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Developmental Risk and Young Children's Regulatory Strategies: Predicting Behavior Problems at Age Five

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Abstract

Children with early developmental delays are at heightened risk for behavior problems and comorbid psychopathology. This study examined the trajectories of regulatory capabilities and their potentially mediating role in the development of behavior problems for children with and without early developmental delays. A sample of 231 children comprised of 137 typically developing children and 94 children with developmental delays were examined during mildly frustrating laboratory tasks across the preschool period (ages 3–5). Results indicated that children with delays had greater use of maladaptive strategies (distraction, distress venting) and lower use of adaptive strategies (constructive coping) than typically developing children. For both groups, strategies had similar rates of growth across time; maladaptive strategies decreased and adaptive strategies increased. The intercept of strategy use, but not the slope, was found to mediate the relation between developmental risk and externalizing behaviors. Findings support that dysregulation, rather than the developmental risk, may be responsible for the high levels of comorbid psychopathology.

Keywords

emotion regulation; intellectual disability; externalizing problems; growth curves

The presence of early developmental compromise conveys risk for the emergence of behavior problems that may be three times the rate for children who are typically developing (Baker, Blacher, Crnic, & Edelbrock, 2002). Despite some recent attention to behavioral phenotypes associated with specific developmental disorders (Dykens & Hodapp, 2007), little is known about the mechanisms that underlie this increased risk. Although family functioning has been often implicated as a key determinant, Crnic, Pedersen y Arbona, Baker, & Blacher (2009) have recently suggested that various family and parenting processes may contribute, but are mediated by emerging emotion and self-regulatory capacities that have a more direct role in influencing children's behavioral competencies.

The ability to regulate emotions and behavior is an essential skill for young children to acquire (Cole, Michel, & Teti, 1994) and has been linked to a child's future social competence as well as the emergence of problem behaviors when not managed well

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(Calkins, Gill, Johnson, & Smith, 1999; Eisenberg et al., 2001; Gilliom, Shaw, Beck, Schonberg & Lukon, 2002; Rydell, Berlin, & Bohlin, 2003). Although the construct of emotion regulation is not without its controversies with respect to both conceptualization and measurement (Cole, Martin, & Dennis, 2004), it has emerged as a factor of substantial interest within developmental psychopathology given its explicit implications for emotion-related disorders of childhood and approaches to treatment (Thompson, Lewis, & Calkins, 2008). Despite the intense interest however, children's regulatory capacities under conditions of developmental risk remain largely unexplored.

Emotion regulation can be understood from multiple perspectives, and this diversity has contributed to the lack of consensus in defining the construct. This conceptual and methodological confusion has posed the greatest challenge to the construct (Cole et al., 2004), but also offers notable opportunity to advance our understanding of the underlying mechanisms of emerging child disorder (Cole & Hall, 2008). Toward that end, Thompson's (1994) proposal that emotion regulation involves "the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals" (pp. 27–28) has provided an important core set of features descriptive of regulatory function. Further, Cole and colleagues have argued convincingly about the need to disentangle emotion expression (especially negative emotions) from those processes that are expressly regulatory with respect to emotion (Cole et al., 1994; Cole et al., 2004; Cole, Luby, & Sullivan, 2008) as key to advancing both measurement and conceptual models of emotion regulation and its connection to child psychopathology. Still, there remains no single approach that offers a unified perspective on the construct and its function.

Despite the centrality of emotion regulation in models of developmental psychopathology, knowledge about the contribution of early regulatory strategies to the emergence of behavior problems over time is limited. Even less knowledge has accrued to describe change in regulatory strategy use over time in either risk or non-risk populations (Eisenberg, Spinrad, & Eggum, 2010). That said, attention to the use of specific regulatory strategies may help to predict child maladaptation or competency (Calkins et al., 1999; Contreras, Kerns, Weimer, Gentzler, & Tomich, 2000; Gilliom et al., 2002) although the ways in which strategy use may change with development are not yet fully understood and may well affect the nature of the predictions. Exploring strategy use over time should not only provide more insight into how this capacity develops in children, but also to the ways in which change in specific regulatory functions are related to subsequent behavior problems.

Specific regulatory strategies can address the intensity, duration, frequency, and dynamics of the emotion expression in the immediate context at hand, providing fuller evaluation of emotion regulation processes. Indeed, research has highlighted certain regulatory strategies as important in predicting social competence or difficulty. In a longitudinal study of disadvantaged boys, Gilliom et al. (2002) reported that the ability at age 3 to shift attention away from a frustrating stimulus was associated with decreased anger, lower externalizing problems, and greater cooperation with others at age 6. In younger children (2 year olds), distress combined with anger venting and greater attention to a focal object was associated with high peer conflict, while distress combined with distraction and orientation to mother or oneself was not (Calkins et al., 1999). With older school aged children, self-reports of greater ability to cope constructively with the task at hand predicted greater peer competence (Contreras et al., 2000). Thus, evidence suggests that regulatory strategy use is meaningfully related to children's early social and behavioral competencies, but critical questions remain regarding the mechanisms that explicate these relations, and the nature of developmental change in children's strategy use over time.

Although a wealth of recent research has focused on the emotion regulation skills of typically developing children, regulatory processes may operate differently under conditions of developmental risk. Young children may develop maladaptive patterns of emotion regulation that deteriorate into ineffective regulation over time. In particular, children with early developmental delay represent an especially salient risk group, as they have critical cognitive deficits in executive skills central to regulatory function (Bekman, 2009) and may exhibit less effective regulation than their typically developing peers (Crnic, Hoffmann, Gaze, & Edelbrock, 2004) as well as substantially increased risk for psychopathology (Baker, Neece, Fenning, Crnic, & Blacher, 2010). Early onset of psychopathology can be marked by high levels of challenging behavior in the preschool years, relative to typically developing children (Baker et al., 2002; Baker, McIntyre, Blacher, Crnic, Edelbrock, & Low, 2003), and diagnoses such as attention deficit hyperactivity disorder, anxiety or oppositional defiant disorder often co-exist with the intellectual disability. But despite the potential to explicate a number of critical issues with respect to regulatory function and developmental process, few studies have specifically focused on the presence of developmental risk.

