Attention Problems Mediate the Association Between Severity of Physical Abuse and Aggressive Behavior in a Sample of Maltreated Early Adolescents

Edward F. Garrido, Heather N. Taussig, Sara E. Culhane and Tali Raviv

The Journal of Early Adolescence 2011 31: 714 originally published online 11 June 2010

DOI: 10.1177/0272431610373102

Journal of Early Adolescence
31(5) 714–734

DOI: 10.1177/0272431610373102
http://jea.sagepub.com

Attention Problems Mediate the Association Between Severity of Physical Abuse and Aggressive Behavior in a Sample of Maltreated Early Adolescents

Edward F. Garrido[1], Heather N. Taussig[1], Sara E. Culhane[1], and Tali Raviv[2]

Abstract

Empirical evidence has accumulated documenting an association between childhood physical abuse and aggressive behavior. Relatively fewer studies have explored possible mediating mechanisms that may explain this association. The purpose of the current study was to examine whether caregiver- and youth-reported attention problems mediate the association between physical abuse severity and aggressive behavior. A sample of 240 maltreated early adolescents (ages 9-11) and their caregivers were interviewed within 14 months of being removed from the home. Results from multiple regression analyses indicated that caregiver- and youth-reported attention problems were partial mediators of the association between physical abuse severity and aggressive behavior. These associations were significant even after

[1]University of Colorado Denver School of Medicine
[2]Children's Memorial Hospital, Chicago and Northwestern University, Feinberg School of Medicine

Corresponding Author:
Edward F. Garrido, The Gary Pavilion at the Children's Hospital,
Anschutz Medical Campus, 13123 E. 16th Ave., B390, Aurora, CO 80045
Email: garrido.edward@tchden.org

controlling for children's intellectual functioning, sex, age, and severity of other maltreatment types. Possible explanations for the detrimental impact of physical abuse on behavior are discussed, along with the implications of the current study's results for interventions aimed at reducing early adolescent aggressive behavior.

Keywords

maltreatment, abuse severity, aggressive behavior, attention problems

A considerable body of literature documents a strong link between childhood physical abuse and aggressive behavior in early and middle adolescence (Lynch & Cicchetti, 1998; Margolin & Gordis, 2000; Mayfield & Widom, 1996). Physically abused children are rated as more verbally and physically aggressive than nonphysically abused children by a number of observers, including peers (Manly, Cicchetti, & Barnett, 1994; Salzinger, Feldman, Hammer, & Rosario, 1993), teachers (Haskett & Kistener, 1991), and parents (Trickett, 1993) and are more likely to be diagnosed with disruptive behavior disorders (Kaplan et al, 1998; McCabe, Lucchini, Hough, Yeh, & Hazen, 2005). Childhood physical abuse is associated with aggressive behavior even after controlling for a child's exposure to other types of maltreatment and to witnessing community and interparental violence (McCabe et al., 2005; Turner, Finkelhor, & Ormrod, 2006).

A number of causal mechanisms have been proposed to explain the link between physical abuse and aggression, including the modeling of a violent parent's behavior (Dodge, Pettit, & Bates, 1997), insecure early-life attachments (Crittendon & Ainsworth, 1989), biased social information processing (Dodge, Pettit, McClaskey, & Brown, 1986), genetic predisposition (Caspi et al., 2002), and dysfunctional neurobiological development (Lee & Hoaken, 2007). Although many causal mechanisms have been proposed, few studies have examined their ability to mediate the physical abuse-aggression link (Lee & Hoaken, 2007; Margolin & Gordis, 2000). In addition, those studies that have examined these mechanisms as mediators have found that they only partially explain the association between physical abuse and aggression (Dodge, Pettit, Bates, & Valente, 1995).

Maltreatment and Attention Problems

One mechanism that may account for the adverse effects of physical abuse on aggression involves the impact of childhood maltreatment on attention

problems. A growing body of literature suggests that maltreated children are more likely than nonmaltreated children to experience attentional dysregulation. Maltreated children, for example, are more likely to have attention problems and are more easily distractible compared with nonmaltreated, community-matched controls (Erickson, Egeland, & Pianta, 1989; Salzinger et al., 1993; Shields & Cicchetti, 1998). Maltreated children, particularly those who have been physically abused, are also more hypervigilant to environmental cues perceived as threatening. For example, they are more likely than nonphysically abused children to rate ambiguous stimuli as threatening (Pollak & Kistler, 2002) and are more likely to sustain attentional focus on these perceived threats, even when presented with contextually relevant, nonthreatening information (Dodge et al., 1995; Pollak, Cicchetti, Klorman, & Brumaghim, 1997; Shackman, Shackman, & Pollak, 2007). Although this biased vigilance may be adaptive for physically abused children as a means of protecting themselves from unpredictable and threatening situations, it may also be maladaptive, as it limits their ability to take in relevant information and prolongs their arousal (Pollak, Vardi, Bechner, & Curtin, 2005). This prolonged arousal may, in turn, have adverse long-term consequences on a child's neuroendocrine functioning (Cicchetti & Rogosch, 2001).

Attention Problems and Aggression

In general samples of youths, attention problems in childhood are robust predictors of aggressive behavior problems in adolescence (Harachi et al., 2006; Hawkins et al., 1998; Lipsey & Derzon, 1998; Nagin & Tremblay, 2001). Relatively fewer studies, however, have examined the association between attention problems and aggressive behavior among maltreated youths. Shields and Cicchetti (1998) found that in a sample comprised of both maltreated and nonmaltreated children, attention deficits mediated the association between maltreatment status and emotional dysregulation, which was predictive of aggressive behavior. Similarly, in a study conducted with preschool-aged children, some of whom were at risk for the occurrence of maltreatment, researchers found that poor self-regulation (defined as both attentional and emotional control) mediated the longitudinal association between maltreatment risk and aggressive behavior (Schatz, Smith, Borkowski, Whitman, & Keogh, 2008).

