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QUICK RESPONSE RESEARCH REPORT #63

1993

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A STUDY OF THE PSYCHOLOGICAL EFFECTS OF HURRICANE ANDREW ON AN ELEMENTARY SCHOOL POPULATION

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INTRODUCTION

On 24 August 1992, Hurricane Andrew devastated South Miami with winds of 164 MPH damaging approximately 100,000 homes, apartments and trailers, leaving 85,000 unemployed with 35 hurricane reported deaths. By October 1992 over 10,000 children, 25% of the school population in the pathway of the hurricane had taken flight from south Dade County.

The psychological effects of disastrous events on children has become an emerging focus of study in recent years(Bloch et. al, 1956; Newman, 1976; Terr, 1981, 1983; Burke et. al., 1986; Pynoos et. al, 1987; Green et. al., 1991; Kiser et. al.,1993). Terr (1991) has noted the important role of psychic trauma as a crucial etiological factor in the development of a number of serious psychiatric disorders of childhood and adulthood. Studies of children after natural disaster have consistently demonstrated a spectrum of post-traumatic symptoms to include trauma specific fears, fears of recurrence, anxiety, intrusive recollection of the images and percepts of the traumatic event, post-traumatic play, behavioral reenactments, regressive behavior, somatic ills, avoidance of traumatic reminders, behavioral and school problems and changed attitudes about the self, world and the future. A number of risk factors have been associated with vulnerability to post traumatic symptomatology i.e. proximity to the zone of impact, personal injury, a family member being injured or killed, parental response and psychopathology, degree of life threat, family ambience, gender, preexisting anxiety and depression and early separations (Bloch et. al., 1956; Milgram and Milgram, 1976; Pynoos et. al.,1987; Terr, 1983, 1991; Green et. al., 1991; Breslau et. al., 1991)

In an effort to study further the evolution of the psychological effects of disaster we have undertaken a study of elementary school age children who were directly in the pathway of hurricane Andrew (HI-IMPACT SCH) and a comparable elementary school population north of Miami(LO-IMPACT SCH).

METHODS

One hundred forty four school age (71 boys, 73 girls) children 6-11 years (mean age 8.2, S.D. 1.55) were evaluated. At the time of the interview 82 (57%) of the children were enrolled at HI-IMPACT SCH and 62 (43%) were located at LO-IMPACT SCH. At the time of the hurricane 62 (43%) were enrolled at HI-IMPACT SCH, 44 (31%) at LO-IMPACT SCH and residing in their home with 38 (26%) enrolled in another school or not residing in their home at the time of the hurricane. For the purpose of this study the "other" group was excluded leaving 106 children for our analysis.

Table 1 presents various demographic variables for each school. As can be seen from this table, the two schools were quite similar. One notable exception is grade placement, where a significant chi-square was obtained indicating that there is an unequal grade distribution between the two schools.

TABLE 1

PROCEDURE

At eight weeks post hurricane the children were administered an instrument measuring the degree of severity of exposure to the hurricane and Pynoos's Post-traumatic Stress Disorder Reaction Inventory (PTSDRI). In addition, the student's primary classroom teacher completed Achenbach's Teacher's Report Form (TRF) on each child. The PTSDRI and the TRF were repeated at 32 weeks post-hurricane for HI-IMPACT SCH.

Pre-hurricane school year (1991-1992) and post-hurricane school year (1992-1993) data on the frequency of 40 measures of overt and covert disruptive behaviors were obtained from the Dade County Public Schools. However only 21 measures of covert and overt disruptive behavior were utilized in the present study because of the low prevalence of elementary school children engaging in such behaviors as gambling, concealing a weapon, extortion, selling, using or distributing mood modifying drugs etc. Data obtained were broken down by grading period for the pre-hurricane school year (1991-1992) and the post-hurricane school year (92/93) for HI-IMPACT SCH and LO-IMPACT SCH, as well as for the broader school regions i.e. Region VI (HI-IMPACT SCH) and Region II (LO-IMPACT SCH). Measures of Overt disruptive behavior included: General disruptive behavior, defiance of school authority, disruption on the school bus, assault, theft, vandalism, battery on a student or staff member, fighting, robbery, continuous disruptive behavior, damaging school property, and aggravated assault. Measures of Covert disruptive behavior included: Use of provocative language, cutting class, dress code violation, excess unsatisfactory absences, in an unauthorized location, leaving class without permission, rude and discourteous, excessiveness tardiness, and trespassing. The proportion of students per student body reported to the school district for the composite overt and covert disruptive behaviors were compared for the year before and after the hurricane within grading period.