Several studies, however, are instructive and suggest that children with developmental delays may use emotion regulation strategies differently than typically developing children. Wilson (1999) explored regulatory strategy use and found that 8 year old boys with delays showed a different pattern of strategy use than their typically developing peers, including using less gaze aversion, less use of new strategies after being ignored, and more return to solitary play after social failure. Although instructive, this study’s operationalization of emotion regulation as specific to play behavior differs importantly from more widely accepted conceptualizations of regulation strategies (i.e. distraction or self-soothing). In contrast, Konstantareas and Stewart (2006) compared use of typical regulatory strategies in the face of frustration (removal of attractive toy) between children aged 3 to 10 with Autism Spectrum Disorder (ASD) and typically developing peers. Increasingly adaptive regulatory strategies were coded, including: focus on the frustration object, self-soothing, and active engagement with a substitute toy. Children with ASD exhibited more maladaptive emotion regulation strategies; however, both groups of children exhibited equal levels of active engagement with a substitute toy or alternative activity, a strategy considered to be more adaptive. The ubiquitous expectation that risk would be associated with greater dysregulation across domains may be in question.

Although the relations among risk, emotion regulation, and behavior problems have been inferred, existing research has not yet fully explored the mechanisms that may underlie these relations. In one study, Baker, Fenning, Crnic, Baker & Blacher (2007) found that observed global regulatory functioning at age four significantly predicted social skills two years later, and at least partially mediated the relation between early developmental risk and later social skills. These findings suggest that the presence of early developmental risk may create conditions, especially difficulties with executive functioning and problem solving, under which children develop maladaptive patterns of emotion regulation that deteriorate into ineffective regulation over time. This ineffective regulation or dysregulation in turn may predispose the child toward more problematic behavioral responding. Although intriguing, the potential links among risk, regulatory functioning and behavior problems require further empirical validation to understand the nature of the increased early risk for psychopathology in this population (Baker et al., 2010). Especially critical will be the explication of regulatory function over time. To date, even studies that are longitudinal in scope rarely explore the trajectory of regulatory skills, but instead use emotion regulation at a single time point as a predictor for later behavior problems (Eisenberg, Zhou, Spinrad, Valiente, Fabes, & Liew, 2005).

The current study explored regulatory strategy use across the preschool period as a mediator between the nature of developmental risk at age 3 and the presence of child behavior problems at age 5. For this study, risk was referenced by the presence of early developmental delay, and contrasted with children who were typically developing. This study focuses on two specific questions: 1) would children's use of specific emotion regulation strategies change in a linear fashion over time, such that use of distress venting and distraction decrease, and use of constructive coping and self-soothing increase; and 2) would changes (e.g. growth trajectories) in emotion regulation strategies over time mediate the link between developmental risk and later behavior problems? In particular, and with respect to likely conceptual linkages, it is hypothesized that distress venting will significantly mediate externalizing behaviors, self-soothing will significantly mediate internalizing behaviors, and constructive coping and distraction will mediate both internalizing and externalizing behavior problems.

Method

Design Overview

Data for the current study were drawn from a multi-site (Central Pennsylvania and Southern California), longitudinal investigation that prospectively examined the interrelations among children's developmental risk, family processes, child characteristics, and the emergence of psychopathology in children aged 3 to 9 years. Data for the larger study were collected using a multi-method approach involving structured parent interviews, independent observations of parent-child interactions in naturalistic and lab-based settings as well as questionnaires assessing a range of variables related to family functioning, parental psychopathology, and child behavior problems. Children's cognitive functioning was assessed at age 3 to determine developmental risk. The current study incorporated longitudinal data collected during structured observations of mothers and children at child ages 3, 4, and 5 as well as parent questionnaires at age 5.

Participants

The participants of the current study included typically developing children as well as children with developmental delays and their families who were part of the larger longitudinal study. At 3 years of age, children's developmental risk was determined by their Mental Development Index (MDI) scores on the Bayley Scales of Infant Development (BSID-II; Bayley, 1993). Families who had children with developmental delays at age 3 were recruited primarily through state or community agencies, such as family resource centers, preschools, and daycare centers, and the selection criteria for the children with developmental disabilities included: (1) age of 36 months at time of initial home visit; (2) an MDI score on the BSID-II between 30 and 75; (3) the absence of significant motor impairment; and (4) the absence of diagnosed autism at age 3. In general, children identified for participation had undifferentiated global delay (no known cause), although a small number had Down syndrome or mild cerebral palsy, reflecting recent indications that genetic conditions account for many children who function in the mild to moderate range of developmental delays (Odom, Horner, Snell, & Blacher, 2007). Thus, all children in the developmentally delayed (DD) group had cognitive disabilities, and some also had speech or motor disabilities, but all deficits were mild enough to allow full participation in all project activities. Typically developing (TD) children and their families were recruited primarily through pre-schools, day-care centers, and flyers in the community. The selection criteria for a TD child were: (1) age of 36 months at the time of initial home visit; (2) a score on the MDI of the BSID-II of 85 or above; (3) full term gestation (≥36 weeks at birth); and (4) no known neurobiological difficulties. Approximately one-fourth of the families were recruited from rural/suburban communities in Central Pennsylvania, and three-fourths of the families were recruited from Los Angeles and Riverside counties in Southern California to provide sufficient numbers of children with DD and allow for a more geographically and ethnically diverse sample. As the families from Southern California had higher family incomes, mothers with more education, and more ethnic diversity than the families from Pennsylvania, these variables were included as potential covariates in analyses.

The study initially screened 260 subjects, all of whom qualified for entry into the study, however, 17 subjects chose not to participate. There were 12 participant children who had scores in the borderline range (between 75 and 85) on the Bayley, and those children and families were omitted from the current analyses to ensure clearly distinct groups. Thus, the participants included 231 children: 137 TD children and their families (Mean MDI = 104.57, SD = 11.70) and 94 children with DD and their families (Mean = 57.30, SD = 11.44). Between child age 3 and 5 years, there was a 9.1% attrition rate, with 7.4% of the families dropping out at the 4 year-old data collection, and 1.7% dropping out at the 5 year-old collection. Subjects who attrited did not significantly differ from subjects who remained on any demographic or study variables.