Although the two studies described above provide evidence that attention problems mediate the association between maltreatment and aggressive behavior, it is unclear whether a similar model, with attention problems as a mediator, can be used to explain the association between maltreatment

severity and aggression. Examination of maltreatment severity provides a more specific characterization of the maltreatment experience and can add to our understanding of the mental health and behavioral impact of maltreatment. As Clemmons, Walsh, DiLillo, and Messman-Moore (2007) pointed out, "It is crucial for researchers to go beyond simple classification of individuals as either abused or nonabused and to consider the various characteristics that . . . are indicators of severity of these complex experiences" (p. 179). Indeed, findings from studies indicate that maltreatment severity is associated with externalizing problems, even after controlling for the occurrence of maltreatment (Litrownik et al., 2005; Manly, Kim, Rogosch, & Cicchetti, 2001).

The Current Study

In the current study, we examined the associations between severity of physical abuse, caregiver- and youth-reported attention problems, and aggressive behavior in a sample of maltreated early adolescents in out-of-home care. Based on the results of previous studies, we expected that severity of physical abuse would be associated with more attention problems and more aggressive behavior. We also expected that attention problems would be positively associated with aggressive behavior. Finally, we hypothesized that caregivers' and youths' reports of attention problems would partially mediate the association between physical abuse severity and aggressive behavior.

Method

Participants

Recruitment. Participants in the current study included youths and their substitute caregivers who were recruited for participation as part of a randomized controlled trial (RCT) of a preventive intervention for 9- to 11-year-olds placed in out-of-home care (see Taussig, Culhane, & Hettleman, 2007, for a description of the intervention). Youths were eligible for the RCT if (a) they had been court-ordered into out-of-home care within the preceding 14 months, (b) the court order was due to maltreatment, and (c) they remained in out-of-home care at the time of the baseline interview. Ninety-three percent of those youths meeting eligibility requirements were enrolled in the study. The current study examines data collected at the baseline assessment (prerandomization) only. Although 286 youths were interviewed at baseline, the sample for this study included only 240 youths and caregivers. Data from

youths and caregivers were excluded for the following reasons: 28 children were siblings of others included in the sample (when siblings were interviewed, one was chosen at random to be included in the current study's analyses), 11 children's scores on achievement and intelligence tests indicated significant cognitive impairment (full scale IQ < 70), 4 children were not proficient enough in English to comprehend study questions, and 3 children had missing data on one or more study variables (only participants with complete data on all of the study variables were included in the current study's analyses). Results of *t* tests indicated that those youth and caregivers excluded from the current study's analyses because of missing data did not significantly differ from participants on any of the predictor, outcome, or mediator variables.

Participant characteristics. The final sample of 240 youths was 48.3% female ($n = 116$), with a mean age of 9.85 years ($SD = .91$). Youths were placed primarily in foster care (47.1%) or kinship care (47.1%), with the remaining 5.8% placed in group homes, shelters, and residential treatment centers. At the time of the baseline interview, youths had been in out-of-home care an average of 6.45 months ($SD = 3.71$), and they had been at their current placement an average of 5.27 months ($SD = 3.83$). The sample was ethnically diverse, with 49.2% of youths reporting their ethnicity as Hispanic, 47.1% as White, 25.8% as African American, 12.9% as Native American, and 3.3% as Asian or Pacific Islander (nonexclusive categories). The sample of caregivers was primarily female ($n = 210$; 87.5%) and was also ethnically diverse, with 31.7% of caregivers self-reporting their ethnicity as Hispanic, 47.1% as White, 24.2% as African American, 14.6% as Native American, and 2.9% as Asian or Pacific Islander (nonexclusive categories). All caregivers in the study were substitute caregivers.

Procedure

Youths and caregivers were interviewed separately at the child's current residence (e.g., foster home, kinship home, residential treatment facility) or other community location with the stipulation that the child had been at the placement for at least 3 weeks. All measures were administered as standard questionnaires; however, the response scales were presented verbally and the questions were read aloud to participants. This technique helped to ensure that participants were engaged in the assessment process and understood the questions. Children and their caregivers were each paid US$40 for their participation. The study protocol was approved by the Colorado Multiple Institutional Review Board and informed consent and assent were obtained from participants prior to beginning the baseline interview.

Measures

Physical abuse and other maltreatment type severity. Child Protection Services' (CPS) intake reports and dependency and neglect petitions (narratives of the history and events precipitating the legal filing) were used to code the type and severity of maltreatment that led to the child's removal from the home. Using the maltreatment classification system developed by Barnett, Manly, and Cicchetti (1993), severity of physical abuse was coded when participants had experienced an act of physical abuse in the events leading to their removal. Two to three trained research assistants coded severity of physical abuse using a 1- to 5-point scale that was anchored as follows: "1" was indicative of incidents of abuse that left minor marks and "5" was indicative of incidents that required hospitalization or which resulted in the death of the child. Research assistants resolved all discrepancies by consensus, and one of the project's senior investigators resolved any discrepancy in coders' ratings that could not be resolved. A severity score of "0" was used to code severity when physical abuse had not occurred. Previous work by Litrownik and colleagues (Litrownik et al., 2005) has established the predictive utility of assigning severity scores of zero to participants with no physical abuse occurrence. Data related to youths' CPS involvement prior to the current study were not available; thus, CPS system effects were not considered in the present study.