RESULTS

The hurricane exposure instrument provided an easy straight forward method of determining the severity of exposure to the hurricane (Appendix A). As expected students in HI-IMPACT SCH had a significantly higher mean score (number of positive endorsements) ($M = 6.0$, $SD = 2.1$) than students in LO-IMPACT SCH ($M = 2.2$, $SD = 1.9$), $t(115) = 10.51$, $p < .0001$., although this trend was not universal. Table 2 presents the individual item endorsements for HI-IMPACT SCH and LO-IMPACT SCH along with supporting chi-square

tests. The severity of exposure for students in HI-IMPACT SCH is quite obvious, for example, 82% of the students had a window broken or door blown open; 56.5% had part of the roof blown away or caved in; 87% reported being scared that a loved one would be hurt or killed, 24% reported a pet hurt or killed and 39% reported staying out of their home after the hurricane was over.

Table 2

Pynoos (1992) categorizes severity on the PTSDRI with the following criteria: Doubtful (score less than 12), mild (score range 12 to 24), moderate (score range from 25 to 39), severe (score range from 40 to 59), and very severe (a score greater than 60) with the maximum score of 80. Due to sparse data in the contingency tables the PTSDRI were collapsed by combining Doubtful-Mild and Severe-Very Severe. Table 3 presents the PTSDRI endorsement frequencies for HI-IMPACT SCH and LO-IMPACT SCH. As can be seen from this table the great majority of students endorsed post-traumatic symptoms with 87% of the children at HI-IMPACT SCH and 80% of the children at LO-IMPACT SCH endorsing at least moderate levels of post-traumatic symptomatology as measured by this instrument. There was no statistically significant difference in PTSDRI symptomatology between the two schools. While a comparable percentage of students at both schools endorse MILD and MODERATE symptoms, HI-IMPACT SCH had twice as many students in the SEVERE category. When the two schools were compared for age, ethnic and gender effects there were no difference in post-traumatic symptomatology.

Table 3

On Achenbach's Teacher Report Form, T-tests indicated that the boys at HI-Impact SCH-A had significantly lower scores on the Unpopular scale, ($p = .05$). However, T-tests identified several significant differences on the TRF scales were observed for females. Females in HI-IMPACT SCH showed significantly lower mean scores on Internalizing ($p < .01$), Externalizing ($p < .05$), Anxious ($p < .01$), Unpopular ($p < .01$), Self-Destructive ($p < .05$), and Aggressive ($p < .05$) than children in HI-IMPACT SCH (Table 4). There was an evident trend with LO-IMPACT SCH demonstrating more psychopathology as measured by the TRF with HI-IMPACT SCH exhibiting less indices of psychopathology.

Table 4

Finally, at 32 weeks post hurricane, we were able to repeat the PTSDRI measures on 64/65 children previously tested in HI-IMPACT SCH. There was a statistically significant change in PTSDRI symptomatology, $X(4, N = 64) = 17.3$, $p < .005$ indicating a reduction in post-traumatic symptomatology suggesting gradual recovery (Table 5). Nevertheless, 80% of the students were still rated in the MODERATE and SEVERE to VERY SEVERE categories indicated continuing psychological distress.

Table 5

At the 32 week re-evaluation only 28 TRFs were returned back from the school. There were no statistically significant findings on the TRF scales for males and only one for females

although the trend in means always evidenced a higher value at week thirty-two for both genders. At 32 weeks post hurricane, females at HI-IMPACT SCH showed a significantly greater mean score on the Unpopular scale ($p < .05$). The lack of statistical significance on the TRF is likely due to low power.

Next we examined the relative risk of observing covert and overt disruptive behaviors reported to DCPS for both the educational regions where HI-IMPACT SCH (Region VI) and LO-IMPACT SCH (Region II) are located and for each school, for each grading period for the school year after the hurricane. School-based disruptive behavior showed a marked decrease ($p < .0001$) in prevalence for both overt and covert behavior for the grading period immediately following the hurricane in Region VI (Figure 1) but a marked increase ($p < .0001$) in Region II relative to the school year preceding the hurricane (Figure 2). The decrease in Region VI's overt behavior fell back to the previous year's level by the second grading period while covert behavior significantly rose ($p < .0001$) above the previous year's levels for covert behaviors.

Figures 1 & 2

Examining the same data at the school level reveals a simpler but similar trend. For the first and second grading periods at HI-IMPACT SCH there was a significant decrease in both overt and covert disruptive behaviors (p 's $< .05$) after which a significant increase in overt behavior ($p < .01$) was observed while covert behavior returned to the preceding year's level. The fourth grading period showed the levels of overt behavior returning to the preceding year's levels but a significant decrease in covert behavior ($p < .05$)(Figure 3). The trends in LO-IMPACT SCH, however, look very different. In LO-IMPACT SCH there was a significant increase in the likelihood of both overt and covert disruptive behaviors for the first three

grading periods (p 's $< .05$) with levels only returning to previous year's levels in the fourth grading period (Figures 4)

