Published in final edited form as:

Child Abuse Negl. 2012 February ; 36(2): 95–107. doi:10.1016/j.chiabu.2011.09.016.

Longitudinal study of self-regulation, positive parenting, and adjustment problems among physically abused children

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Abstract

Objective—Research using normative and high-risk samples indicates a significant link between problems with self-regulation and child maladjustment. Nevertheless, little is known about the processes that may modify the link between self-regulation and maladjustment. This longitudinal study examined the joint contributions of child self-regulation and positive parenting behaviors to the development of externalizing and internalizing symptomatology spanning from preschool to 1st grade.

Methods—Data were collected on a total of 95 physically abused children (58% boys); our longitudinal analyses involved 43 children at Time 1 (preschool), 63 children at Time 2 (kindergarten), and 54 children at Time 3 (1st grade). Children's self-regulation was measured by parent report, and their externalizing and internalizing symptomatology was evaluated by teachers. Parents completed self-report measures of positive parenting.

Results—Our structural equation modeling analyses revealed positive parenting as a protective factor that attenuated the concurrent association between low self-regulation and externalizing symptomatology among physically abused children. Our findings regarding longitudinal changes in children's externalizing symptomatology supported the differential susceptibility hypothesis: Physically abused children who were at greater risk due to low levels of self-regulation were more susceptible to the beneficial effects of positive parenting, compared to those with high levels of self-regulation.

Conclusions—Findings suggest that although physical abuse presents formidable challenges that interfere with the development of adaptive self-regulation, positive parenting behaviors may ameliorate the detrimental effects of maladaptive self-regulation on the development of externalizing symptomatology. In addition, the positive and negative effects of caregiving behaviors were more prominent among physically abused children at great risk due to low self-regulation.

Practice Implications—Findings from the present study highlight the importance of attending to positive parenting behaviors and child self-regulation when working with physically abused children who are exhibiting externalizing symptomatology.

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Early maltreatment experiences pose considerable risk for maladaptation in childhood (Cicchetti & Toth, 2005). A large volume of research indicates that maltreated children are at increased risk for emotional and behavioral problems at home and at school. Particularly, mounting evidence suggests that physically maltreated children exhibit greater difficulties in regulating and differentiating affective experiences than nonmaltreated children (Cicchetti, Ganiban, & Barnett, 1991). Research using both normative and high-risk samples indicates a significant link between problems with self-regulation and child maladjustment. Nevertheless, little is known about processes that modify the link between self-regulation and maladjustment. The overall aim of this longitudinal study is to examine the joint contributions of child self-regulation and positive parenting behaviors to the development of externalizing and internalizing symptomatology as high-risk children, who have been physically abused, move from preschool to elementary school.

Self-regulation in maltreated children

One of the important developmental tasks in early childhood is gaining the ability to monitor, understand, and modulate one's affect and behavior—tasks referred to as self-regulation. Consistent with the view posited by Cole, Michel, and Teti (1994), well-regulated children would respond to the ongoing demands of experiences with a range of responses that are socially acceptable and sufficiently flexible to allow for spontaneity as well as inhibition of behavior. In contrast, children with dysregulation would show excessive emotional/behavioral reactivity and emotional/behavioral deficits including constricted emotions, contextually inappropriate affective displays, and difficulties in inhibition of behavior.

Parents shape their children's regulatory styles through sensitive caregiving in the absence of hostility (Eisenberg et al., 2001), and through models of emotion expressivity (Dunsmore & Halberstadt, 1997) and affective regulation (Zahn-Waxler, Kochanska, Krupnick, & McKnew, 1990). Given the poor-quality of attachment, lack of warmth, limited discussion of emotion (Shipman & Zeman, 1999), and the negative emotional tone of homes in which maltreated children are reared, it follows that emotional dysregulation would characterize these children. Indeed, literature indicates that maltreated children evidence numerous deficits in the recognition, expression, and understanding of emotions (e.g., see Camras, Sachs-Alter, & Ribordy, 1996 for a review). Furthermore, prior studies indicate that maltreated children have poor self-regulation (Shipman et al., 2007), and their self-regulatory abilities predict emotional and behavior problems, including internalizing and externalizing symptomatology (Kim & Cicchetti, 2010).

The link between parenting behaviors and self-regulation

Interpersonal relationships exert strong organizing influences on individual development throughout the lifespan (Sroufe, 1989). The longstanding premise is that early attachment relationships with caregivers influence children's beliefs and expectations about themselves and others, as well as their more general understanding of the world (Bowlby, 1969/1982). Empirical evidence has demonstrated that experiences of poor quality caregiving are related to negative behavioral outcomes (Sroufe, 1997). In contrast, children whose parents show warmth and positive expressivity tend to have secure attachment (Contreras, Kerns, Weimer, Gentzler, & Tomich, 2000), and show empathy and cooperation (Zhou et al., 2002) and low levels of externalizing problems (Eisenberg et al., 2005).

Although some studies indicate abusive parents demonstrate low levels of positive behaviors in interactions with their children (e.g., Kavanagh, Youngblade, Reid, & Fagot, 1988; Toth, Cicchetti, & Kim, 2002) and show disproportionate rates of negative to positive behavior (see discussion by Wolfe, 1999), other studies show there is variation among abusive parents

in levels of warmth and sensitivity (Haskett, Allaire, Kreig, & Hart, 2008). Furthermore, there is evidence that positive parenting behaviors may serve as a protective factor for maltreated children. For example, maltreated children with less positive perceptions of their mothers showed higher levels of externalizing and internalizing symptomatology (Toth & Cicchetti, 1996; Toth et al., 2002). In a recent cross-sectional study, maltreated children who reported a secure pattern of relatedness with mothers were less likely to show impairment in their emotion regulation abilities, which in turn were related to lower externalizing and internalizing symptomatology (Alink, Cicchetti, Kim, & Rogosch, 2009). Collectively, the findings imply a buffering effect of positive parent-child relationship quality against maltreated children's maladjustment.