In order to control for the severity of other maltreatment types, we created a composite variable by summing severity ratings across three abuse types: sexual abuse, failure to provide, and lack of supervision.

Caregiver-reported attention problems. Caregivers completed the 113-item, Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). The CBCL is a widely used, standardized measure of child behavior problems with sound psychometric properties. Attention problems were examined in the current study with the 10-item, Attention Problems Scale. Sample items from the Attention Problems Scale included the following: "Can't concentrate, can't pay attention for long"; "Can't sit still, is restless, or hyperactive"; and "Is impulsive or acts without thinking." Caregivers were asked to indicate how true the items were for their child "now or within the past 6 months," with response options ranging from 0 (*not true*) to 2 (*very true or often true*). Following Achenbach's recommendations (Achenbach & Rescorla, 2001), CBCL raw scores were used in all analyses. Higher scores on the Attention Problems Scale indicate greater levels of problems.

Youth-reported attention problems. We constructed a three-item measure of youth-reported attention problems. Two items were taken from the Revised Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 2000):

"It is hard for me to keep my mind on my schoolwork" and "I wiggle in my seat a lot." Participants were asked to consider their current functioning and indicate (*yes* = 1/*no* = 0) whether they "ever have thoughts and/or feelings like these." The final item of the youth-reported attention problems measure asked participants to report how often (never, sometimes, most of the time) "I act without stopping to think." In order to dichotomize this item for the purpose of aggregating it with the RCMAS items, mean standardized scores on the CBCL Attention Problems Scale were examined for youths in the three response categories. Youths who responded that they acted without stopping to think "most of the time" had a significantly higher attention problems score on the CBCL ($\bar{X}$ = 68.88; *SD* = 12.04) than youths who endorsed "sometimes" ($\bar{X}$ = 61.15; *SD* = 10.43) or "never" ($\bar{X}$ = 62.81; *SD* = 12.58). Thus, we coded those youths who responded that they acted without stopping to think "most of the time" with a value of 1 and youths who acted without stopping to think "sometimes" and "never" with a value of 0. A composite youth-reported attention problems score was then computed by taking the sum of participants' responses to the three items, with higher scores indicative of a greater degree of attention problems. The youth-reported attention problems measure was significantly correlated with the CBCL Attention Problems Scale, $r = .22$, $p < .05$.

Aggressive behavior. Aggressive behavior was measured with the Aggressive Behavior Scale of the CBCL (Achenbach & Rescorla, 2001). The Aggressive Behavior Scale consists of 18 items such as "argues a lot," "gets in many fights," and "threatens people." Caregivers were asked to indicate how true the items were for their child "now or within the past 6 months." CBCL raw scores were used in all analyses, with higher scores indicating greater levels of aggressive behavior.

IQ. The Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1990) was used to assess IQ. The K-BIT is a screening measure of intelligence that yields verbal, nonverbal, and composite estimates of IQ for individuals aged 4 to 90. Verbal items assess word knowledge and verbal concept formation. Matrices (nonverbal) items assess ability to perceive relationships and complete analogies. Considerably shorter than the Wechsler Intelligence Scale for Children (WISC), the K-BIT is nonetheless highly correlated with the WISC (r =.64 to .81; Naugle, Chelune, & Tucker, 1993; Prewitt, 1995). The K-BIT Composite score, combining verbal and matrices items, was used in the current study. The K-BIT has a mean of 100 and a standard deviation of 15. Higher scores on the K-BIT indicate better intellectual functioning.

Youths' characteristics. Youths self-reported their sex (1 = *male*; 0 = *female*) and age.

Analysis Plan

We first examined the descriptive statistics of the study variables and the bivariate associations. Afterwards, we conducted two sets of multiple regression analyses (one for caregivers' reports of attention problems and one for youths' reports) to determine whether the four conditions of mediation outlined by Baron and Kenny (1986) were met: (a) whether physical abuse severity predicted aggressive behavior, (b) whether physical abuse severity predicted attention problems, (c) whether attention problems predicted aggressive behavior, and (d) whether the direct effect of physical abuse severity on aggressive behavior was reduced or eliminated with the inclusion of attention problems in the model. Because Baron and Kenny's approach has been shown to suffer from low power, we also used the Sobel Test (1982) to determine whether the indirect effect of abuse severity on aggression was significant (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). Prior research suggests that risk factors for aggression and attention problems vary by a child's sex, age, and level of intellectual functioning (Harachi et al., 2006; Moffitt, Caspi, Rutter, & Silva, 2001). For this reason, we controlled for these variables, along with the severity of other maltreatment types, in all analyses.

Results

Descriptive Statistics and Bivariate Correlations

Physical abuse was experienced by 28.8% ($n = 69$) of the participants prior to their removal from the home, with comparable prevalence rates observed for boys (26.6%) and girls (31.0%). In terms of other maltreatment types, 11% of the sample had experienced sexual abuse (3% boys; 18% girls), 52% had been the victim of a caregiver's failure to provide (55% for boys; 49% for girls), and 77% had experienced a lack of supervision (75% for boys; 78% for girls).

Approximately three quarters of those who experienced physical abuse received a severity rating of either 1 (38%) or 2 (36%). The remainder received severity ratings of either 3 (16%) or 4 (10%), with no incidents of physical abuse rated as a 5. To address the skewed distribution of the physical abuse severity ratings, we categorized participants into three groups: those who experienced no physical abuse, those who experienced minor physical abuse (severity ratings of either a 1 or 2), and those who experienced severe physical abuse (severity ratings of either a 3 or 4). We then dummy coded these three categories into two variables—minor physical

abuse (0 = *no occurrence*; 1 = *occurrence*) and severe physical abuse (0 = *no occurrence*; 1 = *occurrence*)—and these two variables were used in all subsequent analyses.