Figures 3 & 4

DISCUSSION

Our findings are in agreement with a number of studies of the effects of disaster on children which have demonstrated that psychological distress is correlated with proximity to the zone of impact (Bloch *et. al.*, 1956, Pynoos *et. al.*, 1987) What is of interest is that children in LO-IMPACT SCH had the same prevalence of mild and moderate categories of post-traumatic symptomatology as did children in the immediate pathway of the storm. This finding suggests the effects of media exposure, the press of evacuation, emotional contagion, the peripheral impact of the storm and the initial uncertainty as to where the storm would strike precipitated considerable emotional responsivity in the control group. It is also possible that since our measures were eight weeks post-hurricane these children were reacting to the considerable disruption in all of Dade County and the influx of additional students to the "northern schools" due to the flight of families out of south Dade County. There is increasing awareness of the impact of anticipatory anxiety associated with an impending disaster on post-traumatic symptomatology. Kiser *et. al.* (1993) have described the effects of anticipatory anxiety in initiating mild and moderate post-traumatic symptomatology in a group of school children who were told that an earthquake would occur which in fact never happened. HI-IMPACT SCH was twice as likely to have children who were rated "severe to very severe" in their endorsement of post-traumatic symptomatology. This finding is congruent with the severity of exposure and the proximity to the eye of the storm.

While post-traumatic symptoms at 32 weeks were significantly reduced compared to

the period immediately following the hurricane, the level of symptomatology remained high. The high prevalence of PTS at 32 weeks post-hurricane, we believe is due to the secondary effects of the devastation wrought by Hurricane Andrew.

The failure to note a gender, grade and ethnic effect on the PTSDRI is congruent with Pynoo's study of a school population following a sniper incident (1987). The failure to delineate a gender effect along the lines suggested by Green et al, (1991) and Breslau et. al. (1991) may reflect a relative insensitivity of the instrument to gender differences.

The most interesting finding is the documented reduction in the manifestations of non PTSDRI emotional and behavioral problems in the immediate aftermath of the hurricane in the schools located in the zone of impact. The finding that HI-IMPACT SCH in the pathway of Hurricane Andrew manifested reduced indices of psychopathology on Achenbach's Teacher Rater Form compared to LO-Impact SCH-B, more significantly for females; and concomitantly manifested significantly reduced reported overt and covert disruptive behavior compared to LO-IMPACT SCH and the previous year's level of disruptive behavior is we believe due to a generic shock-like, numbing effect in the immediate aftermath of the hurricane which dampened the behavioral responses to the disaster. Results from an analysis of all 39 schools in Region VI confirmed this finding that following the storm there was an initial and significant reduction in overt and covert disruptive behaviors compared to Region II (37 schools), north of Miami and compared to the previous year's level of disruptive behavior for all the schools.

There is evidence that the initial decline in non-PTSDRI emotional and disruptive behaviors in HI-IMPACT SCH and its larger educational area, Region VI, is followed by a rebound effect which is followed by a relative quick return to normalcy. We believe the relative quick return to levels congruent with the previous years indices of disruptive behaviors is associated with the significant investment of mental health professionals, crisis mobile teams and the introduction of crisis intervention specialists into the schools which

commenced in November 1993.

Contrarily, there was a reported increase in overt and covert disruptive behaviors and seemingly increased levels of psychopathology as measured by the TRF at LO-IMPACT SCH and its larger school region, Region II (north of Miami) in the first grading period following the hurricane. This seems to be related to a number of factors. One of the most important is that the flight of refugees from South Dade resulted in a 6% increase in the school population in Region II and a 13% increase in the LOW-IMPACT SCH with increased demands on limited resources. Another variable was a relatively lessening of mental health resources as forces were martialled to provide assistance to the schools in Region VI and other schools (south of Miami) located in the pathway of the storm. It is apparent that overt and covert disruptive behaviors remained high in north Miami throughout most of the school year subsequent to the hurricane with only a gradual return to normalcy by the end of the school year. This finding suggests the need for mental health professionals to be responsive not only to the victims of disaster but the derivative effects on surrounding communities.

We speculate that the initial high levels of PTSDRI symptomatology resonates with the "event" trauma. The impact of a sudden, unexpectant, well circumscribed stressor like a hurricane with its bodily and life threat precipitates characteristic post-traumatic symptomatology. The initial disaster was followed by an array of "secondary stressors". The continuing high level of PTSDRI symptomatology at 32 weeks we believe is related to the emergence of a "process" trauma. (Terr, 1991). The effect of the hurricane was to destroy the infrastructure of a community with high unemployment, 100,000 dwellings rendered uninhabitable, the exodus of a large proportion of the population, the loss of electricity, telephones and logistical support systems for many months. The initial hopefulness of recovery following the input of federal resources was followed by increasing pessimism as families struggled with the inherent adversarial relationship with insurance companies,

contractors and code inspectors. The public schools in an effort to make up for lost time canceled many of the normal holidays and school days usually allocated to the schools. The teachers became the "silent victims". There were increasing indices of social, family and marital dysfunction manifested by increased divorce cases, child abuse, disruptive behaviors and absenteeism both for teachers and students. It is our hypothesis that the impact of the "event" stressor was quickly followed by the enduring impact of an array of chronic "process" stressors seemingly without end as the community began the slow process of recovery and reparation. Paralleling the chaotic disarray there was the increasing indices of social maladjustment. The increased spectrum and frequency of emotional and behavior problems in children resonated with this process.

