The Effects of a Natural Disaster on Child Behavior: Evidence for Posttraumatic Stress

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The Effects of a Natural Disaster on Child Behavior: Evidence for Posttraumatic Stress

ABSTRACT

Objectives. A prospective study of children examined both before and after a flood disaster in Bangladesh is used to test the hypothesis that stressful events play a causal role in the development of behavioral disorders in children.

Methods. Six months before the disaster, structured measures of selected behavioral problems were made during an epidemiological study of disability among 2- to 9-year-old children. Five months after the disaster, a representative sample of 162 surviving children was reevaluated.

Results. Between the pre- and postflood assessments, the prevalence of aggressive behavior increased from zero to nearly 10%, and 45 of the 134 children who had bladder control before the flood (34%) developed enuresis.

Conclusions. These results help define what may be considered symptoms of posttraumatic distress in childhood; they also contribute to mounting evidence of the need to develop and evaluate interventions aimed at ameliorating the behavioral and psychological consequences of children's exposure to extreme and traumatic situations. (*Am J Public Health.* 1993;83:1549–1553)

Maureen S. Durkin, PhD, DrPH, Naila Khan, MD, PhD, Leslie L. Davidson, MD, MSc, Sultana S. Zaman, PhD, and Zena A. Stein, MA, MB, BCh

Introduction

Stressful life events have long been suspected of causing behavioral and emotional disorders in children,[1,2] but their true causal role is difficult to distinguish in a controlled manner from effects.[3] Clearly defined events such as disasters can be distinguished from effects of a child's behavior because they occur independently of the behavior and because their timing in relation to the behavior is unambiguous. Unfortunately, methodological weaknesses[4] and the inconsistency between studies render the literature on children who have survived disasters,[5–14] wars,[1,15–18] and other acute events[19–21] inconclusive with regard to emotional and behavioral effects. Some studies report excess levels of anxiety, depression, and/or behavioral problems including aggression, enuresis, and eating and sleeping disorders,[1,5–7,9–11,15,18,19] while others report no apparent adverse effects on behavior or on psychological well-being.[8,12,14,16,17]

The present study used the strongest feasible design, a natural experiment, to investigate this issue. Natural experiments are prospective studies in which investigators can systematically observe the outcome of interest in a population both before and after a well-demarcated exposure or event.[22] Only two previously published studies of children exposed to severe events were able to use such a design; in one, 85 Israeli children (aged 10 to 11 years) were studied before and during war[18]; in the other, 64 American children (aged 4 years) were studied before and after a storm disaster.[7] In both studies, the prevalence of psychological distress symptoms increased significantly after the exposure compared with baseline. At the same time, neither study found evidence of a linear or dose-response relationship between the severity of the event for individual children and the probability of those children exhibiting symptoms.

The present study observed a larger number of children (162) and a wider age range (2 to 9 years) than the two previous prospective studies. In September 1988, 6 months after our international team completed a population-based study of child health and disability in Bangladesh, a flood disaster occurred. It was the most severe ever recorded in this densely populated country. More than three quarters of the land was submerged, much of it for 20 days or more. Throughout the country, millions of people were left homeless and more than 2000 died as an immediate consequence.[23] Five months after the flood (in February and March 1989), a representative sample of children evaluated during the initial survey was selected for reevaluation. We hypothesized that, despite maturation of the cohort, the prevalence of aggression, extreme shyness, and enuresis would be significantly higher after the flood than before.

Maureen S. Durkin, Leslie L. Davidson, and Zena A. Stein are with the G. H. Sergievsky Center, Columbia University, New York, NY. Dr Durkin and Dr Stein are also with the New York State Psychiatric Institute in New York, and Dr Davidson is also with Columbia University's Department of Pediatrics. Naila Khan is with the Dhaka Shishu Children's Hospital in Dhaka, Bangladesh, and Sultana S. Zaman is with the Department of Psychology at the University of Dhaka.

Requests for reprints should be sent to Maureen Durkin, PhD, DrPH, Sergievsky Center, Faculty of Medicine, Columbia University, 630 W 168 St, New York, NY 10032.

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Editor's Note. See related editorial by Richman (p 1522) in this issue.