Given the multiple risk factors present for physically abused children, it follows that they would be at high risk for problems in the transitions through preschool, kindergarten, and elementary school. Indeed, physically abused children tend to experience pervasive and severe difficulties in many areas of school adjustment (Veltman & Browne, 2001) and social adjustment, including peer rejection (Bolger & Patterson, 2001) as well as difficulty forming healthy relationships with teachers (Lynch & Cicchetti, 1991). In particular, with regard to psychopathology, investigators have documented internalizing problems such as somatic complaints, depressive symptoms, and externalizing problems including aggression and conduct problems among physically abused children (Dodge, Pettit, & Bates, 1997; Kim & Cicchetti, 2010). Because early school success lays a foundation for later developmental tasks, identifying risk and protective factors for maltreated children in these school transitions is essential for the prevention of long-term adjustment problems.

The present study

We incorporated a *bioecological model* (Bronfenbrenner & Morris, 1998) as a theoretical basis for examining how parenting processes, in combination with child characteristics, may differentially influence development. According to this model, it is hypothesized that the influence of proximal processes (e.g., positive or negative parenting behaviors) is expected to vary with characteristics of the child (e.g., self-regulation) as well as elements of time (e.g., developmental progress). The current investigation tested two theoretically based hypotheses to evaluate the joint contributions of children's self-regulation and parents' positive behaviors to child adjustment. First, *the differential susceptibility hypothesis* (Belsky, 1997; Belsky & Pluess, 2009) emphasizes that children vary in their susceptibility to environmental influences (plasticity), specifically with respect to rearing experience, for evolutionary-biological reasons. Some previous studies reported, for example, evidence for the differential susceptibility hypothesis suggesting that the effects of maternal discipline practices on childhood externalizing problems were moderated by child characteristics such as difficult temperament and negative emotionality (Bradley & Corwin, 2008; Lengua, 2008; Pluess & Belsky, 2010). Based on the differential susceptibility hypothesis, we tested a putative moderating role of child self-regulation regarding the effects of positive parenting on child adjustment. Specifically, children with high vs. low self-regulation would react differentially to parenting behaviors such that those with low self-regulation would be more susceptible to parental influences, in both the positive and the negative conditions (Belsky & Pluess, 2009).

Statistically, we followed a series of evidentiary criteria for establishing differential susceptibility proffered by Belsky and Pluess (2009). First, we were mindful of the fact that a significant correlation between the susceptibility factor and the outcome suggests dual risk (or gain) instead of differential susceptibility (e.g., low self-regulation would be related to higher externalizing symptomatology but even more so when combined with negative parenting). Second, we tested whether the identified moderation reflected a crossover

interaction that covered both the positive and negative aspect of the environmental predictor. With a crossover interaction, it was expected that one subgroup defined on the basis of the susceptibility factor would score highest and lowest, given the environmental influence under investigation.

Alternatively, we hypothesized a putative moderating role of positive parenting such that it may be a protective factor that buffers harmful effects of low self-regulation on adjustment problems. In accord with Luthar, Cicchetti, and Becker (2000), we defined a protective factor as involving interactive effects operating differently at high- and low-risk conditions (as opposed to a direct ameliorating effect operating at both high- and low-risk conditions). If positive parenting were a protective factor, then the effects of low self-regulation on maladjustment would be attenuated in the presence of high positive parenting. Conversely, in line with the transaction/dual-risk model (Sameroff, 1983), low self-regulation would be linked to higher maladjustment especially when combined with insensitive or negative parenting.

We used a prospective longitudinal design based on multiple informant data to examine developmental changes in the associations among children's self-regulation, positive parenting (both reported by parents) and child adjustment problems (reported by teachers) as high-risk children navigated throughout preschool, kindergarten, and 1st grade. No prior study has systematically examined the interactive contributions of positive parenting and self-regulation to maltreated children's adjustment over time.

Method

Participants

The participants included a total of 95 children from economically disadvantaged families, involving 43 children at Time 1 (preschool), 63 children at Time 2 (kindergarten), and 54 children at Time 3 (1st grade). These children, between the ages of 4 and 7 years, were selected based on a substantiated report of physical abuse within the year prior to enrollment in the study. The sample size was larger at Time 2 than at Time 1 because additional children entered the study at that time point. The sample also included primary caregivers of those children (parents hereafter; 95% "mothers" including 87% biological mothers, 10% grandmothers, and 3% other mother figures, and 5% biological fathers¹). The same parents participated in the longitudinal study over the three time points. Mean child age was 4.89 ($SD = .39$) at Time 1, 5.82 ($SD = .39$) at Time 2, and 6.62 ($SD = .39$) at Time 3. Children (58% boys) were from diverse ethnic backgrounds: 71% African American, 21% European American, 2% Latino, and 6% other ethnic groups. The children were primarily from economically disadvantaged families: the mean of Hollingshead's (1975) index of socioeconomic status was 3.68 ($SD = 1.11$; range 1~5, 5 = lowest) at Time 1, 3.69 ($SD = 1.09$) at Time 2, and 3.58 ($SD = 1.08$) at Time 3. The mean age of parents was 32.07 ($SD = 8.03$) at Time 1, 33.03 ($SD = 9.26$) at Time 2, and 34.66 ($SD = 8.27$) at Time 3. About 33% of parents were married at Time 1, 24% at Time 2, and 27% at Time 3. All but three children had mothers as perpetrators of physical abuse incidents.

