



Published in final edited form as:

J Trauma Stress. 2008 October ; 21(5): 479–486. doi:10.1002/jts.20362.

Creation of a Community Violence Exposure Scale: Accounting for What, Who, Where, and How Often

Shakira Franco Suglia,

Department of Environmental Health, and Department of Epidemiology, Harvard School of Public Health, Boston, MA

Louise Ryan, and

Department of Biostatistics, Harvard School of Public Health, Boston, MA

Rosalind J. Wright

Department of Environmental Health, and Channing Laboratories, Harvard School of Public Health, Boston, MA

Abstract

Previous research has used the Rasch model, a method for obtaining a continuous scale from dichotomous survey items measuring a single latent construct, to create a scale of community violence exposure. The authors build upon previous work and describe the application of a Rasch model using the continuation ratio model to create an exposure to community violence (ETV) scale including event circumstance information previously shown to modify the impact of experienced events. They compare the Rasch ETV scale to a simpler sum ETV score, and estimate the effect of ETV on child posttraumatic stress symptoms. Incorporating detailed event circumstance information that is grounded in traumatic stress theory may reduce measurement error in the assessment of children's community violence exposure.

Rates of experiencing and witnessing community violence among children are high, particularly in lower socioeconomic urban communities (Campbell & Schwarz, 1996; Schubiner, Scott, & Tzelepis, 1993). The majority of urban youth has witnessed violent events, and among older children, a third or more report being a direct victim (Osofsky, Wewers, Hann, & Fick, 1993; Sheehan, DiCara, LeBaily, & Christoffel, 1997). Furthermore, community violence exposure is a major cause of childhood morbidity in urban U.S. communities (Wright, 2006). Children who are victims of or witnesses to violence in their communities have more behavioral problems, depressive symptoms, aggression problems and are more likely to develop posttraumatic stress disorder (PTSD; Freeman, Mokros, & Poznanski, 1993; Schwab-Stone et al., 1999). Research links community violence exposure to physiologic markers of the stress response—children who experience high levels of community violence have higher basal diastolic blood pressure, heart rate, and cortisol levels (Murali & Chen, 2005) and increased cardiovascular reactivity and cortisol in response to laboratory stressors (Clark, Benkert, & Flack, 2006; Kliewer, 2006; Wilson, Kliewer, Teasley, Plybon, & Sica, 2002). Others have linked community violence to decreased lung function and increased asthma morbidity (Franco Suglia, Ryan, Laden, Dockery, & Wright, 2007; Wright, 2006). Although notable advances have been made, a number of methodological issues that could strengthen this line of research have also been underscored (Selner-O'Hagan, Kindlon, Buka, Raudenbush, & Earls, 1998; Trickett, Duran, & Horn, 2003).

Measurement of community violence exposure presents many challenges (Brandt, Ward, Dawes, & Flisher, 2005; Trickett et al., 2003). All events are not of equal significance, e.g., being a victim of a shooting generally does not have the same impact as hearing gunshots. Yet, studies have traditionally summed items to create an unweighted linear composite scale without accounting for severity of events—a significant limitation. Traumatic stress theory suggests still other factors that may contribute to the impact of violence exposure (e.g., location and characteristics of the perpetrator and victim [stranger vs. nonstranger]; Lynch, 2003; Ward, Flisher, Zissis, Muller, & Lombard, 2001). Children are more affected by violence happening to a family member than to a stranger (Lynch, 2003; Osofsky, 1995) and have more anxiety symptoms when the perpetrator or victim is known to the child (Patterson, 1995; Ward et al., 2001). Thus, consideration of whether the perpetrator or victim is a child's caregiver or someone else from the child's most proximate environment (Lynch, 2003; Schwab-Stone et al., 1999) may provide a more complete and accurate determination of the covariate of interest. Delineating which types of violent experiences occurring in different contexts carry the greatest threat to child development may also better inform interventions (Richters, 1993).