Male children comprised 56.7% of the sample. Ethnicity is representative of the populations at each site. In the current study 60.6% of the children were Caucasian, 15.6% were Hispanic, 7.4% were African American, 2.6% were Asian and 13.9% identified as "other" (typically multiracial). Recruitment initially focused on intact families; at child age 3, 86.1% of the parents were married. The sample was primarily middle and upper-middle class, with 48.1% of mothers having had a college education or higher and 64.8% of the families earning $70,000 or less per year (in 1999–2000). When comparing families of children with DD to families of TD children, children with DD were more likely to be male, $X^2(1)=4.32$, $p<.05$ (51.1% of TD and 64.9% of DD). Children with DD were also more likely to have mothers with fewer years of education, $t(229)=4.12$, $p<.001$, fathers with fewer years of education, $t(211)=4.40$, $p<.001$, and families with a lower annual income $t(228)=3.17$, $p<.01$. On average, children with DD had parents with roughly 1.5 less years of education (i.e. 14.1 years in comparison to 15.8 in paternal education), and families in lower income brackets (i.e. $35,000-$50,000 for DD families and $50,000-$70,000 for TD families). The groups did not differ by child race ($X^2(1)=.07$, p=ns) or marital status ($X^2(1)=3.73$, p=ns). Because of the potential for the children with DD to have experienced some environmental or socioeconomic risk, demographic variables that significantly differed between groups were included as potential covariates in analyses.

Procedure

Once identified as potential participants, families were contacted by phone and an initial home-based visit was scheduled when the child was approximately 36 months old. During this visit, children were administered the BSID-II, from which the child's MDI was computed and used to determine whether the child met criteria for inclusion in the DD or TD group. The Bayley scale was administered by trained graduate students with assessment experience and training on standardized administration. Demographic information was also obtained for the family during this initial visit, and mothers and fathers completed several questionnaires to assess child functioning, family functioning, parental attitudes and beliefs, and the parent-child relationship. Parents were asked to complete these questionnaires independently.

Subsequent laboratory visits were conducted once per year around the time of the child's birthday from age 3 to age 5. Each year, demographic information was updated and parents were given questionnaires to complete similar to the initial set. For the current study, the focus involved child ages that span multiple important developmental changes that children experience in early childhood. To obtain the richest possible assessment of change in emotion regulation over time, data regarding regulatory strategy use were taken from child ages 3, 4, and 5 years. Behavior problems were assessed by maternal and paternal report at child age 5. During each lab visit, parent-child interactions and independent child behaviors were observed during structured lab tasks designed to assess child regulatory behavior as well as parenting characteristics. All lab visits followed a standardized protocol as approved by the IRBs of participating universities. The lab settings were similar at each of the three universities.

Measures

Child developmental risk—At 3 years of age, the Mental Development Index (MDI) was measured using the Bayley Scales of Infant Development (BSID-II; Bayley, 1993). The child's score on the BSID was used to place them in either the TD or DD groups for the larger study.

Child behavior problems—Every year as part of the larger study, parents filled out the Child Behavior Checklist (CBCL; Achenbach 1991) detailing the problem behaviors of the children in the study. The current study used both parents' ratings from child age 5. Responses are scored on 7 narrow-band factors, 2 broadband factors, and a total score. The internalizing and externalizing broad band factors were of interest to the current study.

Emotion regulation strategies—During the lab visits each year, the child and mother completed a clean up task and three problem solving tasks of increasing difficulty. Tasks similar to these (clean-up and difficult problem solving tasks) have been used by others (e.g. Calkins & Dedmon, 2000, Kochanska, Coy & Murray, 2001) as measurements of emotion regulation in children and offer a valid approach to observing developmental processes of emotion regulation (Cole et al., 2004). For each task, coders assessed the intensity of a child's use of several different emotion regulation strategies, each chosen to reflect aspects of regulatory function previously identified in related theory or research. In a single task, the intensity of each strategy use was rated between 0 (no use of strategy) to 3 (most intense use of strategy) on every emotion regulation strategy demonstrated. For the current study, the maximum intensity score was used to capture the highest level of the emotion regulation strategy the child was capable of showing. As the tasks varied in difficulty and activity demand, maximum intensity scores were considered likely to vary as a function of individual children's response to challenge. Each strategy scale score reflected the mean of maximum intensity scores across all four tasks, thereby indicating children's greatest demonstrated regulatory capacity across the variety of tasks. Four regulatory strategies were assessed: distress venting, distraction, constructive coping, and self-soothing.

Distress venting captured behaviors or statements that expressed the child's frustration, displeasure, anger or unhappiness with the task or environment. Behaviors ranged from whining and negative statements to the emotional dynamics associated with temper tantrums outbursts (e.g. rise time, lability, etc.), with prolonged or intensive crying/screaming, throwing task objects, or sustained lashing out at persons or objects representative of higher scores. Although distress venting shares some features with externalizing behaviors, the focus was on the dynamic nature of the emotionality associated with the behaviors (see Results section for more clarification). Distraction involved child focus on some object/ event other than the assigned task, including gaze aversion, playing with task pieces and escape from the situation. Higher scores on distraction reflected child attempts to escape the situation or playing with the task materials rather than working for more than a quarter of the total task. Constructive coping strategies were characterized as behaviors that directly related to achieving the task goal. More intense constructive coping was coded when the child was highly focused and using a systematic approach toward reaching the end goal.

Higher scores on constructive coping reflected the use of consistent, persistent, and extended task effort, whereas lower scores involved passive looks at task materials but no engagement in the task, or only isolated periods of constructive coping. Self-soothing strategies involved behaviors or statements that children might display to help themselves feel better while working on the task, such as sighing, thumb-sucking, rocking, and self-talk. In order for self-talk to qualify as self-soothing, participants had to make self-directed statements, rather than directed toward their mothers. Examples of self-soothing talk would include, "I almost got it" or "maybe I'll get it if I move this piece here." Higher scores on self-soothing required that a child display multiple self-soothing behaviors simultaneously, or one self-soothing behavior for an extended period of time. To maintain reliability, a master coder (trained graduate student) presided over a team of trained undergraduate coders. Average interclass correlations indicate adequate coding reliability for each emotion regulation strategy: Distress Venting = .85; Distraction = .86; Constructive Coping = .95; Self-Soothing = .90.