Twenty percent of participants scored in the clinical range (*T* scores at the 97th percentile and above) on the Attention Problems Scale of the CBCL, and 29.1% scored in the clinical range on the Aggressive Behavior Scale. Youth-reported attention problems were normally distributed (skewness = .13; kurtosis = –.84; range = 0-3), with youths, on average, endorsing slightly more than one of the attention problem items as descriptive of their thoughts and behaviors ($\bar{X}$ = 1.13; *SD* = 0.84). Intellectual functioning among the sample was also normally distributed (skewness = –.36; kurtosis = –.16), with participants having a mean K-BIT composite score of 95.67 (*SD* = 12.83). Finally, the other maltreatment type severity variable was normally distributed (skewness = .42; kurtosis = –.78; range = 0-10), with a mean severity rating of slightly greater than three ($\bar{X}$ = 3.34; *SD* = 2.53).

The bivariate correlations among the study variables are presented in Table 1. Minor physical abuse was associated with higher levels of youth-reported attention problems and with greater levels of aggressive behavior. Severe physical abuse was associated with higher levels of caregiver-reported attention problems and was also associated with greater levels of aggressive behavior. In addition, higher levels of caregiver- and youth-reported attention problems were associated with greater levels of aggressive behavior. Among the control variables, age, sex, and other maltreatment type severity were not associated with any of the independent, mediator, or dependent variables. Greater IQ, however, was associated with lower levels of caregiver- and youth-reported attention problems and lower levels of aggressive behavior.

Multiple Regression Analyses Examining Mediation

We conducted a series of multiple regression analyses, all of which controlled for IQ, sex, age, and other maltreatment type severity. Table 2 provides the results of the multiple regression analyses examining caregiver-reported attention problems as a mediator of the physical abuse severity-aggression association. In the first model, we examined the direct effect of physical abuse severity on aggressive behavior. Results indicated that the minor and severe physical abuse variables were both positively associated with aggressive behavior. There was also a trend suggesting that higher IQ was associated with lower levels of aggressive behavior. Age, sex, and other maltreatment type severity were not significantly associated with aggressive behavior. In the second model, we examined the association between physical abuse

Table 1. Bivariate Correlations Among Study Variables (N = 240)

Variable	1	2	3	4	5	6	7	8	9
1. Minor physical abuse	—	–.11	–.07	.09	.16**	.14**	.03	.06	–.05
2. Severe physical abuse		—	.02	.16**	.11	.13**	–.10	.08	–.01
3. Other maltreatment type severity			—	.07	.10	.03	.03	–.08	.01
4. CBCL attention problems				—	.22****	.66****	–.20***	–.05	.11
5. Youth-reported attention problems					—	.27****	–.21***	–.06	–.01
6. CBCL aggressive behavior						—	–.13**	.06	.08
7. Intellectual functioning							—	–.07	.04
8. Age								—	–.04
9. Sex									—

Note: CBCL = Child Behavior Checklist. The point-biserial coefficient was computed for correlations involving dichotomous variables; sex was operationalized as (1 = *males*; 0 = *females*).
**p < .05. ***p < .01. ****p < .001.

severity and caregiver-reported attention problems. Results indicated that severe physical abuse was associated with greater levels of attention problems, and there was a trend suggesting that minor physical abuse was also associated with greater levels of attention problems. Higher IQ was associated with lower levels of attention problems, and there was a trend suggesting that boys had greater levels of attention problems than girls. Age and other maltreatment type severity were not associated with attention problems. In the third model, when level of aggressive behavior was regressed on attention problems, higher levels of attention problems were associated with greater levels of aggressive behavior. In addition, older youths exhibited greater levels of aggressive behavior. IQ, sex, and other maltreatment type severity were not significantly predictive.

Table 2. Multiple Regression Analyses Evaluating Caregiver-Reported Attention Problems as a Mediator of the Association Between Physical Abuse Severity and Aggression

Variables	*b*	*SE* (*b*)	β	*t*
Model predicting aggressive behavior (direct effect)				
Minor physical abuse	3.23	1.28	.17	2.58**
Severe physical abuse	6.33	3.11	.13	2.04**
Other maltreatment types severity	0.16	0.22	.05	0.72
Intellectual functioning	−0.08	0.04	−.11	−1.76*
Sex	1.42	1.10	.08	1.29
Age	0.57	0.65	.06	0.88
Model predicting caregiver-reported attention problems				
Minor physical abuse	1.41	0.72	.12	1.94*
Severe physical abuse	4.34	1.76	.16	2.47**
Other maltreatment types severity	0.15	0.12	.08	1.22
Intellectual functioning	−0.07	0.02	−.19	−2.99***
Sex	1.07	0.62	.11	1.72*
Age	−0.34	0.37	−.06	−0.93
Model predicting aggressive behavior (without physical abuse severity)				
Caregiver-reported attention problems	1.17	0.09	.67	13.39***
Other maltreatment types severity	−0.04	0.17	−.01	−0.21
Intellectual functioning	0.01	0.03	.01	0.28
Sex	0.11	0.85	.01	0.13
Age	1.04	0.50	.10	2.09**
Model predicting aggressive behavior (indirect effect)				
Caregiver-reported attention problems	1.14	0.09	.66	12.91***
Minor physical abuse	1.69	0.99	.09	1.71*
Severe physical abuse	1.37	2.41	.03	0.57
Other maltreatment types severity	−0.01	0.17	−.01	−0.09
Intellectual functioning	0.01	0.03	.01	0.22
Sex	0.20	0.85	.01	0.24
Age	0.97	0.50	.09	1.93*

*$p < .10$. **$p < .05$. ***$p < .01$.