Therefore, specifying a method for deriving a summary measure that combines the sampled violence events and accounts for specific characteristics surrounding the events that influence their impact would be a significant advance. This may reduce measurement error that may bias results linking exposure to health outcomes. Earlier studies have begun to explore the use of Rasch models to characterize community violence exposure (Kindlon, Wright, Raudenbush, & Earls, 1996; Selner-O'Hagan et al., 1998). Classical Rasch models (Rasch, 1960) are a specialized type of latent variable model used to obtain a continuous measure from a set of binary responses to a series of questions assumed to be related to a single underlying latent construct. Historically used in the education field to score aptitude tests (Bond & Fox, 2001), they have been increasingly applied in health research (Duncan, Bode, Min Lai, & Perera, 2003; Fitzpatrick, Norquist, Dawson, & Jenkinson, 2003). Rasch models can be most easily explained using an example from the context in which they were developed, namely the scoring of educational achievement tests. In such tests, the more difficult questions tend to be those that are correctly endorsed by fewer subjects, whereas the easier questions are correctly answered by many. The ability or capacity of the subject in the matter being tested determines the probability of the subject endorsing an item. Rasch models use these two parameters, item difficulty or severity and subject ability, to determine the probability of endorsing each item and use those probabilities to create a linear scale of aptitude scores for each subject. Rasch models are similar in concept to factor analysis in that they assume that each observable variable is related to an unobserved latent variable. Whereas factor analysis models assume that continuous observed variables are related through linear regression to the latent score, Rasch models apply to binary observed variables and are based on a logistic regression relationship with the unobserved latent score. Rasch models are a special case of the more general item response theory model. Item response theory models allow each observed variable to have its own unique slope on the latent variable; Rasch models make the simplifying assumption that each observed variable has the same slope relating it to the unobserved latent variable. This simplifying assumption improves the numerical stability of the model and makes it much easier to fit (Bartholomew & Knott, 1999).

Kindlon et al. (1996) previously described the development of a Rasch model for the creation of a violence exposure scale using the adjacent logit formulation of the multinomial regression. We propose to build upon that work by extending the Rasch modeling technique applied in standard mixed models software using the continuation ratio formulation of the multinomial regression which allows us to create a more comprehensive violence indicator that accounts more fully for event circumstance information. The two different multinomial formulations differ according to how they set up the contrasts between different levels of the categorical outcome. For example, suppose a variable has three levels, A, B, and C. Whereas the adjacent

logit model is formulated in terms of two linked models for B versus A as well as C versus B, the continuation ratio model is formulated in terms of (B or C) versus A as well as B versus C. In our setting, the continuation ratio formulation has an appealing interpretation. The first component can be interpreted as a model on the probability that the event occurred, whereas the second can be interpreted as the conditional probability that a particular condition applied (e.g., the subject knew the perpetrator), given that the event occurred.

We illustrate the use of this more comprehensive exposure to violence (ETV) scale obtained using this approach from the Rasch model to estimate the effect of violence exposure on posttraumatic stress symptoms in children. We compare our results using the Rasch ETV score to a more traditional approach that simply sums the discrete violent events ascertained in the survey without accounting for severity or event circumstance information. In this way we can directly compare whether using Rasch modeling to account for event circumstances will create a more robust measure and therefore be a better predictor of child distress symptoms when compared against a simple unweighted sum of the reported violent events.

METHOD

Participants

The sample was drawn from women and their children already enrolled in a prospective cohort designed to study the effects of prenatal tobacco smoke exposure on childhood respiratory health. This study has been described in detail previously (Hanrahan et al., 1992). In brief, pregnant women receiving prenatal care at an urban community health center in Boston, Massachusetts, were enrolled between 1986 and 1992 prior to the 20th week of gestation. Women who did not speak either English or Spanish, who did not plan to have pediatric follow-up at the clinic, and whose age was less than 18 years at the time of delivery were excluded. One thousand women were eligible and enrolled, of whom 848 continued participation and delivered a live-born infant. In November 1996, new study initiatives were implemented, including the assessment of violence, at which time approximately 500 women continued active follow-up. Of them, 412 gave voluntary written consent and completed a violence exposure assessment; 171 children who were 8 years of age or older at this time also completed the self-report violence assessment. Those who did not answer the violence assessment differed significantly from those who responded based on race/ethnicity and smoking status (Hispanics, 45% nonresponders vs. 52% responders; current smokers, 42% nonresponders vs. 28% responders). The study protocol was approved by the human studies committees at the Brigham & Women's Hospital and the Beth Israel Deaconess Medical Center.

Measures

Violence was assessed using the Survey of Children's Exposure to Community Violence (Richters & Martinez, 1993) structured to measure lifetime exposure to community violence. Children who were 8 years of age or older at the time of the survey reported on their own violence experiences. For these analyses we consider lifetime exposure to events self-reported by the child. Acceptable internal consistency, test-retest reliability, and validity have been described for this scale (Selner-O'Hagan et al., 1998; Thomson, Roberts, Curran, Ryan, & Wright, 2002). The violence exposure survey specifically measures both witnessing and direct victimization of five specific events: (a) shoving, punching, or kicking; (b) knife attacks; (c) shootings; (d) hearing gunshots; and (e) witnessing verbal abuse of their primary caregiver. The survey also accounts for event circumstance information, including familiarity with the perpetrator or victim, events occurring more than once, and whether the events occurred at home versus in the community. For example, children who responded yes to the question of whether they had seen someone shoved would then be asked, "Did you know the person who did this?"

