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Effortful Control, Positive Emotional Expression, and Behavior Problems in Children Born Preterm

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Abstract

The present study focused on the role of high effortful control in the expression of positive emotion and development of behavior problems in children born preterm (mean gestational age = 31.4 weeks). Using data from a prospective longitudinal study, the present study assessed effortful control and behavior problems at 24 and 36 months and positive emotional expression at 24 months in a sample of 173 children born preterm. Less positive emotional expression was associated with higher effortful control for boys but not girls. Higher effortful control was associated with fewer total behavior problems, but this relation was attenuated when socioeconomic assets were included in the model. More socioeconomic assets were associated with fewer behavior problems for both boys and girls and higher effortful control for girls. Socioeconomic assets appear to be an important factor in the development of effortful control and behavior problems in children born preterm regardless of gender, whereas positive emotional expression was important for boys. Future intervention research should examine fostering adaptive levels of effortful control in high-risk populations as a means to facilitate resilience processes.

Keywords

effortful control; gender; internalizing problems; positive emotion; preterm infants

1. Introduction

Although infants born preterm (< 37 weeks gestation) are more likely to survive than ever before, preterm infants continue to experience elevated morbidity rates such as cognitive delays and behavior problems. Estimates suggest that 50 to 70% of infants born preterm may develop behavioral difficulties, including externalizing and internalizing problems (Aylward, 2005; Bhutta, Cleves, Casey, Cradock, & Anand, 2002; Pinto-Martin et al., 2004; Taylor, Klein, & Hack, 2000). These behavioral disturbances in preterm infants may be related to early impairments in self-regulation (e.g., Davis & Burns, 2001), including

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problems with sustained attention, inhibitory control, and emotion regulation (Berger et al., 2007). One temperament-related construct that reflects emerging self-regulation (Zhou, Chen, & Main, in press) is effortful control (EC), the capacity to suppress a dominant response in order to express a subdominant response (Rothbart & Bates, 2006). The present study examined the associations among effortful control, positive emotional expression, and children's behavior problems in boys and girls born preterm. The study sought to examine whether high effortful control was associated with less positive emotional expression and higher internalizing behavior problems in children born preterm, and if these associations differed between girls and boys.

1.1. Effortful control and behavior problems

Temperament theory describes effortful control as the regulatory aspect of temperament that serves to modulate reactivity (Rothbart & Bates, 2006). Behavior problems are thought to reflect, in part, impairments in the ability to self-regulate. Therefore, children low in EC, including delay of gratification, slowing motor activity, lowering one's voice, suppressing and initiating an activity upon signal, and effortful attention (Kochanska, Coy, & Murray, 2001), are expected to exhibit higher behavior problem scores than children high in EC. In healthy full-term children, low EC predicts higher externalizing behavior problem scores (e.g., Eiden, Colder, Edwards, & Leonard, 2009; Kochanska & Knaack, 2003; Kochanska, Barry, Jimenez, Hollatz, & Woodward, 2009), especially behavior problems that reflect impulsivity or attentional difficulties (Murray & Kochanska, 2002; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005). However, the association between EC and internalizing behavior problems appears more complex. Some studies have found that high EC predicts higher internalizing behavior problem scores (Kochanska, Murray, & Harlan, 2000; Murray & Kochanska, 2002), whereas other studies have documented no association (e.g., Dennis, Brotman, Huang, & Gouley, 2007). Moreover, in a sample of low-risk children, Murray and Kochanska (2002) found a curvilinear relationship between EC and behavior problems, in which moderate levels of EC predicted the fewest total behavior problems. Post-hoc tests indicated that high EC was associated with higher internalizing behavior problem scores whereas low EC was associated with higher externalizing behavior problems.