Data Analytic Plan

To address each aim, data were analyzed using Mplus version 5 (Muthén & Muthén, 2005). All models were estimated using full information maximum likelihood. Patterns of missingness were considered random, as they were not associated with demographic or study variables. Overall, missingness was at a maximum of 18.6% at five years, which included an attrition rate of 9.1%. Data missing at five years was due to mothers or fathers not completing questionnaires or families being unable to come into the laboratory visit at that year only. Full information maximum likelihood has been shown to properly account for such missing data well (Enders & Bandalos, 2001). The first analyses addressed change in strategy use over time using linear latent growth curve modeling (Duncan, Duncan, Stycker, Fuzhong, & Alpert, 1999). A linear growth curve was created for each strategy, and the analysis assessed mean intercept, mean slope, variance of intercept, variance of slope, and covariance between intercept and slope. As shown in Figure I, the loadings from the two latent growth parameters (intercept and slope) were fixed so that the intercept represents the intensity of strategy use at 3 years old and the slope represents the rate of change in strategy use per year. Fit indices reported include a corrected CFI* procedure with an alternative baseline model that has been suggested as more suitable for growth models because of its consideration of mean structure in addition to covariance structure (Wu, West, and Taylor, 2009). Although non-significant chi-squares traditionally indicate a good fit in the model, significant chi-squares can also exist in good-fitting models with larger sample sizes (Wu et al., 2009). Next, mediation analyses were conducted to test strategy use as a mediator between developmental risk and behavioral outcomes. The mediation analyses tested the role of both the intercept and the slope of each strategy, as created in the earlier step. The specific indirect effect for the mediation was calculated via the product of the coefficients method (MacKinnon, 2008). Significance of the indirect effect was tested using the Sobel test (Sobel, 1982), and using 95% confidence intervals constructed by bias-corrected bootstrapping (MacKinnon, 2008). Family income and child gender were included as covariates in all mediation analyses. Other demographic variables (including maternal and paternal education, ethnicity, and marital status) were examined as potential covariates, but were not significantly associated with outcome and therefore were not included in the final models.

Results

Descriptive Statistics

To create each emotion regulation strategy variable, the mean of the maximum intensity scores for each strategy was calculated across the four structured tasks at each time point for each child. Across all strategies, maximum intensity scores at each time point were moderately correlated across the four tasks, with an average correlation of r=.31, and Cronbach's alphas ranging from α=.49 to α=.63. The four tasks varied in the degree of challenge they presented, and therefore some variability was expected in the indices of maximum intensity between tasks. All tasks showed significant variability across the 3 time periods, although decreases in variability were noted at child age 5 for constructive coping across tasks, for distress venting during the clean-up and second problem solving task, and distraction during the second problem solving task. Nonetheless, creating an index of the highest level of each strategy employed across the four tasks provided the best index of children's capability within each strategy, and greater breadth of knowledge about strategy use across a variety of situations.

Significant differences emerged between TD and DD groups on initial MDI, distress venting, distraction, and constructive coping at each child age, and behavior problems at 5 years. Children with DD had higher levels of distress venting, distraction, and behavior problems, and lower levels of constructive coping (Table 1). Levels of self-soothing did not differ significantly between risk groups at any of the time points. Additionally, externalizing behaviors at 60 months had small to moderate correlations with distress venting in TD children, and a range of small to large correlations with distress venting in children with DD, suggesting that these constructs are predominantly distinct (Table 2).

Change in Strategy Use Over Time

The first question addressed whether use of emotion regulation strategies would change over time, such that distraction and distress venting strategies would decrease, while constructive coping and self-soothing strategies would increase. The model fit assessment and parameter estimates are shown in Table 3. The CFI* and SRMR indicated good or adequate model fit for all strategy use. RMSEA indicated poor model fit for distress venting and distraction. Given that there are only three time points in our data, we chose the linear growth model to represent the increase or decrease over time. The mean intercepts and slopes were significantly different from zero for all strategy use (Table 3). Strategy use could range between zero and three; the mean intercepts are the estimated strategy use at 3 years (e.g., 0.58 for distress venting, 1.23 for distraction). The mean slopes indicated that the use of distress venting strategy use decreased by 0.09 per year, and the use of distraction decreased by 0.31 per year. In contrast, the use of constructive coping and self-soothing strategies increased by 0.12 and 0.16, respectively, per year. All four strategies had significant intercept variances, indicating that there were individual differences in strategy use at age 3. However, only distress venting and self-soothing showed significant slope variance, indicating that there were significant individual differences in how fast or slow the strategy use changed over time.

Developmental status was associated with differences in some, but not all measures of strategy use. Children with DD had significantly higher intercepts of distress venting (0.77 versus 0.45, $p < .001$), but did not differ significantly in slope (−0.11 versus −.07, $p = .36$). Children with DD also had significantly higher intercepts of distraction (1.54 versus 1.01, $p < .001$), but did not differ significantly in slope (−0.33 versus −.29, $p = .35$). Children with DD had significantly lower intercepts of constructive coping (2.39 versus 2.77, $p < .001$), but also had more steeply increasing slopes (.16 versus .08, $p < .05$). Children with DD did not differ from TD children on intercept (.39 versus .47, $p = .13$) or slope (.16 versus .15, $p = .84$) of self-soothing.

Child sex was also associated with changes in strategies over time for distress venting and constructive coping. At age 3, boys demonstrated higher levels of distress venting (unstandardized B=0.21, $p < .01$), but also showed more steeply declining slopes (unstandardized B = −0.10, $p < .05$). Boys showed lower levels of constructive coping at age

3 (unstandardized B = −0.23, $p < .01$), but improved at a faster rate (unstandardized B = 0.10, $p < .05$).

Mediation Analyses

Next, we addressed whether emotion regulation strategies over time would mediate the link between developmental risk and later behavior problems. Results of mediation analyses are in Table 4. All models adequately fit the data, with the exception of self-soothing (which was subsequently omitted). When not including the indirect effect, developmental risk significantly predicted both externalizing (β= 0.26, $p < .001$,β= 0.33, $p < .001$, for mothers and fathers, respectively) and internalizing behavior problems (β= 0.25, $p < .001$,β= 0.20, $p < .01$, for mothers and fathers, respectively). As hypothesized, a direct prediction from developmental risk at age 3 to externalizing and internalizing behavior problems exists at age 5 when regulatory strategies are not considered.

