Published in final edited form as:

J Health Soc Behav. 2015 March ; 56(1): 19–36. doi:10.1177/0022146514567576.

Children's Cognitive Performance and Selective Attention Following Recent Community Violence

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Abstract

Research has shown robust relationships between community violence and psychopathology, yet relatively little is known about the ways in which community violence may affect cognitive performance and attention. The present study estimates the effects of police-reported community violence on 359 urban children's performance on a computerized neuropsychological task using a quasi-experimental fixed-effects design. Living in close proximity to a recent violent crime predicted faster but marginally less accurate task performance for the full sample, evolutionarily adaptive patterns of “vigilant” attention (i.e., less attention toward positive stimuli, more attention toward negative stimuli) for children reporting low trait anxiety, and potentially maladaptive patterns of “avoidant” attention for highly anxious children. These results suggest that community violence can directly affect children's cognitive performance while also having different (and potentially orthogonal) impacts on attention deployment depending on children's levels of biobehavioral risk. Implications for mental health and sociological research are discussed.

Keywords

children; cognition; mental health; neighborhoods; violence

Decades of research have shown neighborhood characteristics such as poverty, segregation, and disorder to have important implications for the mental and physical development of young people, even when controlling for individual and family characteristics (Aneshensel and Sucoff 1996; Latkin and Curry 2003; Leventhal and Brooks-Gunn 2003; Ross and Mirowsky 2001). One of the primary mechanisms for explaining the relationship between community stratification and health is individuals' perceptions of safety and stability in their neighborhoods. In particular, researchers posit that children's experiences of their communities as unsafe or threatening are likely to affect their mental health through increasing their psychological stress, disrupting their processing of social information, and altering the ways in which they selectively engage with—or disengage from—their environments (Aneshensel and Sucoff 1996; Massey 2004; Ross and Mirowsky 2001). Despite this evidence, few studies have attempted to actually quantify these “biopsychosocial” links between community-level stressors and individual-level

neurocognitive processing or how they might vary for children showing different levels of biobehavioral risk.

In the present paper, we aim to merge the sociological and neurobiological literatures to explore the specific connections between violent crime in predominantly low-income Chicago communities and children's micro-level cognitive performance and engagement with social information. In particular, we examine whether children characterized by high levels of trait anxiety may be more at risk for the maladaptive cognitive sequelae of community violence than their low-anxiety peers. To measure children's outcomes, we use methodology drawn from cognitive neuroscience to capture (1) the speed and accuracy with which children are able to perform a simple computer task and (2) their attention toward or away from emotional images, both of which are linked to stress responsivity and mental health. In contrast to previous studies that have measured perceived and/or chronic crime exposure, we use objective police reports of recent community violence to estimate the effects of individual crimes on the immediate outcomes of children who may or may not be aware of their occurrence. In doing so, we are able to collectively quantify both the direct effects of victimization and witnessing estimated by previous studies and the indirect effects that violence may have on children via immediate social and emotional changes in communities and families.

BACKGROUND

Biopsychosocial Perspectives on Communities and Child Mental Health

Multiple decades of sociological research have revealed links between high levels of neighborhood socioeconomic disadvantage and low levels of safety, stability, and order in communities, each of which has important implications for the mental health of children and youth (Leventhal and Brooks-Gunn 2003; Sampson, Morenoff, and Gannon-Rowley 2002; Turner et al. 2013). In particular, a large body of research from clinical psychology, sociology, and medicine has outlined clear and robust relations between early exposure to community violence and increases in symptoms of aggression, depression, posttraumatic stress, and negative peer relationships (Fowler et al. 2009; Guerra, Huesmann, and Spindler 2003; Osofsky 1995; Richters and Martinez 1993; Stockdale et al. 2007). In addition to this work, several studies have found links between violence or disorder and more proximal, micro-level processes that underlie psychopathology, including children's reports of fear and stress (Margolin and Gordis 2000; Perkins and Taylor 1996; Ross and Mirowsky 2001).

Understanding the specific biopsychosocial processes that link social stratification and individual health is critical for building a better understanding of both the sources of social inequities and mechanisms for intervention (Anderson and Armstead 1995; Massey 2004). One promising but relatively untested hypothesis is that the stress of experiencing community violence may increase children's risk of psychological and behavioral difficulties by disrupting the ways that they attend to, make sense of, and react to social information (Margolin and Gordis 2000). Testing the associations between community violence and short-term disruptions in cognitive processing represents a promising new direction for research on sociology and behavioral health, as patterns of cognitive response following environmental threat tend to relate to children's development of coping skills and later

mental and behavioral health (Crick and Dodge 1994; Pine et al. 2005). Psychological research using laboratory paradigms, for example, has shown differential patterns of cognitive performance (i.e., the speed and accuracy with which individuals are able to take in, process, and respond to external information), selective attention (i.e., the ways that individuals volitionally deploy their attention toward or away from different types of environmental stimuli), and other neuropsychological indicators to be directly related to hyperactivity, inattention, aggression, depression, and withdrawal in both children and adults (e.g., Joormann, Talbot, and Gotlib 2007; Mayberg 2003; Nigg et al. 1999; Ochsner, Bunge, Gross, and Gabrieli 2006; Pine et al. 2005; Vasterling et al. 2002). Indeed, research has found evolutionarily maladaptive response patterns characterized by slow and/or error-prone cognitive performance and avoidance of threatening environmental stimuli to be related strongly with diagnosis of posttraumatic stress disorder and major depression (Pine et al. 2005; Tsourtos, Thompson, and Stough 2002).

Stress, Cognition, and Differential Susceptibility

Biomedical research has found that direct exposure to an environmental stressor like community violence results in immediate activation of neuroendocrine, attentional, and neurocognitive systems, which collectively aid in heightening vigilance, drawing attention toward threat, and taking quick action for self-protection (Davies et al. 2007). When paired with higher-order skills such as cognitive reappraisal and problem solving, such vigilant responses are also thought to help individuals build positive coping strategies to deal with future instances of stress (Herman-Stabl, Stemmler, and Petersen 1995; Roth and Cohen 1986; Taylor and Stanton 2007). At the same time, when this stress exposure occurs repeatedly or in the context of high social or biological vulnerability, children begin to experience a “wear and tear” process known as allostatic load. Allostatic load is characterized by less activation in brain regions like the prefrontal cortex that are responsible for reflective self-regulation and sustained attention and increased activation in regions of the limbic system that are associated with automated, emotion-related responses to threat (Arnsten 2000; Blair 2010; Davidson, Putnam, and Larson 2000; Ganzel, Morris, and Wethington 2010; McEwen 2004; McEwen and Stellar 1993).