TABLE 1—Baseline Characteristics of Those Children Selected for Follow-Up and of Those Children Followed

	Children Selected for Follow-Up, % (n = 204)	Children Followed, % (n = 162)
Sex		
Boys	51.5	52.5
Girls	48.5	47.5
Age, y		
2	9.3	6.8
3	7.8	8.6
4	7.8	13.6
5	7.8	8.0
6	9.3	9.3
7	22.6	21.0
8	19.1	14.8
9	16.2	17.9
Disability status		
Not disabled	68.6	69.8
Disabled[a]	31.4	30.2
Cognitive disability	12.6	11.7
Motor disability	3.9	4.9
Hearing disability	11.9	13.0
Vision disability	2.9	3.1
Seizure disability	2.5	1.9

[a]Thirteen children selected for follow-up and seven children followed had multiple disabilities.

Methods

Study Sample

In March 1988, we completed a population-based study of neurodevelopmental disabilities in 2667 2- to 9-year-old children representative of Dhamrai, a rural, agricultural community north of Dhaka, Bangladesh. Households generally included nuclear and extended families; homes were built of reed and mud with earth flooring and one or two rooms. Half of the fathers and a quarter of the mothers had attended any level of primary school. All children who tested positive for disability on the Ten Questions screening instrument and a 10% random sample of those who tested negative were referred for standard clinical evaluations by a pediatrician and a psychologist, and a structured interview was conducted with a parent or guardian.[24–29] In all, 434 children were referred for evaluations and 64 were judged to have disabilities.

After the September 1988 flood, some of the children who were initially evaluated were selected for reevaluation, including all 64 with disabilities and a random sample (140) of the remainder (no more than one child per household). Of those, 2 children, 1 of whom had a disability, had died from diarrheal disease after the flood; moreover, 14 children with disabilities and 26 other children could not be traced (see Table 1). Thus, in February 1989, 162 children (49 disabled and 113 not disabled) were reevaluated.

Testing Instruments

During the postflood evaluation, the pediatricians asked the identical two questions about aggression and shyness that were asked before the flood (Appendix). However, the psychologists asked the question on sphincter control in different but comparable ways on the two occasions (Appendix).

The postflood psychological assessment added a child behavior screening scale administered to parents: the Richman Child Behavior Checklist[30] for children aged 3 to 6 years at follow-up and the Rutter Child Behavior Questionnaire[31] for those aged 7 to 10 years at follow-up. These brief and simple instruments are reliable and valid indicators of psychopathology and are widely used in culturally diverse populations.[30–32] In addition, the Self-Reporting Questionnaire[33] (a measure of psychological distress) was asked of the mother.

Each of these three scales was translated into Bangla, backtranslated, and revised appropriately. Internal consistency reliability coefficients (lower-bound estimates of reliability[34]) were good to excellent: 0.78 for the Richman checklist, 0.67 for the Rutter questionnaire, and 0.60 for the Self Reporting Questionnaire. Finally, a structured questionnaire measured the flood experiences of the community.

Statistical Analyses

The McNemar test[35,36] was used to test differences in the prevalence of problems before and after the disaster. T tests[37] were used to assess the differences in mean scores of postdisaster behavior scales between children reported to be aggressive after the flood and other children. Logistic regression[38] analyses were used to test for the effects of age, gender, disability, and severity of the disaster experiences on the dichotomous behavior outcomes (e.g., postdisaster onset of enuresis and aggressive behavior). Chi-square tests[36] were used to assess the significance of associations between the occurrence of two behavioral problems (aggression and enuresis). Lastly, the Taylor series method was used to calculate confidence intervals for the ratios of post- to preflood prevalence of incontinence.[39]

Results

The postflood survey documented major effects of the flood on the 162 households. Less than 10% had any warning of the flood. In more than a third, water rose to a level higher than an adult's waist, and more than half remained flooded after 10 days. Thirty-eight percent were badly damaged or destroyed. In half of the families, at least one member became seriously ill; in 7% a household member died, and in 4% the child was separated from the parents for more than a day.

