Israeli Preschool Children Under Scuds: A 30-Month Follow-up

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ABSTRACT

Objective: Longitudinal studies of children exposed to traumatic events show contrasting findings regarding their symptomatic change over time. The present study reports on a 30-month follow-up of preschool children and their mothers who had been exposed to Scud missile attacks. **Method:** Families displaced during the Gulf War after their homes had been damaged by the missile attack and a control group whose homes remained intact were interviewed about posttraumatic and general symptomatology, the mothers' capacity to control images, and the children's adaptive behavior. **Results:** Stress symptoms decreased in the displaced children but not in their mothers. Both reported more posttraumatic symptoms than did the control group. No differences in the children's adaptive behavior were observed. Posttraumatic symptoms of the displaced children correlated with the mothers' avoidant symptoms. The mothers' avoidant symptoms at follow-up were statistically explained by the mothers' symptoms during the war and their capacity for image control, the duration of displacement, and the cohesion of the family. **Conclusions:** The maternal stress-buffering capacity constitutes a central element in children's protective matrix and is crucial in minimizing long-term internal suffering of traumatized preschool children. *J. Am. Acad. Child Adolesc. Psychiatry,* 1997, 36(3):349–356. **Key Words:** posttraumatic stress disorder, preschool children, trauma, war.

Longitudinal studies of children's reactions to catastrophic events provide clinicians with a dynamic perspective of their capacity for adaptation. Review of these studies reveals that the prevalence of posttraumatic symptoms in children does not decrease during the first 4 years after the traumatic exposure. This has been found to be true for such experiences as kidnapping (Terr, 1983), a bushfire (McFarlane, 1986), concentration camps (Kinzie et al., 1989), and organ transplants (Stuber et al., 1991). However, the few available longer-term follow-up studies of traumatized children report contrasting findings. Green et al. (1994), in a 17-year study of the Buffalo Creek dam collapse, found that psychiatric symptoms significantly decreased in the exposed population, and the rate of posttraumatic stress disorder (PTSD) declined from 32% to 7%. No significant differences in psychiatric symptoms were noted between the affected population and an unexposed sample.

Few authors have examined the factors that protect children from persistent symptomatology or that facilitate adaptation after a traumatic event. The present work is the second phase of a follow-up study of Israeli preschool children and their mothers exposed to direct Scud missile attacks during the Gulf War. In the first phase, conducted 6 months after the attack, we compared the symptomatic response of families displaced and not displaced from a neighborhood hit by missiles (Laor et al., 1996). Results showed that the persistent stressful reaction (fear, anxiety, sleep problems, and regressive symptoms) and externalizing symptoms (aggression, acting out, hyperactivity) in the displaced children were related to both human factors

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(mother's symptomatology, cohesion of the family, child's personality) and environmental factors (displacement, destruction of the house, level of exposure to event). These have been traditionally viewed as protective/vulnerability factors (Anthony, 1987). However, taken as a whole, we postulated that they functioned as a "protective matrix"—a combination of the cultural, social, physical, familial, and personal adaptive mechanisms that regulate stressful environmental stimuli (Winnicott, 1965). We also found that the components of the matrix showed systemic changes with age; that is, the symptomatic reaction of the older (aged 5 years) children was less dependent than that of the younger (aged 3 to 4 years) children on the mother's symptomatology and the family's cohesion. Thus, we concluded that the mother's stress-buffering function is an integral part of the protective matrix of the younger child. This view of a dynamic matrix rather than a static protective shield is in line with current theories of child development and mother–child interaction (Solan, 1991; Stern, 1985).

During the 2 years after the war, community and national systems restabilized: families returned to their homes and schools and health and community centers resumed regular functioning. At the 30-month time point, we raised several questions, some clearly stated as hypotheses, others left open to be answered in the course of the study: (1) Do changes occur in the symptomatic reactions of children and mothers between 6 and 30 months after the traumatic event? We hypothesize that the displaced population shows a decrease in symptoms. (2) What are the symptomatic differences at 30 months between displaced and nondisplaced subjects? (3) What is the prevalence of PTSD symptoms in children and mothers? (4) Does the adaptive behavior of displaced and nondisplaced children differ? (5) What is the relationship between the children's adaptive behavior and the symptomatic reactions of the children and their mothers? (6) What variables explain the severity of the children's posttraumatic symptoms? We hypothesize that the more severe the maternal symptomatology, the worse the child's symptoms and the poorer his or her adaptation.