Distress venting—Using reports from both parents, developmental risk significantly predicted the intercept of distress venting, which in turn, significantly predicted externalizing behavior. The intercept of distress venting was also significantly related to mother-reported internalizing behavior. The direction of path coefficients indicated that children with DD showed higher use of distress venting at age 3 and that the higher use of distress venting was associated with more externalizing and internalizing behavior problems at 5 years. Overall, the indirect effect of developmental risk on externalizing behavior as mediated by the intercept of distress venting was significant based on both mother's (β= 0.25, $p < .01$, 95% CI [1.56, 11.42]) and father's (β= 0.30, $p < .01$, CI [2.11, 14.39]) report. The direct effect of developmental risk to externalizing behaviors was not significant after accounting for distress venting, indicating the process was fully mediated by the intercept of distress venting. The indirect effect of development risk on internalizing behavior as mediated by the intercept of distress venting was not significant as reported by mothers, although there was a trend toward significance. The indirect effect of developmental risk on internalizing behaviors was not significant as reported by fathers using the Sobel test, however, 95% bootstrapped confidence intervals did indicate significance (β= 0.22, $p = .14$, CI [1.33, 11.20]). The slope of distress venting was significantly related to externalizing behaviors. A steeper decrease in distress venting was associated with fewer externalizing behaviors. The relation between developmental risk and the slope of distress venting was nonsignificant, suggesting no difference in slope between the two groups.

Distraction—Developmental risk significantly predicted the intercept of distraction, which, in turn, significantly predicted externalizing behavior, based on both parents' reports. Thus, the indirect effect of developmental risk on externalizing behavior as mediated by the intercept of distraction was significant using mother's (β= 0.23, $p < .01$, CI [1.69, 10.19]) and father's (β= 0.32, $p < .01$, CI [2.63, 11.30]) report. The direction of path coefficients indicated that children with DD showed higher use of distraction at age 3 and that the higher use of distraction was associated with more externalizing behavior problems at 5 years. The direct effect of developmental risk to externalizing behaviors was not significant, indicating the process was fully mediated by the intercept of distraction. Using maternal report, the indirect effect of developmental risk as mediated by the distraction intercept on internalizing behaviors was nonsignificant, and thus a direct effect remained, such that children with DD had more internalizing behaviors. However, the indirect effect of developmental risk on internalizing behaviors was significant as reported by fathers when using 95% bootstrapped confidence intervals (β= 0.17, $p = .16$, CI [0.29, 7.71]). The slope of distraction was not related to developmental risk, nor with any of the outcomes.

Constructive coping—Using both parents' reports, developmental risk significantly predicted the intercept of constructive coping, indicating that children with DD showed lower use of constructive coping. The intercept of constructive coping was not associated with either externalizing or internalizing behaviors. Thus, the indirect effect of developmental risk on externalizing and internalizing behaviors through constructive coping was not significant using the Sobel test. However, 95% bootstrapped confidence intervals did indicate that the intercept of constructive coping was a significant mediator for both externalizing (mother-report CI[6.76, 59.29], father-report CI[3.05, 42.50]) and internalizing behaviors (mother-report CI[2.39, 26.67], father-report CI[2.11, 28.82]). The slope of constructive coping was significantly related to developmental risk (β= .29, $p < .05$), indicating that children in the DD group had steeper constructive coping slopes (i.e. more rapidly improving) than those in the TD group. The slope of constructive coping was not related to any outcome, nor were there indirect effects with slope.

Discussion

Children's dysregulation has long been considered to act as a precursor to developing psychopathology. Broadly, constructs such as low effortful control and low reactive control have been implicated in the development of externalizing disorders (Eisenberg et al., 2001, 2005, Olsen, Sameroff, Kerr, Lopez, & Wellman, 2005), while negative emotionality and high reactive control have been associated with internalizing behaviors. Yet, recent work has begun to examine the ways in which the path from emotion regulation to the development of psychopathology may be far more intricate and differentiated. Nigg (2006) theorized a number of specific pathways through which differences in self-regulatory capabilities may lead to specific disorders, (i.e. high negative affect/anger combined with low reactive or effortful control acts as a pathway toward conduct problems). The findings from Nigg suggest that the role of regulatory strategies is especially complex, particularly for children who are already at increased risk.

For children with early developmental delays, the need to understand the development of psychopathology is particularly crucial because these children develop comorbid behavior problems at much higher rates than their typically developing counterparts (Baker et al., 2002). The results from the current study suggest that children with delays may demonstrate poorer use of regulatory strategies (Konstantareas & Stewart, 2006), and the established path between developmental risk and increased externalizing behavior problems appears to be mediated by specific regulatory strategies (i.e. distress venting and distraction). The connections between strategy use and behavior problems provide insight into the development of psychopathology, as well as its prevention, particularly for children with developmental risk. Indeed, a child's early ability to control his or her negative emotionality and avoid distraction appear to be key factors in the ability to behave appropriately across a variety of situations.

As would be expected with children who are growing in their regulatory capabilities, both typically developing children as well as those with delays change in their use of emotion regulation strategies over time. Adaptive strategies (e.g. constructive coping and self-soothing) appear to increase, while maladaptive strategies (e.g. distress venting and distraction) appear to decrease across this preschool period. These apparent developmental processes are in keeping with other emerging reports on the growth of regulatory strategies over time. Kochanska, Murray and Harlan (2000) reported increases in effortful control between ages two and three, while Kannass, Oakes, and Shaddy (2006) likewise noted significant increases in child attention span across the first three years of life. Nonetheless, there has been surprisingly little research on the stability of emotion regulation through the preschool years (Eisenberg et al., 2010).

On average, both groups of children not only improved in their regulatory capabilities across the preschool period, but also mostly progressed at relatively similar rates. Similarities in developmental growth in the use of distress venting and distraction between risk groups suggest that there may be an inherent predisposition in all children to improve in regulation at roughly the same rate as they age. This is consistent with Eisenberg et al.'s (2005) demonstration that children maintain relative stability in their regulatory capabilities as they develop, although that study used a sample of children in middle childhood.

