

# Violence Exposure, Trauma, and IQ and/or Reading Deficits Among Urban Children

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**Background:** Exposure to violence in childhood has been associated with lower school grades. However, the association between violence exposure and performance on standardized tests (such as IQ or academic achievement) in children is unknown. It is also not known whether violence exposure itself or subsequent symptoms of trauma are primarily responsible for negative outcomes.

**Objective:** To examine the relationship between violence exposure and trauma-related distress and standardized test performance among early school-aged urban children, controlling for important potential confounders.

**Design:** A total of 299 urban first-grade children and their caregivers were evaluated using self-report, interview, and standardized tests.

**Main Outcome Measures:** The child's IQ (Wechsler Preschool and Primary Scale of Intelligence–Revised) and

reading ability (*Test of Early Reading Ability*, second edition) were the outcomes of interest.

**Results:** After controlling for confounders (child's gender, caregiver's IQ, home environment, socioeconomic status, and prenatal exposure to substance abuse) violence exposure was related to the child's IQ ( $P=.01$ ) and reading ability ( $P=.045$ ). Trauma-related distress accounted for additional variance in reading ability ( $P=.01$ ). Using the derived regression equation to estimate effect sizes, a child experiencing both violence exposure and trauma-related distress at or above the 90th percentile would be expected to have a 7.5-point (SD, 0.5) decrement in IQ and a 9.8-point (SD, 0.66) decrement in reading achievement.

**Conclusion:** In this study, exposure to violence and trauma-related distress in young children were associated with substantial decrements in IQ and reading achievement.

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**S**URPRISINGLY HIGH levels of self-reported violence, both via witnessing of and victimization by violent events, are consistently found in young urban children.<sup>1,2</sup> Children reporting high levels of violence exposure have demonstrated higher levels of both internalizing and externalizing behaviors.<sup>3,4</sup> In addition, evidence of poor school outcomes among older children affected by violence is also mounting. For example, community violence exposure (such as witnessing or experiencing a robbery, or being threatened with a weapon) was associated with a decrease in school attendance and grades in a large (N=2099) sample of middle- and high-school students.<sup>5</sup> Adolescent girls (aged, 12-21 years) in a primary care setting and meeting criteria for posttraumatic stress disorder (PTSD) were more likely to have failed a school grade.<sup>6</sup>

Such research, however, has excluded young children at an early school age. In addition, reports have focused only on relations between violence exposure and grade suppression, which could result from associated behavioral problems, emotional problems, or decreased attendance. Evidence that school difficulties are associated with deficits on standardized tests of academic achievement or intelligence would have additional implications. For example, concern regarding violence exposure would be further heightened if it affected the children's actual ability to demonstrate or to acquire academic skills. Alternately, our understanding of and ability to prevent violence exposure and associated outcomes could be enhanced if children with limited intellectual ability were shown to be more at risk.

Research findings from related areas suggest that children exposed to high levels of violence are likely to show deficits

## PARTICIPANTS AND METHODS

### PARTICIPANTS

Participants in the current single-group within-subjects study were part of a larger subject group participating in a National Institute on Drug Abuse–funded project studying the outcomes of 6- to 7-year-old African American children prenatally exposed to cocaine and alcohol and their unexposed (control) peers.<sup>12</sup> The sample for the current investigation was selected from the control group who had no history of prenatal exposure to hard illicit drugs (eg, cocaine, heroin, methadone, amphetamines [uppers], barbiturates [downers], and any other drugs). The control group did include children of mothers who used alcohol and/or marijuana during pregnancy. Prenatal marijuana exposure was reported by 21% of this sample; some level of prenatal alcohol exposure was reported by 60%.

Of 376 African American caregiver–child dyads who were contacted, 97% (n=366) agreed to participate. However, multiple missed appointments (n=46) or incomplete data (n=21) reduced the final sample to 299 participants (80% of the original sample). The 299 participants did not differ from those who refused to participate, who provided incomplete data, or who missed multiple appointments, when compared using prenatal and neonatal characteristics (infant birth weight, length, gestational age, Apgar scores, prenatal alcohol or nicotine exposure, maternal age, educational level, parity, or gravidity).