One potential marker of allostatic load and general biobehavioral vulnerability is children's levels of trait anxiety, or their stable, intrinsic proneness to anxious thoughts and behaviors. Laboratory research suggests that individuals with high levels of trait anxiety are not only more likely to show elevated levels of stress in their daily lives but also to show differential reactivity following an acute stressor (Hubert and de Jong-Meyer 1992; van Eck et al. 1996). As a result, we hypothesize that highly anxious children may also exhibit more maladaptive cognitive and behavioral responses to stressful stimuli in their communities, including reduced cognitive capacity, avoidance of potentially threatening stimuli, withdrawal, and reduced coping (Evans 2003; Pine et al. 2005).

The Present Study

The present study builds on this body of literature to understand the ways that a recent incident of community violence affects two dimensions of children's cognitive processing: (1) their *cognitive performance*, or ability to quickly and accurately respond to informational

cues, and (2) their *selective attention*, or deployment of attention toward or away from emotional stimuli. We hypothesize that children living in close proximity to a recent violent crime will show significantly different patterns of cognitive performance and selective attention relative to their peers from the same communities who were assessed before or well after a violent crime took place (i.e., our “control” group). However, we also hypothesize that the specific patterns or “directions” of effects will differ for children with biobehavioral profiles characterized by high versus low levels of trait anxiety. Recent evidence suggests that children's intrinsic proneness to anxious thoughts or behaviors may change the extent to which they are differentially susceptible to the impact of their environments, particularly in terms of neuroendocrine and attentional functioning, by altering their levels of autonomic arousal and allostatic load (Blair and Raver 2012; Boyce and Ellis 2005; Obradovi et al. 2010; Pérez-Edgar et al. 2010). Given this, we hypothesize that violence will lead to maladaptive response patterns for children who report high levels of trait anxiety and adaptive response patterns for children who report low levels of trait anxiety.

In addition to contributing to the literature on environmental stress and child functioning, this study aims provide a methodological complement to past work examining neighborhood processes in observational datasets (Ellen, Mijanovich, and Dillman 2003). As with other neighborhood characteristics, the merits and drawbacks of using subjective versus objective measures of community violence have been hotly debated (Hill and Maimon 2013; McCoy 2013; Turner et al. 2013). Although children's own subjective reports of community violence are more likely than objective measures like crime rates to represent their individual experiences of victimization, they also have the potential to be directly conflated with children's cognitive functioning following violence exposure (e.g., where children experiencing avoidant responses may underreport experiences of violent crime and negative symptoms and children experiencing overly vigilant responses may overreport crime and negative outcomes). In addition, although the acute stress of witnessing violence or being directly victimized is likely to exert the largest influence on children's cognition and mental health, previous research has found that even hearing secondhand about community violence is associated with severe psychopathology such as posttraumatic stress disorder (Fowler et al. 2009). To address these concerns and complement the previous research in this area that has relied primarily on subjective measurement strategies, we make use of police reports of individual violent crimes geocoded for their proximity to each sample child's home as a proxy of individual violence exposure. Although this approach does not permit nuanced understanding of the specific mechanisms linking violent crime and child outcomes or understanding of relative impacts of different forms of exposure, it does allow us to provide an overall estimate that takes into account the ways that violence indirectly affects children—consciously or unconsciously—through more subtle but temporally linked changes in the environment (e.g., peers' emotional reactions, changes in parenting practices, increased police presence), even when the child is not directly victimized or aware that the violence has taken place.

Second, this study uses a novel radial distance fixed-effects approach to model the effects of violence. Much of the prior literature on neighborhood processes using observational data

has been subject to selection bias, where children experiencing high levels of community violent crime are more likely to experience a host of additional characteristics that also place them at risk for negative outcomes, including general neighborhood disorder/chaos, abuse within the family setting, poverty, and so forth. The use of fixed effects in the present study allows for an empirically sound estimate of the impact of community violence by comparing children living within the same radial distance from an incident of violent crime who were assessed immediately after the violence took place to those who were assessed either before the incident or well after. This type of approach capitalizes on a set of real-world exogenous environmental “shocks” (rather than artificially induced laboratory paradigms), greatly reduces issues of selection bias at the community and child level, and allows for a more precise understanding of the effects that distance and timing of violence may have on children's outcomes.

DATA AND METHODS

Sample

Data for the present study were taken from the Chicago School Readiness Project, which was a socioemotional intervention trial conducted in Head Start preschool programs in Chicago across two cohorts in 2004 and 2005. A total of 602 children (83% of those eligible) were originally recruited from 35 classrooms within 18 Head Start sites, which were chosen for participation based on their location in high-poverty, high-crime neighborhoods. (See Raver et al. 2008 for full inclusion criteria.) Data for the present study were collected in 2010 and 2011 as part of a comprehensive follow-up assessment. In total, this study includes 359 nine- and ten-year-old children, representing approximately 60% of the original sample. The remaining 243 children who were excluded from the present set of analyses were either unable to be contacted, had parents who did not provide consent for their participation, or had moved outside of the city of Chicago. Included and excluded children were not significantly different on the majority of their baseline demographic characteristics (e.g., family income, caregiver education, caregiver marital status, caregiver employment, immigrant status), though included children were more likely to be black versus white or Hispanic, $t(600) = 2.966, p = .01$. (See Table 1 for sample demographic characteristics for the six-year follow-up.)

Procedure

Child-level data were collected by a team of trained, ethnically diverse assessors from Chicago Public Schools. Child assessments took place during the school day in quiet locations away from classrooms. Demographic information was collected from caregivers in person or by phone in respondents' preferred language (English or Spanish). Records of violent crime were collected from the Chicago Police Department for the two-year time period during which participants from both cohorts were assessed. All procedures were approved by institutional review boards from New York University and Chicago Public Schools.