We tested whether several demographic background variables were associated with missingness in the longitudinal data. Children who had data at both Time 1 and Time 2 and those only at Time 1 (but not Time 2) were comparable, and children who had data at both Time 2 and Time 3 and those only at Time 2 (but not Time 3) were comparable with respect

¹Including the five fathers did not result in outliers on any study variables. When we tested our main analyses with and without including those five children whose caregivers were fathers, we found that the pattern of findings is the same with or without their inclusion.

to child gender ($p = .18$ and $p = .09$, respectively), child ethnicity (White vs. Non-White, $p = .24$ and $p = .06$, respectively), family socioeconomic status ($p = .22$ and $p = .54$, respectively). Children who had data at both Time 1 and Time 2 were less likely to have parents who were married at Time 1 (21% of parents were married) compared to those whose data were available only at Time 1 (57% of parents were married), $\chi^2(1, n = 322) = 5.71, p < .05$. However, there was no significant difference in terms of parents' marital status at Time 2 between children who had data at both Time 2 and Time 3 those whose data were available only at Time 2 ($p = 1.00$).

Procedure

Maltreated children had been identified through the Child Protective Services (CPS) as having experienced physical abuse. Criteria for inclusion were a substantiated report of physical abuse and child age between 4 to 7 years. Exclusionary criteria included history of sexual abuse, non-proficient English language skills, and placement in foster care. The majority of children (63%) enrolled in the study in the spring prior to entering kindergarten and about 26% of children entered the study during the kindergarten year. Data were collected at three time points – in preschool (Time 1), kindergarten (Time 2), and 1st grade (Time 3)². The retention rates were 77% between Time 1 and Time 2 or Time 3, and 71% between Time 2 and Time 3. A CPS social worker mailed recruitment letters to eligible parents who voluntarily called the project office to enroll. After obtaining parental consent and child assent, research assistants administered measures in a clinic setting. Teacher-report measures were completed within one month of the clinic-based assessment. All procedures were approved by the institutional review board of the university.

Measures

Preschool Parenting Measure (PPM; Sessa, Avenevoli, Steinberg, & Morris, 2001)—Self-report of parenting was assessed using the PPM at Times 1, 2, and 3. Parents indicated the degree to which each item represented their relationship with their child, using a 4-point scale (1-4). Scales include Positive Affect (4 items; e.g., “When my child and I play, we laugh a lot”), Responsiveness (4 items; e.g., “I talk to or hold my child when he/she is scared”), Hostility (5 items; e.g., “I snap at my child when he/she gets on my nerves”), and Structure (5 items; e.g., “There is a fixed routine for my child at bedtime that seldom changes”). For this sample, internal consistency (α) of scales ranged from .58 (Structure) to .77 (Hostility).

Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy & Kenworthy, 2000)—Parents' reports on the BRIEF were used to assess children's self-regulation. The measures of self-regulation used in the current study provided an assessment of behavioral characteristics that can be seen as behavioral indicators related to temperament facets of effortful control. The BRIEF-Preschool (for ages 3-5) was used at Time 1, and the BRIEF (for ages 5-18) was used at Times 2 and 3. For the purposes of this study, Inhibit (16 items for BRIEF-Preschool and 10 items for BRIEF; e.g., “becomes too silly”), Shift (10 items for BRIEF-Preschool and 8 items for BRIEF; e.g., “has trouble moving from one activity to another”), and Emotion Control (10 items for both BRIEF-Preschool and BRIEF; e.g., “has explosive outbursts”) subscales were used. Each item was scored on a three-point scale (1 = never, 2 = sometimes, and 3 = often). T scores were generated by age and gender, based on national norms. Higher T scores indicate lower levels of self-regulation. In the

²Time 1 data were collected in the middle of the last year of preschool (Jan-Feb.), Time 2 data were collected in the spring of kindergarten (April), and Time 3 data were collected in the middle of first grade (Jan-Feb). Therefore, there were approximately 15 months between Time 1-Time 2 and 9 months between Time 2-Time 3.

current study, internal consistency (α) of scales ranged from .87 to .97 for the BRIEF-P and .88 to .96 for the BRIEF.

Achenbach System of Empirically Based Assessment—The Teacher Report Form (TRF; Achenbach & Rescorla, 2001a) is a 112-item teacher report of adjustment of children ages 6 and above regarding a wide range of behavioral, emotional, and social problems displayed in the prior six months. It was administered at Times 2 and 3 for children who were age 6 and older at those time points. The Caregiver-Teacher Report Form (C-TRF; Achenbach & Rescorla, 2001b) is a 99-item teacher report form comparable to the TRF for children ages 5 and under. It was used for all children at Time 1 and for 16 children at Time 2 because those children were still 5 at the time of the kindergarten assessment. For both forms, T-scores (based on age and gender) were generated for the two broadband dimensions of child psychopathology: externalizing symptomatology (e.g., aggressive behaviors and delinquent behaviors; $\alpha = .95$ for the TRF and C-TRF) and internalizing symptomatology (e.g., withdrawal, somatic complaints, and anxiety-depression; $\alpha = .91$ for the TRF and .90 for the C-TRF). Approximately 35% of the children at Time 1, 43% of the children at Time 2, and 26% of the children at Time 3 showed externalizing symptomatology above the borderline level (T score = 60); 21% of the children at Time 1, 24% of the children at Time 2, and 15% of the children at Time 3 showed internalizing symptomatology above the borderline level (T score = 60).

Statistical Analysis

We first examined measurement models of positive parenting and self-regulation by performing confirmatory factor analyses (CFAs) using structural equation modeling (SEM; Bollen, 1989). Next, we tested whether the factor structure of self-regulation and positive parenting changed over time using the Amos 7.0 program (Arbuckle, 2007) that estimated parameters incorporating full information maximum likelihood (FIML) methods. The FIML methods allow data from all individuals to be included regardless of their pattern of missing data and are more appropriate than other methods such as mean substitution.