Besides studying the sequelae of maternal buffering failure, we sought to gain a closer look at what constitutes the maternal stress-buffering capacity. In a previous study of adult PTSD subjects exposed to a Scud attack (Laor et al., 1992), we found that those with a high capacity to control mental images had a lower physiological response than those with a low mental image control capacity. This notion of image control as a regulative psychopathological function in PTSD concurs with the one proposed by Horowitz (1983). Thus, we asked one final question: (7) Given that posttraumatic states are clinically defined by image dysregulation (e.g., intrusive symptoms), is image control an independent variable predicting posttraumatic symptoms in mothers and children? We hypothesize that the greater the mother's capacity to control mental imagery, the lower her posttraumatic symptoms.

METHOD

The Traumatic Event

On January 17, 1991, the Gulf War broke out, and for the next 3 weeks the Israeli civilian population was attacked several times by Iranian Scud missiles. Hundreds of families whose homes were damaged were forced to temporarily relocate to hotels. The stress had already been building, though, since October 1990 when, faced with the blatant threat of aggression, the government issued gas masks to every person in Israel and instructed the people to prepare sealed rooms in the event of chemical warfare. Thus, this entire 4-month period may be viewed as a continuous stressor related to expected yet uncontrollable events.

Subjects

The first phase of this study was performed 6 months after the war and included three groups of preschool children and their mothers, all matched for sex, age, and socioeconomic status: two groups from the same disadvantaged neighborhood in Tel Aviv (Israeli bottom quartile) that had been hit by Scud missiles, one displaced because their homes had been destroyed and a control group that was not because their homes remained intact; and a second control group from the city of Beer Sheba in the south of Israel that was also under threat of attack but was not hit. No siblings were included in the sample. Since no significant differences were found between the two control groups, only the first served in the present work, performed at 30 months. Of the 75 displaced families investigated in phase 1, 13 could not be located and 11 refused to participate in phase 2. Hence, our experimental group consisted of 51 subjects and the control group of 56. Comparisons of the variables assessed in the 6-month study between those who did and did not participate in the 30-month follow-up showed no significant differences (all p values $>.05$). Table 1 describes the sample distribution by group, sex, and age.

Procedures and Measures

Mothers and children were interviewed in a 2-hour session with the same symptom scales used at 6 months (marked here by *) and several additional measures, all in the Hebrew version.

Child Measures. The following child measures were used: (1) The Child Behavior Checklist* (Achenbach and Edelbrock, 1983) consists of 10 behavioral scales empirically derived from an Israeli sample (Auerbach and Lerner, 1991). (2) The Preschool Children's

TABLE 1
Distribution of Subjects According to Group, Age, and Sex

	Displaced		Undisplaced		
Age[a]	Boys	Girls	Boys	Girls	Total
3 yr	4	15	4	17	40
4 yr	7	9	10	8	34
5 yr	7	9	5	12	33
Total	18	33	19	37	107

[a] Age of child at 6 months; 2½ years older at 30 months.

Assessment of Stress Scale* (Mayes and Cohen, 1990) examines stress reactions (fear, anxiety, sleep problems, mood changes, regressive symptoms) (Cronbach's α = .89). Scales from these two instruments were factor-analyzed at 6 months, and three domains of nonoverlapping symptoms were defined: internalizing (poor communication, depression, somatic complaints); externalizing (aggression, delinquency, hyperactivity, odd, immature, or unpopular behavior); and stress-related behavior (separation and sleep problems, mood changes, fears, tension, regression). (3) The Child Post-Traumatic Stress Reaction Index (Pynoos et al., 1987), a 20-item scale, is administered to the child. (4) The Vineland Adaptive Behavior Scales (Sparrow et al., 1984) examine communication, socialization, and daily living skills. Standard scores for each domain and for the Adaptive Behavior Composite were derived from norms formulated from an American sample.