Measures

Violent Crime—Individual incidents of violent crime from the Chicago Police Department were downloaded from the City of Chicago's public use data portal. Children's home addresses and the locations of each individual crime were then geocoded using ArcGIS software (ESRI 2011). Density of violent crime and approximate child residential addresses can be found in Figure 1. Children whose residential addresses fell within a half mile of a particular crime were said to live within that crime's "community." Treatment status within these radial communities was then further defined based on the relative timing of the incident to the child's assessment: Children whose assessment fell within seven days after the violent event were considered to be in the "treatment" group, those whose assessment fell either before the crime or more than 14 days after the crime were considered to be in the "control" group. To provide a clear contrast between treatment and control conditions and avoid "spillover," we chose to exclude those children whose assessment fell between eight and 14 days following a violent crime from the already large control group under the assumption that they may still have been experiencing minimal but lingering effects of violent crime. Although somewhat arbitrary, these time cut-offs have been used successfully in previous studies and are based on previous empirical evidence suggesting that the acute effects of a recent violent crime on other forms of cognitive performance are linear, as they are strongest within one week but tend to diminish entirely by the end of two weeks (Sharkey 2010; Sharkey et al. 2012). Of the 1,049 violent crimes that took place within a half mile of participants' homes and seven days of their assessment, approximately 15% were categorized as assaults, 33% were batteries, 4% were criminal sexual assaults, 1% were homicides, 1% were offenses involving children, and 47% were robberies. Overall, 79% of these crimes took place in public settings (e.g., the street, sidewalks, public parks, restaurants and stores, school grounds, public transportation) and none (to our knowledge) took place in sample children's homes.

In addition to measuring violence within a half mile and seven days, three sets of analyses were run to test the sensitivity of results to alternative definitions of treatment. In particular, treatment status was redefined to include violent crime within a half mile and four days, within an eighth mile and seven days, and within an eighth mile and four days. (For all analyses, "control" status was defined as living within a half mile of the crime but not being assessed within 14 days of its occurrence.) This approach allowed us to test the hypothesis that effects of violence on child outcomes are largest when the violence takes place in close proximity to children's homes and just before assessment, as children, their families, and their peers are more likely to witness or indirectly experience the violence, feel threatened by it, and continue to show symptoms of exposure. Such an approach presented a trade-off in terms of statistical power, as there were far fewer violent events within an eighth mile of children's homes and four days of their assessments relative to those within a half mile and seven days (see Table 1 for sample sizes). To encourage a sufficiently large sample size to detect statistical significance, we focused on the results using the broadest definition of treatment (i.e., half mile, seven days) but also considered the magnitude of coefficients within a more tightly specified area and time frame. We also interpreted findings of marginal statistical significance (i.e., $p < .10$) across all definitions to understand overall patterns of effects in the context of limited power.

Cognitive Performance and Selective Attention—Children's cognitive performance and selective attention to emotional stimuli were assessed using a computerized dot probe task, which captured children's accuracy and latency (response time in milliseconds) in identifying the position of a target dot on a computer screen after a brief presentation of emotionally positive (e.g., smiling baby), negative (e.g., threatening dog, weapon), and/or neutral (e.g., book) images primarily taken from the International Affective Picture System (Lang, Bradley, and Cuthbert 1999). Whenever possible, stimuli relevant to urban, ethnic minority, elementary school-aged children were selected to increase salience across both emotional and nonemotional images.

Each trial began with a fixation cross for 500 milliseconds to draw children's attention to the center of the screen. Next, a pair of pictures—one neutral and the other either neutral, positive, or negative—appeared side by side on the screen for 250 milliseconds, followed immediately by a single “dot” (asterisk) on either the left or the right side of the screen. Children were instructed to indicate as quickly as possible using one of two computer keys whether the dot was on the right or the left side of the screen. If the child did not respond within 5,000 milliseconds, the next trial—beginning with a blank screen for 2,000 milliseconds—began automatically. The order of the 72 trials (including the position of the images and dot stimuli) was held constant across all participants.

Children's accuracy and response time for each trial were captured and aggregated using standard practice to calculate a set of six variables. Overall percentage of correct responses and average response latency across all valid trials were used as operationalized measures of basic *cognitive performance*. In addition, positive and negative facilitation and positive and negative disengagement were used as operationalized measures of *selective attention* based on field standards of the dot probe (e.g., see Koster et al. 2004). Specifically, facilitation represents children's attention toward emotional images and was calculated based on children's response time to emotionally congruent displays (i.e., those in which the dot appeared on the same side as the emotional stimulus). Higher, more positive scores on facilitation indices indicated children's greater attention toward emotional images. Disengagement targets children's speed to disengage their attention from emotional images and was assessed based on response time to emotionally incongruent displays (i.e., those in which the dot appeared on the opposite side from the emotional image). Higher, more positive scores on disengagement indices represented children's greater ability to disengage from emotional images. The calculations of both facilitation and disengagement trials included subtracting response time on congruent or incongruent trials from children's average response time on neutral/neutral trials to account for any individual differences in basic processing speed. Cronbach's alpha for the dot probe scores ranged from .91 to .95, indicating adequate internal consistency.

Child Trait Anxiety—Children's levels of trait anxiety were self-reported using the trait subscale of the State-trait Anxiety Index for Children (Spielberger et al. 1973). In contrast to the state subscale, which captures anxiety as a “fleeting emotional state” that may be affected by external forces, the trait subscale is designed to capture “relatively stable individual differences in anxiety proneness” that are rooted in personality (Spielberger et al. 1973). The trait subscale includes 20 questions about how children usually feel, such as, “I

worry about things that might happen,” “Unimportant thoughts run through my mind and bother me,” and “It is difficult for me to face my problems.” Children were asked to respond using response categories of “hardly ever” (1), “sometimes” (2), and “often” (3). The Cronbach's alpha on the trait subscale was .85, representing adequate inter-item reliability.

Although children's trait anxiety was measured on the same day as their dot probe assessments (i.e., after their treatment assignment), several factors mitigated concerns that their scores might be biased in ways that artificially inflated results. First, past studies using the trait subscale found high levels of test-retest reliability, suggesting the temporal stability of this construct is high (Barnes, Harp, and Jung 2002). Second, children were asked to report both on their trait anxiety (how they usually feel) and on their state anxiety (how they feel right now). By directly contrasting these two representations of anxiety, children may have been more likely to accurately represent their usual experiences of anxiety when reporting trait anxiety, rather than symptoms that may have resulted from their treatment group assignment. Third, bivariate correlations revealed that children's reports of trait anxiety do not appear to be related to either the total number of violent crimes occurring in children's census tracts in the previous year or their dot probe outcomes (range of $r_s = .00$ to $.07$, all n_s), and t -tests comparing children's acute exposure suggested that, if anything, children in the treatment group reported marginally lower levels of trait anxiety (mean = 1.85 , $SD = .37$) compared to control children (mean = 1.88 , $SD = .34$), $t(1737) = 1.64$, $p = .10$.