Based on the CFA results, composite scores were created by averaging subscale scores. Items were reverse scored if necessary so that higher scores indicated higher levels of the construct. In order to examine the moderating effects of self-regulation and positive parenting on maladjustment, a series of path analyses were conducted. The main effects of self-regulation and positive parenting were centered to prevent possible multicollinearity problems between predictors and their interaction terms. These SEM analyses first tested main and interaction effects of self-regulation and positive parenting on child maladjustment measured at a concurrent time, and then extended to test the longitudinal main and interaction effects after controlling for the prior levels of adjustment (i.e., measured at a preceding occasion). For significant interaction effects, we tested simple effects based on the conditional values of plus or minus one standard deviation around the mean of the moderator (Aiken & West, 1991). An α level of .05 was used for all statistical tests except in the case of the interactions. As prior research on differential susceptibility has practiced (e.g. Pluess & Belsky, 2010), we used $\alpha = .10$ for testing interactions, considering the low power that characterizes analyses of moderator effects in quasi-experimental research designs (Cohen, 1988; McClelland & Judd, 1993).

Results

Preliminary analyses

Means and standard deviations for all study variables and correlations among these variables are presented in Table 1. Zero-order correlations between the two predictors— self-

regulation and positive parenting—and externalizing and internalizing symptomatology outcomes indicated that children with lower self regulation tended to have higher externalizing symptomatology ratings by teachers at a concurrent time at Time 1 ($r = .47, p < .05$), Time 2 ($r = .22, p < .05$), and Time 3 ($r = .26, p < .05$). Children with lower self-regulation showed higher internalizing symptomatology in kindergarten (at Time 2, $r = .26, p < .05$). There was no significant concurrent association, however, between positive parenting and externalizing and internalizing symptomatology (r ranged from $-.14$ to $.17$, and p ranged from $.11$ to $.50$).

We conducted SEM analyses to investigate measurement models of self-regulation and positive parenting factors. In particular, we were interested in testing invariance of relative contributions of the subscale dimensions to the latent construct over time. We fit a series of single-factor CFA models for positive parenting and for self-regulation at each time point to test *internal validity* (McArdle, 1996). For positive parenting, we retained positive affect, responsiveness, and hostility subscales as they had factor loadings on the latent factors that were above the cutoff of $.3$ (accounting for 9% of the variance; Pedhazur & Schmelkin, 1991), with one exception of $-.28$ for the hostility subscale of the PPM at Time 2. Factor loading estimates ranged from $.43$ to $.90$ at Time 1, from $.28$ to $.80$ at Time 2, and from $.34$ to $.85$ at Time 3. For self-regulation, all three subscales of Inhibit, Shift, and Emotion Control had substantial factor loadings, ranging from $.73$ to $.81$ at Time 1, from $.65$ to $.90$ at Time 2, and from $.78$ to $.88$ at Time 3.

Cross-sectional analyses testing interactions between self-regulation and positive parenting

To examine main and interaction effects of self-regulation and positive parenting on child maladjustment, we conducted path analyses separately for externalizing and internalizing symptomatology. As shown in Table 2, the results indicated developmental changes in contributions of self-regulation and positive parenting to child externalizing symptomatology over time. Specifically, during the preschool years (Time 1), only low self-regulation was a significant vulnerability factor for child externalizing symptomatology ($b^* = .40, p < .05$).

During the kindergarten years (Time 2), there was a significant interaction effect for self-regulation and positive parenting regarding children's externalizing symptomatology ($b^* = -.30, p < .05$). Given that the significant correlation between child self-regulation and externalizing symptomatology ($r = .22, p < .05$) suggested dual risk, we tested the moderating effects of positive parenting on the link between self-regulation and externalizing symptomatology. As shown in Figure 1, simple effect tests revealed that among physically abused children with lower levels of positive parenting, those with lower levels of self-regulation (i.e., High Risk, indicated by higher scores of BRIEF) showed higher levels of externalizing symptomatology ($b = .56, SE = .19, b^* = .55, p < .05$). In comparison, self-regulation was not related to externalizing symptomatology among physically abused children with higher levels of positive parenting ($b = -.12, SE = .21, b^* = -.12, p = .57$). In 1st grade (Time 3), self-regulation and positive parenting had additive effects, as indicated by significant main effects, on externalizing symptomatology instead of interaction effects. Children with lower levels of self-regulation ($b^* = .34, p < .05$) and higher levels of positive parenting ($b^* = .28, p = .05$) showed higher levels of externalizing symptomatology.

Turning to the findings for internalizing symptomatology, a significant main effect of self-regulation indicated that children with lower levels of self-regulation showed higher levels of internalizing symptomatology in kindergarten ($b^* = .30, p < .05$); but self-regulation was not related to internalizing symptomatology in preschool or 1st grade (see Table 2). Neither

the main effect of positive parenting nor the interaction effect between self-regulation and positive parenting were predictive of child internalizing symptomatology across ages 4 to 7.

Longitudinal associations among self-regulation, positive parenting, and child maladjustment

We extended the cross-sectional SEM analyses to test the effects of self-regulation and positive parenting on child maladjustment after controlling for the prior levels of adjustment (i.e., controlling for the *baseline* level that was measured at a preceding occasion). Due to the relatively small sample size, we examined longitudinal associations between two adjacent time points (rather than considering changes across all three time points simultaneously) and also used the derived variable approach. The derived variable approach involves the reduction of the repeated measurements into a summary variable (such as average scores or change scores across time) and is recommended for when the sample size is small and the number of observations per subject is 2 (e.g., Hedeker & Gibbons, 2006). Conceptually, in our longitudinal analyses, we were interested in whether the stable, trait-like levels of self-regulation and positive parenting predict changes in child adjustment outcomes over time. We also considered the possibility that changes in self-regulation and positive parenting (regardless of the levels) may be predictive of changes in adjustment outcomes. Therefore, we constructed the predictors of changes in child outcomes in two different ways: (1) average level defined as the mean of a given child's repeated measurements that represent reliable scores capturing stable, trait scores (e.g., Kim & Cicchetti, 2009; i.e., the averaging Time 1 and Time 2 scores of self-regulation and positive parenting to predict Time 2 outcome scores after controlling for Time 1 outcome scores), and (2) change score between the two adjacent time points (i.e., subtracting Time 1 scores from Time 2 scores, thus positive scores indicate increases whereas negative scores indicate decreases). First, we tested whether changes in child maladjustment between Time 1 and Time 2 were predicted by main and interaction effects of self-regulation and positive parenting. These analyses were based on 29 children who had data at both Times 1 and 2. Next, we repeated such analyses to test whether changes in child maladjustment between Time 2 and Time 3 were predicted by self-regulation and positive parenting (calculated by averaging Time 2 and Time 3 scores), based on 43 children who had data at both Times 2 and 3.