Children also completed the Checklist of Children's Distress Symptoms (CCDS; American Psychiatric Association [APA], 1987; Richters & Martinez, 1993). The CCDS, based on diagnostic criteria described in the Diagnostic and Statistical Manual of Mental Disorders, Third Edition Revised (American Psychiatric Association, 1987), was developed for a community violence project. The 28-item scale assesses children's distress symptoms in the past 6 months related to their reported community violence experiences. Symptoms include problems with attention, sleep, intrusive thoughts, flashbacks, worries, and reminders of things that happened in the past, which constitute factors related to posttraumatic stress symptoms including intrusive thoughts, emotional numbness, avoidant behavior, arousal, and hopelessness or despondency about the future. Responses are based on a 5-point scale ranging from 1, *never* to 5, *most of the time*. Scores are summed to obtain an overall distress symptom score, the score is then divided by the number of questions so that the final score ranges between 1 and 5. Higher scores correspond to more adverse psychological symptoms. The measure has been demonstrated to have high inter-rater reliability and concurrent validity (Hurt, Malmud, Brodsky, & Giannetta, 2001; Martinez & Richters, 1993). Good internal consistency has been demonstrated for the overall score (α .88; Howard, Feigelman, Li, Cross, & Rachuba, 2002). Increased levels of violence exposure have been associated with higher CCDS scale scores in prior research providing evidence of construct validity (Howard et al., 2002).

Variables previously identified as being related to both violence exposure and psychological functioning were examined as potential confounders (Brandt et al., 2005; Howard et al., 2002; Selner-O'Hagan et al., 1998). Data ascertained through standardized questionnaires were available on demographics and markers of socioeconomic status including the child's age, race/ethnicity, and gender and maternal educational level and marital status. Prenatal alcohol use and tobacco exposure were ascertained at each clinic visit during pregnancy. Maternal prenatal smoking was based on their response to the standardized questionnaire and was additionally validated using urine cotinine, a nicotine metabolite, as previously detailed (Hanrahan et al., 1992). Smoking during pregnancy has been shown to be associated with more stressful violent environments (Anderson, Roux, & Pruitt, 2002; Ganz, 2000) as well as increased externalizing behaviors in children (Fergusson, Woodward, & Horwood, 1998). Likewise consumption of alcohol during pregnancy has been associated with violence exposure (Amaro, Fried, Cabral, & Zuckerman, 1990) and behavioral problems among children (Sood et al., 2001). We have previously demonstrated that the mothers of these children are also at high risk for experiencing community violence, which may contribute to maternal psychopathology (Clark et al., 2007). The adverse effects of maternal depression on child development and psychological functioning have, in turn, been well documented (Goodman & Gotlib, 1999). Maternal depression was assessed using the depression subscale from the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983; Derogatis & Spencer, 1982), the subscale ranges from 1 to 5 with a higher score indicating more symptoms. The BSI depression subscale is a reliable measure among White and Latino women in urban low-income populations (Skilbeck, Acosta, Yamamoto, & Evans, 1984) and has good internal consistency among Latinas (α = .82) and Whites (α = .80) in this cohort.

Data Analysis

Using Rasch modeling techniques, a continuous ETV measure was obtained by modeling the conditional probabilities of responding yes to each violence question given the severity of each question and the true but unobserved violence exposure level of each person. The model is generalized to account for salient features of each event including whether the event occurred once or more than once, whether the event occurred at home versus the community and whether the child knew the victims or perpetrators of these violent acts. Incorporating these additional questions into a Rasch modeling framework requires care because the questions are no longer independent (thus violating one of the fundamental Rasch assumptions). Our approach was to