Covariates—A small set of child- and family-level covariates was also included in analyses to increase the precision of estimates. In particular, children's age (in months), gender (1 = boy), and race-ethnicity (1 = black) were included alongside a family risk score composed of an average of whether the child's caregiver was single, whether he or she was unemployed, whether he or she had less than a high school education, and whether the family income-to-needs ratio placed the household below the poverty line. This composite was used rather than individual items to account for socioeconomic and demographic risk while conserving statistical power (Burchinal et al. 2000).

Analytic Plan

The following regression model with radial community fixed effects was used to conceptualize the impact of violence exposure on children's outcomes:

$$Y_{ij} = b_0 + b_1 Treat_{ij} + b_2 Anxiety_i + b_3 \Sigma Covar_i + b_7 \Sigma FE_i + e_{ij}$$

where Y_{ij} was equal to the respective outcome variable for child i following crime j (making the unit of analysis the “person-crime”); b_0 indicated the overall intercept; b_1 represented the relationship between treatment and the outcome; $Treat_{ij}$ represented a dummy indicator of ‘1’ if child i lived within a half mile and was assessed within seven days of violent crime j and ‘0’ if child i lived within a half mile of violent crime j but was assessed before or more than 14 days after violent crime j took place; $Anxiety_i$ represented child i 's trait anxiety score; $\Sigma Covar_i$ represented child i 's age, gender, race-ethnicity, and family risk score; ΣFE_i

represented a set of n fixed-effect dummy indicators for whether child i 's home address was within the specified radius of each crime; and e represented residual error. This same model was repeated for each dot probe outcome and for each of the three alternative specifications of treatment. Across all analyses, standard errors were adjusted to account for the fact that children were included more than once in the dataset when their home addresses fell within the radii of multiple violent events. On average, children were included in the dataset 7.90 times (range = 1 to 26). To test whether the relationship between violent crime and outcomes differed based on children's trait anxiety, the above regression model was reanalyzed to include an interaction term between children's trait anxiety (which was centered for analysis) and their treatment status.

The above model provided internally valid estimates in two primary ways. First, the use of a radial community fixed-effects model allowed us to estimate a within-community treatment effect by comparing treatment and control children from the area immediately surrounding the crime. This approach eliminated variation in or “controls for” all time-invariant demographic or structural aspects of communities that may be related to both children's violence exposure and outcomes (e.g., neighborhood poverty, local school quality). Second, due to the nature of data collection, it was assumed that the timing of violent events in children's communities *relative to* the timing of their assessments was randomly distributed across the sample. As a result, any child- and family-level confounding characteristics (e.g., family poverty, parental monitoring) were also randomly distributed across treatment status. Together, these features reduced selection bias at both the community and individual/family level, creating nonbiased, causal estimates of the impact of acute violence on children's outcomes.

RESULTS

Results of our primary analyses examining main effects of treatment within a half-mile radius and a seven-day time period can be found in Panel A of Table 2. These results suggest that children living within a half mile of a violent crime that took place within the week leading up to their assessment showed significantly faster, $b = -17.18$, $SE = 6.10$, $p = .01$, and marginally less accurate, $b = -.002$, $SE = .001$, $p = .10$, performance on the dot probe task relative to children from the same communities who were not assessed recently after a crime. There were no detectable overall differences in selective attention toward or away from emotional stimuli based on treatment status for the full sample.

Results exploring the consistency of the relationship between the primary definition of treatment and all outcomes for children with different levels of trait anxiety can be found in Panel A of Table 3. These analyses revealed detectable differences for children's average response time, $b = 33.49$, $SE = 14.36$, $p = .05$, and positive facilitation, $b = 14.69$, $SE = 7.08$, $p = .05$, but not for other child outcomes. Tests of simple slopes of the effect of treatment status on outcomes for children with high (one standard deviation above the mean) and low (one standard deviation below the mean) trait anxiety were conducted to understand the nature of these interactions. These results revealed that for anxious children, being in the treatment group was predictive of only slightly faster response time relative to being in the control group, $b = -4.65$, $SE = 7.85$, $p = ns$. For low-anxiety children, however, treatment

status was predictive of significantly faster response time relative to control status, $b = -28.33$, $SE = 7.96$, $p = .01$ (see Figure 2). For positive facilitation, post hoc tests showed that for highly anxious children, treatment status was predictive of *more* attention toward positive images, $b = 7.50$, $SE = 3.89$, $p = .10$, whereas for low-anxiety children, treatment status was associated with *less* attention toward positive stimuli, $b = -2.89$, $SE = 3.61$, $p = ns$ (see Figure 3).

In addition to examining violence within a half-mile radius and seven-day time period, we evaluated whether the magnitude of effects would be larger when looking at children living even closer to the crime (i.e., within an eighth of a mile) who had been assessed even more recently (i.e., within four days of the violent event). For results of the main models for each alternative definition of treatment, see Panels B through D of Table 2, and for a summary of the interactions between anxiety and alternative treatment definitions, see Panels B through D of Table 3. Although several results (e.g., main effects of violence on accuracy) were no longer significant within more constrained definitions of treatment status and limited power, patterns of these findings were largely consistent with our hypotheses. In particular, the coefficient for the interaction term between anxiety and treatment status predicting negative facilitation was statistically significant for children living within an eighth of a mile of the crime who had been assessed within four days of the crime, $b = -42.74$, $SE = 20.86$, $p = .05$. These results showed patterns that were opposite of those found for positive facilitation scores, where for high-anxiety children, treatment status was predictive of *less* facilitation toward negative stimuli relative to control status, $b = -9.28$, $SE = 14.56$, $p = ns$, and for low-anxiety children, treatment was associated with *greater* attention toward negative stimuli, $b = 20.93$, $SE = 9.99$, $p = .05$ (see Figure 4).

DISCUSSION

The present study tested the relationships between violent crime within low-income, urban children's residential communities and their subsequent performance on a neuropsychological assessment (administered via a computer task) tapping their cognitive performance and selective attention. In testing these relationships, we aim to shed light on previous research showing strong links between social stratification and mental health by explaining the ways that violence—a strong correlate of socioeconomic disadvantage—may be linked to cognitive processing—a micro-level predictor of mental health. Results of this study suggest that community violence does, in fact, have direct implications for children's cognitive processing in ways that may place them at significant risk of longer-term psychological difficulty.