### PROCEDURE

The Wayne State University institutional review board, Detroit, Mich, approved all data collection procedures; all caregivers signed informed consent forms before participating in this study. Self-report, interview, and standardized test data were collected from children and their caregivers during half-day evaluation sessions at our laboratory. Separate research assistants interviewed children and caretakers independently. All research assistants were blind

to prenatal exposure status, which was matched to laboratory collected subject information by a database manager after contact with all subjects was completed. A licensed psychologist trained and closely supervised the research assistants in the administration of all test instruments.

### MEASURES

#### Independent Variables

Previous research findings have suggested that parents underreport a child's exposure to violence when compared with the child's self-report<sup>13</sup>; consequently, a child report measure was used in this study. The Things I Have Seen and Heard scale consists of 20 items and assesses the frequency of children's self-reported exposure to violence and violence-related themes.<sup>14</sup> Items are rated on a 5-point scale indicating the frequency of exposure to each event. The Things I Have Seen and Heard scale has been shown to have adequate test-retest reliability ( $r=0.81$ ),<sup>15</sup> good internal consistency ( $\alpha=.80-.83$ ),<sup>16,17</sup> and has been used in many community violence studies.<sup>3,16-19</sup>

Children's trauma-related distress was evaluated using the Levonn scale.<sup>13</sup> This measure of traumatic distress symptoms was modified from its original version<sup>20</sup> for use with urban children. The Levonn scale consists of 29 cartoon picture items where children rate on a 3-point scale how often they feel like the child in the cartoon. A total score as well as subscales representing depression, anxiety and/or intrusive thoughts, and sleep problems can be derived, and have reported reliability coefficients ranging from 0.71 to 0.84.<sup>13</sup> One-week test-retest reliability for the total score is good ( $r=0.81$ ),<sup>13</sup> and the Levonn scale has been used with success in multiple research projects.<sup>13,21,22</sup>

#### Outcomes

Children's reading ability was assessed with the *Test of Early Reading Ability*, second edition,<sup>23</sup> a brief measure of the

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in standardized test scores in addition to lower school grades. For example, child maltreatment has been associated with lower scores on standardized tests of academic achievement.<sup>7-9</sup> Similar results were found in a study of Lebanese adolescent schoolchildren, in whom PTSD was associated with lower scores on standardized achievement tests.<sup>10</sup> Moderate correlations between IQ and PTSD in male combat veterans have also been reported.<sup>11</sup>

While reports of the relation between community violence exposure and school grades have been published, virtually no studies specifically evaluate the influence of community exposure to violence on actual academic or cognitive ability. In the current investigation, relations between violence exposure and academic outcomes were examined in a group of 6- to 7-year-old children, accounting for several methodological considerations: (1) socioeconomic status, prenatal drug or alcohol exposure, quality of the home environment, sex of the child, and primary caregiver IQ were all measured to control for confounding variance from these sources; (2) data were obtained from child self-report and trained interviewers-psychometrists using vali-

dated instruments; and (3) trauma-related symptoms were also measured to explore the relative contributions of violence exposure and trauma-related symptoms in explaining the variance in academic functioning. Given previous findings from studies of maltreated children and male combat veterans, it was hypothesized that a child's report of exposure to violence would be associated with deficits in IQ and reading ability, even after controlling for the aforementioned confounding factors.

## RESULTS

The final sample consisted of 157 boys (52%) and 142 girls (48%), with a mean age of 6.9 years (age range, 5.9-7.9 years). The sample was primarily of moderately low socioeconomic status, with 48% of the caregivers reporting a total annual family income of less than \$15 000; 69% of the primary caregivers have a high school or General Educational Development diploma. Exposure to community violence and trauma-related distress were both prevalent in this sample (**Table 1**).

children's reading ability with a mean (SD) of 100 (15) points. It has been validated with a representative sample of more than 1400 children, has an internal consistency coefficient of 0.93, and (in the standardization sample) demonstrated a 2-week test-retest reliability of  $r=0.89$ .<sup>23</sup> The *Test of Early Reading Ability*, second edition, has successfully discriminated between learning disabled and healthy children, has been associated with age and school experience, and correlated significantly with alternate measures of early academic achievement (eg, *Basic School Skills Inventory: Diagnostic*<sup>24</sup>;  $r=0.61$ ,  $P<.01$ )<sup>23</sup> Child IQ was evaluated using the Wechsler Primary and Preschool Scale of Intelligence-Revised,<sup>25</sup> an extensively standardized and validated measure of the child's ability to complete verbal and nonverbal intellectual tasks.