consider the combined questions as a type of ordered categorical response, so that a child could be thought of as providing one of three possible responses to the shoving question: “No, I have not seen shoving” (group 0), “Yes, I have seen it but I did not know the person who did it” (group 1) or “Yes, I have seen it and I knew the person who did it” (group 2). Previous violence exposure scales created using the Rasch model have applied the adjacent logit model, in which contrasts are made between adjacent response categories rather than the entire response scale (Kindlon et al., 1996; Selner-O'Hagan et al., 1998). For example, using the adjacent model the contrast in the above question would be made between the children who responded “No, I have not seen shoving” and those who responded “Yes, I have seen it but I did not know the person who did it” (i.e., between group 0 and group 1), leaving out the group of children who responded, “Yes, I have seen it and I know the person who did it.” The second contrast is made between the children who responded, “Yes, I have seen it but I did not know the person who did it,” and those who responded, “Yes, I have seen it and I knew the person who did it” (i.e. between group 1 and group 2). A better way to make these comparisons is to use the continuation ratio model where we can contrast the children who responded, “No, I have not seen shoving” with those who responded “Yes, I have seen it” (i.e., group 0 vs. groups 1 and 2). The second contrast group would remain the same as stated in the adjacent logit model (i.e., group 1 vs. group 2). The advantage to applying the continuation ratio model is that when we ask what is the probability that a child saw the event, we contrast children who did not see the event (group 0) and all those (group 1 and 2) who did see the event. As discussed by McCullagh and Nelder (1989), the continuation ratio formulation of the multinomial distribution provides a suitable model for characterizing the relationship between an underlying continuous violence scale and the response to such a question, which can be illustrated as follows. For each different type of event, the likelihood contribution for a child who answered no to a question regarding whether or not the event had been seen is simply $1 - p_1$, where p_1 is the probability that the event is seen. For a child who answers yes to the first question (i.e., they had seen the event) and no to the second (i.e., they did not know the person who did it), the likelihood contribution is $p_1(1 - p_2)$, where p_2 is the conditional probability that the child knew the perpetrator, given that they reported seeing the event. For a child who answered that they had seen the event and knew the perpetrator, the likelihood contribution is $p_1 p_2$.

To fit this model, the data needed to be treated as repeated measurement data where each child had repeated lines of observation, one for each question they responded to on the survey. Each child has one row of data corresponding to their response to the first basic question for each event type. Only children who respond yes then have an additional row of data corresponding to their answer to the event context questions. This model can be fitted as a random effects model with “response” declared as the outcome, “child” declared as the subject, and declaring “question” as a categorical variable. Models were implemented using logistic nonlinear mixed models (NLMIXED) in SAS 9.0 (SAS Institute, Cary, NC). A binary distribution was specified for the outcome variable and a random effect was defined to have known mean 0 and a variance to be estimated as part of the model-fitting procedure.

In addition, a sum ETV score was created based on the sum of the responses to the violence survey. We compare results using the Rasch ETV score to this simpler sum ETV score in both bivariate and multivariate regression analyses estimating the effect of the ETV scores on the child's posttraumatic stress symptoms while adjusting for child's gender, age, race/ethnicity, maternal education, marital status, maternal depression and tobacco and alcohol consumption during pregnancy.

RESULTS

Of the 171 children who completed the ETV survey, 165 also completed the CCDS scale. Analyses were conducted on a sample of 162 children as three had missing covariate

information. Children's demographic and environmental exposure information is presented in Table 1. Mean age of the children was 9.3 years ($SD = 1.0$). The mean overall CCDS score was 2.34 ($SD = 0.73$) and ranged from 1 to 4.6. Sixty-one percent of children reported witnessing shoving, 20% reported hearing gunshots, and 26% reported witnessing caregiver verbal abuse (Table 2). Due to concerns over how well the model would fit if we used events with very low frequencies, we limited the items used to the five discrete witnessing event questions, three victimization questions, and questions on event circumstance information with a frequency greater than five; thus, we only used 14 of the 22 questions available.

The distribution of the Rasch ETV score ranges from -1.3 to 3.1 . Although the scores cannot be interpreted in an absolute sense, they can be interpreted in a relative sense (someone with a Rasch score of 1.2 has a lower exposure, less severe events, and less actual events witnessed, than someone with a Rasch score of 2.3). The higher the Rasch score the fewer number of children per category representing fewer children responding to multiple events including the more severe forms of violence exposure. The sum ETV score ranges from 0 to 5. To make the results comparable between the sum ETV and the Rasch ETV scales, linear regression effect estimates are presented per one unit increase in the standard deviation of the scale.

Both the sum ETV scale and the Rasch ETV score were associated with the CCDS overall score in the expected direction (Table 3). In multivariate models, a one standard deviation increase in the summed ETV scale predicted a 0.26 increase in the CCDS scale; a one standard deviation increase in the Rasch ETV scale predicted a 0.24 increase in the CCDS scale. To assess for a threshold or a dose-response association, we also implemented multivariate models using tertiles of both the summed ETV and the Rasch ETV model. In multivariate analyses of the violence categorical variables, the third tertile of the simple sum scale for ETV, relative to the first tertile, was associated with a 0.60 increase (95% confidence interval [CI] = 0.32–0.89) in the CCDS scale. The Rasch ETV, including the event circumstance information, was more strongly related to child posttraumatic stress symptoms and showed a dose-response relationship. Relative to the first tertile of the Rasch ETV scale the second tertile was associated with a 0.34 (95% CI = 0.06–0.61) increase in the CCDS scale and the highest tertile compared to the first was associated with a 0.62 (95% CI = 0.34–0.90) increase in the CCDS scale.