Specifically, we find that children whose cognitive performance was assessed within one week after a violent event occurred within a half mile of their home were faster and marginally less accurate in locating the position of a dot on a computer screen than their peers who came from the same community but who were assessed either before or well after a violent crime took place. These results suggest that the physiological and mental demands of dealing with an environmental stressor may reduce children's cognitive capacity to focus on a simple task and instead lead to more automatic (i.e., faster but error-prone) task performance. Such impulsive response patterns are in line with clinical research showing

short-term impairments in information processing, effortful control, and other aspects of higher-order self-regulation following trauma (Brandes et al. 2002; Nader and Fairbanks 1994) and may help to explain previously observed reductions in children's academic performance and regulatory capacity following exposure to homicide (Sharkey 2010; Sharkey et al. 2012). Future research that includes longitudinal data on psychological and behavioral functioning is needed to understand the degree to which the short-term effects of violent crime on cognitive performance may lead to more stable deficits in mental/behavioral health over time.

Importantly, the observed relationship between community violence and average response time was driven primarily by children reporting low trait anxiety (a proxy for low levels of biobehavioral arousal), whereas highly anxious children maintained relatively consistent response time regardless of violence. Differential response patterns for children characterized by varying levels of anxiety were also observed when testing children's selective attention outcomes. Children with low levels of trait anxiety who were assessed immediately after a nearby violent event showed vigilant response patterns, including increased attention toward negative images and decreased attention toward positive images compared to their peers who were assessed before or well after a crime took place. Highly anxious children, on the other hand, exhibited response patterns more associated with avoidance, including decreased attention toward negative images and increased attention toward positive images following a crime. Consistent across analyses, the magnitude of the impact of violence on child outcomes was largest when the violent crime took place within a short distance from children's homes and within a short time period prior to assessment.

Collectively, these results highlight the complexity of the relationships between neighborhood characteristics, individual traits, and child functioning. First, these results provide partial support for the well-known theory that the impacts of stressful events on children's functioning tend to be largest when the sources of threat are physically proximal to the child (Cicchetti and Lynch 1993). At the same time, our ability to assess the relative effects of "psychological proximity" (e.g., experiences of direct victimization vs. indirect exposure to changes in parenting behavior) is limited by virtue of the fact that we do not include children's subjective experiences of violence in this study. Second, these findings extend work from the clinical literature showing that individuals' patterns of selective attention following stressful events differ depending on the valence of the emotional cue, with increases in attention toward negative stimuli being directly associated with decreases in attention toward positive stimuli and vice versa (McCabe and Gotlib 1995).

Third, these results have important implications for the ways that sociological processes might confer positive versus negative outcomes for different subgroups of children and may help to explain why certain children appear more resilient to community violence than others. In particular, research has shown that attention toward threatening stimuli in the environment is not only biologically and evolutionarily normative immediately following a stressful event but also critical for children's development of enduring coping strategies, including the ability to identify, appraise, process, and adapt to future social circumstances (see Taylor and Stanton 2007 for a review). The patterns of faster response time, attention toward negative stimuli, and avoidance of positive stimuli shown in this study by low-

anxiety children following a crime are in line with this overall pattern of vigilance and may represent low-anxiety children's ability to appropriately deploy cognitive resources to cope with the immediate effects of stress.

Children reporting high levels of anxiety, on the other hand, showed patterns of avoidance that may indicate deficits in coping and potentially increased risk for later mental health problems. Past research has found that highly anxious children show particularly high levels of day-to-day parasympathetic arousal and psychological load (Thayer, Friedman, and Borkovec 1996). Consistent with a diathesis-stress or allostatic load framework, the additional stress resulting from a violent crime's taking place in their community may have exacerbated this arousal, making it difficult for highly anxious children to appropriately deploy the strategies necessary to draw attention to immediate threat in productive ways. Although these avoidant responses may have allowed deployment of the basic cognitive resources necessary to complete the relatively simple dot probe task, such patterns of avoidance may prohibit anxious children from using higher-order reflective processing skills (e.g., reappraisal, problem solving) that are necessary for dealing with more cognitively demanding tasks not measured in the present study and building reliable coping skills.

The development of healthy stress response systems, cognitive processing, and coping strategies is especially important for individuals who live in environments where exposure to violence and other community and family stressors is common and risk for negative outcomes is high. Indeed, longitudinal research has shown that low-income, violence-exposed women who attended toward negative stimuli and used proactive coping strategies had significantly higher rates of mental health service receipt and reduced impacts of trauma than those who did not utilize such strategies (Rayburn et al. 2005). Future research using biopsychosocial frameworks is needed for exploring the best ways for promoting individual resilience to social processes and to understand the degree to which the heterogeneity in effects observed in the present study can also be generalized to other sociological phenomena (e.g., overall levels of disorder, concentrated poverty) and long-term outcomes for children (e.g., direct measures of mental health, academic achievement/attainment).

Limitations and Future Directions

Although this study has numerous conceptual and methodological strengths, it is not without limitations. First, although this work provides an important complement to previous research examining individuals' self-reported experiences with violence (in which relationships between reported exposure and negative outcomes may be artificially inflated due to endogeneity bias), the use of objective, police department reports of crimes in the present study limits the conclusions that can be made in terms of children's actual experiences of violent events in their communities. "Treated" children in the present sample likely did not hear about or otherwise experience many (if not most) of the violent events that occurred in their communities. Although this approach allows us to capture indirect pathways between community violence and child outcomes (e.g., through changes in the actions and emotions of peers and adults around the child), it does not allow us to explore the relative influence of different forms or types of exposure with different levels of individual salience (Hill and Maimon 2013). As such, the observed relationships between violence and child outcomes in

the current study may represent an underestimate of the ways that direct or otherwise salient exposure affects children cognitively and emotionally. In addition, it is impossible to know whether children's actual experiences with violence were evenly distributed across the sample. Of particular concern is that caregivers of highly anxious children may have been more likely to try to protect them from experiencing or knowing about the crime or that the parents of anxious children may have reacted differently to the crime because they were more likely to be anxious themselves. Because of this, we cannot necessarily know that it is the child's biobehavioral profile of anxiety, per se, that is driving differences in outcome patterns or whether it may be an unmeasured, related characteristic that underlies these findings.