Few studies have examined links between EC and behavior problems in children born preterm. In one exception, Poehlmann, Schwichtenberg, Shah, Schlafer, Hahn, and Maleck (2010) documented a link between low EC and concurrent symptoms of inattention and Attention-Deficit/Hyperactivity Disorder (ADHD) but not broadband behavior scales. High EC is often conceptualized as an asset or optimal outcome, as children may be protected from developing disorders related to inattention and disinhibition when they excel at suppressing a dominant (or impulsive) response. However, given previous findings regarding EC and internalizing problems in low-risk samples, it is possible that very high levels of EC may represent a tendency toward over-control. Eisenberg and colleagues (e.g., Eisenberg & Morris, 2002; Eisenberg et al., 2005) have proposed a model regarding three types of control: undercontrol, overcontrol, and optimal control. Overcontrolled individuals are hypothesized to reflect a combination of optimal and less optimal aspects self-regulation. Specifically, high reactive control and low impulsivity are thought to reflect better self-regulation, whereas low effortful attention is thought to reflect poorer self-regulation (Eisenberg, Hofer, & Vaughan, 2007). In addition, overcontrolled individuals are thought to develop internalizing behavior problems and low levels of positive emotion, and they may find it difficult to engage with attractive stimuli or be spontaneous (Eisenberg, et al., 2009; Eisenberg, Hofer & Vaughan, 2007). Following these hypothesized relations, some researchers suggest that higher internalizing problems are associated with low impulsivity and attentional regulation, although the associations are complex (Eisenberg et al., 2009). Studies with preterm children have not examined such possibilities, nor have they examined

the relation between positive emotion expression and EC. Optimal effortful control may represent a possible source of resilience for preterm infants (Poehlmann et al., 2010). In order to promote positive development in these vulnerable infants, very high and low levels of effortful control and positive emotion expression and their relations to behavior problems should be investigated.

1.2. Positive emotional expression and effortful control

Temperament theory, as described by Rothbart and colleagues (e.g., Rothbart & Bates, 2006), posits two broad temperamental systems: reactive and regulatory. EC is viewed as a regulatory temperament construct, whereas positive affect can be viewed as a reactive temperament construct. EC serves as the “brakes” on the “acceleration” of the temperamental reactive system, which include positive affect and approach (Rothbart & Ellis, 2004). According to Rothbart and colleagues, the strength of the brakes and the force of the acceleration can influence each other. High levels of EC can serve to modulate expression of intense emotions; therefore children who exhibit few emotional expressions may also have high EC. High EC may not be adaptive or desirable in all situations, as when it results in difficulty expressing positive emotions. Rothbart and Ellis warn, “The ends achieved through EC may or may not be adaptive ones, however, and when control results in rigid response to social situations, the outcomes may not be favorable ones (1994, p. 452).” Therefore, it is possible that high levels of EC may inhibit children’s ability to express positive emotions, even in socially acceptable circumstances.

Low levels of positive emotions appear to be associated with high EC in healthy full-term children. For example, Kochanska and Knaack (2003) found that both parent-reported and observed joy was negatively associated with EC scores at 33 and 45, but not 22 months in typically developing children. Similarly, Kochanska, Murray, and Harlan (2000) found that children who exhibited less intense joy displays had higher EC scores at 22 and 33 months. Consistent with temperament theory, the authors suggest that EC may serve to modulate intense emotions, and therefore a stronger EC system would be associated with less intense emotional displays. This modulation, however, may not always be optimal when it occurs in excessive amounts, especially in vulnerable children. It is possible that preterm children with high EC may find it difficult to express positive emotions, even when appropriate. Moreover, difficulty expressing positive emotions has been associated with elevated anxiety and internalizing problems (Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996). Children who demonstrated low positive affect during a laboratory temperament assessment had a frontal EEG asymmetry, which is associated with depression (Shankman, Tenke, Bruder, Durbin, Hayden, & Klein, 2005). In addition, Lengua, Sandler, West, Wolchik, and Curran (1999) found that higher positive emotionality in children post-divorce was related to fewer depressive symptoms, threat appraisals, and conduct problems, and more active coping. The authors suggest that low levels of positive emotionality are linked to unrewarding experiences and the absence of pleasurable engagement, which then may lead to apathy and depression. However, high positive emotional expression can be associated with maladaptive outcomes as well. For example, high levels of positive emotionality have been linked to externalizing behavior problems and low levels of prosocial behavior, especially when accompanied by low levels of regulation (Rydell, Berlin, & Bohlin, 2003; Eisenberg, Fabes, Guthrie, et al., 1996). It is particularly important to understand children’s positive emotional expression in relation to EC in young children born preterm to determine if high EC functions as an asset or possible risk.

1.3. Gender

In general, girls score higher on EC tasks than boys. A recent meta-analysis found substantial and significant gender differences in EC, with girls displaying higher EC than

boys (Else-Quest, Hyde, Goldsmith, & Van Hulle, 2006). Moreover, boys born preterm display higher rates of ADHD and behavior problems than girls born preterm (Blair, 2002; Lindstrom, Lindblad, & Hjern, 2011). EC may be a particularly important skill for boys born preterm, as it may protect them from developing ADHD and other problems related to inattention and impulsivity. In the present study, we assessed the main effects of gender as well as examining gender as a moderator of the relation between EC and behavior problems in children born preterm.