In the final model, when both physical abuse severity and caregiver-reported attention problems were used to predict aggressive behavior after controlling for IQ, age, sex, and other maltreatment type severity, the association between

Table 3. Multiple Regression Analyses Evaluating Youth-Reported Attention Problems as a Mediator of the Association Between Physical Abuse Severity and Aggression

Variables	*b*	*SE* (*b*)	β	*t*
Model predicting youth-reported attention problems				
Minor physical abuse	0.37	0.12	.19	3.05***
Severe physical abuse	0.53	0.29	.11	1.81*
Other maltreatment types severity	0.04	0.02	.11	1.81*
Intellectual functioning	−0.01	0.01	−.21	−3.34***
Sex	−0.01	0.10	−.01	−0.13
Age	−0.09	0.06	−.09	−1.45
Model predicting aggressive behavior (without physical abuse severity)				
Youth-reported attention problems	2.68	0.67	.26	4.02***
Other maltreatment types severity	0.04	0.22	.01	0.19
Intellectual functioning	−0.04	0.04	−.06	−1.01
Sex	1.36	1.09	.08	1.25
Age	0.96	0.64	.09	1.50
Model predicting aggressive behavior (indirect effect)				
Youth-reported attention problems	2.34	0.68	.23	3.44***
Minor physical abuse	2.43	1.27	.12	1.91*
Severe physical abuse	2.09	3.06	.11	1.67
Other maltreatment types severity	0.07	0.22	.02	0.33
Intellectual functioning	−0.04	0.04	−.07	−1.03
Sex	1.46	1.08	.08	1.35
Age	0.78	0.64	.08	1.22

*$p < .10$. ***$p < .01$.

severe physical abuse and aggressive behavior was no longer significant, and there was a trend of minor physical abuse and aggressive behavior being associated. The association between attention problems and aggressive behavior, however, remained significant. Results of the Sobel Test for the association between severe physical abuse and aggressive behavior indicated there was a significant indirect effect, $z = 2.42$, $p < .05$, with approximately 77% of the effect attenuated by attention problems. There was also a significant indirect effect between minor physical abuse and aggressive behavior, $z = 1.94$, $p = .05$, with approximately 47% of the effect attenuated by attention problems.

Table 3 presents results from mediational analyses examining youth-reported attention problems as a mediator. In Model 1, minor physical abuse was associated with greater levels of youth-reported attention problems, while there was a trend of an association between severe physical abuse and

greater levels of attention problems. Higher IQ scores were associated with lower levels of attention problems in Model 1, and there was a trend suggesting that greater severity of other maltreatment types was associated with higher levels of attention problems. In Model 2, higher levels of youth-reported attention problems were associated with greater levels of aggressive behavior. IQ, age, sex, and other maltreatment type severity were not associated with aggressive behavior in Model 2. When aggressive behavior was regressed on physical abuse severity and attention problems in Model 3, after controlling for IQ, age, sex, and other maltreatment type severity, attention problems remained a significant predictor. There was a trend of an association between minor physical abuse and aggressive behavior; however, results of the Sobel Test indicated there was a significant indirect effect, $z = 2.30$, $p < .05$, with a significant reduction in the predictive power (by 29%). The indirect effect of severe physical abuse on aggressive behavior was not significant, $z = 1.61$, $p = .11$.

Discussion

The current study replicates and adds to the extant research literature on the deleterious behavioral and cognitive consequences associated with childhood physical abuse. Using a sample of youths with a recent history of maltreatment, we examined the associations among physical abuse severity, attention problems, and aggressive behavior. Consistent with our hypotheses, and after controlling for youths' age, sex, intellectual functioning, and the severity from other maltreatment types, we found that both minor and severe physical abuse were associated with greater levels of caregiver- and youth-reported attention problems and with aggressive behavior.

Whereas previous studies have established the role of maltreatment occurrence as a predictor of attention problems and aggressive behavior (Schatz et al., 2008; Shields & Cicchetti, 1998), the current study replicated these findings with a focus specifically on physical abuse severity. Because all the participants recruited for the current study had a recent and substantiated occurrence of some type of abuse or neglect, our results suggest that physical abuse severity, above and beyond the effects associated with other types of abuse, may be a particularly salient predictor of adverse outcomes for maltreated youths. Consistent with this hypothesis, prior studies have found that physical abuse, relative to other types of maltreatment, was a stronger predictor of externalizing problems, including hyperactivity (see Margolin & Gordis, 2000, for a review). Researchers should continue to explore the role that characteristics of the maltreatment experience (e.g., chronicity, frequency, etc.)

may play in the development of adolescent psychopathology (Clemmons et al., 2007; Higgins, 2004).

The current study also expanded earlier work by incorporating measures of attention problems from multiple sources. Consistent with previous studies of maltreated youth that used teacher-reports of attention problems (Shields & Cicchetti, 1998), we found that both caregiver- and youth-reported attention problems partially mediated the association between physical abuse severity and aggression. Caregiver-reported attention problems accounted for over three quarters of the direct effect between severe physical abuse and aggressive behavior and almost half of the direct effect between minor physical abuse and aggressive behavior. Youth-reported attention problems accounted for a little over a quarter of the direct effect between minor physical abuse and aggressive behavior.