DISCUSSION

In this article, we have presented a method for the creation of a violence exposure scale using Rasch models that account for conditional responses which tap into circumstances related to discrete events that are theoretically associated with the magnitude of the impact of experiencing different events. Incorporating more detailed information on circumstances surrounding discrete events that is grounded in traumatic stress theory may reduce measurement error in the assessment of the child's true exposure to violence. In our analyses predicting child distress symptoms the continuous scale of the sum ETV and the Rasch ETV produced qualitatively similar results, only when assessing a dose-response effect did we notice a difference between the two scales. The Rasch model, which incorporates the event circumstance information, creates a more parsimonious scale, better discriminating between children with low and high violence exposure by using all available information, including information that is conditional on other survey questions. Specifically, the Rasch model tends to produce more adequate spread of items along the linear measurement summary scale, which can enhance the power to detect differences in effects across the scale. Although only 11 children reported the most extreme events, 70% reported some form of violence exposure. Use of a more precise scale is even more important for these children who would globally be considered to have low or nonextreme violence exposure. Regardless of what tool we use to score violence, children with very high levels of exposure (i.e., the 11 who witnessed the more extreme event—witnessing a stabbing and/or a shooting—and presumably also witnessed the

less extreme events) will always be classified in the highest exposure group. As an example, note that there was no change among the third tertile of exposure regardless of whether we used the sum or the Rasch ETV score in relation to distress symptoms (Table 3). It is the children in the low-medium exposure group that without a more precise scale we would potentially classify as not exposed or exposed at low levels and miss any impact their violence exposure may have on their physical and mental health. Among the middle group (second tertile), we do see a difference of effects on distress symptoms dependent on the scoring measure used (Table 3). Indeed, the Rasch measure in comparison to the more conventional sum score was more clearly associated with posttraumatic stress symptoms in these children in a dose-response manner.

Our findings corroborate others that have documented relationships between violence exposure and adverse psychological outcomes. Freeman, Mokros, and Poznanski (1993) found that children who experienced violence suffer higher rates of depression than those who were not exposed. In a study of sixth graders, those with higher exposure to violence had significantly more symptoms of depression, posttraumatic stress, and somatization syndromes (Campbell & Schwarz, 1996). This study also expands the literature linking community violence exposure to child psychological distress as we adjusted for a number of potential confounders. Increasing levels of violence predicted higher posttraumatic stress symptoms scores even after accounting for socioeconomic indicators and demographic factors as well as other risk factors not available in other studies (i.e., smoking and alcohol exposure during pregnancy, maternal psychological symptoms).

Although the reported approach extends our understanding of the operationalization of community violence exposure in epidemiological research, it is worth underscoring some limitations. First, the creation of the Rasch scale is based on the assumption that events experienced less frequently in the population are therefore more severe. A subjective assignment of severity of events could potentially be more appropriate. In a recent article, an objective assignment of event severity compared to the child's perception of event severity, which is a more subjective approach, showed little correlation. However, it is notable that it was the objective measure of severity which was correlated with PTSD symptomatology and not the child's perception of event severity (Aisenberg, Ayon, & Orozco-Figueroa, in press). Second, although the Rasch scores can always be interpreted as higher scores indicating more severe violence exposure, the scores are not directly comparable across populations. Although the traditionally used sum score can be compared across populations, the Rasch model has advantages over the simple sum in that one can obtain a better spread of exposure across the continuous scale. Furthermore, although the Rasch scores will be different among different studies, so will the sum scores due to the inconsistency of survey instruments used in the community violence and child development literature (Trickett et al., 2003).

In summary, we presented a method for operationalizing community violence exposure with greater precision using a continuation ratio model implemented using widely available standard statistical software. An accurate measure of exposure is crucial for epidemiological research which attempts to relate exposure to violence with adverse health outcomes. There is increasing interest in researching the influences of community violence exposure on mental health consequences in children as well as physiological correlates that may result in even broader health effects. Measurement error in the exposure assessment can bias findings and may obscure true effects; thus, the best evidence would come from studies that most validly classify children according to their true level of exposure. Future research should not only measure a broad number of discrete violent events, but also account more fully for factors that may influence the impact on those experiencing such events as considered in this study. The health effects of community violence exposure would be even further clarified if future research considers an even broader host of psychosocial factors that may influence heterogeneity of

effects including preexisting anxieties or other psychopathology, social buffers, and coping strategies (Rasmussen, Aber, & Bhana, 2004; Wright, 2006).