The finding of increasing comorbid psychological and behavior problems concomitant with post-traumatic symptomatology has been suggested by other authors (Erikson, 1976; Lifton & Olson, 1976; Adams & Adams, 1984). Breslau (1991) observed that in her sample of young adults with a history of PTSD that compared to controls they were twice as likely to manifest psychiatric comorbidity. Others (Krystal, 1978,) have noted that frequency with which the initial symptoms of post-traumatic symptomatology are followed by other psychological morbidity.

The limitations of the study are the dependence on reported measures of disruptive behavior by school counselors before and after the hurricane. Paradoxically there is the advantage that they are blind to the study. There is the possibility that the teachers were more tolerant of disruptive and oppositional behavior in the immediate aftermath of the storm. This seems to be refuted by the increased reporting of oppositional and disruptive behavior in schools adjacent to the hurricane impacted area.

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Table 1

DEMOGRAPHY
HI-IMPACT SCH and LO-IMPACT SCH

	HI-IMPACT SCH	LO-IMPACT SCH
Males	37	19
Females	25	25
Racial/Ethnic		
White	25	14
Black	10	11
Hispanic	24	14
Other	3	5
Primary Language		
English	52	40
Spanish	8	3
Other	1	1
Grade*		
First	14	9
Second	20	8
Third	4	4
Fourth	16	17
Fifth	17	6
Live with Mother		
Yes	56	43
No	5	1
Live with Father		
Yes	42	29
No	19	15

* Chi-square = 11.28, $p < .05$

Table 2

Hurricane damage exposure for SCH-A and SCH-B (N = 106).

Item	HI-IMPACT SCH	LO-IMPACT SC	χ^2	p
Doors or windows break or come open?	51(82.3%)	5(9.6%)	51.91	<.0001
Roof blown away or cave in?	35(56.5%)	2(2.6%)	30.52	<.0001
Did you get hurt?	3(4.8%)	1(2.3%)	0.47	NS
Did anyone with you get hurt?	10(16.1%)	0(0.0%)	7.84	.005
Were you scared that a loved one would be hurt/killed?	54(87.1%)	29(65.9%)	6.80	.009
Did you see anyone get hurt?	7(11.3%)	2(4.6%)	1.51	NS
Was anyone with you very scared?	54(87.1%)	30(68.2%)	5.60	.018
Did you get wet from rain/seawater?	36(58.0%)	6(13.6%)	21.23	<.0001
Went outside due to damage to home?	8(12.9%)	1(2.3%)	3.74	<.053
Did a pet get hurt or die?	15(24.2%)	2(4.6%)	7.38	.007
Stay out of your home after the hurricane?	24(39.3%)	4(9.1%)	11.96	.001
Are you still out of your home?	12(19.4%)	0(0.0%)	9.60	.002
Did a grownup lose his/her job?	15(24.2%)	3(6.8%)	5.51	.019
Did you lose anything important?	25(40.3%)	11(25.0%)	2.69	NS
Did your family get separated for awhile?	5(8.1%)	1(2.3%)	1.62	NS
Do you feel safe since the hurricane? (No responses)	9(14.5%)	2(4.6%)	2.75	NS
Trouble getting food or water?	24(38.7%)	14(31.8%)	0.53	NS

Table 3

Comparison of post-traumatic symptomatology in HI-IMPACT SCH and LO-IMPACT SCH

Degree of Symptomatology	HI-IMPACT SCH	LO-IMPACT SCH
Doubtful to Mild	8(12.9%)	9(20.5%)
Moderate	19(30.7%)	18(40.9%)
Severe to Very Severe	36(56.5%)	17(38.6%)