Although replication of the mediational findings across multiple informants strengthens the validity of the model, there remains the question of why attenuation was stronger with caregiver reports of attention problems. One possibility is shared informant and method variance. More specifically, because caregiver reports of attention problems and aggression both relied on the CBCL, the association between these two variables may have been artificially high. Thus, it would be beneficial for future studies to attempt to replicate the current study's findings using multimethod and multi-informant measures of attention problems and aggression, particularly measures that broadly assess different aspects of these constructs.

The results of the current study are consistent with previous research that suggests attention problems play an important role in explaining the maltreatment-aggression link. Given this consistency in findings, future research may find it beneficial to further explore the exact mechanism by which attention problems affect aggressive behavior. One possibility is that youths with a history of maltreatment who evidence attention problems have difficulty exerting attentional control, which may hamper their ability to regulate their emotional and behavioral responses to environmental stimuli. Effective attentional control enables an individual to perceptually and conceptually shift attention away from threatening stimuli and focus, instead, on a safer stimulus (Derryberry & Reed, 2002). These types of shifts can limit the affective impact of the perceived threat and help regulate or attenuate the behavioral response (Rothbart, Ellis, Rueda, & Posner, 2003). Conversely, those with poor attentional control are less able, when presented with stimuli perceived as threatening, to either think of less aversive stimuli or visually shift attention away from the threat (Derryberry & Reed, 2002). This inability to

shift attention increases the number of situations an individual perceives to be threatening, which increases the likelihood of responding aggressively.

The direct assessment of attentional control has typically involved reaction time tasks that examine an individual's ability to either inhibit a prepotent response or focus/shift attention on or between environmental stimuli (see Derryberry, 2002, for a review). Researchers have found, however, that caregiver and youth reports of attentional skills (or lack thereof), such as the ability to concentrate, the ability to flexibly shift attention between stimuli, and the ability to inhibit responses, correlate well with performance on the aforementioned reaction time tasks (Derryberry & Reed, 2002). Thus, there appears to be at least some evidence of an association between attention problems and an individual's ability to engage in effective attentional control. Future studies, however, may find it useful to attempt to replicate the mediational model examined in the current study using a direct measure of attentional control that examines a youth's ability to perceptually shift attention away from a threatening stimulus.

The results of the current study also have implications for the design of preventive interventions aimed at reducing the occurrence of youth violence and delinquency among samples of maltreated children. Although there are numerous interventions that target the prevention of externalizing problems among children and adolescents, few of these programs attempt to modify participants' attentional control abilities. One exception is the curriculum of the Promoting Alternative THinking Strategies (PATHS) program, which places an emphasis on engaging children in active attentional and emotional self-control (Greenberg, 2006). Greenberg and colleagues (Riggs, Blair, & Greenberg, 2003) have examined the impact of the PATHS program among low-income youths and have found promising preliminary results, with post-treatment improvements in attentional control mediating the association between involvement in the treatment group and reductions in teacher-reports of externalizing problems. We are currently examining whether these promising results using the PATHS curriculum can be extended to maltreated youths in out-of-home care (Taussig et al., 2007).

Although the current study extends our knowledge of possible mechanisms by which physical abuse may affect aggressive behavior, our investigation was not without limitations. First, the design of our study was cross-sectional and our knowledge of childhood physical abuse experiences was limited to the events that occurred prior to the child's removal from the home. Thus, in the absence of longitudinal data, we could not determine with certainty the direction and nature of causality among the variables in the mediational

model. Future research studies should examine the development of attention problems and aggressive behavior longitudinally within a sample of children with early-life physical abuse experiences. Second, the current study was limited by a lack of data from biological parents. Because our sample was comprised of children who had been removed from their parents and placed in out-of-home care, it was not possible for us to collect data from biological parents. Thus, we were unable to control for possible genetic influences on our mediator and dependent variables. Several studies have found a significant genetic basis for cognitive and behavioral disorders, including attention deficit hyperactivity disorder (Biederman, Faraone, Keenan, Knee, & Tsuang, 1990) and conduct disorder (Faraone, Biederman, & Monuteaux, 2000). Therefore, we cannot rule out the possibility that the results of the current study were in fact a product of genetic factors rather than physical abuse. Third, the medication status of the youth in the current study was unknown, particularly the use of attention-focusing medications. Future research should consider the impact of these types of medications when examining attention problems as a mediator of the physical abuse-aggression association. Finally, it should be pointed out that the data in the current study reflect participants' perceptions of attention problems and aggressive behavior. In the absence of social desirability data, we cannot decipher the extent to which biases affected these perceptions.

Despite its limitations, the current study provides support for previous evidence of the negative cognitive and behavioral consequences associated with physical abuse. The current study also offers a possible cognitive explanation for the association between physical abuse and aggression. Although more research needs to be conducted that specifically examines the neurobiological mechanisms implicated by our findings, the current study is a first step in integrating a diverse body of literature to help explain a well-studied association.

Authors' Note

The content is solely the responsibility of the authors and does not represent the official views of the National Institute of Mental Health or the National Institutes of Health.

Acknowledgments

The authors would like to thank the Departments of Social Services in participating counties for their partnership in our research efforts. They would also like to express their appreciation to the children and families who made this research possible.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

Funding

This study was supported by grants from The Children's Hospital of Denver's Research Institute, the Pioneer Fund, and the Daniels Fund. Federal funding for the study was provided through the National Institute of Mental Health (1R21MH067618, 5R01MH076919, and 3R01MH076919).

References

Achenbach, T. M., & Rescorla, L. A. (2001). *Manual for the ASEBA school-age forms and profiles*. Burlington: University of Vermont, Research Center for Children, Youth, & Families.