1.4. Family socioeconomic status and infant birthweight

Previous studies have documented the effects of family socioeconomic (SES) risks on child outcomes, including children born preterm (e.g., Brooks-Gunn & Duncan, 1997; Candelaria, Teti, & Black, 2011; Linver, Brooks-Gunn, & Kohen, 2002). For example, children from families with fewer socioeconomic assets (e.g., less maternal education) have more health problems and elevated parent-reported behavior problems (e.g., Ruijsbroek et al., 2011). Thus, we examined models with and without SES variables to assess the effect of such risks on relations between EC, positive emotional expressions, and child behavior problems.

Building on the research reviewed above, we addressed five research questions using models that incorporate infant birthweight, gestational age, gender, and socioeconomic assets.

1. In children born preterm, is EC associated with total behavior problems in a curvilinear or linear fashion?
2. Do preterm children with very high EC show higher internalizing problems and do preterm children with very low EC show higher externalizing problems?
3. Are EC and positive emotion expression inversely related in preterm children?
4. Do the associations between EC, positive emotion expression, and behavior problems vary by gender?
5. Does the inclusion of family SES affect relations among EC, positive emotion expression, behavior problems and gender in children born preterm?

2. Methods

2.1. Participants

Infants born preterm and their mothers were recruited from three neonatal intensive care units (NICUs) in southeastern Wisconsin between 2002 and 2005. A research nurse at each hospital invited families to participate in the study if they met the following criteria: (a) infants were born at or less than 35 weeks gestation or weighed less than 2500 grams at birth, (b) infants had no known congenital malformations or prenatal drug exposures (including significant neurological complications like PVL or grade IV IVH), (c) mothers were at least 17 years of age, (c) mothers could read English, and (d) mothers self-identified as the child's primary caregiver. Infants and families were assessed at six Timepoints: just prior to the infant's NICU discharge (Time 1), and at 4 (Time 2), 9 (Time 3), 16 (Time 4), 24 (Time 5) and 36 months (Time 6), corrected for prematurity. Corrected age is calculated based on the infant's due date and is commonly used in assessments of preterm infants (DiPietro & Allen, 1991). If children were part of a multiple birth, one infant was randomly selected to participate in the study.

Initially, 181 infants and their mothers were recruited. Only infants who were preterm (< 36 weeks), had no significant neurological complications, and completed laboratory visits at Times 5 and 6 were included in this study. Data screening revealed that two children were diagnosed with pervasive developmental disabilities (i.e., Autism or Cerebral Palsy), three

children experienced a grade IV IVH prior to hospital discharge, and three children were born after 36 weeks gestation. These children were removed from all analyses, resulting in a final sample size of 173 infants and their mothers. Sample characteristics are detailed in Table 1.

From Time 1 to Time 6, there was a 17% attrition rate. At Time 5, 154 families continued to participate. This number declined slightly to 150 at Time 6. Multivariate Analysis of Variance (MANOVA), follow-up ANOVAs, and Chi-square analyses were conducted to test for significant differences between families lost to attrition and families who remained in the study at Time 6. Families lost to attrition did not differ from families who remained in the study on infant health variables, child gender, paternal age, family income, number of children in the family, and maternal race. However, families were more likely to be lost to attrition when the mother was younger, $F(1, 180) = 9.20, p < .01$, and single, $\chi^2(1) = 10.57, p < .01$, and had completed fewer years of education, $F(1, 180) = 17.55, p < .01$, and when the father had completed fewer years of education, $F(1, 180) = 8.74, p < .05$. In addition, infants lost to attrition were less likely to be Caucasian, $\chi^2(1) = 7.48, p < .05$.

2.2. Procedure

A research nurse at each NICU informed eligible families about the study. Interested families signed an IRB-approved consent form and were contacted by study personnel to schedule a visit prior to NICU discharge. During this visit, a researcher collected demographic data from the mother and infant health risk information from the infant's medical chart. At 24 months postterm, families visited the laboratory playroom and researchers assessed the child's positive emotional expression. At this visit, as well as at a similar one at 36 months postterm, the child's effortful control was assessed and mothers completed the Child Behavior Checklist. Families were paid \$80 for the 24 month visit and \$85 for the 36 month visit. Children were given an age-appropriate book or toy.