Table 4

Means and standard deviations for the TRF by school gender

	Males		Females	
	HI-IMPACT SCH	LO-IMPACT SCH	HI-IMPACT SCH	LO-IMPACT SCH
Internalizing	1.92(2.76)	4.31(5.65)	2.92(5.20)	9.15(8.19)
Externalizing	10.27(13.65)	17.38(18.42)	6.64(8.63)	16.85(20.13)
Anxious	0.92(1.67)	2.5(3.33)	1.56(3.37)	6.20(5.52)
Social Withdrawn	1.00(1.41)	1.81(2.99)	1.36(2.53)	2.95(3.49)
Unpopular	0.70 (1.05)	1.75(1.81)	0.76(1.30)	4.30(4.74)
Self Destructive	0.41(0.86)	0.56(0.73)	0.28(0.54)	1.20(1.64)
Obsessive-Compulsive	0.77(1.06)	1.13(1.36)	0.08(0.28)	0.30(0.73)
Inattentive	4.68(5.32)	7.69(7.52)	3.96(6.23)	6.60(8.56)
Nervous -Overactive	0.81(1.17)	1.38(1.41)	1.00(1.44)	1.80(1.99)
Aggressive	4.78(8.89)	8.32(11.02)	1.68(2.30)	8.45(11.51)