Behavior

Before the flood, no child was reported to be very aggressive, and only one was reported to be extremely shy and withdrawn (Table 2). Twenty-seven (16.8%) had problems with sphincter control (bowel and/or bladder). After the flood, 16 children were newly reported to be very aggressive ($P < .0001$), shyness persisted in one affected child, and lack of sphincter control had increased from 16.8% to 40.4% ($P < .0001$). The increases in aggression and incontinence occurred among both children with and without disabilities and regardless of gender. (Although 11.8% of boys developed aggressive behavior compared with 7.8% of girls, this gender difference is not statistically significant in a logistic regression analysis.) Aggressive behavior increased at nearly every age. (Numbers are small, and specific age differences are not significant.)

Mean scores on the Richman checklist and the Rutter questionnaire (overall and on the conduct disorder subscale but not on the neurotic subscale) were significantly higher for children reported to be aggressive than for other children. The mean scores on the measure of psychological distress (the Self Reporting Questionnaire) were not significantly higher for mothers of children reported to be very aggressive than for mothers of other children.

For incontinence, the prevalence more than doubled (prevalence ratio 2.41, Table 2.) The increases were somewhat greater for children without disabilities than for those with disabilities, and for boys than for girls, but these increases are not statistically significant ($P = .57$ and $P = .50$, respectively, on logistic regression analysis). With no aggressive behavior observed at the preflood assessment, prevalence ratios for aggression could not be calculated.

The single question about sphincter control asked before the flood did not allow bladder control to be distinguished from bowel control. The postflood questions did

allow this distinction. The increased prevalence of incontinence after the flood was owing entirely to new cases of enuresis. Among 134 children continent before the flood, none developed encopresis while 45 developed enuresis. All enuresis was nocturnal in children aged 3 to 6 years. (At 7 to 10 years, night and day wetting could not be distinguished.)

Incontinence

Before the flood, age-specific prevalence rates were as expected, with very high rates for 2- to 4-year-old children and much diminished prevalence thereafter (Figure 1). After the flood, the pattern differs from that expected. In children aged 2 and 3 years before the flood, prevalence declined less than expected, with maturation over a period of 11 months. In those aged 4 to 9 years, prevalence increased substantially.

Among younger children (3 to 8 years at follow-up), the risk of developing enuresis was high and relatively uniform (37% to 45%). At the oldest ages (9 to 10 years at follow-up), the risk was significantly lower (χ^2 vs all younger children = 6.47; P = .011) but still substantial (21%).

Twenty of 28 children wetting or soiling before the flood were still doing so after (with postflood data missing for 1 child). Another 45 previously continent children had "onset enuresis" at the second assessment, at a mean age of 6.3 years vs 2.9 years for those not yet toilet trained.

Aggression and Enuresis

We compared postflood development of aggression in three mutually exclusive groups with respect to continence: (1) those continent at both assessments (pre- and postflood), (2) those incontinent at the preflood evaluation; and (3) those continent before the flood and enuretic postflood (Table 3). Children incontinent before the flood had twice the prevalence of postflood aggressive behavior as other children (χ^2 = 2.20; P = .333, not significant).

Household experiences varied in terms of depth of water, degree of damage, illness, and loss. On logistic regression analyses, however, we found no relation between the severity of the flood experiences in individual children and the development of behavioral problems.

Discussion

In accordance with our prior hypothesis and with previous studies, the prevalence of both aggressive behavior and enuresis in children rose sharply after exposure to major environmental stress. The observed increase in enuresis is particularly striking when one considers that the cohort had matured nearly 1 year between the first and second assessments.