As shown in Table 3, there was a significant interaction effect for the average levels of self-regulation and positive parenting regarding changes in externalizing symptomatology between Times 1 and 2 ($b^* = -.24, p = .08$). Partial correlations indicated no significant associations between average levels of self-regulation and positive parenting (i.e., averaged scores between Time 1 and Time 2) and Time 2 levels of externalizing symptomatology after controlling for Time 1 levels of externalizing symptomatology. Therefore, we tested the moderating effects of both self-regulation and positive parenting. As can be seen in Figure 2, simple effect tests using self-regulation as the moderator revealed that among children with lower levels of self-regulation, those with higher average levels of positive parenting between Times 1 and 2 tended to show lower levels in externalizing symptomatology at Time 2 even after controlling for Time 1 externalizing symptomatology ($b = -10.63, SE = 5.90, b^* = -.42, p = .08$). In comparison, positive parenting was not related to changes in externalizing symptomatology among children with higher levels of self-regulation ($b = .69, SE = 3.87, b^* = .03, p = .86$). Simple effect tests with positive parenting as the moderator revealed no differences in the patterns of the link between self-regulation and changes in externalizing symptomatology depending on the level of positive parenting ($b = -.16, SE = .16, b^* = -.18, p = .32$ among children with high positive parenting and $b = .25, SE = .20, b^* = .28, p = .24$ among children with low positive parenting).

For changes in externalizing symptomatology between Times 2 and 3, children with higher average levels of positive parenting ($b^* = .41, p = .05$) were likely to show higher externalizing symptomatology at Time 3 after controlling for Time 2 symptomatology ($b^* = .41, p = .05$). Main effects of self-regulation and the interaction between self-regulation and positive parenting were not significant.

Regarding internalizing symptomatology, children with lower Time 1-Time 2 average levels of self-regulation were likely to show higher internalizing symptomatology at Time 2 after controlling for Time 1 symptomatology ($b^* = .37, p < .05$). However, average levels of self-regulation were not related to changes in internalizing symptomatology from Time 2 to Time 3. Positive parenting and the interaction between self-regulation and positive parenting were not significantly predictive of changes in internalizing symptomatology between Times 1 and 2 or between Times 2 and 3.

Table 4 presents predictions of changes in child outcomes based on changes in self-regulation and positive parenting. Changes in self-regulation and positive parenting between Times 1 and 2 were not significant predictors for externalizing symptomatology at Time 2 after controlling for Time 1 levels of symptomatology (see Table 4). However, there was a significant interaction effect between changes in self-regulation and changes in positive parenting for externalizing symptomatology at Time 3 after controlling for Times 2 externalizing symptomatology ($b^* = -.47, p < .05$). Partial correlations indicated no significant associations between change scores of self-regulation and positive parenting (i.e., Time 3 – Time 2 scores) and Time 3 levels of externalizing symptomatology after controlling for Time 2 levels of externalizing symptomatology. Therefore, we tested the moderating effects of both self-regulation and positive parenting. For simple effect tests using changes in self-regulation as the moderator (see Figure 3), among children with decreased levels of self-regulation between Times 2 and 3 (i.e., Low Self-Regulation), those with increases in positive parenting tended to show higher levels of externalizing symptomatology at Time 3 after controlling for previous levels of symptomatology ($b = 10.86, SE = 6.06, b^* = .25, p = .08$). In comparison, changes in positive parenting between Times 2 and 3 were not predictive of externalizing symptomatology at Time 3 (after controlling for Time 2 symptomatology) among children with increased levels of self-regulation (i.e., High Self-Regulation; $b = 6.67, SE = 5.73, b^* = .16, p = .25$). Simple effect tests with positive parenting as the moderator revealed no differences in the patterns of the link between changes in self-regulation and changes in externalizing symptomatology depending on the changes in positive parenting ($b = .03, SE = .23, b^* = .02, p = .91$ among children with increased positive parenting and $b = .29, SE = .22, b^* = .19, p = .18$ among children with decreased positive parenting).

Regarding internalizing symptomatology, significant main effect of self-regulation indicated that children with decreases in self-regulation between Times 1 and 2 showed lower levels of internalizing symptomatology at Time 2 after controlling for the symptomatology level at Time 1 ($b^* = -.39, p < .05$). Changes in positive parenting and the interaction between changes in self-regulation and changes in positive parenting were not significantly predictive of longitudinal changes in internalizing symptomatology.

Additionally, we examined child gender and ethnicity (minority vs. non-minority) as potential covariates. There were no significant main effects of child gender and ethnicity, and the significance of the main and interaction effects of self-regulation and positive parenting did not change after including the two demographic covariates. This result indicates that the effects of self-regulation and positive parenting on child adjustment were independent of child gender and ethnicity.

Discussion

The present study extends current knowledge about the role of self-regulation in child psychopathology by illustrating how parenting processes can contribute to the link between self-regulation and psychopathology among high-risk children. Within child maltreatment literature, researchers have heavily focused on examining protective factors that may buffer the effects of maltreatment. Unlike previous studies, our study focused on protective factors that may explain within-group differences among abused children. Our main findings suggest that positive parenting is a protective factor that attenuated the concurrent association between low self-regulation and externalizing symptomatology among physically abused children. Furthermore, physically abused children, at greater risk due to stable low levels of self-regulation, were more susceptible to the salutary effects of positive parenting as well as the detrimental effects of insensitive parenting on changes in their externalizing symptomatology, compared to physically abused children with high levels of self-regulation.