Furthermore, several factors may have led to misclassification of control group children, including the fact that many violent events (including community-based incidents as well as domestic abuse, bullying) are not reported to the police and were therefore not accounted for in the present study. Similarly, because only 44% of children attended school within a half mile of their home, a large portion of the sample may have experienced violence outside of their communities, either on their way to school or during school hours. Although we find no evidence that distance from school (a proxy for increased probability of exposure outside of the residential neighborhood) was related to other study characteristics (e.g., treatment classification, number of times included in the file), it is important to note that unmeasured sources of violence exposure may have resulted in misclassification and/or biased results in unknowable ways. Future research using larger samples and additional measures of violence will be useful in teasing apart potential sources of misclassification and alternative representations of treatment status.

Finally, this study provides information on the cognitive and attentional processing of a particularly vulnerable group of urban children from some of the most dangerous communities in the country (see Figure 1) who had remained in the city of Chicago for six years after attending Head Start. It is unknown how violence exposure might affect children who lived outside of these particular contexts or even how it might affect the 40% of the original sample who were not able to be tracked longitudinally. The high levels of violence faced by this sample may also have important implications for interpreting the relationships between acute violence and children's outcomes, as even those children who had not been recently or proximally exposed to a violent crime have likely been exposed to violence at other points in their past. For this reason, the pretreatment levels of arousal and psychological coping techniques of this sample may be fundamentally different from those in less violent communities, and results must be interpreted in this light. Future research that examines violence and stress exposure in less disadvantaged contexts, that combines objective and subjective reports of crime and other community characteristics, that compares different types of violent crime (e.g., more overtly threatening crimes like public homicide vs. less salient crimes like burglary), that includes measures of violence in children's residential and school communities (as well as homes and schools themselves), and that examines the impact of chronic exposure over long periods of time can help to tease apart these processes and help us better understand the specific ways that violence exposure relates to child functioning.

Implications and Conclusions

Together, the results of this study provide empirical depth to existing biopsychosocial theories of stratification, stress, psychological functioning, and individual health (e.g., Massey 2004). This study provides novel evidence on the ways that violent crime may disrupt individual cognitive processing and perpetuate inequities. In particular, the results of this study revealed that a recent violent crime in children's residential communities leads to more impulsive and automatic (i.e., faster but less accurate) task performance, which may have important implications for their mental health as well as their ability to focus in school and perform on academic assessments. For anxious children in particular, exposure to violent crime was also associated with patterns of avoidant attention that may have negative consequences for their ability to appropriately identify, appraise, and process future threat cues. As a result, these anxious children may be less likely to cope with future incidences of stress, leading to higher rates of psychopathology and increased conflict with peers and adults. Nonanxious children, on the other hand, showed patterns of vigilant attention consistent with normative short-term responses to stress, which are predictive of increased coping, lower mental health problems, and more proactive methods of conflict resolution.

In addition to their significance for explaining how violence may affect children directly, these results provide alternative methodological approaches for studying sociological processes and individual health. First, anxious and nonanxious children's orthogonal responses to acute environmental stress "cancelled each other out" when examining the effects of violence in the full sample. In the future, researchers must be careful to include tests of subgroup differences based on nontraditional moderators (e.g., psychological characteristics) to better understand the degree to which some children may be more or less resilient to social adversity. Second, this study is one of the first to demonstrate the feasibility of linking micro-level changes in children's cognitive processes with an objectively measured, real-world environmental stressor using an internally valid analytic approach. Future studies should attempt, whenever possible, to combine subjective measures with similarly creative measurement and analytic strategies to mitigate concerns over reporter and selection bias in observational data.

From an applied perspective, the present study provides important information to practitioners, educators, and policy makers aiming to improve the psychological and social resilience of children embedded in violent contexts. In addition to a need for systemic efforts to reduce violent crime in the first place (e.g., improving policing strategies, reducing social stratification), these results support the use of early intervention to help children to deal with the acute impacts of a violent event (e.g., New Haven's Child Development Community Policing program) as well as the implementation of preventative programs to promote cognitive and emotional coping skills for children living in high-risk contexts. Many such programs have been shown to be effective in building children's capacity for emotion regulation, reducing impulsive responses, changing perceptions of hostility and threat, and providing critical environmental buffers and supports when they are needed the most. To be most beneficial, these strategies should be sensitive to individual children's biopsychosocial needs, for example, by helping particularly anxious children to explore their thoughts and

emotions in the context of a safe and supportive environment (e.g., a clinician's or school counselor's office) or by addressing other social stressors in the home and school context.

Acknowledgments

FUNDING The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R305B080019 to New York University. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

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Figure 1.
Approximate Location^a of Participant Homes and Total Violent Crimes by 2000 Census Tract.

^aAlthough precise address location was used for actual analyses, dots in Figure 1 represent a random location in children's residential census tract to maintain confidentiality.

Figure 2.

Predicted Means for Latency and 95% Confidence Intervals (CIs) across All Dot Probe Trials Based on Children's Treatment Status (Violent Crime within Half Mile, Seven Days) and Trait Anxiety.

Note: Low anxiety represented as value of anxiety that is 1 standard deviation (*SD*) below sample mean; high anxiety represented as value of anxiety that is 1 *SD* above sample mean; although 95% CIs are overlapping, the interaction between treatment status and anxiety (measured continuously) is statistically significant at $p < .05$. The simple slope of the effect of treatment status for low-anxiety children is also statistically significant at $p < .01$. See Cumming and Finch (2005) for additional information regarding the interpretation of graphical CIs and statistical significance.

Figure 3.

Predicted Means for Positive Facilitation (in Milliseconds) and 95% Confidence Intervals (CIs) Based on Children's Treatment Status (Violent Crime within a Half Mile, Seven Days) and Trait Anxiety.

Note: Low anxiety represented as value of anxiety that is 1 standard deviation (*SD*) below sample mean; high anxiety represented as value of anxiety that is 1 *SD* above sample mean; although 95% CIs are overlapping, the interaction between treatment status and anxiety (measured continuously) is statistically significant at $p < .05$. The simple slope of the effect of treatment status for high-anxiety children is also statistically significant at $p < .10$. See Cumming and Finch (2005) for additional information regarding the interpretation of graphical CIs and statistical significance.

Figure 4.

Predicted Means for Negative Facilitation (in Milliseconds) and 95% Confidence Intervals (CIs) Based on Children's Treatment (Violent Crime within an Eighth Mile, Four Days) and Trait Anxiety.