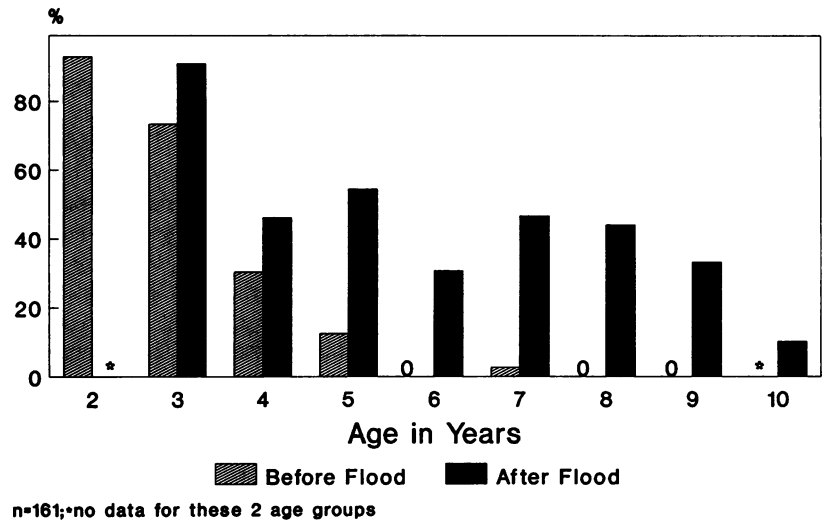
Onset enuresis has long been considered a marker for anxiety, but experimental findings are rare. Control of the bladder during sleep is a subtle balancing act that requires either the child to wake to the stimulus of the full bladder (and get out of bed to void) or the sphincter to stay shut while the bladder is signaled to expand. For the sleeping child to lose a previously acquired skill, one need not invoke factors such as bladder size, depth of sleep, or cognition. Regression of bladder control such as that observed after the flood may imply autonomic system incoordination occurring at an age when the system is susceptible to being thrown off balance by an upsetting experience. As the child matures, the system stabilizes and regression is less likely. In Bangladesh, it appears that both regression and primary delay in sphincter control may have taken place. Previous studies have tended to associate regression rather than delay with emotional disturbance.[40-43]

Both increased aggression and onset enuresis were reported in Freud and Burl-

TABLE 2—Frequency of Selected Behavioral Problems Recorded during the Clinical Assessment before and after the Flood

	Before		After			Prevalence Ratio (95% Confidence Interval)[b]
	No.	%	No.	%	P[a]	
Very aggressive toward others						
All children (n = 162)	0		16	9.9	<.0001	
Nondisabled children (n = 113)	0		10	8.8	.0020	
Disabled children (n = 49)	0		6	12.2	.0313	
Boys (n = 85)	0		10	11.8	.0020	
Girls (n = 77)	0		6	7.8	.0313	
Extremely shy/withdrawn						
All children (n = 162)	1	0.6	1	0.6	1.0000	1.00
Lack of sphincter control[c]						
All children (n = 161)[d]	27	16.8	65	40.4	<.0001	2.41 (1.63, 3.56)
Nondisabled children (n = 112)	18	16.1	48	42.9	<.0001	2.67 (1.21, 3.19)
Disabled children (n = 49)	9	18.4	17	34.7	.0768	1.89 (0.93, 3.82)
Boys (n = 85)	10	11.8	35	41.2	<.0001	3.50 (1.85, 6.61)
Girls (n = 76)	17	22.4	30	39.5	.0106	1.76 (1.07, 2.92)

[a]McNemar test of the significance of the difference between the proportions affected before and after the flood.
[b]Prevalence ratio for aggression cannot be calculated because of zero prevalence in the denominator (i.e., before the flood).
[c]The question asked before the flood referred to enuresis and/or encopresis. After the flood, separate questions were asked about enuresis and encopresis. The increased prevalence after the flood is owing solely to new cases of enuresis.
[d]Excluded is one child who was not fully toilet trained at baseline (a nondisabled girl, age 3) and who had missing information about enuresis and encopresis after the flood.



n=161; *no data for these 2 age groups

FIGURE 1—Prevalence of incontinence by age, before and after the flood.

TABLE 3—Cross-Tabulation of Enuresis Status by Postflood Development of Aggressive Behavior

Behavior, %	Total	Prevalence of Postflood Aggressive Behavior, %
Continent at pre- and postflood evaluation	89	6.7[a]
Incontinent at preflood evaluation	28	14.3
Continent at preflood evaluation, enuretic at postflood evaluation	45	13.3
Total	162	9.9

[a]The lower prevalence of aggressive behavior in this group is not statistically different from that of the other two groups combined ($\chi^2 = 2.20$; $P = .333$).

ingham's[1] detailed observations of children in shelters (war nurseries) during the World War II bombings of London, and were interpreted as regressive behaviors provoked by children's separation from their parents and the overwhelming stresses of wartime. Similar observations of increases in both aggressive behavior and enuresis were made among 198 children discharged from a hospital burn unit compared with a comparison group of uninjured siblings.[44] Aggressive behavior and/or enuresis have also been reported in studies of children during the aftermath of a wide variety of disasters including an earthquake,[8] Australian bushfires,[9] a school disaster,[11] a flood disaster,[10] a lightning-strike disaster,[6] a tornado,[5] and a cyclone.[15] In addition to aggressive behavior and onset enuresis, many of these studies also reported increased anxiety, specific fears, and eating and sleep disorders.