Barnett, D., Manly, J. T., & Cicchetti, D. (1993). Defining child maltreatment: The interface between policy and research. In D. Cicchetti & S. L. Toth (Eds.), *Child abuse, child development, and social policy* (pp. 7-74). Norwood, NJ: Ablex.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.

Biederman, J., Faraone, S. V., Keenan, K., Knee, K., & Tsuang, M. T. (1990). Family-genetic and psychosocial risk factors in DSM III attention deficit disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 29*, 526-533.

Caspi, A., McClay, J., Moffitt, T. E., Martin, J., Craig, I. W., Taylor, A., et al. (2002). Role of genotype in the cycle of violence in maltreated children. *Science, 297*, 851-853.

Cicchetti, D., & Rogosch, F. A. (2001).The impact of child maltreatment and psychopathology on neuroendocrine functioning. *Development and Psychopathology, 13*, 783-804.

Clemmons, J. C., Walsh, K., DiLillo, D., & Messman-Moore, T. L. (2007). Unique and combined contributions of multiple child abuse types and abuse severity to adult trauma symptomatology. *Child Maltreatment, 12*, 172-181.

Crittendon, P. M., & Ainsworth, M. D. S. (1989). Child maltreatment and attachment theory. In D. Cicchetti & V. Carlson (Eds.), *Child maltreatment: Theory and research on the causes and consequences of child abuse and neglect* (pp. 432-463). New York: Cambridge University Press.

Derryberry, D. (2002). Attention and voluntary self-control. *Self and Identity, 1*, 105-111.

Derryberry, D., & Reed, M. A. (2002). Anxiety-related attentional biases and their regulation by attentional control. *Journal of Abnormal Psychology, 111*, 225-236.

Dodge, K. A., Pettit, G. S., & Bates, J. E. (1997). How the experience of early physical abuse leads children to become chronically aggressive. In D. Cicchetti & S. L. Toth (Eds.), *Developmental perspectives on trauma: Theory, research, and intervention* (pp. 263-288). Rochester, NY: University of Rochester Press.

Dodge, K. A., Pettit, G. S., Bates, J. E., & Valente, E. (1995). Social information-processing patterns partially mediate the effect of early physical abuse on later conduct problems. *Journal of Abnormal Psychology, 104*, 632-643.

Dodge, K. A., Pettit, G. S., McClaskey, C. L., & Brown, M. (1986). Social competence in children. *Monographs of the Society for Research in Child Development, 51* (2, Serial No. 213).

Erickson, M. F., Egeland, B., & Pianta, R. (1989). The effects of maltreatment on the development of young children. In D. Cicchetti & V. Carlson (Eds.), *Child maltreatment: Theory and research on the causes and consequences of child abuse and neglect* (pp. 647-684). New York: Cambridge University Press.

Faraone, S. V., Biederman, J, & Monuteaux, M. C. (2000). Attention-deficit disorder and conduct disorder in girls: Evidence for a familial subtype. *Biological Psychiatry, 48,* 21-29.

Greenberg, M. T. (2006). Promoting resilience in children and youth: Preventive interventions and their interface with neuroscience. *Annals of the New York Academy of Science, 1094*, 139-150.

Harachi, T. W., Fleming, C. B., White, H. R., Ensminger, M. E., Abbott, R. D., Catalano, R. F., et al. (2006). Aggressive behavior among girls and boys during middle childhood: Predictors and sequelae of trajectory group membership. *Aggressive Behavior, 32*, 279-293.

Haskett, M. E., & Kistener, J. A. (1991). Social interaction and peer perceptions of young physically abused children. *Child Development, 62*, 979-990.

Hawkins, J. D., Herrenkohl, T. L., Farrington, D. P., Brewer, D., Catalano, R. F., & Harachi, T. W. (1998). A review of predictors of youth violence. In R. Loeber & D. P. Farrington (Eds.), *Serious and violent juvenile offenders: Risk factors and successful interventions* (pp. 106-146). Thousand Oaks, CA: Sage.

Higgins, D. J. (2004). The importance of degree versus type of maltreatment: A cluster analysis of child abuse types. *Journal of Psychology, 138*, 303-324.

Kaplan, S. J., Pelcovitz, D., Salzinger, S., Weiner, M., Mandel, F. S., Lesser, M. L., et al. (1998.). Adolescent physical abuse: Risk for adolescent psychiatric disorders. *American Journal of Psychiatry, 155*, 954-959.

Kaufman, A. S., & Kaufman, N. L. (1990). *Kaufman Brief Intelligence Test Manual.* Circle Pines, MN: American Guidance Service.

Lee, V., & Hoaken, P. N. S. (2007). Cognition, emotion, and neurobiological development: Mediating the relation between maltreatment and aggression. *Child Maltreatment, 12*, 281-298.

Lipsey, M. W., & Derzon, J. H. (1998). Predictors of violent and serious delinquency in adolescence and early adulthood: A synthesis of longitudinal research. In R. Loeber & D. P. Farrington (Eds.), *Serious and violent juvenile offenders: Risk factors and successful interventions* (pp. 86-105). Thousand Oaks, CA: Sage.

Litrownik, A. J., Lau, A., English, D. J., Briggs, E., Newton, R. R., Romney, S. et al. (2005). Measuring the severity of child maltreatment. *Child Abuse & Neglect, 29*, 553-573.

Lynch, M., & Cicchetti, D. (1998). An ecological-transactional analysis of children and contexts: The longitudinal interplay among child maltreatment, community violence, and children's symptomatology. *Developmental Psychopathology, 10*, 235-257.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*, 83-104.