2.3. Measures

2.3.1. Effortful control—We examined five components of children's effortful control at 24 and 36 months using a behavioral battery described in Kochanska et al. (2000): effortful attention (Animal Shapes), slowing motor activity (Walk-a-line Slowly), lowering voice (Whisper), ability to delay (Snack Delay and Gift Bag at 24 months; Magic Mountain at 36 months), and suppressing-initiating activity to signal (Towers at 24 months; Cards at 36 months). The tasks were administered by a trained graduate student.

2.3.1.1. Effortful attention: Effortful attention was measured by a Stroop-like task called Animal Shapes in which the researcher presented the child with animal cards and asked them to point to the less salient animal. For example, the card may contain a large dog with a picture of a small bird in the middle, and the child would be asked to point to the bird. The child was shown two sets (of three cards each) with a small picture of an animal imbedded within a larger picture of a different animal. The child's responses were coded as *refusal or pointing to incorrect animal* (0), *pointing to large rather than small animal* (1), *self-correction* (2), and *correctly pointing to small animal* (3). Higher scores indicated more effortful attention. Coders achieved average kappas of .95 at 24 months and .86 at 36 months.

2.3.1.2. Lowering voice: The Whisper task included raising the child's activity level (e.g., playing a chasing game at 24 months and jumping on a trampoline at 36 months) and then asking the child to whisper across two trials. The task was coded as 0 (*no response*), 1 (*responds but does not whisper*), or 2 (*whispers*), with a kappa of 1.0 at 24 months and .87 at 36 months.

2.3.1.3 Slowing motor activity: The Whisper task was immediately followed by the Walk-a-line-slowly task, when the child was asked to walk on a line taped to the floor as slowly as possible for two trials. The seconds that it took the child to walk across the line were averaged to arrive at a final score. Interrater reliability was 1.0 at 24 months and .92 at 36 months within 1 second of children's walk times (the 1-second standard was used because of the brief times of each trial). Higher scores indicate more ability to slow motor activity.

2.3.1.4. Ability to delay: The Snack Delay task at 24 months included four trials, with each successive trial requiring the child to wait for longer periods of times (range of 10 to 30 seconds). In this task, the child was asked to wait with his hands on the table until the experimenter rang a bell before retrieving a candy from underneath a clear plastic cup. Delay to touch the cup (in seconds) was coded for each trial and averaged across all four trials. The delay task was independently coded by two trained students, who attained 100% reliability with each other within 1 second of the child's response (the 1-second standard was used because of the short time for each trial). For the Gift Bag task at 24 months, the child was presented with a brightly colored gift bag filled with tissue paper and a small prize and asked not to touch the bag for 2 minutes (after which the child was allowed to retrieve the prize). The task was rated using mutually exclusive categorical codes ranging from 1 (*child pulls gift from bag*) to 5 (*child does not touch bag*). The Gift Bag task was independently coded by two trained students who attained 100% reliability ($\kappa = 1.0$).

To assess delay at 36 months, we presented the child, who was seated at a small table, with an interesting toy (Magic Mountain) and asked him to refrain from touching it until the adults returned to the room. The mother and researcher then left the child in the room alone with the toy for 3 minutes. Children were coded on the variables *seconds until touch* and *seconds until manipulation of the toy*. Interrater reliability for this task ranged from .90 to 1.0 (considered correct if agreement was within 2 seconds; a 2-second standard was used because of the relatively long length of this observation).

2.3.1.5. Suppressing-initiating activity to signal: At 24 months, the Towers task included providing instruction regarding expectations for turn taking, then asking the child to build a block tower with the experimenter across two trials. The task was coded as a function of the average number of turns the child allowed the experimenter, with higher scores indicating more turn taking ($\kappa = 1.0$).

At 36 months, we adapted the Towers task. Instead of using blocks, we used cards with brightly colored characters. Children were instructed to play a game in which they took turns with the researcher when matching the cards on a board. The Cards task was coded as a function of the number of turns the child allowed the experimenter to take. Higher scores indicated more turn-taking, $\kappa = .94$.