Note: Low anxiety represented as value of anxiety that is 1 standard deviation (*SD*) below sample mean; high anxiety represented as value of anxiety that is 1 *SD* above sample mean; although 95% CIs are overlapping, the interaction between treatment status and anxiety (measured continuously) is statistically significant at $p < .05$. The simple slope of the effect of treatment status for low-anxiety children is also statistically significant at $p < .05$. See Cumming and Finch (2005) for additional information regarding the interpretation of graphical CIs and statistical significance.

Table 1

Descriptive Statistics for Sample Demographics, Dot Probe Outcome Scores, and Treatment Status ($N = 359$ Children).

	Total N	Mean or %	SD	Range
<i>Child</i>				
Anxiety	359	1.85	.36	1–2.65
Cohort 1	359	52.36%		
Gender (boy)	359	46.52%		
Age (in years)	359	9.89	.71	8–12
Race-ethnicity (black)	359	70.47%		
Race-ethnicity (Hispanic)	359	24.23%		
Race-ethnicity (white or other)	359	5.29%		
Family risk score	359	.37	.28	0–1
Accuracy (mean correct)	345	.98	.04	.74–1.00
Latency (mean response time, milliseconds)	346	559.62	115.76	345.12–1,037.61
Positive facilitation	328	–23.36	50.50	–240.43–127.50
Negative facilitation	327	–22.68	46.87	–188.33–152.46
Positive disengagement	334	–16.23	51.53	–172.79–153.92
Negative disengagement	329	–11.22	48.93	–188.40–156.33

	Total N	# Treatment	# Control	% Treatment
<i>Radial Distance</i>				
Eighth mile, four days	2,896	61	2,835	2.11%
Eighth mile, seven days	2,929	94	2,835	3.21%
Half mile, four days	3,448	613	2,835	17.78%
Half mile, seven days	3,884	1,049	2,835	27.01%

Note: Because children's homes can be located within a radial distance from multiple violent events (and are therefore counted multiple times in these analyses), the total N for the radial distance definitions of communities is greater than the number of children in the full sample. The number of control children is consistent for each definition of treatment and included only children living within a half mile of the crime who were assessed before or more than 14 days after the crime took place.

Table 2

Results of Radial Community Fixed-effects Models Examining the Main Effect of Each Definition of “Treatment” for Each Dot Probe Outcome.

% Correct			Mean Latency			Positive Facilitation			Negative Facilitation			Positive Disengagement			Negative Disengagement		
b	SE	p	b	SE	p	b	SE	p	b	SE	p	b	SE	p	b	SE	p
A) Treatment within one-half mile and seven days																	
Treatment	-.002	.001	*	-17.18	6.10	***	1.97	2.76	1.13	2.85		-.01	3.46		-.17	3.29	
Anxiety	-.008	.006		17.31	24.53		2.27	10.95	2.08	12.00		2.16	12.06		8.05	10.53	
Child gender (boy)	-.004	.005		-28.77	14.55	**	-2.62	7.86	-2.69	7.87		2.05	9.03		-3.81	8.57	
Child age (months)	.007	.003	***	-28.43	11.54	***	6.44	6.04	-.49	5.60		-.38	6.62		6.56	5.75	
Child race (black)	-.015	.007	**	-15.11	21.02		8.77	10.61	6.24	10.41		.60	16.54		12.96	13.24	
Family risk score	.008	.008		6.65	25.87		35.5	14.63	3.93	13.40	**	-8.68	15.36		-7.94	13.05	
Constant	.938	.031	***	836.85	139.81	***	-108.08	64.62	-27.26	61.81	*	-14.20	73.29		-95.18	64.12	
B) Treatment within one-half mile and four days																	
Treatment	-.006	.003	***	-16.49	7.58	**	.79	3.53	.48	3.55		.49	4.21		-.91	4.29	
Anxiety	-.008	.007		13.84	24.92		.79	11.25	3.39	12.42		1.59	12.10		7.59	11.10	
Child gender (boy)	-.004	.005		-27.61	15.10	*	-2.01	8.21	-2.80	8.11		.93	9.21		-4.15	9.14	
Child age (months)	.006	.003	**	-28.44	11.67	**	6.42	6.32	-.36	5.71		-.66	6.88		7.19	6.02	
Child race (black)	-.014	.007	**	-9.15	21.66		8.88	10.94	5.14	10.11		-2.85	16.98		14.24	13.32	
Family risk score	.007	.008		3.90	27.17		36.53	15.55	2.20	14.14	**	10.18	16.07		-6.47	14.96	
Constant	.944	.032	***	839.24	141.38	***	-105.56	67.53	-29.79	63.18		-6.75	76.89		-102.29	67.43	
C) Treatment within one-eighth mile and seven days																	
Treatment	.002	.004		-28.36	15.42	*	-2.77	8.07	-.10	8.14		1.81	9.25		5.79	8.50	
Anxiety	-.009	.007		6.24	24.63		-2.08	11.81	4.48	12.69		1.38	12.98		7.81	11.38	
Child gender (boy)	-.004	.005		-27.49	15.88	*	-2.04	8.65	-3.34	8.32		-.29	9.68		-3.01	9.54	
Child age (months)	.006	.003	**	-28.11	11.78	**	5.96	6.52	-.16	5.66		-2.12	7.32		7.87	6.20	
Child race (black)	-.013	.006	**	-10.23	23.78		5.50	11.02	3.31	9.47		-10.05	18.06		16.58	13.74	
Family risk score	.006	.009		6.89	28.13		35.58	16.55	-.28	14.94	**	-10.28	16.72		-5.27	15.71	
Constant	.948	.031	***	849.34	141.23	***	-92.08	69.60	-31.13	63.44		14.05	81.67		-112.13	70.23	
D) Treatment within one-eighth mile and four days																	
Treatment	-.001	.004		-35.37	18.60	*	-.86	9.53	8.58	10.03		10.29	8.99		3.05	8.92	
Anxiety	-.009	.006		6.02	24.74		-2.02	11.83	4.70	12.77		1.42	12.88		8.13	11.43	

	% Correct			Mean Latency			Positive Facilitation			Negative Facilitation			Positive Disengagement			Negative Disengagement		
	b	SE	p	b	SE	p	b	SE	p	b	SE	p	b	SE	p	b	SE	p
Child gender (boy)	-.004	.005		-27.42	15.99	*	-1.69	8.69		-3.09	8.37		-.31	9.67		-2.68	9.56	
Child age (months)	.006	.003	**	-28.08	11.82	**	6.14	6.49		-.20	5.69		-1.67	7.27		8.07	6.23	
Child race (black)	-.024	.007	**	-10.81	23.75		5.90	11.04		3.50	9.49		-9.20	17.74		16.38	13.73	
Family risk score	.006	.009		6.94	28.28		35.20	16.66	**	-.60	15.07		-10.91	16.68		-5.24	15.77	
Constant	.948	.031	***	850.15	141.90	***	-94.27	69.37		-31.35	63.77		9.25	81.09		-114.68	70.52	

Note: All standard errors are robust to account for instances when children were included in analyses more than once.