Table 5

HI-IMPACT SCH A: PTSDRI Symptomatology

	8 Weeks	32 Weeks
DOUBTFUL-MILD	12	13
MODERATE	23	27
SEVERE TO VERY SEVERE	29	24

Figure 1

REGION VI ; OVERT & COVERT DISRUPTIVE BEHAVIOR
FOR THE POST HURRICANE SCHOOL YEAR BY GRADING PERIOD

Relative Risks

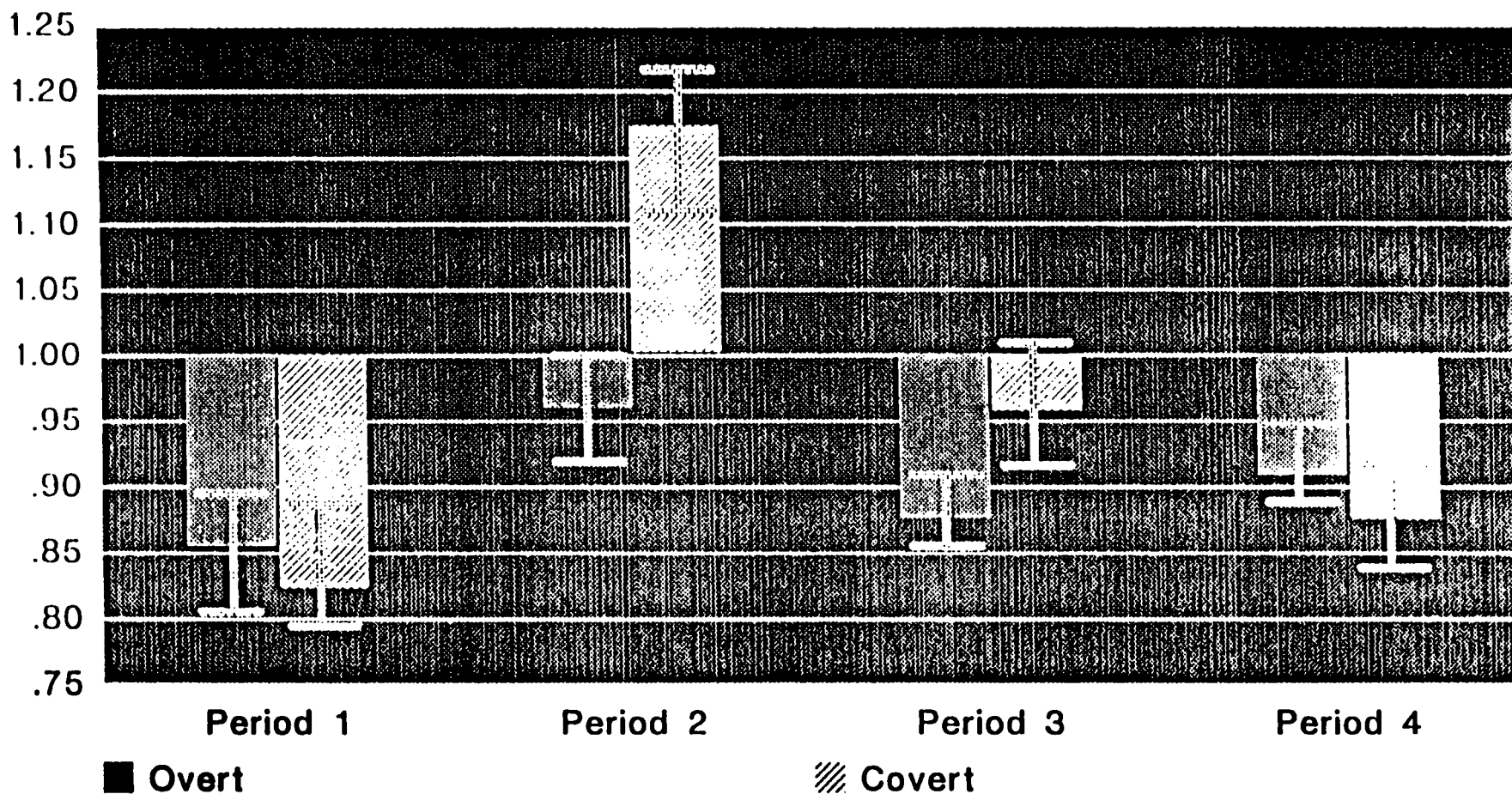


Figure 2

REGION II; OVERT & COVERT DISRUPTIVE BEHAVIOR