2.3.1.6. EC composites: Because studies with children born full-term have combined these tasks into an effortful control composite (EC composite; Kochanska et al., 2000, 2001), we also used this approach. At 24 months, the EC composite was created by averaging standardized scores from Gift Delay, Snack Delay and each of the two trials of Walk-a-line, Whisper, Animal Shapes, and Towers. The 24 month EC composite had a Cronbach's α of .60 (10 items), with higher scores indicating more effortful control skills. At 36-months, we created an EC composite by averaging the standardized scores from Cards, each of the two trials of Walk-a-line, Whisper, and Animal Shapes, and the two delay variables from the Magic Mountain task ($\alpha = .71$; 9 items). Again, higher scores reflected more effortful control skills. Internal consistency for the EC composite for Kochanska et al.'s (2000) full-term 22-month-olds was .42, and for 33-month-olds it was .77, similar to our composites.

2.3.2 Positive emotional expression—Following administration of EC tasks at the 24 month visit, children were invited to catch bubbles that the researcher blew from a small soap bubble container. The researcher blew the bubbles and the child's reactions were videotaped for a period of one to three minutes. To standardize the length of time used in analyses, the first minute of child behavior was coded in 10 second intervals for the presence of smiles, laughs, positive vocalizations, and positive motor behaviors. Definitions of codes were taken from the joy and pleasure episodes of the manual of the Laboratory Assessment of Temperament (Lab-TAB) (Goldsmith & Rothbart, 1999), a widely-used observational assessment (Gagne, Van Hulle, Aksan, Essex, & Goldsmith, 2011). Smiles were coded as present if there were upturned lips and at least some movement of the cheeks; intensity of smiles was not coded. Positive vocalizations were defined as the presence of positively toned squealing, babbling, and other similar behaviors, and positive motor behaviors were defined as the presence of clapping, waving arms in excitement, and similar behaviors. A laugh was defined as rhythmic vocalizations accompanied by a smile. Three children (2%) participated in only 30 seconds of the bubbles activity so their scores were considered as missing. Cronbach's alphas for the smile, laugh, vocalization, and motor codes were .76, .77, .75, and .84, respectively. For the positive emotion expression composite (used in analyses) Cronbach's alpha was .82. Average kappa values for interrater reliability were as follows: smile, $\kappa = .73$; laugh, $\kappa = .80$; positive vocalizations, $\kappa = .78$; and positive motor activity, $\kappa = .88$.

2.3.3. Behavior problems—The internalizing, externalizing, and total problem scales of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000) were used to assess maternal reports of children's behaviors at 24 and 36 months. The CBCL is a widely-used standardized behavior rating scale that is completed by an adult with whom the child lives. The preschool form lists 99 problem behaviors. Mothers rated each problem behavior on a three point scale, *not true (0)*, *somewhat or sometimes true (1)*, or *very true or often true (2)*, regarding the child's behaviors during the past two months. The internalizing scale (36 items) reflects overcontrol problems such as anxiety, depression, and withdrawal, whereas the externalizing scale (24 items) reflects undercontrol problems such as aggression, hyperactivity, and noncompliance. These two broadband scales were developed empirically through factor analyses (Achenbach & Rescorla, 2000). The total problem scale includes all 99 items from the CBCL. The CBCL has been shown to differentiate between clinically referred and non-referred children (Achenbach & Rescorla, 2000). The CBCL has high internal consistency ($\alpha = .78$ to $.97$) and has been used with preterm children (e.g., Gray et al., 2004; Yu, Buka, McCormick, Fitzmaurice, & Indurkha, 2006). Cronbach's alphas for the present study ranged from .85–.91.

2.3.4. Family assets—Mothers completed a demographic questionnaire at the NICU visit. On the basis of this report, standardized scores for family income, maternal age and education were summed to generate an index of family socioeconomic (SES) assets, with higher scores reflecting more family SES assets (Poehlmann, Schwichtenberg, Bolt, & Dilworth-Bart, 2009). Cronbach's α was .76. Family socioeconomic asset scores at all other timepoints were highly correlated with NICU scores; therefore, we used the NICU index to minimize missing data.

2.3.5. Neonatal risk—Infant birthweight and gestational age were collected from infant NICU medical records. We standardized and summed them to generate an index of infant prematurity.