* $p < .10$.

** $p < .05$.

*** $p < .01$.

Table 3

Results of Radial Community Fixed-effects Models Examining the Interaction between Each Definition of “Treatment” and Child Anxiety for Each Dot Probe Outcome.

	% Correct			Mean Latency			Positive Facilitation			Negative Facilitation			Positive Disengagement			Negative Disengagement		
	b	SE	p	b	SE	p	b	SE	p	b	SE	p	b	SE	p	b	SE	p
A) Treatment within one-half mile and seven days																		
Treatment	-.002	.001	*	-16.49	6.06	***	2.31	2.80		.90	2.83		.08	3.48		-.22	3.29	
Anxiety	-.009	.007		9.30	24.76		-1.19	11.26		4.52	12.53		1.05	12.47		8.42	11.02	
Child gender (boy)	-.004	.005		-28.69	14.54	**	-2.59	7.84		-2.76	7.85		2.06	9.04		-3.81	8.57	
Child age (months)	.007	.003	***	-28.34	11.53	**	6.50	6.03		-.53	5.60		-.36	6.61		6.55	5.75	
Child race (black)	-.016	.007	**	-15.44	21.04		8.66	10.63		6.30	10.42		.55	16.55		12.97	13.24	
Family risk score	.008	.008		6.42	25.84		35.38	14.63	**	3.99	13.37		-8.70	15.37		-7.93	14.05	
Anxiety × Treatment	.002	.005		33.49	14.36	**	14.69	7.08	**	-10.74	8.12		4.71	7.76		-1.56	7.97	
Constant	.922	.026	***	868.61	117.12	***	-104.33	60.34	*	-22.99	55.93		-10.28	66.68		-80.05	60.78	
B) Treatment within one-half mile and four days																		
Treatment	-.006	.003	***	-15.61	7.59	**	1.27	3.59		.09	3.60		.51	4.17		-.93	4.28	
Anxiety	-.008	.007		8.49	25.03		-2.07	11.41		5.57	12.78		1.44	12.80		7.71	11.33	
Child gender (boy)	-.004	.005		-27.71	15.09	*	-2.10	8.19		-2.80	8.09		.93	9.21		-4.15	9.15	
Child age (months)	.006	.003	**	-28.44	11.67	**	6.43	6.30		-.37	5.69		-.66	6.88		7.19	6.02	
Child race (black)	-.014	.007	**	-9.28	21.64		8.83	10.94		5.14	10.14		-2.85	16.99		14.24	13.32	
Family risk score	.007	.008		3.65	27.19		36.36	15.58	**	2.32	14.12		-10.19	16.08		-6.46	14.97	
Anxiety × Treatment	.004	.007		34.70	18.42	*	19.10	9.15	**	-15.20	9.31	*	1.03	11.27		-.81	11.04	
Constant	.929	.026	***	865.46	118.66	***	-104.05	63.07	**	-23.41	57.06		-3.76	69.64		-88.09	63.97	
C) Treatment within one-eighth mile and seven days																		
Treatment	.002	.005		-25.88	15.55	*	-1.49	8.43		-1.73	8.21		1.68	9.34		5.74	8.32	
Anxiety	-.008	.007		4.70	25.05		-2.98	11.86		5.60	12.91		1.48	13.07		7.84	11.57	
Child gender (boy)	-.004	.005		-27.32	15.88	*	-1.95	8.66		-3.46	8.32		-.30	9.68		-3.01	9.53	
Child age (months)	.006	.003	**	-28.10	11.79	**	5.96	6.51		-.14	5.65		-2.12	7.32		7.87	6.20	
Child race (black)	-.014	.007	**	-9.92	23.78		5.68	11.02		3.00	9.48		-10.07	16.73		16.57	13.76	
Family risk score	.006	.009		6.62	28.18		35.38	16.60	**	-.05	14.94		10.26	16.73		-5.26	15.73	
Anxiety × Treatment	-.013	.015		46.48	34.48		25.91	19.76		-32.51	19.72	*	-2.94	20.10		-.91	22.29	

	% Correct			Mean Latency			Positive Facilitation			Negative Facilitation			Positive Disengagement			Negative Disengagement		
	b	SE	p	b	SE	p	b	SE	p	b	SE	p	b	SE	p	b	SE	p
Constant	.931	.026	***	860.79	119.46	***	-.96.09	65.18		-.22.80	56.91		16.65	73.64		-.97.52	66.52	
<i>D) Treatment within one-eighth mile and four days</i>																		
Treatment	-.001	.004		-.31.87	18.99	*	1.68	10.30		5.83	10.08		9.63	9.05		3.20	8.72	
Anxiety	-.008	.007		4.76	25.07		-.3.03	11.83		5.77	12.91		1.68	13.04		8.07	11.58	
Child gender (boy)	-.004	.005		-.27.48	16.00	*	-.1.75	8.68		-.3.06	8.36		-.29	9.67		-.2.68	9.59	
Child age (months)	.006	.003	**	-.28.04	11.83	**	6.16	6.48		-.19	5.68		-.1.67	7.28		8.07	6.23	
Child race (black)	-.013	.007	**	-.10.57	23.75		6.08	11.04		3.21	9.51		-.9.25	17.75		16.39	13.74	
Family risk score	.006	.009		6.58	28.34		34.89	16.72	**	-.28	15.06		-.10.84	16.69		-.5.26	15.80	
Anxiety × Treatment	-.011	.014		52.21	43.91		40.23	24.69	*	-.42.74	20.86	**	-.10.37	21.75		2.20	21.75	
Constant	.932	.026	***	861.07	119.95	***	-.98.22	64.79		-.22.54	57.17		11.95	73.11		-.99.48	66.76	

Note: Although not shown, all models include main effects for anxiety, the respective definition of treatment, and all covariates. Standard errors are robust to account for instances when children were included in analyses more than once.

*
p .10.

**
p .05.

p .01.