (PTSS) was adapted from the Impact of Event Scale-Revised (IES-R).³³ It consisted of 22 items representing the three PTSD symptom clusters, with 15 items measuring intrusion and avoidance from the Impact of Event Scale (IES)³⁴ and additional items assessing arousal.³³ Participants were asked to rate the frequency of the 22 reactions to the bombing in "the past 7 days" on a scale with four response categories ("not at all," "rarely," "sometimes," and "often"). The PTSS score summed the 22 items. The possible range of scores was 22 to 88, with higher scores indicating more intense reactions. The basic psychometric properties of the IES^{34,35} and IES-R³³ have been established for adults. The IES has been used in other studies involving children.^{6,36-39} Its reliability was established in a study of over 1,700 refugee schoolchildren,³⁶ and the instrument was part of a psychological screening battery found to be effective in identifying traumatized children.³⁸ Cronbach α was .90 for this sample.

Data Analysis

Stepwise multiple regression analyses were performed to determine significant predictors of retrospectively reported peritraumatic response at the time of the incident and of current total posttraumatic stress reactions (PTSS). Predictor variables for each outcome included gender and retrospectively reported physical, interpersonal, and television exposure. Peritraumatic response and WORRY were also assessed as predictors of PTSS. Gender differences for each predictor and outcome were assessed with independent sample *t* tests. Ethnic group differences were assessed with analyses of variance (ANOVA) for physical exposure, television exposure, peritraumatic response, WORRY, and PTSS. A χ^2 analysis was used for assessing gender and ethnic group differences on interpersonal exposure.

The large sample size increased power and contributed to finding statistically significant effects at the .0001 level for some variables that were not considered meaningful effects (i.e., trivial effects accounting for less than 2% variance in an outcome or detection of less than 0.2 SD difference between means). To address this concern, effect sizes (ESs) for each variable were computed for interpretation of the results using conventional values suggested by Cohen⁴⁰ instead of significance levels. In the regression analyses, the effect size was calculated as the proportion of unique variance explained by the predictor divided by the proportion of variance not explained by the model. A small effect size was defined as 0.02, a medium effect size was 0.15, and a large effect size was 0.35. For evaluating differences between means, a small effect size was considered to be 0.2 SD, a medium effect size was 0.5 SD, and a large effect size was 0.8 SD.

TABLE 1. Variables used in the analyses

Variable	N	M	SD	Possible range	Actual range
Physical exposure	2,379	3.6	1.5	2–8	2–8
Interpersonal exposure	2,381	0.5	0.5	0–1	0–1
Television exposure	2,377	3.8	0.9	1–5	1–5
Peritraumatic response*	2,367	34.9	9.5	12–60	4–60
Safety concerns and worry (WORRY)	2,342	4.4	1.7	2–8	2–8
Posttraumatic stress (PTSS)	2,317	41.3	13.1	22–88	22–85
Difficulty functioning	2,327	0.1	0.3	0–1	0–1

*The lower bound for the actual range is less than that for the possible range due to missing responses.

RESULTS

Descriptive statistics for the exposure, peritraumatic response, WORRY, and PTSS variables are shown in Table 1. Differences in sample sizes for each variable reflect missing data. There were no ethnic group differences on any of the study variables.

Exposure

Approximately two thirds ($n = 1,578$, 66%) of the students reported hearing and/or feeling the blast. A surprisingly large number ($n = 1,203$, 51%) reported knowing someone killed and/or injured in the explosion. See Table 2 for the distribution of relationships to direct victims. Of the total sample, 368 (15%) knew someone injured, 128 (5%) knew someone killed, 704 (30%) knew someone killed and someone injured, 2 (<1%) knew someone killed but we were missing data for knowing someone injured, and 1 (<1%) knew someone injured but we were missing data for knowing someone killed. Television exposure was extensive, with approximately two thirds ($n = 1,581$, 66%) of the sample reporting that all or most of their television viewing in the aftermath of the incident was bomb related. There were no significant gender differences on physical, interpersonal, or television exposure.

TABLE 2. Interpersonal exposure

Relationship	Killed		Injured	
	n	%	n	%
Parent	21	<1	35	1
Sibling	16	<1	27	1
Other relative	171	7	273	11
Friend	230	10	252	11
Acquaintance	394	17	486	20
No one	1,544	65	1,306	55
Missing responses	5	<1	2	<1

Peritraumatic Response

Retrospectively reported peritraumatic responses to the bombing from the peritraumatic response scale are presented in Table 3. The three most frequently reported peritraumatic responses were fear that someone in the family would be hurt, fear that a friend would be hurt, and feeling nervous or afraid.

Females ($M = 36.66$, $SD = 8.90$) scored significantly higher than males ($M = 32.66$, $SD = 9.87$) on peritraumatic response, $t(2,004) = 10.07$, $P < .0001$, $ES = .43$.

The three exposure variables and gender were evaluated as predictors of peritraumatic response in a multiple regression analysis. Female gender ($ES = 0.03$), physical exposure ($ES = 0.06$), interpersonal exposure ($ES = 0.03$), and television exposure ($ES = 0.03$) accounted for 16% of the total variance in peritraumatic response, $F(4,2314) = 107.80$, $P < .0001$.

Posttraumatic Stress

In a multiple regression analysis ignoring the influence of peritraumatic response, physical exposure ($ES = 0.02$), interpersonal exposure ($ES = 0.04$), and television exposure ($ES = 0.04$) accounted for 12% of the total variance in PTSS, $F(3,2308) = 101.4$, $P < .0001$. Although females ($M = 43.09$, $SD = 12.93$) scored significantly higher than males ($M = 38.74$, $SD = 12.86$) on PTSS, $t(2,081) = 7.96$, $P < .0001$, $ES = 0.34$, gender was not a significant predictor in the context of the exposure variables. In a multiple regression model evaluating peritraumatic response in the context of the exposure variables, physical and interpersonal exposure were not significant. In a two-predictor model, television exposure ($ES = 0.03$) and peritraumatic response ($ES = 0.26$) accounted for 25% of the total variance in PTSS, $F(2,2304) = 385.4$, $P < .0001$. The interaction of gender and peritraumatic response was not a significant predictor of PTSS.