Acknowledgements

Data collection for this study was funded by K08 HL 04187 and a Deborah Monroe Noonan Foundation grant. During preparation of this manuscript Shakira Franco Suglia was supported by F31 HD049317-01 and T32 MH073122; Rosalind J Wright was supported by R01 ES10932, R01 HL080674, and U01 HL072494.

REFERENCES

- Aisenberg E, Ayon C, Orozco-Figueroa A. The role of young adolescents' perception in understanding the severity of exposure to community violence and PTSD. *Journal of Interpersonal Violence*. in press
- Amaro H, Fried LE, Cabral H, Zuckerman B. Violence during pregnancy and substance use. *American Journal of Public Health* 1990;80:575–579. [PubMed: 2327535]
- American Psychiatric Association. 3rd ed.. Author; Washington, DC: 1987. Diagnostic and statistical manual of mental disorders.
- Anderson C, Roux G, Pruitt A. Prenatal depression, violence, substance use, and perception of support in pregnant middle-class women. *Journal of Perinatal Education* 2002;11:14–21. [PubMed: 17273282]
- Bartholomew, D.; Knott, M. Latent variable models and factor analysis. Hodder Arnold; London: 1999.
- Bond, TG.; Fox, CM. Applying the rasch model: Fundamental measurement in the human sciences. Erlbaum; Mahwah, NJ: 2001.
- Brandt R, Ward CL, Dawes A, Flisher AJ. Epidemiological measurement of children's and adolescents' exposure to community violence: Working with the current state of the science. *Clinical Child & Family Psychology Review* 2005;8:327–342. [PubMed: 16362258]
- Campbell C, Schwarz DF. Prevalence and impact of exposure to interpersonal violence among suburban and urban middle school students. *Pediatrics* 1996;98(3 Pt 1):396–402. [PubMed: 8784363]
- Clark C, Ryan L, Kawachi I, Canner MJ, Berkman L, Wright RJ. Witnessing community violence in residential neighborhoods: A mental health hazard for urban women. *Journal of Urban Health* 2008;5:22–38. [PubMed: 17965940]
- Clark R, Benkert RA, Flack JM. Violence exposure and optimism predict task-induced changes in blood pressure and pulse rate in a normotensive sample of inner-city Black youth. *Psychosomatic Medicine* 2006;68:73–79. [PubMed: 16449414]
- Derogatis, L.; Spencer, P. The Brief Symptom Inventory administration, scoring and procedures manual-I. Clinical Psychometric Research; Baltimore, MD: 1982.
- Derogatis LR, Melisaratos N. The Brief Symptom Inventory: An introductory report. *Psychological Medicine* 1983;13:595–605. [PubMed: 6622612]
- Duncan PW, Bode RK, Min Lai S, Perera S. Rasch analysis of a new stroke-specific outcome scale: The Stroke Impact Scale. *Archives of Physical Medicine and Rehabilitation* 2003;84:950–963. [PubMed: 12881816]
- Fergusson DM, Woodward LJ, Horwood LJ. Maternal smoking during pregnancy and psychiatric adjustment in late adolescence. *Archives of General Psychiatry* 1998;55:721–727. [PubMed: 9707383]
- Fitzpatrick R, Norquist JM, Dawson J, Jenkinson C. Rasch scoring of outcomes of total hip replacement. *Journal of Clinical Epidemiology* 2003;56:68–74. [PubMed: 12589872]
- Franco Suglia S, Ryan L, Laden F, Dockery DW, Wright RJ. Violence exposure, a chronic psychosocial stressor, and childhood lung function. *Psychosomatic Medicine* 2008;70:160–169. [PubMed: 18158365]
- Freeman LN, Mokros H, Poznanski EO. Violent events reported by normal urban school-aged children: Characteristics and depression correlates. *Journal of the American Academy of Child and Adolescent Psychiatry* 1993;32:419–423. [PubMed: 8444773]
- Ganz ML. The relationship between external threats and smoking in central Harlem. *American Journal of Public Health* 2000;90:367–371. [PubMed: 10705853]