The concept that children of varying developmental risk develop certain regulatory capabilities at roughly similar rates seems simplistic, but is actually novel and important given the population at hand. Various definitions of developmental disabilities suggest that these children have delays or impairments in various domains of development, including cognition, communication, social, and motor capabilities (Odom et al., 2007). Prior research has suggested that levels of regulatory capabilities in children with delays is lower than in their typically developing peers (Konstantareas & Stewart, 2006; Wilson, 1999), and the findings from our study confirm those differences. Our findings demonstrate, however, a catch-up effect in which children at risk early improve at a somewhat faster pace of constructive coping. This catch-up may reflect the fact that regulatory strategies were examined in the context of coregulation with the mother where parents may concentrate more on having their child focus and attend to the task. Still, relatively little is known about the process of regulatory development in children with delays in comparison to their typically developing peers. Examining this phenomenon across the school-age period will be critical to determine whether child regulatory capabilities continue to be parallel independent of risk, or whether the growth of strategies diverges at some later point.

Strategy use appears to change over time (increasing or decreasing), but such change does not appear to affect behavior problems. Only the absolute level of strategy use at age 3 mediated the link between developmental risk and externalizing behavior problems; change over time was not a meaningful mediator. Although this may be due in part to limited variability in some measurements at later ages, it is the initial capability level, rather than its increase or decrease, which appears to be a more critical determinant of behavior problems. Consequently, if early strategy use is the better predictor of later behavior problems for risk and non-risk children, then temperament and early regulatory capabilities are key in understanding the development of psychopathology, irrespective of developmental risk.

Links between a child's distress or anger venting and later development of externalizing behaviors have been previously reported (Calkins et al., 1999; Gilliom et al., 2002), and are also consistent with Nigg's (2006) hypothesis that conduct disorder may emerge under conditions in which children demonstrate low reactive control and high negative emotionality. However, although connections between increased focus on frustrating stimuli and co-occurring behavior problems have been suggested (Calkins et al., 1999; Contreras et al., 2000; Gilliom et al., 2002) our findings suggest the opposite is true: decreases in attention to frustrating stimuli may be connected with later externalizing problems. This seeming contradiction might be understood as a function of the context in which a child must regulate his or her emotions.

Context serves a critical role in the interpretation of regulation as adaptive or maladaptive (Cole et al., 1994). Previous studies focused on a frustrating stimulus in a context in which the child was not in control: being forced to wait before eating a cookie (Gilliom et al., 2002), refused access to an attractive toy (Calkins et al., 1999; Konstantareas & Stewart, 2006), or being rejected then ignored by a confederate peer (Wilson, 1999). Distraction from a frustrating stimulus when a child has no control of the situation may be adaptive, that is, the child minimizes exposure to the offending situation allowing time to calm. However, in

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the current study, a focus on the object was paramount to completing the task. Thus, distraction from the task did not further the child in their goal and often was in direct opposition to a parent's direction to continue the task. From this perspective, distraction would be sensibly associated with later externalizing behavior problems (Murray & Kochanska, 2002).

Less comprehensible was the failure of self-soothing to mediate the association between developmental risk and later behavior problems. We assumed that a child's ability to self-soothe would be integral to avoid later behavior problems, as previous research indicates that self-orienting behaviors such as thumb-sucking and hair-twirling (Calkins et al, 1999) in combination with use of other regulation strategies, may protect the child from problems such as peer conflict (Calkins et al, 1999). Although we addressed behavior problems more broadly, the apparent failure of self-soothing to prove more adaptive was unanticipated. It is likely that descriptive markers of self-soothing vary in their adaptive quality as children develop, thereby making it more difficult to demonstrate the expected relations. Indeed, self-soothing behaviors such as thumb-sucking and rocking may be appropriate at age 3, but are less appropriate as the child ages and regulatory skills become more internalized. In contrast, many self-soothing behaviors, such as self-talk and sighing, increase as children develop and may be quite adaptive during difficult tasks. Although our coding system was designed to capture positive self-talk that would act as soothing, it is possible that the coded self-talk simply reflected children's growing language skills, as talking aloud may reflect verbal thinking. The developmental significance of overt self-soothing, and the behaviors that identify it, require further explication to address the complexity of its function in children's early competence.

Several limitations in the current study should be considered when interpreting the results. In this study, poor emotion regulation strategy use was hypothesized to be a mediator to emerging behavior problems, and prior work indeed suggests that early dysregulation signals risk for the emergence of psychopathology (Cole & Hall, 2008; Eisenberg et al., 2010). Yet, there are similarities in the behaviors and emotions that address strategy use as well as behavior problems. In particular, distress venting and externalizing behaviors may share some features. Weems and Pina (2010) acknowledge the inherent difficulty in measuring these overlapping constructs and the potential measurement contamination that may arise. We intentionally tried to minimize these issues by focusing more on the dynamic qualities of the strategies, and through divergent approaches to assessment (observations and parental report), but potential overlap does remain.

It was expected that constructive coping strategy use would mediate the relation between developmental status and behavioral outcomes, but the findings were equivocal. Within the context of the specific statistical techniques employed (i.e. bias-corrected bootstrapping), the significance test indicated that constructive coping was a mediator. However, it was not clear if there was a meaningful pathway between constructive coping and behavior problems. Given these conflicting aspects in our findings, the actual role of constructive coping remains unclear and requires further attention.

Finally, it cannot fully be determined if the contexts in which emotion regulation was measured created conditions sufficient to elicit the need for children to regulate their emotions. This begs the question to what degree the observed strategies reflect actual regulated emotion behavior, particularly as the children aged. While it is prudent to be cautious in interpreting the implications of these findings, variability was apparent in children's emotional responses to the situations (problem-solving, clean-up), offering some validation for Cole et al.'s (2004) suggestion that these tasks can serve as valid contexts to assess regulatory behavior.

Questions remain regarding the developmental processes involved in children's early regulatory strategy use and the implications for emerging psychopathology. Such inquiries may be especially relevant for children with developmental delays, as risk for psychopathology in these children is much greater than for that of children who are typically developing. Although developmental delay itself was initially thought to result in higher rates of comorbid psychopathology, the current study contributes to emerging evidence that these children have poorer regulatory capabilities, and such dysregulation may be an important contributor to the high rates of behavior problems for children with early identified developmental risk. Explanatory models that add breadth to the developmental periods under investigation, as well as the contexts in which the regulatory strategies are employed, will help to further explicate those mechanisms that underlie emerging psychopathology in these risk groups.