Safety Concerns and Worry

At the time of the interview, 7 weeks after the bombing, many students continued to have safety concerns. In response to the survey question "I feel safe now," 765 (32%) replied a lot, 587 (25%) some, 648 (27%) a little, and 348 (15%) not at

TABLE 3. Peritraumatic response items

Item	N	M	SD	Agree, n	Agree, %
Thought I would die	2,361	2.2	1.1	318	13
Trembling or shaking	2,361	2.9	1.3	802	34
Heart beat fast	2,364	3.1	1.4	1,073	45
Nervous or afraid	2,363	3.3	1.3	1,267	54
Made me jump	2,362	2.9	1.4	845	36
On "automatic pilot"	2,237	2.5	1.2	418	19
Scared someone in my family would be hurt	2,362	3.8	1.3	1,602	68
Scared a friend would be hurt	2,360	3.5	1.4	1,361	58
Scared my teacher would be hurt	2,356	2.5	1.3	507	22
Frightened by how scared my teachers acted	2,354	2.7	1.3	645	27
Upset by how I acted	2,355	2.5	1.2	451	19
Helpless	2,345	3.2	1.3	927	40

all. To the item "I worry that something will happen to me or my family," 879 (37%) replied none, 661 (28%) a little, 407 (17%) some, and 409 (17%) a lot.

Females ($M = 4.66$, $SD = 1.63$) scored significantly higher than males ($M = 4.06$, $SD = 1.71$) on WORRY, $t(2,043) = 8.52$, $P < .0001$, $ES = 0.36$.

When WORRY was added to the multiple regression model including peritraumatic response and television exposure as predictors of PTSS, television exposure was not significant. In a two-predictor model, peritraumatic response ($ES = 0.18$) and WORRY ($ES = 0.06$) explained 27% of the total variance in PTSS, $F(2,2289) = 431.54$, $P < .0001$. The interaction of gender and WORRY was not a significant predictor of PTSS.

DISCUSSION

Peritraumatic response was the strongest predictor of PTSD reactions in this sample of children. It was even more important than physical exposure, relationship to direct victims, bomb-related television viewing, and lingering safety concerns and worry in predicting PTSD reactions. These findings are consistent with other studies^{25-27,29,41-43} and support the inclusion of the child's subjective experience at the time of exposure in the diagnostic criteria for PTSD.

Our findings with respect to the relative importance of peritraumatic response, however, also may reflect the fact that our sample included many children who would be considered indirect victims. While close to two thirds of these children heard and/or felt the explosion, most were in school at the time of the incident and therefore not at the site. We would expect physical proximity and peritraumatic response to have more influence on later distress in samples with a larger proportion of direct victims physically present at the disaster. Furthermore, while slightly over one half of the children in this sample reported knowing someone killed and/or injured, most of these were related through extended family, friends, and/or acquaintances rather than immediate family. A stronger association between interpersonal exposure and PTSS would more likely be found in a sample of children with closer relationships to direct victims.

This study examined PTSD reactions without attempting to establish a diagnosis. Diagnosis represents a generally agreed upon set of symptoms with implications for prognosis and treatment. It is unclear the extent to which factors such as physical proximity, preexisting psychiatric conditions, or prior exposure to trauma, which are important in predicting subdiagnostic symptoms, are also important in determining diagnoses.

These factors may be mediators or moderators of peritraumatic response in predicting PTSD diagnosis. The exposure variables—physical, interpersonal, and television—were significant in predicting the children's peritraumatic responses. They accounted for only small effects, however, suggesting that other factors were more important determinants. Preexisting emotional and behavioral problems^{26,41,44-46} and prior trauma^{27,44} may influence the child's response at the time of exposure and later. Preexisting internalizing symptoms such as anxiety and depression,^{25,26,41} which themselves may influence the child's peritraumatic response to a traumatic experience, are especially important. The retrospective report of peritraumatic response also may have been biased by current symptomatology as items on the peritraumatic response and PTSS scales and the WORRY variable, to some extent, measured similar feeling states.

A primary goal of terrorism is to instill fear and intimidation in a group of

people, community, or nation. Therefore, these children's enduring concerns about safety and worry are also of clinical interest. While these concerns may represent worry about other issues such as community violence, they appear to have been aggravated by the bombing and the children's reactions to it. Indeed, in this study of largely indirect victims, peritraumatic response, posttraumatic stress reactions, and ongoing safety concerns and worry were intercorrelated.

The terrorist actions of September 11, 2001, led to heightened concern about security and our future vulnerability. In addition to the many direct victims of the September 11th attacks, thousands of children in the communities hit, and even more across the United States who watched the events unfold, were indirectly impacted. Our findings suggest that their peritraumatic responses play a role in their reactions to these events. This exposure, coupled with the ongoing threat of future terrorist assault, may maintain concerns about safety and worry. As we look ahead to address the mental health needs of children in this new environment, studies like this help elucidate factors that identify children in need of mental health assessment and services.

In summary, our results support the consideration of subjective distress as a form of exposure and its inclusion in the stressor criterion of the diagnosis of PTSD.⁹ Our findings suggest that children with intense peritraumatic responses and ongoing worry about safety should be more formally evaluated and followed in the aftermath of trauma exposure, and that peritraumatic response can be used as a screening measure for large populations of indirect child victims of terrorism.

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