- Goodman SH, Gotlib IH. Risk for psychopathology in the children of depressed mothers: A developmental model for understanding mechanisms of transmission. *Psychological Review* 1999;106:458–490. [PubMed: 10467895]
- Hanrahan JP, Tager IB, Segal MR, Tosteson TD, Castile RG, Van Vunakis H, et al. The effect of maternal smoking during pregnancy on early infant lung function. *American Review of Respiratory Disease* 1992;145:1129–1135. [PubMed: 1586058]
- Howard DE, Feigelman S, Li X, Cross S, Rachuba L. The relationship among violence victimization, witnessing violence, and youth distress. *Journal of Adolescent Health* 2002;31:455–462. [PubMed: 12457578]
- Hurt H, Malmud E, Brodsky NL, Giannetta J. Exposure to violence: Psychological and academic correlates in child witnesses. *Archives of Pediatrics and Adolescent Medicine* 2001;155:1351–1356. [PubMed: 11732955]
- Kindlon D, Wright B, Raudenbush S, Earls F. The measurement of children's exposure to violence: A Rasch analysis. *International Journal of Methods in Psychiatric Research* 1996;6:187–194.
- Kliwer W. Violence exposure and cortisol responses in urban youth. *International Journal of Behavioral Medicine* 2006;13:109–120. [PubMed: 16712428]
- Lynch M. Consequences of children's exposure to community violence. *Clinical Child & Family Psychology Review* 2003;6:265–274. [PubMed: 14719638]
- Martinez P, Richters JE. The NIMH community violence project: I. Children's distress symptoms associated with violence exposure. *Psychiatry* 1993;56:22–35. [PubMed: 8488209]
- McCullagh, P.; Nelder, J. *Generalized linear models*. Chapman and Hall; London: 1989.
- Murali R, Chen E. Exposure to violence and cardiovascular and neuroendocrine measures in adolescents. *Annals of Behavioral Medicine* 2005;30:155–163. [PubMed: 16173912]
- Osofsky J, Wewers S, Hann D, Fick A. Chronic community violence: What is happening to our children? *Psychiatry* 1993;56:36–45. [PubMed: 8488211]
- Osofsky JD. The effects of exposure to violence on young children. *American Psychologist* 1995;50:782–788. [PubMed: 7574189]
- Patterson, J. Conceptualizing family adaptation to stress.. In: Tanner, J., editor. *Children, families and stress*. Report of the twenty-fifth Ross roundtable on critical approaches to common pediatric problems. Abbott Laboratories, Ross Products Division; Columbus, OH: 1995.
- Rasch, G. *Probabilistic models for some intelligence and attainment tests*. The Danish Institute of Educational Research; Copenhagen: 1960.
- Rasmussen A, Aber MS, Bhana A. Adolescent coping and neighborhood violence: Perceptions, exposure, and urban youths' efforts to deal with danger. *American Journal of Community Psychology* 2004;33:61–75. [PubMed: 15055755]
- Richters JE. Community violence and children's development: Toward a research agenda for the 1990s. *Psychiatry* 1993;56:3–6. [PubMed: 8488210]
- Richters JE, Martinez P. The NIMH community violence project: I. Children as victims of and witnesses to violence. *Psychiatry* 1993;56:7–21. [PubMed: 8488215]
- Schubiner H, Scott R, Tzelepis A. Exposure to violence among inner-city youth. *Journal of Adolescent Health* 1993;14:214–219. [PubMed: 8323933]
- Schwab-Stone M, Chen C, Greenberger E, Silver D, Lichtman J, Voyce C. No safe haven. I: The effects of violence exposure on urban youth. *Journal of the American Academy of Child and Adolescent Psychiatry* 1999;38:359–367. [PubMed: 10199106]
- Selner-O'Hagan MB, Kindlon DJ, Buka SL, Raudenbush SW, Earls FJ. Assessing exposure to violence in urban youth. *Journal of Child Psychology and Psychiatry and Allied Disciplines* 1998;39:215–224.
- Sheehan K, DiCara J, LeBaily S, Christoffel K. Children's exposure to violence in an urban setting. *Archives of Pediatrics and Adolescent Medicine* 1997;151:502–504. [PubMed: 9158444]
- Skilbeck WM, Acosta FX, Yamamoto J, Evans LA. Self-reported psychiatric symptoms among Black, Hispanic, and White outpatients. *Journal of Clinical Psychology* 1984;40:1184–1189. [PubMed: 6490914]