### Control Variables

Socioeconomic status was estimated using the Hollingshead 2-factor index.<sup>26</sup> Information regarding maternal prenatal alcohol use was collected during each prenatal visit and converted to average absolute ounces of alcohol per day during pregnancy. Information regarding maternal prenatal illicit drug use was also collected at each prenatal visit. Any indication of prenatal use of cocaine, heroin, or other illicit drugs (such as lysergic acid diethylamide or amphetamines) except for prenatal marijuana use, resulted in exclusion from the current sample. To control for maternal or caregiver intellectual ability (a possible confounding biological influence on child academic outcomes, as well as a possible confounding environmental influence), caregiver IQ was measured with the performance subscale of the Wechsler Adult Intelligence Scale-Revised.<sup>27</sup> The performance subscale of the Wechsler Adult Intelligence Scale-Revised was chosen because of its time advantages over full-scale Wechsler Adult Intelligence Scale-Revised administration, its excellent reliability (split-half reliability coefficient=0.93; test-retest=0.89), and its high correlation with full-scale IQ ( $r=0.91$  across all age groups).<sup>27</sup>

Home environment was evaluated using an interview, conducted in the laboratory, based on the Home Observation for Measurement of the Environment (HOME).<sup>28</sup> This scale used observations of caregiver-child interactions during the laboratory visit (eg, caregiver responds to the child's questions, caregiver's voice conveys positive feelings when speaking to the child, caregiver introduces examiner to the child), and asked for caregiver report for other items taken from the HOME (eg, "Child is encouraged to read on his own."). As with the HOME, multiple-item scores on this interview were summed to create a continuous scale representing the quality of the home environment. Higher scores denoted better quality of home environment. Thus, while the laboratory-based interview used for this study was not previously validated, it bore significant similarities to the HOME scale and incorporated opportunities for observation. Further, this measure demonstrated a promising pattern of external correlates in the current study, similar to that found for the HOME in previous research.<sup>28</sup> Scores from the current measure of the quality of the home environment were positively associated with socioeconomic status ( $r=0.36$ ,  $P<.001$ ), caregiver's performance IQ ( $r=0.33$ ,  $P<.001$ ), and child's IQ ( $r=0.32$ ,  $P<.001$ ), and were negatively associated with a child's report of trauma-related distress (using the Levonn scale, described below;  $r=-0.11$ ,  $P<.05$ ). While these findings do not constitute a thorough validation of this measure, they (along with the face validity of the interview) do suggest that variance related to the quality of the home environment was being tapped.

### DATA ANALYSIS

The current research hypothesis was tested using multiple regression, with stepwise selection of confounders and subsequent simultaneous entry of independent variables (community violence exposure and distress). Two analyses using this variable set were conducted, one each for reading ability and child's IQ, using the Statistical Package for the Social Sciences, Version 10.07.<sup>29</sup>

The 2 independent variables, community violence exposure and trauma-related distress, were significantly related ( $r=0.25$ ,  $P<.001$ ). However, collinearity statistics were well within the acceptable range (tolerance, 0.96-0.99). Many other potentially confounding variables were correlated with the outcome measures, including the home environment, the caretaker's verbal ability, the child's gender, socioeconomic status, and amount of prenatal alcohol exposure. These variables were considered as confounders in all further analyses. The first regression equation examined community violence exposure and trauma-related distress as predictors of a child's IQ. After controlling for confounders, community violence exposure accounted for significant variance in a child's IQ ( $P<.05$ ), with higher violence exposure associated with lower IQ scores. However, trauma-related distress was not significantly related to a child's IQ (**Table 2**). The total equation accounted for 23% of the variance in the child's IQ. Using the derived regression equation (entering scores, multiplying them by derived  $\beta$  weights, and summing to

yield a predicted score on the dependent variable), a child scoring at or above the 90th percentile on both community violence exposure and trauma-related distress would be expected to have a decrement of 7.5 IQ points when compared with a child at the lowest (first) percentile on both variables (**Figure**). This difference of half an SD represents a medium effect size.<sup>30</sup>