Additive and interactive concurrent effects of self-regulation and positive parenting on child externalizing symptomatology

Using longitudinal data spanning from preschool to 1st grade, we examined the effects of child self-regulation and positive parenting on child maladjustment. The results indicated developmental changes in additive or interactive contributions of self-regulation and positive parenting to child externalizing symptomatology. In preschool, low self-regulation was significantly predictive of high externalizing symptomatology, whereas positive parenting was not related to externalizing symptomatology. In kindergarten, there was evidence for interactive effects of self-regulation and positive parenting; such that positive parenting was a protective factor against the detrimental effects of low self-regulation on externalizing symptomatology among physically abused children. In 1st grade, however, self-regulation and positive parenting played as independent predictive factors that had additive effects (as opposed to protective factors as in the interaction effects). Specifically, abused children with higher self-regulation showed lower levels of externalizing symptomatology compared to abused children with lower self-regulation. Unexpectedly, our data indicated that abused children whose parents reported higher positive parenting had higher externalizing symptomatology ratings by teachers than those whose parents reported lower positive parenting.

The moderating effects of positive parenting on the concurrent association between low self-regulation and externalizing symptomatology clearly indicated that the association between low self-regulation and externalizing symptomatology was reactive to the protective processes of positive parenting. In particular, positive parenting appeared to be a *protective-stabilizing* factor (Luthar et al., 2000) such that physically abused children with high positive parenting were not affected by the risk condition of low self-regulation. This finding is consistent with the transactional/dual-risk model (Belsky & Pluess, 2009; Sameroff, 1983) that suggests that vulnerable individuals (i.e., children with low self-regulation) are more likely than others to be adversely affected by unsupportive contextual conditions. That is, the disadvantage linked with low self-regulation was heightened with increasing levels of risks—insensitive parenting.

Overall, our investigations of cross-sectional associations among self-regulation, positive parenting, and maladjustment revealed preliminary evidence for developmental changes in the patterns over time regarding roles of self-regulation and positive parenting. Specifically, low self-regulation was a consistent risk factor for child externalizing symptomatology from preschool to 1st grade. In contrast, the role of positive parenting seemed to vary according to child age, as evidenced by its non-significant effects during the preschool year, its

significant protective effect during the kindergarten year, and its exacerbating additive effect in 1st grade. One caveat is that it is possible that differences in findings across ages might reflect in part the difference in the sample composition across our assessment times rather than intra-individual developmental changes.

Predicting changes in child externalizing symptomatology based on average level and intraindividual change of self-regulation and positive parenting

Our longitudinal analyses regarding the contributions of stable levels of self-regulation and positive parenting to changes in child maladjustment during the preschool and kindergarten years supported the differential susceptibility hypothesis. Specifically, positive parenting was related to declines and insensitive parenting was related to increases in externalizing symptomatology among physically abused children with low self-regulation. In contrast, no significant effects of positive parenting were observed among physically abused children with high self-regulation. Thus, our data indicated that physically abused children who were more “vulnerable” due to lower self-regulation were more susceptible to the beneficial effects of positive parenting as well as detrimental effects of insensitive parenting, compared to children with higher self-regulation.

Our finding is consistent with the few prior longitudinal studies examining the differential susceptibility regarding changes in child adjustment. Lengua (2008) studied the interaction effect between child temperament and parenting on changes in externalizing and internalizing problems using a community sample of children ages 8-12 years. Children high in negative emotion showed increases in externalizing problems over one year when maternal rejection was high but showed decreases in externalizing problems when maternal rejection was low. No such effects of maternal rejection were observed among children low in negative emotion. In a recent study, Pluess and Belsky (2010) used a large sample of children from diverse backgrounds and found that children with histories of difficult temperament as infants were more susceptible to the rearing effects of parenting and child care quality when their functioning was evaluated at age 10-11 years. Specifically, higher maternal sensitivity was related to higher social competence and better child-care quality was related to lower levels of externalizing behaviors more strongly among children with difficult temperaments compared to those with easy temperaments.

Most prior studies on differential susceptibility focused on child temperament and externalizing symptomatology and heavily relied upon samples of children at relatively low-risk. We extended prior research by testing the differential susceptibility of self-regulation to both externalizing and internalizing symptomatology using a sample of high-risk children due to their experiences of physical abuse. The current study makes some unique contributions to our understanding of differential susceptibility. Unlike previous findings that focused on difficult temperament, our findings offer evidence for differential susceptibility of self-regulation. In addition, our findings provide evidence for differential susceptibility concerning high-risk children's environmental influences that could have been seen as having a limited range—i.e., it is assumed that sensitive parenting behaviors among abusive parents would be low and restricted in variability. The literature suggests a difference between abusive and nonabusive parents in the balance of positive to negative behaviors, not necessarily an absence of positive behaviors in physically abusive parents (e.g., Wolfe, 1999). There is also the possibility of range restriction (i.e., high positive parenting scores) in the current sample due to social desirability and response bias, particularly given the families have recent CPS involvement. Such response bias in abusive parents' reports on their parenting behaviors may in part explain the counter-intuitive finding that high positive parenting was related to high levels of externalizing symptomatology among abused children in 1st grade.

Methodologically, it is important to note that our findings met crucial evidentiary criteria for establishing differential susceptibility according to Belsky and Pluess (2009). There was no significant correlation between self-regulation (averaged between Times 1 and 2) and changes in externalizing symptomatology between Time 1 and Time 2, which precluded the possibility of dual risk. The moderation reflected a crossover interaction as shown in Figure 2, demonstrating that children with low self-regulation showed the highest externalizing symptomatology when positive parenting was low (i.e., high risk) but showed the lowest externalizing symptomatology when positive parenting was high (i.e., low risk). However, such a crossover interaction was not replicated when the other putative susceptibility factor—positive parenting—and externalizing symptomatology outcome were used. This finding clearly demonstrates the *specificity* of the differential susceptibility effect (Belsky & Pluess, 2009).