Maternal Measures. The following maternal measures were used: (1) The Symptom Checklist-90-R* (Derogatis, 1983) was used for measuring general maternal symptomatology with the Global Severity Index (GSI). (2) The Civilian Mississippi Scale is a 39-item questionnaire based on the Mississippi Scale for Combat-Related PTSD (Keane et al., 1988). (3) The PTSD Inventory (Solomon et al., 1993) covers the *DSM-III-R* diagnostic criteria and has been shown to have a high convergent validity with the Structured Clinical Interview for *DSM-III-R* and Impact of Event Scale (IES). (4) The IES (Horowitz et al., 1979) measures intrusive and avoidant symptoms after a traumatic event. (5) The Gordon Test of Imagery Control (as revised by Richardson, 1969), a 12-item scale which measures capacity to manipulate mental images (i.e., changing their color, position, or movement), has been found to be internally consistent, with adequate test-retest reliability and good correlation with other pencil-and-paper measures of imagery (White et al., 1977).

Data Analysis

Differences between the two time points (6 versus 30 months) were determined by a 2 × 2 × 3 × 2 multivariate analysis of variance (MANOVA) with repeated measures. Group (displaced versus nondisplaced), age (3 or 4 or 5 years), and sex (boys versus girls) were the between-subject factors, while the dependent measures were the symptom-scale scores of the children (Internalizing, Externalizing, and Stress) and the mothers (GSI). Differences in the adaptive behavior domains and in the children's and mothers' posttraumatic symptoms at 30 months were calculated with 2 (group) × 3 (age) × 2 (sex) MANOVA. Finally, stepwise regression analyses were performed to assess the contribution of symptoms, image control, family functioning, and the event to the statistical explanation of the mothers' and the children's posttraumatic symptoms at 30 months. Significance levels were adjusted for multiple comparisons and set at .01 (Bonferroni correction).

RESULTS

Comparison of Subjects at 6 and 30 Months

Comparison of the children's symptom scales at 6 and 30 months yielded a significant phase × group interaction for the Stress domain ($F[1,102] = 7.94$, $p < .01$) but not for the Internalizing or Externalizing domains. This interaction reflects a significant decrease in the stress symptoms of the displaced children (means ± standard deviations; 42.3 ± 18.2 and 31.6 ± 14.7, respectively) but not of the undisplaced children (29.1 ± 12.9 and 27.0 ± 12.1).

Among the mothers, there was a significant main effect for group. Displaced mothers reported a stronger symptomatic reaction to the traumatic event (GSI) at both 6 and 30 months (165.7 ± 64.7 and 160.3 ± 60.8, respectively) than did the undisplaced mothers (133.0 ± 41.3 and 132.9 ± 47.4) ($F[1,87] = 6.41$, $p < .05$). No significant decrease was found in the mothers' group symptomatology from 6 to 30 months ($p > .05$).

Presentation at 30 Months

At 30 months, the displaced children showed marginally more posttraumatic symptoms than the undisplaced children ($F[1,104] = 4.35$, $p < .05$). However, they did not differ significantly in the Internalizing ($F[1,104] = 3.28$, $p > .05$), Externalizing ($F[1,104] = 1.15$, $p > .05$), or Stress ($F[1,104] = 2.96$, $p > .05$) domains. Analysis of these domains revealed no significant interactions between the independent variables (group, sex, and age) and no sex or age main effects.

The relationship between the children's posttraumatic symptoms and the mothers' general and posttraumatic symptomatology was different in the study groups. In the displaced group, the posttraumatic symptoms of the 5-year-old children did not correlate with their mothers' symptoms at either 6 or 30 months, while those of the 4-year-old children correlated significantly with the mothers' general (GSI) ($r = .67$, $p < .005$) and intrusive ($r = .48$, $p < .05$) symptoms, both assessed at 30 months. Finally, the posttraumatic symptoms of the 3-year-old displaced children strongly

correlated with the mothers' intrusive (r = .67, p < .005) and avoidant (r = .60, p < .005) symptoms at 30 months and with the mothers' general symptomatology at 6 (r = .83, p < .001) and 30 months (r = .74, p < .005). Within the undisplaced group, there was no significant correlation between children's and mothers' symptoms in any of the age subgroups.

Severity of PTSD Symptomatology

Each group of children was categorized according to the classification of Pynoos et al. (1993) for PTSD symptomatic severity. Among the displaced children, 19.6% had "doubtful," 35.3% had "mild," 37.3% had "moderate," and 7.8% had "severe" symptomatology. Corresponding symptomatology figures for the control group were 33.3%, 35.1%, 28.1%, and 3.5%. No child was classified as having "very severe" posttraumatic symptoms.