FOR THE POST HURRICANE SCHOOL YEAR BY GRADING PERIOD

Relative Risk

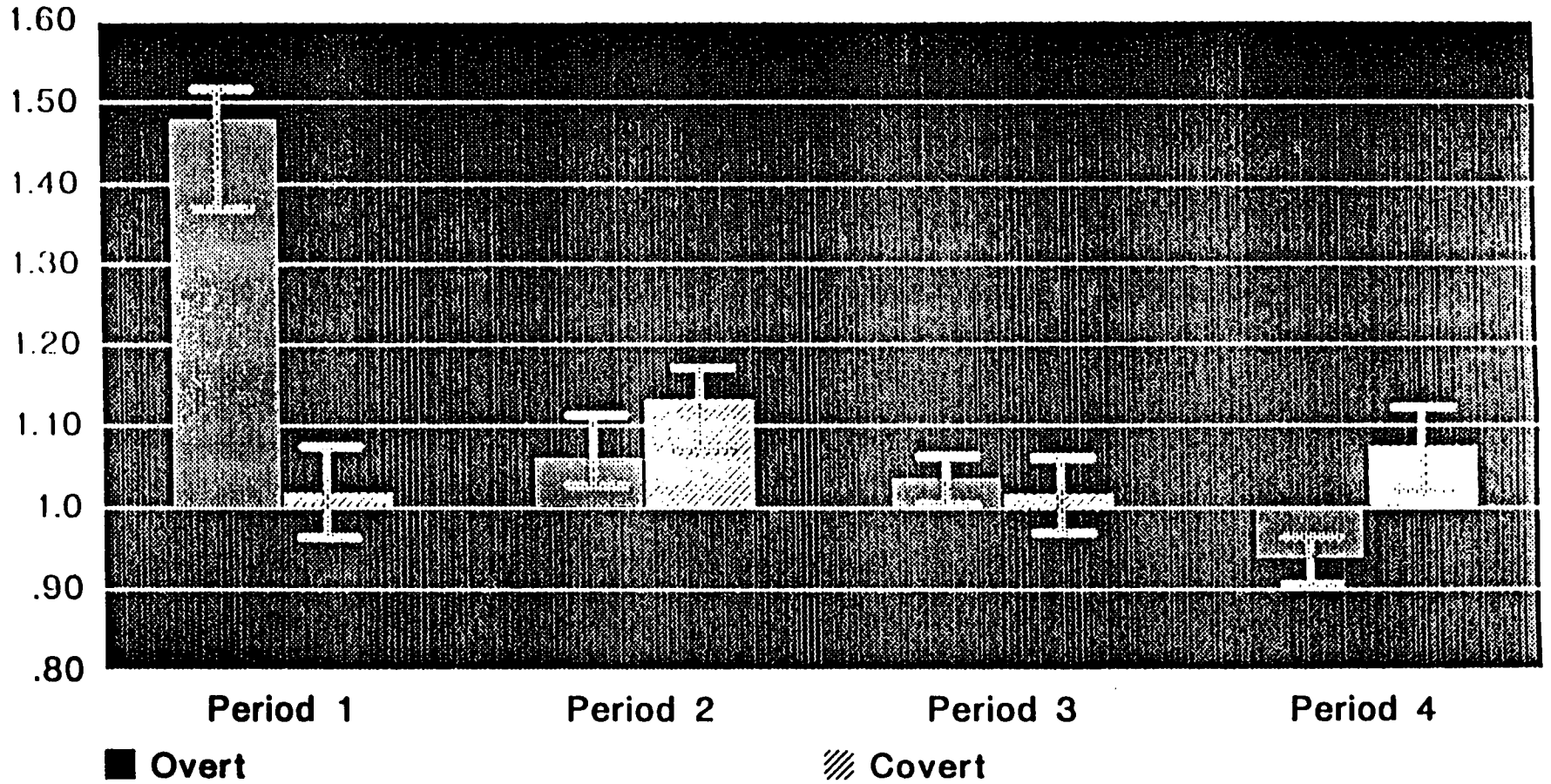


FIGURE 3
HI-IMPACT SCH- A's OVERT & COVERT DISRUPTIVE BEHAVIOR
FOR THE POST HURRICANE SCHOOL YEAR BY GRADING PERIOD

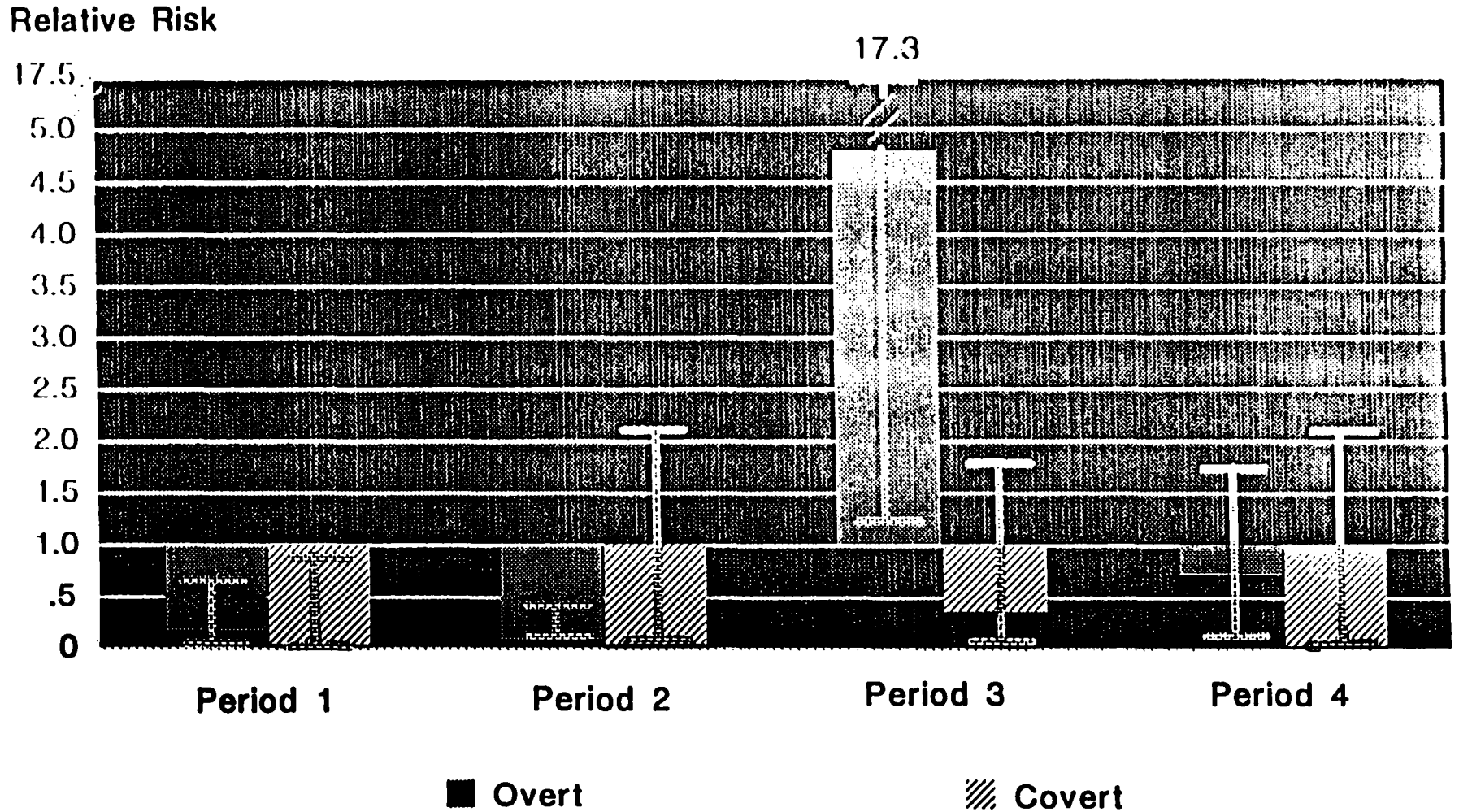
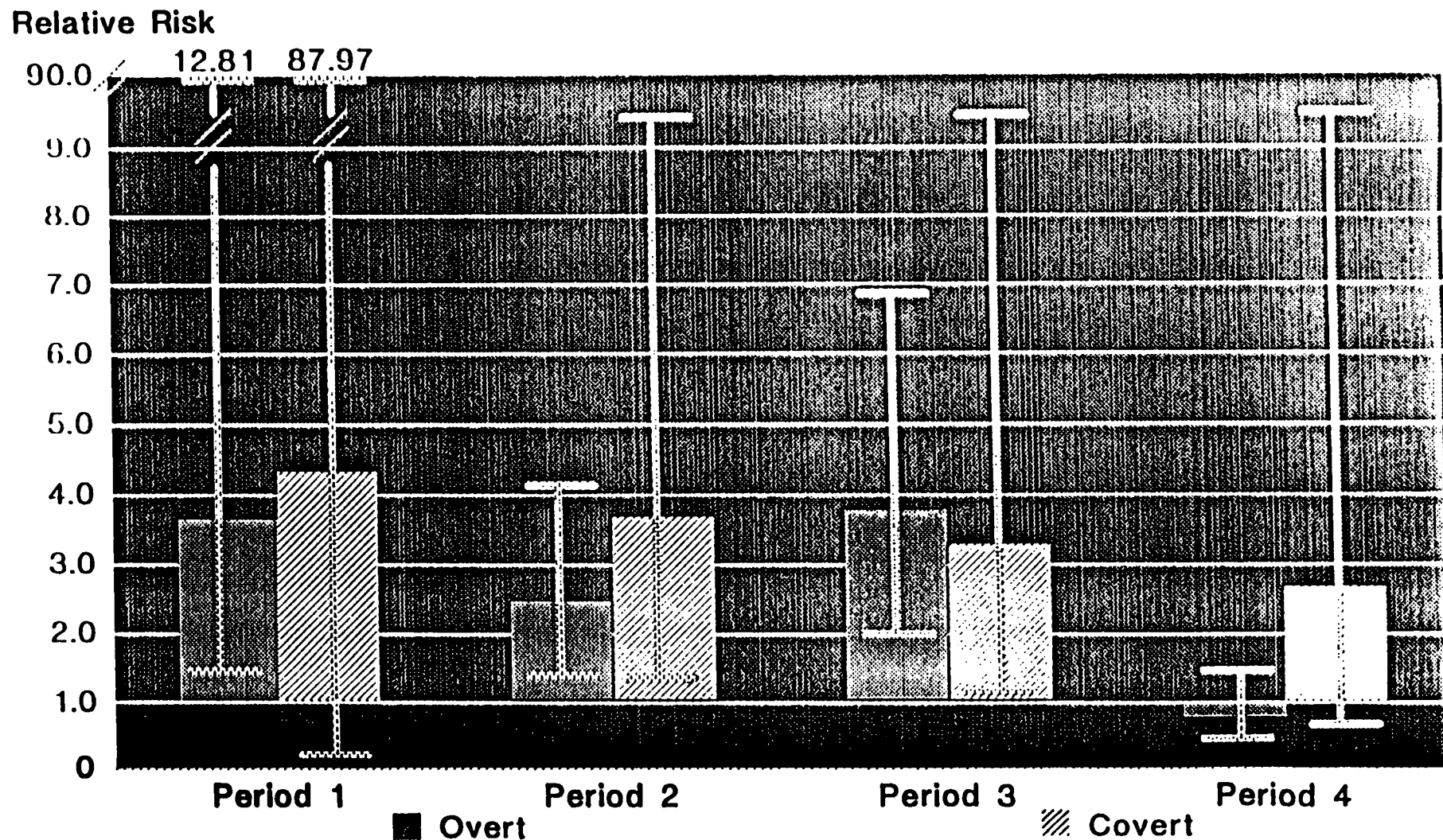