Manly, J. T., Cicchetti, D., & Barnett, D. (1994). The impact of subtype, frequency, chronicity, and severity of child maltreatment on social competence and behavior problems. *Development and Psychopathology, 6*, 121-143.

Manly, J. T., Kim, J. E., Rogosch, F. A., & Cicchetti, D. (2001). Dimensions of child maltreatment and children's adjustment: Contributions of developmental timing and subtype. *Development and Psychopathology, 13*, 759-783.

Margolin, G., & Gordis, E. B. (2000). The effects of family and community violence on children. *Annual Review of Psychology, 51*, 445-479.

Mayfield, M. G., & Widom, C. S. (1996). The cycle of violence. *Archives of Pediatrics & Adolescent Medicine, 150*, 390-395.

McCabe, K. M., Lucchini, S. E., Hough, R. L., Yeh, M., & Hazen, A. (2005). The relation between violence exposure and conduct problems among adolescents: A prospective study. *American Journal of Orthopsychiatry, 75*, 575-584.

Moffitt, T. E., Caspi, A., Rutter, M., & Silva, P. A. (2001). *Sex differences in antisocial behavior: Conduct disorder, delinquency, and violence in the Dunedin Longitudinal Study*. New York: Cambridge University Press.

Nagin, D. S., & Tremblay, R. E. (2001). Parental and early childhood predictors of persistent physical aggression in boys from kindergarten to high school. *Archives of General Psychiatry, 58*, 389-394.

Naugle, R. I., Chelune, G. J., & Tucker, G. D. (1993). Validity of the Kaufman Brief Intelligence Test. *Psychological Assessment, 5*, 182-186.

Pollak, S. D., Cicchetti, D., Klorman, R., & Brumaghim, J. T. (1997). Cognitive brain event-related potentials and emotion processing in maltreated children. *Child Development, 68*, 773-787.

Pollak, S. D., & Kistler, D. J. (2002). Early experience is associated with the development of categorical representations for facial expressions of emotion. *Proceedings of the National Academy of Sciences, USA, 99*, 9072-9076.

Pollak, S. D., Vardi, S., Bechner, A. M. P., & Curtin, J. J. (2005). Physically abused children's regulation of attention in response to hostility. *Child Development, 76*, 968-977.

Prewitt, P. N. (1995). A comparison of two screening tests (the Matrix Analogies Test–Short Form and the Kaufman Brief Intelligence Test) with the WISC-III. *Psychological Assessment, 7*, 69-72.

Reynolds, C. R., & Richmond, O. B. (2000). *Revised Children's Manifest Anxiety Scale (RCMAS) Manual*. Los Angeles: Western Psychological Services.

Riggs, N. R., Blair, C., & Greenberg, M. T. (2003). Concurrent and 2-year longitudinal relations between executive function and the behavior of 1st and 2nd grade children. *Child Neuropsychology, 9*, 267-276.

Rothbart, M. K., Ellis, L. K., Rueda, M. R., & Posner, M. I. (2003). Developing mechanisms of temperamental effortful control. *Journal of Personality, 71*, 1113-1143.

Salzinger, S., Feldman, R. S., Hammer, M., & Rosario, M. (1993). The effects of physical abuse on children's social relationships. *Child Development, 64*, 169-187.

Schatz, J. N., Smith, L. E., Borkowski, J. G., Whitman, T. L., & Keogh, D. A. (2008). Maltreatment risk, self-regulation, and maladjustment in at-risk children. *Child Abuse & Neglect, 32*, 972-982.

Shackman, J. E., Shackman, A. J., & Pollak, S. D. (2007). Physical abuse amplifies attention to threat and increases anxiety in children. *Emotion, 7*, 838-852.

Shields, A., & Cicchetti, D. (1998). Reactive aggression among maltreated children: The contributions of attention and emotion dysregulation. *Journal of Clinical Child Psychology, 27*, 381-395.

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhart (Ed.), *Sociological methodology* (pp. 290-312). San Francisco: Jossey-Bass.

Taussig, H. N., Culhane, S. E., & Hettleman, D. (2007). Fostering healthy futures: An innovative preventive intervention for preadolescent youth in out-of-home care. *Child Welfare, 86*, 113-131.

Trickett, P. K. (1993). Maladaptive development of school-aged, physically abused children: Relationship with the child rearing context. *Journal of Family Psychology, 7*, 134-147.

Turner, H. A., Finkelhor, D., & Ormrod, R. K. (2006). The effect of lifetime victimization on the mental health of children and adolescents. *Social Science & Medicine, 62*, 13-27.

Bios

Edward F. Garrido, PhD, is a senior instructor of pediatrics at the University of Colorado Denver School of Medicine and the Kempe Center for the Prevention and Treatment of Child Abuse and Neglect. He is a researcher on the Fostering Healthy Futures Program, a randomized controlled trial of a preventive intervention for pre-adolescent youth in foster care.

Heather N. Taussig, PhD, is an associate professor of pediatrics and psychiatry at the University of Colorado Denver School of Medicine and the Kempe Center for the Prevention and Treatment of Child Abuse and Neglect. She directs the Fostering Healthy Futures Program.

Sara E. Culhane, PhD, JD, is a senior research instructor of pediatrics at the University of Colorado Denver School of Medicine and the Kempe Center for the Prevention and Treatment of Child Abuse and Neglect. She is the research director of the Fostering Healthy Futures Program.

Tali Raviv, PhD, is an assistant professor at Northwestern University, Feinberg School of Medicine. She served as the coclinical coordinator of the Fostering Healthy Futures Program.