One third of the sample of children selected for study in Bangladesh had disabilities at baseline; the remainder was a representative sample of the rural population under study. The increase in both aggression and enuresis observed after the flood was similar in the disabled and nondisabled samples. While the possibility remains that the flood could have affected children with specific types of disabilities differentially, the numbers with any one type of disability do not permit further evaluation.

The increases in aggression and enuresis occurred in both boys and girls. However, consistent with other descriptive epidemiological studies,[30,31,45,46] rates tended to be higher in boys.

The preflood rates in 7- to 9-year-old children both of aggressive behavior (none reported) and of enuresis (less than 2%) are lower in this population in Bangladesh than in European populations,[31,47–51] where prevalence rates for this age group range from 5% to 15% for aggressive behavior and from 6% to 10% for enuresis. In at least one study other than this one,[52] Asian children showed fewer behavioral problems than their European or American counterparts.

Consistent with the findings of the two previous prospective studies,[7,18] no dose response for individual children was observed between the severity of disaster experiences and behavior. One possible explanation for this is that an association was present but was confounded by unmeasured differences between households in resources that ameliorated the effects of the disaster. Another is that the disruption resulting from disasters and war is pervasive and communitywide. Thus, the relevant exposure is not the degree of household destruction and danger, but the overall disruption and terror experienced by the population as a whole.

One limitation of this study is that the follow-up was restricted to 5 months after the disaster, leaving uncertain the duration of aggressive behavior and enuresis. Another limitation is the absence of diagnostic evaluations before and after the flood that would have allowed us to determine whether exposure to the disaster resulted in an increased prevalence of actual psychopathology and/or of symptoms other than aggression and enuresis. From the significant associations between the single question on aggressive behavior and the Richman and Rutter behavior scales, we infer that this question, asked both before and after the disaster, appears to have validity. We may also infer that the aggression rating was not connected to stress in the mother since maternal psychological distress was not significantly higher for mothers of children reported to be very aggressive than for mothers of other children.

The results from this study are compatible with the hypothesis that children's exposure to stressful events may play a causal role in the development of psychiatric disorders. They point to the need for further research, particularly in populations at high risk for stressful events such as disasters, which cannot be confused with events precipitated by a child's own behavior. In addition, the mounting evidence to which this study contributes highlights the need to develop and evaluate interventions aimed at ameliorating the behavioral and psychological consequences of disasters and other extreme situations. □

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APPENDIX—Behavior Questions Asked during the Medical Assessment before and after the Flood:

Does he/she act very aggressively toward other people?
1. No 2. Yes

Does he/she act extremely withdrawn and shy?
1. No 2. Yes

Questions about sphincter control asked during the psychological assessment

A. Before the flood:
Does he/she have bowel and bladder control; is he/she toilet trained?
1. Yes, like others his/her age
2. Not consistent
3. No

B. After the flood:
In each set below, specify which applies to your child. For 3- to 6-year-olds (from the Richman Child Behavior Checklist)[30]:
1. Never wets at night
   Wets the bed up to once or twice a week
   Wets the bed three or more times a week
2. Never wets during the day
   Wets during the day once or twice a week
   Wets during the day three or more times a week
3. Completely bowel trained. Never dirties pants.
   Occasionally soils, up to once or twice a week.
   Soils pants 3 or more times a week.

For 7- to 10-year-olds (from the Rutter Child Behavior Questionnaire)[31]:
1. Wets his or her pants:
   Never in the last year
   Less often than once per month
   At least once per month
   At least once per week
2. Soils him/herself or loses control of bowels:
   Never in the last year
   Less often than once per month
   At least once per month
   At least once per week