FIGURE 4

LO IMPACT SCH-B's OVERT & COVERT DISRUPTIVE BEHAVIOR
FOR THE POST HURRICANE SCHOOL YEAR BY GRADING



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WHAT HAPPENED TO YOU DURING AND AFTER THE HURRICANE?

I.D. # _____

1. Where were you during the hurricane? (You can check more than one)
- | | | | |
|--|---------------------|--|--|
| _____ in my home | _____ in a closet | | |
| _____ in a friend's or relative's home | _____ in a bathroom | | |
| _____ in a shelter | _____ in a car | | |
| _____ sleeping | _____ out of town | | |
2. Did any windows or doors break or come open in the place you stayed while the hurricane was here? Yes No
3. Did part or all of your roof get blown away or caved in? Yes No
4. Did you get hurt during the hurricane? Yes No
5. Did anyone with you get hurt during the hurricane? Yes No
6. Did you get very scared that you or someone you love would get hurt or die during the hurricane? Yes No
7. Did you see anyone hurt badly during the hurricane? Yes No
8. Was anyone with you very scared during the hurricane? Yes No
9. Did you get wet from rain or sea water during the hurricane? Yes No
10. Did you have to go outside during the hurricane because the building you were in was badly damaged? Yes No
11. Did a pet you liked get hurt or die during the hurricane? Yes No
12. After the hurricane, did you have to stay out of your home for awhile? Yes No
- a) If yes, how many days/weeks were you out _____
- b) Are you still out of your home? Yes No
13. Did a grownup in you home lose his or her job because of the hurricane? Yes No
14. Did you lose anything really important to you because of the hurricane? Yes No
15. Did your family have to be separated for a while? Yes No
16. Did you feel safe in the places you have stayed since the hurricane? Yes No
17. Did you or your family have trouble getting enough food and water after the hurricane? Yes No
18. Did you have to go to a new school because of the hurricane? Yes No