Differential susceptibility of self-regulation to parenting behaviors may be explained from a neurobiological perspective. As Belsky and Pluess (2009) suggested, one plausible reason why children low in self-regulation may prove most susceptible to environmental influences is because dysregulation reflects a highly sensitive nervous system on which experiences (either positive or negative) register especially strongly. This view is consistent with Boyce and Ellis's (2005) *heightened biological sensitivity to context* concept that argues that the effects of high reactivity (such as dysregulation) on psychiatric and biomedical outcomes are bivalent, rather than univalent, exerting both risk-augmenting and risk-protecting effects in a context-dependent manner.

It should be noted that the pattern of longitudinal interactions between self-regulation and positive parenting was not entirely consistent with the differential susceptibility hypothesis. Unlike stable longitudinal levels (i.e., average levels), intraindividual changes in self-regulation and intraindividual changes in positive parenting interacted such that, among children for whom parents reported decreases in self-regulation between kindergarten and 1st grade, those whose parents reported increases in positive parenting were perceived by teachers as showing increases in externalizing symptomatology. Such an association might suggest that parents who perceived decreases in self-regulation as well as increases in externalizing symptomatology reacted by increasing (at least in their self-reports) positive parenting behaviors in their attempt to ameliorate child problems.

Links among self-regulation, positive parenting, and child internalizing symptomatology

Interestingly, the main effects of self-regulation and positive parenting on internalizing symptomatology were generally weak. There was no evidence for a significant interaction effect of self-regulation and positive parenting in predicting concurrent levels of or changes in internalizing symptomatology. This finding is congruent with some prior studies showing statistical interactions involving effortful control in the prediction of externalizing but not internalizing problems (e.g., Eisenberg et al., 2004; Lengua, 2007). It is important for future researchers to consider other child characteristics (e.g., anxiousness) that may be differentially susceptible to positive parenting behaviors.

Both cross-sectional and longitudinal analyses indicated that children with lower *levels* of self-regulation showed higher levels of internalizing symptomatology. When we examined how *changes* in self-regulation were related to changes in internalizing symptomatology, however, our result suggested that children whose self-regulation decreased between preschool and kindergarten years were rated by their teachers as showing decreases in their internalizing symptomatology. It might be the case that such an association is attributable to 'a third variable' such as negative emotionality (e.g., anger/frustration). That is, increases in anger/frustration might have resulted in parents' perceptions of decreases in self-regulation as well as teachers' perceptions of decreases in internalizing symptomatology. It would be

useful to examine how other child temperamental dimensions interact with self-regulation (reflecting behavioral characteristics of the temperamental dimension of effortful control) to influence the development of child psychopathology.

Limitations

A limitation of this work is its relatively small sample size that may have obscured weak effects such as a main effect of positive parenting and may have contributed to the absence of consistent significant patterns across time points. In addition, considering the low power that characterizes analyses of moderator effects in quasi-experimental research designs (Luthar et al., 2000; McClelland & Judd, 1993), replications with sufficient sample sizes are strongly recommended. The small sample size also precluded us from examining whether there were differences in the interactive effects between child self-regulation and positive parenting as a function of gender and ethnicity. Additionally, given the volunteer nature of the current sample, it is likely that most seriously abusive parents have been excluded as they might have not been willing to participate in the study. Another methodological limitation concerns the fact that we relied solely upon teachers' reports of child symptomatology. Although there are not many strong child self-report measures at the age range observed in this sample (e.g., the companion self-report measure for the TRF is not available for children under the age of 11) and adult reports are often used, it is desirable for future studies to include self-report of problem behaviors. Furthermore, the instrument used for the assessment of positive parenting (PPM) had relatively low reliability (ranging from .58 to .77). Assuming that internal consistency is an appropriate estimate of reliability, the power of the current study to find main and interaction effects of positive parenting may have been compromised by low reliability of the PPM.

Conclusion

The findings of this investigation present significant insights for researchers, as well as for practitioners who wish to provide intervention, by articulating psychological and social processes that contribute to the development of psychopathology in physically abused children. Our results suggest that although physical abuse presents formidable challenges that interfere with the development of adaptive self-regulation, positive parenting behaviors may ameliorate detrimental effects of maladaptive self-regulation on the development of externalizing symptomatology. Our results also imply plasticity in physically abused children by illustrating that the positive and negative effects of caregiving behaviors were more prominent among physically abused children at great risk due to low self-regulation. Thus, the findings highlight the importance of attending to positive parenting behaviors among abusive parents when working with physically abused children who are exhibiting externalizing symptomatology. Such an approach is in line with the belief that abusive parents' behaviors can be changed to promote their children's adjustment. In addition, both prevention and intervention initiatives can be directed towards fostering opportunities for physically abused children to learn adaptive self-regulation skills.

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Figure 1.

Regression lines for Time 2 cross-sectional relations between self-regulation and externalizing symptomatology moderated by positive parenting. b = unstandardized regression coefficient (simple slope). For self-regulation, 'low risk' indicates high self-regulation (i.e., low BRIEF scores) and 'high risk' indicates low self-regulation (i.e., high BRIEF scores).

* $p < .05$.

Figure 2.

Regression lines for longitudinal relations between Time 1–Time 2 average levels of positive parenting and Time 2 externalizing symptomatology moderated by Time 1–Time 2 average levels of self-regulation after controlling for Time 1 externalizing symptomatology. b = unstandardized regression coefficient (simple slope).

* $p < .10$.

Figure 3.

Regression lines for longitudinal relations between Time 2–Time 3 changes in positive parenting and Time 3 externalizing symptomatology moderated by Time 2–Time 3 changes in self-regulation after controlling for Time 2 externalizing symptomatology. b = unstandardized regression coefficient (simple slope).

* $p < .10$.