The second regression equation examined community violence exposure and trauma-related distress as predictors of reading ability (**Table 3**). After control for confounding, both community violence exposure and trauma-related distress explained significant variance in reading achievement ( $P<.05$ ), with higher scores on each independent variable associated with decreased reading achievement. The total equation accounted for 28% of the variance in reading ability. Using the derived regression equation, a child scoring at or above the 90th percentile on both community violence exposure and trauma-related distress would be expected to have a decrement of 9.8 points on the *Test of Early Reading Ability*, second edition, when compared with a child at the low-

**Table 1. Report of Exposure to Violence and Trauma Symptoms by 299 Urban Children\***

Selected Violence Exposure Items†	Never	1 Time	2 Times	3 Times	>3 Times
I have heard guns being shot.	15.4 (46)	27.4 (82)	16.1 (48)	12.4 (37)	28.8 (86)
I have seen somebody being beat up.	18.7 (56)	19.4 (58)	14.0 (42)	18.4 (55)	29.4 (88)
I have seen somebody get stabbed.	75.9 (227)	14.0 (42)	4.7 (14)	2.0 (6)	3.3 (10)
I have seen somebody get shot.	72.2 (216)	15.1 (45)	5.4 (16)	4.0 (12)	3.3 (10)
Grown-ups in my home hit each other.	69.2 (207)	9.0 (27)	6.4 (19)	5.0 (15)	10.4 (31)
Grown-ups in my home threaten to stab or shoot each other.	92.0 (275)	2.0 (6)	2.0 (6)	2.0 (6)	2.0 (6)

Selected Trauma Symptom Items‡	Never	Some of the Time	A Lot of the Time
Saw something scary; can't stop thinking about it.	56.2 (168)	18.4 (55)	25.4 (76)
Hard time going to sleep; remembers something scary.	63.9 (191)	15.7 (47)	20.4 (61)
In class worries about people being shot.	61.9 (185)	19.4 (58)	18.7 (56)

\*Data are given as the percentages of children making this report. The numbers in parentheses refer to the frequency associated with the noted percentages.

†Statements taken from the Things I Have Seen and Heard scale.<sup>14</sup>

‡Statements taken from the Levonn measure of children's distress symptoms scale.<sup>13</sup>

**Table 2. Multiple Regression of a Child's Exposure to Violence and Distress on the Child's IQ\***

Step†	Measure	β Weight (Unique)	Significance of β Weight	β Weight	R <sup>2</sup>	R <sup>2</sup> Change	Significance of R <sup>2</sup> Change
1	Quality of the home environment	0.36	.002	.17	0.10	...	<.001
2	Caretaker performance IQ	0.21	.001	.19	0.16	0.05	<.001
3	Socioeconomic status	0.19	.004	.16	0.18	0.03	.003
4	Child's sex	3.16	.013	.13	0.20	0.02	.007
5	Violence exposure	-0.20	.012	-.13	0.23	0.03	.004
	Trauma-related distress	-0.08	.113	-.09	...	...	...

\*The total sample size was 299 urban 6- to 7-year-old children; intercept = 47.6. Ellipses indicate not applicable.