- Sood B, Delaney-Black V, Covington C, Nordstrom-Klee B, Ager J, Templin T, et al. Prenatal alcohol exposure and childhood behavior at age 6 to 7 years: I. Dose-response effect. *Pediatrics* 2001;108:E34. [PubMed: 11483844]
- Thomson CC, Roberts K, Curran A, Ryan L, Wright RJ. Caretaker-child concordance for child's exposure to violence in a preadolescent inner-city population. *Archives of Pediatrics and Adolescent Medicine* 2002;156:818–823. [PubMed: 12144374]
- Trickett PK, Duran L, Horn JL. Community violence as it affects child development: Issues of definition. *Clinical Child and Family Psychology Review* 2003;6:223–236. [PubMed: 14719635]
- Ward CL, Flisher AJ, Zissis C, Muller M, Lombard C. Exposure to violence and its relationship to psychopathology in adolescents. *Injury Prevention* 2001;7:297–301. [PubMed: 11770655]
- Wilson DK, Kliewer W, Teasley N, Plybon L, Sica DA. Violence exposure, catecholamine excretion, and blood pressure nondipping status in african american male versus female adolescents. *Psychosomatic Medicine* 2002;64:906–915. [PubMed: 12461196]
- Wright RJ. Health effects of socially toxic neighborhoods: The violence and urban asthma paradigm. *Clinics in Chest Medicine* 2006;27:413–421. [PubMed: 16880051]

Table 1
 Mean Checklist of Child Distress Symptoms (CCDS) Scores by Demographics, Environmental, and Violence Exposure Indicators ($N = 162$)

	<i>n</i>	%	<i>M</i>
Demographics			
Child's age			
8–9 years	72	44.4	2.33
>9 years	90	55.6	2.35
Child's gender			
Male	82	51.0	2.29
Female	80	49.0	2.29
Child's race/ethnicity			
White	93	57.4	2.31
Hispanic/other race or ethnicity ^a	69	42.6	2.38
Mother's education level			
Some college	40	24.7	2.20
High school graduate/technical	66	40.7	2.30
Less high school/no graduate	56	34.6	2.49
Mother's marital status			
Married/living with someone	125	77.2	2.88
Separated/divorced/single	37	22.8	2.52
Other exposures			
Prenatal tobacco exposure			
No	116	71.6	2.38
Yes	46	28.4	2.24
Any alcohol during pregnancy			
No	83	51.2	2.32
Yes	79	48.8	2.36
Maternal depression (range) ^b			
1st Tertile (1.0)	68	42.0	2.28
2nd Tertile (1.2–1.33)	35	21.6	2.20
3rd Tertile (1.5–5.0)	59	36.4	2.49

^aIncludes 65 Hispanic, 3 African Americans, and 1 identified as other race/ethnicity.

^bTertiles do not break evenly due to the presence of ties.

Table 2

Frequency of Witnessing and Experiencing Discrete Violent Events and Event Circumstance Information: Child Self-Report ($N = 162$)

Violence questions	Child responses	
	<i>n</i>	%
Ever witnessed someone being shoved/kicked/punched	99	61.1
If so:		
Seen more than once	59	59.6
Know the victim	67	67.7
Know the perpetrator	56	56.6
Event happened at home	8	8.1
Ever been a victim of a shove/kick/punch	2	1.2
Ever witnessed a knife attack	9	5.6
If so:		
Seen more than once	3	33.3
Know the victim	4	44.4
Know the perpetrator	3	33.3
Event happened at home	0	
Ever been a victim of a knife attack	0	
Ever witnessed someone being shot	2	1.2
If so:		
Seen more than once	1	50.0
Know the victim	0	
Know the perpetrator	0	
Event happened at home	0	
Ever been victim of a shooting	0	
Ever heard gunshots	33	20.4
If so:		
Heard gunshots more than once	12	36.4
Event happened at home	15	45.5
Witnessed verbal abuse of caregiver	43	26.7

Table 3

Unadjusted and Adjusted Linear Regression Model of the Checklist of Children's Distress Symptoms (CCDS) scale ($N = 162$)

	CCDS Scale unadjusted		CCDS Scale Adjusted ^a	
	Effect estimate	SE	Effect estimate	SE
Continuous				
Sum ETV Scale per <i>SD</i> (5 items)	0.26*	0.05	0.26*	0.06
Rasch ETV model per <i>SD</i>	0.23*	0.05	0.24*	0.06
Categorical				
Sum ETV Scale (5 items)				
1st Tertile	Reference	—	Reference	—
2nd Tertile	0.18*	0.13	0.20*	0.14
3rd Tertile	0.60*	0.14	0.60*	0.14
Rasch ETV model				
1st Tertile	Reference	—	Reference	—
2nd Tertile	0.29*	0.13	0.34*	0.14
3rd Tertile	0.56*	0.13	0.62*	0.14

Note. ETV = Exposure to community violence; *SD* = standard deviation.

^a Adjusted for the child's age, gender, and race/ethnicity, mother's alcohol use during pregnancy, mother's marital status, prenatal tobacco exposure, maternal depression, and maternal education.

* $p < .05$.