Descriptive Statistics of Self-Regulation, Positive Parenting, and Externalizing and Internalizing Symptomatology among Physically Abused Children

Table 1

Measure	1	2	3	4	5	6	7	8	9	10	11	12	M	SD
1. BRIEF T1	-												65.27	10.38
2. BRIEF T2	.60 [*]	-											54.46	9.56
3. BRIEF T3	.65 [*]	.65 [*]	-										52.82	8.52
4. Positive Parenting T1	-.02	.11	-.22	-									3.38	0.50
5. Positive Parenting T2	.05	-.28 [*]	-.10	.26 [*]	-								3.49	0.28
6. Positive Parenting T3	-.41 [*]	-.26 [*]	-.36 [*]	.55 [*]	.54 [*]	-							3.44	0.32
7. Internalizing T1	.02	.04	.15	.00	.04	-.19	-						52.30	11.71
8. Internalizing T2	.34 [*]	.26 [*]	.04	.26	.10	.11	.03	-					51.33	10.49
9. Internalizing T3	.03	-.22	-.06	.01	.32 [*]	.10	.07	.21	-				49.54	9.51
10. Externalizing T1	.47 [*]	.31 [*]	.36 [*]	-.14	.25	-.09	.60 [*]	.27	.26	-			55.02	12.21
11. Externalizing T2	.25	.22 [*]	.09	-.09	.05	.02	.24	.56 [*]	.20	.73 [*]	-		59.30	9.87
12. Externalizing T3	.10	.16	.26 [*]	-.17	.26	.17	.17	.33 [*]	.47 [*]	.58 [*]	.45 [*]	-	54.41	10.89

Note. $N = 43$ for Time 1, $N = 63$ for Time 2, and $N = 54$ for Time 3. Higher scores of BRIEF (Behavior Ratings Inventory of Executive Function) indicate lower levels of self-regulation. T1 = Time 1, T2 = Time 2, and T3 = Time 3.

* $p < .05$.

Path Analyses for the Concurrent Effects of Self-Regulation and Positive Parenting on Externalizing and Internalizing Symptomatology among Physically Abused Children

Table 2

Variables	Externalizing Symptomatology			Internalizing Symptomatology		
	Time 1 <i>b</i> (SE)	Time 2 <i>b</i> (SE)	Time 3 <i>b</i> (SE)	Time 1 <i>b</i> (SE)	Time 2 <i>b</i> (SE)	Time 3 <i>b</i> (SE)
BRIEF	.46 (.20) [*]	.24 (.13)	.44 (.18) [*]	-.16 (.23)	.33 (.14) [*]	-.07 (.17)
Positive Parenting	-3.47 (3.28)	1.90 (4.54)	9.47 (4.88) [*]	.06 (3.61)	6.12 (4.92)	1.91 (4.57)
Interaction	.52 (.58)	-1.21 (.51) [*]	-.11 (.58)	.79 (.64)	-.44 (.55)	-.26 (.54)
SMC	.28	.15	.14	.04	.11	.02

Note. Interaction = interaction between self-regulation and positive parenting; SMC = squared multiple correlation indicating the proportion of variance in the outcome that is accounted for by the predictors. Higher scores of BRIEF (Behavior Ratings Inventory of Executive Function) indicate lower levels of self-regulation.

[†] *p* < .10

^{*} *p* .05

Table 3

Longitudinal Path Analyses Predicting Changes in Externalizing and Internalizing Symptomatology from the Average Levels of Self-Regulation and Positive Parenting among Physically Abused Children

Variables	<u>Externalizing Symptomatology</u>		<u>Internalizing Symptomatology</u>	
	<u>Time 2 <i>b</i> (SE)</u>	<u>Time 3 <i>b</i> (SE)</u>	<u>Time 2 <i>b</i> (SE)</u>	<u>Time 3 <i>b</i> (SE)</u>
BRIEF	.05 (.12)	.36 (.20)	.42 (.20) *	-.21 (.20)
Positive Parenting	-4.97 (3.33)	18.02 (6.85) *	8.02 (5.84)	3.99 (6.81)
Interaction	-.62 (.35) †	1.37 (.84)	-.09 (.61)	.40 (.83)
Baseline Symptomatology	.52 (.09) *	.41 (.14) *	.00 (.15)	.22 (.15)
SMC	.59	.33	.22	.09

Note. Interaction = interaction between self-regulation and positive parenting; SMC = squared multiple correlation indicating the proportion of variance in the outcome that is accounted for by the predictors. Higher scores of BRIEF (Behavior Ratings Inventory of Executive Function) indicate lower levels of self-regulation.

† $p < .10$

* $p < .05$

Table 4

Longitudinal Path Analyses Predicting Changes in Externalizing and Internalizing Symptomatology from Changes in Self-Regulation and Positive Parenting among Physically Abused Children

Variables	<u>Externalizing Symptomatology</u>		<u>Internalizing Symptomatology</u>	
	<u>Time 2 <i>b</i> (SE)</u>	<u>Time 3 <i>b</i> (SE)</u>	<u>Time 2 <i>b</i> (SE)</u>	<u>Time 3 <i>b</i> (SE)</u>
BRIEF	.18 (.12)	.15 (.20)	-.44 (.21) *	-6.04 (5.78)
Positive Parenting	-1.42 (4.36)	8.49 (5.47)	-1.46 (7.29)	.19 (.21)
Interaction	-.08 (.36)	-2.54 (.70) *	.36 (.60)	-.39 (.72)
Baseline Symptomatology	.54 (.09) *	.45 (.13) *	-.02 (.16)	.17 (.14)
SMC	.58	.42	.21	.13

Note. Interaction = interaction between self-regulation and positive parenting; SMC = squared multiple correlation indicating the proportion of variance in the outcome that is accounted for by the predictors. Higher scores of BRIEF (Behavior Ratings Inventory of Executive Function) indicate lower levels of self-regulation.

† $p < .10$

* $p < .05$.