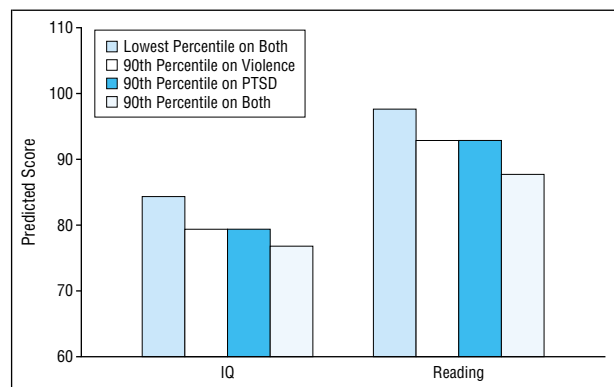
†Steps 1 through 4 are the result of stepwise selection from the range of possible confounding variables (only prenatal alcohol exposure did not enter); step 5 is the forced simultaneous entry of the 2 independent variables (violence exposure and posttraumatic stress disorder symptoms).

est (first) percentile on both measures (Figure). This two thirds of an SD difference represents a moderate- to large-effect size.<sup>30</sup>

**COMMENT**

Our study examined the association between reported community violence exposure and school outcomes. After ruling out or controlling for many potential confounders, using multiple sources of data and standardized measurement of cognitive and reading abilities, self-reported violence exposure in children was negatively correlated with IQ scores and standardized reading achievement test performance. Community violence exposure in urban children appears to be similar to child maltreatment and other trauma in its association with cognitive outcomes.

This finding has clear implications, although the nature of these depends on the directionality of the observed relationship. For example, children of limited intellectual ability may be more likely to witness or experience violence, perhaps because they are unable to verbally mediate dangerous situations, or perhaps because of an inability to accurately predict and avoid violent situations. Preventive efforts might profitably focus on problem-solving skills in children who have a low IQ if later research confirms that intellectual limitations are a risk factor for community violence exposure.



Graph shows the predicted violence-related IQ and reading achievement decrements of an urban cohort of children (N=299) between the ages of 6 and 7 years. Bars indicate expected standard scores for children scoring above the 90th percentile on one or both major independent variables (Things I Have Seen and Heard<sup>14</sup> and the Levonn<sup>20</sup> scales), using β weights from the derived regression equations (Tables 2 and 3). The predicted score indicates the IQ scores of 6- and 7-year-old children using the Wechsler Preschool and Primary Scale of Intelligence-Revised; reading scores using the *Test of Early Reading Ability*, second edition. All scores represent standard scores with a mean (SD) of 100 (15) points that are adjusted for the influence of confounders (Tables 2 and 3). PTSD indicates posttraumatic stress disorder.

Alternately, exposure to violence may actually inhibit intellectual and academic functioning. If community violence exposure does in fact cause such deficits, the estimated number of urban children experiencing vio-

**Table 3. Multiple Regression of a Child's Exposure to Violence and Distress on Reading Ability (TERA-RQ)\***

Step†	Measure	$\beta$ Weight (Unique)	Significance of $\beta$ Weight	$\beta$ Weight	$R^2$	$R^2$ Change	Significance of $R^2$ Change
1	Caretaker performance IQ	0.35	<.001	.26	0.13	...	<.001
2	Quality of the home environment	0.54	<.001	.21	0.19	0.06	<.001
3	Child's sex	5.90	<.001	.20	0.23	0.04	<.001
4	Prenatal alcohol exposure	-10.97	.046	-.10	0.25	0.01	.025
5	Violence exposure	-0.19	.044	-.10	-0.28	0.03	.001
	Trauma-related distress	-0.16	.01	-.13	...	...	...

\*The total sample size was 299 urban 6- to 7-year-old children; intercept = 47.9. TERA-RQ indicates the *Test of Early Reading Ability, Revised Questionnaire*.<sup>23</sup> Ellipses indicate not applicable.

†Steps 1 through 4 are the result of stepwise selection from the range of possible confounding variables (only socioeconomic status did not enter); step 5 is the forced simultaneous entry of the 2 independent variables (violence exposure and posttraumatic stress disorder symptoms).

lence at this level would make this an issue of major concern. For example, Lester and colleagues<sup>31</sup> have previously demonstrated that even very small IQ decrements (only 3.26 points, <0.25 SD) can have a major practical impact if large numbers of children are affected. Levels of community violence exposure were high in the current study, even though the sample was in no way selected for its exposure to violence (Table 1). The inclusion of many parents with high school or General Educational Development diplomas (69%) and the exclusion of children prenatally exposed to any illicit drug other than marijuana makes this group of children potentially less likely to experience violence than other urban samples.<sup>1,2</sup>