The MANOVA comparing posttraumatic and general symptoms between the two groups of mothers at 30 months was statistically significant (F[5,102] = 4.32, p < .001). The univariate analyses revealed higher symptomatic scores in the displaced mothers on the following scales: GSI (F[1,106] = 6.88, p < .01); Mississippi scale (F[1,106] = 7.31, p < .01); PTSD Inventory (F[1,106] = 15.76, p < .001); and IES-Intrusion (F[1,106] = 19.98, p < .001), but not on IES-Avoidance (F[1,106] = 2.56, p > .05) (Table 2). Scores topped the 107 cutoff on the Mississippi scale in 7.8% of the displaced mothers (n = 4) compared with 1.8% (n = 1) of the control group.

Children's Adaptive Behavior

No significant group or sex main effect and no interactions between the independent variables were found in the adaptive behavior domains. The multivariate age effect reached statistical significance (F[6,188] = 3.68, p < .005), indicating a higher score for 3-year-olds compared with 4- and 5-year-olds in the Socialization domain (F[2,96] = 3.24, p < .05). The mean scores on the Vineland scales were similar to those obtained with a U.S. normative sample (means available from authors upon request).

TABLE 2
Mean Scores and Standard Deviations of Mothers' Symptoms at 30 Months

	Displaced		Undisplaced	
	Mean	SD	Mean	SD
IES-Intrusion**	16.4	6.2	11.6	5.0
IES-Avoidance	15.5	5.2	14.0	4.7
Mississippi*	73.6	22.1	63.4	17.1
PTSD Inventory**	35.2	12.8	26.9	8.9
SCL-90-R*	160.3	60.8	132.9	47.4

Note: IES = Impact of Event Scale; Mississippi = Civilian Mississippi Scale; PTSD Inventory = Posttraumatic Stress Disorder Inventory; SCL-90-R = Symptom Checklist-90-Revised.
* p < .01; ** p < .001.

Children's Adaptive Behavior and Mother and Child Symptoms

We computed Pearson correlations between the children's adaptive behavior domains and the symptom domains of both children and mothers. Among the displaced children, the more externalizing symptoms present at 30 months, the lower the scores for the Daily Living Skills (r = −.31, p < .05), Socialization (r = −.40, p < .005), and Adaptive Behavior Composite (r = −.35, p < .005) at the same time point. Adaptive behavior domains were not significantly correlated with the children's symptomatic behavior at 6 months or with the mothers' symptoms at either 6 or 30 months. Among the undisplaced children, externalizing symptoms correlated negatively with adaptive behavior, both measured at 30 months: Communication, r = −.32, p < .01; Daily Living Skills, r = −.36, p < .005; and Adaptive Behavior Composite, r = −.35, p < .005. However, the lower the symptomatic reaction of the undisplaced mothers at 6 months, the higher their children's scores at 30 months on the adaptive behavior scales: Communication, r = −.27, p < .05; Daily Living Skills, r = −.37, p < .005; Socialization, r = −.34, p < .05; and Adaptive Behavior Composite, r = −.38, p < .005. When correlations were computed between children's adaptive behavior and mothers' symptomatology at 30 months, similar results were obtained: Communication, r = −.30, p < .05; Daily Living Skills, r = −.30, p < .05; Socialization, r = −.15, p > .05; and Adaptive Behavior Composite, r = −.28, p < .05.

Predictors of Posttraumatic Symptoms in Children at 30 Months

The variables used in the stepwise regression analyses to statistically explain the children's level of posttraumatic symptoms at 30 months were symptom scales of mothers (GSI) and children (Internalizing, Externalizing, and Stress), family functioning (Cohesion and

Adaptability), personality domains (Child Personality Scales), and distance from the missile impact, all assessed at 6 months, as well as mothers' symptoms (GSI, Mississippi, Intrusion, Avoidance, and PTSD Inventory) and capacity for image control, assessed at 30 months. Upon analysis for the whole sample, the mothers' avoidant symptoms were the only variable that entered into the regression equation (multiple r = .29, $F[1,74] = 6.60$, $p < .05$). When the same analysis was performed separately for each group, results were different: whereas the IES-Avoidance scale entered the equation for the displaced group (multiple r = .46, $F[1,33] = 8.90$, $p < .01$), no variable did so for the control group.