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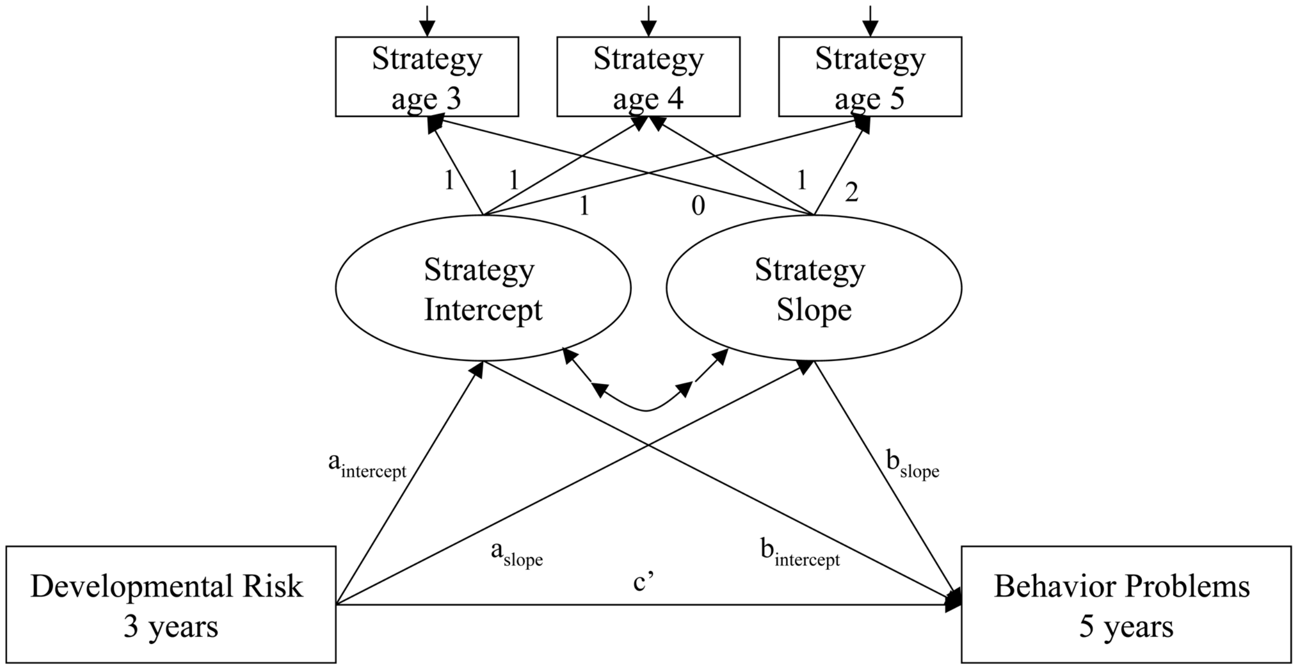

Figure I.
Analysis Model

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Table 1

Descriptive Statistics

	Developmentally Delayed (n=94)		Typically Developing (n=137)		
	Mean(SD)	**Range**	**Mean(SD)**	**Range**	**t**
MDI	57.30 (11.44)	30–75	104.57(11.70)	85–139	30.43***
Distress Venting					
3 years	.74(.59)	0–2.75	.45(.39)	0–1.50	−4.08***
4 years	.77(.61)	0–3.00	.41(.44)	0–2.25	−4.65***
5 years	.51(.54)	0–2.25	.32(.34)	0–1.50	−2.54*
Distraction					
3 years	1.59(.70)	0–3.00	1.07(.61)	0–2.75	−5.99***
4 years	1.10(.65)	0–2.50	.61(.49)	0–2.00	−5.87***
5 years	.92(.66)	0–3.00	.46(.39)	0–1.67	−5.20***
Constructive Coping					
3years	2.35(.64)	.50–3.00	2.75(.34)	1.50–3.00	5.31***
4 years	2.59(.50)	.75–3.00	2.87(.27)	1.50–3.00	4.74***
5 years	2.72(.45)	1.50–3.00	2.93(.16)	2.25–3.00	3.65***
Self-Soothing					
3 years	.41(.45)	0–2.50	.47(.34)	0–1.50	1.21
4 years	.49(.43)	0–1.50	.60(.44)	0–2.00	1.85†
5 years	.75(.44)	0–1.75	.78(.46)	0–2.25	.37
CBCL Mother Externalizing					
5 years	16.62(10.58)	1–41	10.62(8.46)	0–35	−4.02***
CBCL Father Externalizing					
5 years	17.12(9.91)	1–42	10.43(8.18)	0–39	−4.80***
CBCL Mother Internalizing					
5 years	11.94(8.95)	1–57	7.50(6.11)	0–33	−3.92***
CBCL Father Internalizing					
5 years	12.26(9.21)	0–50	8.20(7.80)	0–54	−3.10**

Note:

† $p < .08$,

* $p < .05$,

** $p < .01$,

*** $p < .001$

Table 2

Intercorrelation Table Split by Developmental Risk

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. DV 3 yr	--	.28*	.21	.50***	.07	.03	−.60***	−.17	−.16	.05	−.08	−.01	.16	.04	.07	−.03
2. DV 4 yr	.21*	--	.19	.37**	.22*	.26*	−.33**	−.55***	−.27*	.19	−.13	.07	.26*	.41**	.10	.32*
3. DV 5 yr	.02	.36**	--	.23†	.28*	.58***	−.09	−.33**	−.56***	.30*	−.26*	.22†	.41**	.49***	.21	.32*
4. DIS 3 yr	.43***	.14	.17†	--	.47***	.30*	−.59***	−.33**	−.29*	.08	−.04	−.21	.23*	.28*	.04	−.04
5. DIS 4 yr	.08	.15	.15	.25**	--	.49***	−.18	−.50***	−.33**	.14	−.09	−.03	.20†	.39**	.04	.16
6. DIS 5 yr	−.09	.15	.14	.18†	.24**	--	−.16	−.54***	−.65***	.21	−.14	.05	.31*	.43***	25*	.33*
7. CC 3 yr	−.44***	−.12	−.03	−.46***	−.01	−.05	--	.24*	.16	−.17	−.05	.13	−.26*	−.19	−.10	−.04
8. CC 4 yr	−.13	−.22*	−.01	−.08	−.31**	−.08	−.07	--	.55***	−.28*	.14	−.08	−.32**	−.34**	−.20	−.17
9. CC 5 yr	−.04	−.02	−.11	−.04	.02	−.21*	.05	.24**	--	−.35**	.09	−.01	−.27*	−.43**	−.26*	−.45**
10. SS 3 yr	.20*	.01	.23*	.08	−.06	−.01	−.08	−.05	.01	--	−.03	−.13	.05	.05	−.06	.00
11. SS 4 yr	−.03	−.09	.02	−.02	.08	−.03	.05	.11	.07	.13	--	.02	−.22†	−.25*	−.15	−.17
12. SS 5 yr	−.02	−.04	.12	.07	.10	.12	−.03	.03	−.05	−.16	−.01	--	.06	.04	.12	.13
13. MEXT	.14	.19*	.14	.09	.15	.11	−.08	−.10	−.12	.09	−.07	−.10	--	.69***	.66***	.45***
14. FEXT	.24*	.23*	.20†	.17	.19†	.06	−.24*	−.15	−.19†	.10	−.10	.05	.56***	--	.49***	.68***
15. MINT	.16	.00	−.02	−.13	−.01	.05	−.03	−.06	−.02	.02	−.17†	−.04	.66***	.34***	--	.61***
16. FINT	.30**	.14	.15	.21*	.10	−.02	−.18†	−.15	−.17	.12	−.15	.05	.29**	.76***	.32**	--

Note:

† $p < .08$,

* $p < .05$,

** $p < .01$,

*** $p < .001$

Correlations above and to the right of the diagonal represent the scores for children with developmental delays, scores below and to the left of the diagonal represent the scores for typically developing children. DV=Distress Venting Strategy Use; DIS=Distraction Strategy Use; CC=Constructive Coping; SS=Self-Soothing; MEXT=Maternal Externalizing Behaviors; FEXT= Father Externalizing Behaviors; MINT=Mother Internalizing Behaviors; FINT=Father Externalizing Behavior

Table 3

Linear Growth Models for Strategy Use

	Intercept	Int. Variance	Slope	Slope Variance	χ^2(df)	CFI*	RMSEA	SRMR
Distress Venting	0.58***	0.13**	−0.09***	0.04*	4.15(1)*	.94	.12	.04
Distraction	1.23***	0.24***	−0.31***	0.03	16.35(1)***	.92	.26	.06
Const. Coping	2.61***	0.07**	0.12***	0.02	2.84(1)	.98	.09	.04
Self-Soothing	0.44***	0.07*	0.16***	0.04*	2.23(1)	.98	.07	.03

Note:

* $p < .05$,

** $p < .01$,

*** $p < .001$

CFI* was calculated using the procedure by Wu, West, and Taylor (2009)

Table 4

Mediation Results of All Analyses

	Fit Indices				Parameter Estimates					Indirect Effect	
Outcome	χ^2(df)	CFI*	RMSEA	SRMR	$a_{intercept}$	a_{slope}	$b_{intercept}$	b_{slope}	c′	via Intercept	via Slope
Distress Venting											
CBCL Ext											
Mother	6.90(5)	.99	.04	.03	0.44***	−0.10	0.57**	0.45*	0.05	0.25**[1.56, 11.42]	−0.04[−5.18, 1.65]
Father	8.75(5)	.98	.06	.03	0.45***	−0.11	0.66**	0.58*	0.08	0.30**[2.11, 14.39]	−0.06[−7.53, 2.13]
CBCL Int											
Mother	7.36(5)	.98	.05	.03	0.43***	−0.09	0.28*	0.11	0.14	0.12†[−0.06, 7.48]	−0.01[−3.23, 0.47]
Father	7.70(5)	.98	.05	.03	0.44***	−0.10	0.51	0.31	0.00	0.22[1.33, 11.20]	−0.03[−5.52, 1.16]
Distraction											
CBCL Ext											
Mother	19.73(5)**	.95	.11	.04	0.52***	−0.13	0.44**	0.27	0.06	0.23**[1.69, 10.19]	−0.04[−9.35, 0.53]
Father	19.57(5)**	.95	.11	.04	0.53***	−0.14	0.61**	0.27	0.03	0.32**[2.63, 11.30]	−0.04[−7.34, 0.70]
CBCL Int											
Mother	20.09(5)**	.95	.11	.04	0.52***	−0.13	0.16	0.37	0.22*	0.08[−1.65, 7.63]	−0.05[−6.86, 0.64]
Father	19.56(5)**	.95	.11	.04	0.52***	−0.14	0.33	0.20	0.05	0.17[0.29, 7.71]	−0.03[−6.89, 0.44]
Constructive Coping											
CBCL Ext											
Mother	3.45(5)	1.00	.00	.03	−0.70***	0.29*	−0.97	0.14	−0.46	0.67[6.76, 59.29]	0.04[−0.42, 18.27]
Father	3.20(6)	1.00	.00	.03	−0.69***	0.29*	−0.95	0.00	−0.34	0.59[3.05, 42.50]	0.12[−2.30, 5.74]
CBCL Int											
Mother	3.33(5)	1.00	.00	.03	−0.69***	0.29*	−0.51	−0.01	−0.10	0.35[2.39, 26.67]	−0.00[−0.92, 7.95]
Father	3.43(5)	1.00	.00	.04	−0.69***	0.29*	−0.47	−0.20	−0.08	0.32[2.11, 28.82]	−0.06[−3.96, 2.87]

Note:

† $p < .08$,

* $p < .05$,

** $p < .01$,

*** $p < .001$

The parameter estimates and indirect effects are standardized path coefficients. CFI* was calculated using the procedure by Wu, West, and Taylor (2009). Indirect effect is calculated by the Sobel Test, and 95% confidence intervals were computed using bias-correcting bootstrapping. $a_{intercept}$ and a_{slope} represent the paths between developmental risk and strategy use. $b_{intercept}$ and b_{slope} represent the paths between strategy use and outcome. c’ represents the direct path between developmental risk and outcome, controlling for both slope and intercept of strategy use. Ext=Externalizing Behaviors; Int=Internalizing Behaviors; Mother=Maternal Report of Behaviors; Father=Paternal Report of Behaviors.