If community violence exposure does in fact impair academic ability, efforts to identify factors predicting which urban children are or will be exposed to high levels of violence are needed. Despite the high levels of self-reported violence exposure in this and other studies,<sup>32</sup> many children in the current sample—in spite of the homogeneity of socioeconomic status and city of residence in this study—reported very low levels of exposure. If preventable factors contribute to this variability in community violence exposure, it could lead to interventions that reduce the number of children who witness violence, regardless of the levels of violence present in the community. Second, if violence exposure itself leads to cognitive deficits, interventions targeted at children demonstrating symptoms of trauma may miss children who, although not showing clear PTSD or related symptoms, may be compromised in their ability to function scholastically. The results of our study suggest that interventions would need to be targeted at children who either demonstrate trauma-related symptoms or at those who report high levels of exposure to violence.

It is unclear which causal direction is more likely, or even whether a third variable might cause both violence exposure and intellectual deficits. The possible mechanism underlying the relation is also unknown. Some evidence has suggested that early trauma can lead to autonomic nervous system or hormonal hyperreactivity,<sup>32</sup> affecting a child's ability to remain focused while attempting to learn or to perform complex cognitive tasks. Perhaps more parsimoniously, long-term exposure to violence results in an anxious preoccupation with personal

safety or other concentration difficulties that are incompatible with learning and performing such tasks.<sup>33</sup> Our finding that PTSD-related symptoms accounted for significant variance in reading ability, even when entered along with exposure to community violence, provides some support for this latter suggestion. Alternately, as noted earlier, children with intellectual limitations may somehow be at risk for violence in ways not yet fully understood.

A secondary goal of this study was to explore whether the impact of community violence exposure is primarily limited to children who also demonstrate trauma-related symptoms, or whether violence exposure itself is related to poor academic outcomes even in the absence of high levels of anxiety and distress. When both variables were considered simultaneously, violence exposure had an independent effect on both IQ and reading ability. This finding suggests that reported violence exposure might be associated with negative academic outcomes, whether or not children are subjectively distressed from the exposure. However, trauma-related distress did account for additional variance in reading ability, suggesting that subjectively distressed child victims who experience community violence may be at additional risk for deficits in reading ability.

A major obstacle for our current study and other similar investigations is the lack of well-validated measures of community violence exposure and related trauma. Although the Levonn and Things I Have Seen and Heard scales may be the best available options for measuring young children's reports of community violence exposure and trauma-related distress, they have not yet been subjected to rigorous validation and may have important unknown weaknesses. For example, the low internal consistency of the Things I Have Seen and Heard scale in our sample ( $r=0.68$ ) suggests that multiple and minimally related constructs are being tapped by this scale in its current form.

A final important consideration in interpreting these data is the strong observed relation between other factors and the academic outcomes studied. As already established by previous research,<sup>34,35</sup> the quality of the home environment and prenatal alcohol exposure both accounted for significant variance in academic outcomes in our study. Further, standardized  $\beta$ s for these variables were of greater absolute value than those for vio-

### What This Study Adds

Research findings have increasingly documented high self-reported levels of exposure to violence by even very young urban children. Research findings have also documented a range of troubling correlates of self-reported violence exposure, including elevated levels of externalizing and internalizing behaviors. Evidence that broad and prevalent violence exposure is negatively associated with school outcomes also exists, but such research has relied primarily on grades in school and not more objective measures such as scores on standardized tests (eg, academic achievement and IQ tests).

The current study extends previous findings by demonstrating an association between child self-reported violence exposure and school outcomes when defined as scores on standardized achievement and IQ tests. This research also explored whether violence exposure alone or whether only violence exposure that concurrently occurs with symptoms of trauma-related distress is associated with decrements on measures of school outcomes. The findings suggest that violence exposure may be associated with actual impairments in academic ability and learning potential, even in the absence of distress.

lence exposure or trauma-related symptoms. These findings suggest that the importance of considering the range of biopsychosocial insults faced by urban children, including violence exposure, cannot be overestimated.

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