Thus, our next step aimed at identifying the variables that might statistically explain the avoidant symptoms of displaced mothers. A stepwise regression analysis was performed using as predictors the children's and the mothers' symptoms at 6 months, family functioning, duration of displacement, distance from the missile impact, and mothers' capacity for image control. Four variables entered the regression equation, explaining a significant proportion (53%) of the variance: mothers' general symptoms at 6 months (GSI); duration of displacement; mothers' capacity for image control; and family cohesion (Table 3).

DISCUSSION

This study examined the function of the protective matrix in children's adaptation to traumatic events. Two groups of preschool children and their mothers from a single neighborhood that was hit by Scud missiles during the Gulf War were included, one displaced because their homes were destroyed, and the other not. Although children of the first group showed marked stress symptomatology at 6 months after the war, there was no significant difference from children of the second group in internalizing, externalizing, or stress symptoms or in adaptive behavior scores at 30 months. However, they did report more severe posttraumatic symptoms. These findings invite consideration of the normal adaptive behavior of the displaced children in the face of the marked changes noted in their expression of their inner distress.

Within 6 months after the war the displaced families returned to their prewar social milieu; the children went back to school and all neighborhood agencies renewed regular activities. We believe this reconstitution of the sociocultural layer of the protective matrix may have promoted adaptation in the children and facilitated a reduction in stress symptoms. These data complement the experience of the neighborhood teachers who observed no need for help on the part of the children. By contrast, the symptomatic level of the displaced mothers remained significantly high. Therefore, evidence from Terr's Chowchilla study (Terr, 1983) notwithstanding, it is possible that the personality resilience and cognitive plasticity of younger children (Bjorklund and Green, 1992; MacDonald, 1986; Masten et al., 1990) allow for their relatively faster recovery after trauma, even though they may react adversely to the event and endure long-term internal suffering (Bingham and Harmon, 1996). (For a comprehensive developmental model of childhood traumatic stress, see Pynoos et al., 1995.)

The adaptive behavior of the displaced children at 30 months correlated neither with their symptomatic reaction at 6 months nor with their mothers' symptoms at 6 and 30 months. Hence, this appears to be an independent domain. In the nondisplaced group, the children's adaptive behavior exhibited a significant negative correlation with the mothers' symptoms. This difference between the two groups of children may be explained by other processes that intervene during adaptation to severe stress and may take different courses during normal and pathological reconstitution.

TABLE 3
Multiple Regression Analysis of Displaced Mothers' Avoidant Symptoms 30 Months After the War

Variables in the Equation	Multiple R	Adjusted r^2	r^2 Change	F	p
SCL-90-R phase 1	.59	.33	.33	19.6	.0001
Duration of displacement	.66	.40	.07	13.9	.0000
Low capacity for image control	.72	.48	.08	12.7	.0000
Family cohesion (inadequate)	.76	.53	.05	11.6	.0000

Note: SCL-90-R = Symptom Checklist-90-Revised.

When we attempted to elucidate the variables accounting for the PTSD symptoms of the displaced children, only one, the mothers' level of avoidant symptoms, was statistically significant. Avoidant symptoms reflect not only the mothers' attempts to steer clear of stimuli that remind them of the traumatic event, but also their state of emotional numbing which restricts their capacity for closeness with others. A high level of avoidant symptoms may undermine the mother's capacity to buffer and process the trauma for her young child (see Pynoos et al., 1995, p. 87). This is not to place the blame on the mother, but to emphasize the important role she plays, among other genetic or environmental factors, in regulating the child's well-being.

Four variables statistically explained maternal avoidant symptoms at 30 months: symptom level at 6 months; duration of displacement; capacity for image control; and cohesion of the family. The importance of family flexibility and maternal nurturing in containing children's symptomatic reaction to traumatic stress has been amply documented (Anthony, 1987; Bloch et al., 1956; Green et al., 1991; Laor et al., 1996; McFarlane, 1987; Sullivan et al., 1991). However, image control capacity, though considered by Horowitz (1983) as "one of the important symptoms of psychopathology" (p. 121), has rarely served as an independent variable in the relevant research. This capacity has cognitive, affective, and physiological components. From the cognitive aspect, the better the mental image control, the less rigid the cognitive style, i.e., the greater the ability to form less stereotypic images (Gordon, 1949), think (Shaw and DeMers, 1986) and perceive (Khatena, 1975) creatively, and produce original verbal images (Khatena, 1976). A rigid style may also be reflected in personality traits and psychopathology, such as neuroticism (Stricklin and Penk, 1980) and anxiety (Euse and Haney, 1975). Laor et al. (1992) found that when adults with missile attack–induced PTSD were subjected to auditory stimulation by trauma-related scripts, the poorer their image control capacity, the greater their cardiovascular reactivity.

Thus, a damaged image control capacity in the mother could compromise her buffering capacity and thereby weaken the risk modification function of the protective matrix for the traumatized child. And the younger the child, the more dependent he or she is on this maternal ability to negotiate stressful stimuli. This is in line with our findings that the PTSD symptoms of the 3-year-olds correlated significantly with the mothers' general symptoms at 6 and 30 months and with their intrusive and avoidant symptoms at 30 months, while those of the 4-year-olds correlated only with the mothers' general and intrusive symptoms at 30 months, and of the 5-year-olds, not at all.

On the basis of studies of abused children showing that massive trauma can flood and thereby damage cognitive functions (Einbender and Friedrich, 1989; Trickett et al., 1994), we might have expected similar developmental trends in the children's adaptive behavior. However, only in the undisplaced group were significant correlations found between the children's adaptive behavior and the mothers' symptoms. It may be that a moderate level of stress, such as that experienced by the displaced group, is needed to signal discomfort and set off the more active processes of distancing and separating from the suffering of one's caretaker and oneself. Psychic defense mechanisms of isolation or repression, for example, may be operative. It seems that when more rigid defenses intervene, brittle posttraumatic symptoms ensue, whereas more flexible controls will lead to a healthier, more creative resolution (Kinzie et al., 1989; Saylor et al., 1992; Terr, 1983).

Our 30-month findings of a stronger link between children's psychopathology and maternal symptoms in the 3- and 4-year-olds compared with the 5-year-olds mirror our findings at 6 months (Laor et al., 1996). They are also consistent with the growing body of literature on the development of imagery-based self-control in children. This capacity depends on the ability to regulate verbal behavior (Shapiro, 1979) and inner speech (Meichenbaum, 1975), use mental images and harness them in the service of reflectivity (Messer, 1976), and control impulses (Meichenbaum and Goodman, 1971). Memory strategies (Kreutzer et al., 1975), delay of gratification (Mischel, 1981), and fantasy play (Saltz et al., 1977) are also necessary skills. But children younger than 5 years of age do not have access to all these symbolic regulatory functions (Berkowitz, 1982).

Finally, it should be noted that only 7.8% of our children had sufficient symptoms to warrant a PTSD diagnosis. This rate is similar to that found after a school bus disaster (Milgram et al., 1988), higher than that reported after a nuclear power plant accident (Handford et al., 1986), and very significantly lower than rates reported after the earthquake in Armenia

(Pynoos et al., 1993) or the civil war in Lebanon (Macksoud and Aber, 1996). These differences could be explained by the fact that the population we studied was exposed to an event that may have caused major family disruption, but no one suffered physical harm or witnessed mutilation or death, and there was no separation of family members, lack of adequate housing, loss of employment or community services, or shortages of food and fuel.

Clinical Implications

PTSD, like any other psychopathology, is multidimensionally determined and needs to be diagnosed as such for therapeutic and prognostic purposes. Children and families at risk may be more clearly identified by evaluation of the parent–child dyad, the individual symptoms, and the intrafamilial interactive style. Hence, our findings may also help clinicians formulate triage principles for massive trauma. Furthermore, this study supports the concept that rapid social reconstitution is critical to preventing maladaptive functioning and long-term extensive psychopathology in disaster victims. Finally, our study may give rise to new modes of therapeutic interventions, combining interpersonal, dynamic, and cognitive approaches to suspected dysregulation of the image system in PTSD patients.

A word concerning the limitations of our research: Although we learned about the function of the child's protective matrix in adaptation to traumatic stress, our perspective could be enriched and possibly improved by data about other informants (fathers, siblings, teachers). Furthermore, the development of specific standardized measures to assess posttraumatic symptomatology in very young children may allow for their direct assessment earlier and for comparisons between their functioning at different time points.

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