3. Results

To address our research questions, curve fit estimations were completed in SPSS 20 and a series of structural equation models (SEM) were tested within Mplus 6.12 (Muthén & Muthén, 2011). SEM was chosen over other analytic approaches because it affords the simultaneous testing of multiple pathways, latent constructs, and the hypothesized associations between variables. The SEM models were specified, identified, and tested for assumption violations prior to model and path estimation and interpretation. Additionally, a full information maximum likelihood (FIML) procedure was used to address missing data. In the Mplus FIML procedure, individual missing data patterns are assessed, and means and covariances for each missing data pattern are calculated to inform the observed information matrix (Arbuckle, 1996; Kaplan, 2009). The observed information matrix is used to generate estimates (Kenward & Molenberghs, 1998). Addressing missing data via FIML assumes data missing at random (MAR; Little & Rubin, 1989) and is preferable to pair-wise or list-wise deletion (Arbuckle, 1996).

Data screening revealed an extreme income for one family (more than 3 standard deviations above the mean) and one family did not report an income. For models including income (within the SES assets index), FIML was used to estimate a relative value for these families.

To assess overall EC and behavior problems latent constructs were generated. The EC latent construct contain the 24 and 36 month EC estimates and the behavioral problems constructs contained the 24 and 36 month CBCL scores.

3.2. Curve estimation

Our first research question addressed the nature (linear or quadratic) of the association between EC and behavior problems for: (a) the overall sample and (b) for boys and girls. Effortful control and behavior problems were assessed at 24 and 36 months; therefore we assessed the concurrent association between the two constructs at 24 and 36 months (e.g., 24 month EC with 24 month behavior problems). Additionally, we assessed the association between latent constructs of EC and behavior problems. All analyses revealed that a linear association fit the data better when an association was present; therefore, in subsequent models linear estimates were retained (summarized in Table 2).

3.3. Structural equation models

Structural equation models were assessed in two steps. First, overall model fit was assessed followed by the interpretation of individual path coefficients. To assess the overall model fit, 3 indices were evaluated, including X^2 , root mean square error of approximation (RMSEA), and the comparative fit index (CFI). The X^2 index is a model of misspecification; therefore, a significant X^2 means that the model does not fit the sample data. Because some scholars claim that the exact fit tested in X^2 is an unrealistic standard, indices of approximate fit like RMSEA were also assessed. RMSEA tests whether the model fits the population approximately. In RMSEA, .00 is the best possible fit, with higher values indicating poorer fit. Within this study, the CFI compares the specified model to a null model. The null model posits that there are no associations among the variables. CFI ranges from 0 to 1, with higher values indicating better fit. CFI values > .90 are generally interpreted as acceptable model fit. Models were only interpreted if they had acceptable fit across all 3 indices.

Separate models were run for internalizing, externalizing, and total behavior problems across: (a) the overall sample and (b) for boys and girls. The base specified model is depicted in Figure 1. Effortful control and behavior problems were assessed as latent constructs (as detailed above). To aid in the interpretation of EC, and because our

hypotheses focused on contrasting children with high and low EC, this latent construct was divided into three groups: children with low EC (z-score below $-.25$), average EC, and high EC (z-scores above $.25$) (scored as 1, 2, and 3 respectively). Our final research question focused on family SES factors; therefore, each model was rerun with the addition of family SES assets. In sum, four models were calculated for internalizing, externalizing, and total behavior problems: (a) the base model (Figure 1), (b) the base model with the addition of family SES, (c) the base model across gender and (d) the gender model with the addition of family SES. The sections below detail the significant standardized path coefficients for each model (summarized in Table 3).

3.3.1. Total behavior problems—Within the base model, children with high EC had fewer total behavior problems ($z = -1.94, p = .05; \beta = -.22$). Also within this model, a modest association between infant prematurity and EC emerged ($z = -1.84, p = .06; \beta = .20$). Infants within the low EC group tended to be born earlier and weigh less at birth. Infant prematurity was not associated with any of the other variables of interest. However, the addition of family SES to the base model attenuated the association between EC and total behavior problems ($z = -1.20, p = .23, \beta = -.13$). Family SES was a robust predictor of EC and behavior problems (Table 3, Total Behavior Problems Model 2^a). Children with fewer SES assets had elevated parent-reported behavior problems and were more likely to be in the low EC group. Family SES did not predict positive emotion expression. Additionally, positive emotion expression was not associated with EC or total behavior problems in the SES model.

Within the gender model (Table 3, Total Behavior Problems Model 3^b), positive emotion expression was associated with EC for boys ($z = -2.36, p < .05; \beta = -.32$) but not girls ($z = 1.17, p = .24; \beta = .16$). Boys with high EC exhibited fewer positive emotion expressions. In addition, a small association between infant prematurity and EC was apparent for boys ($z = 1.79, p = .07; \beta = .29$) but not for girls ($z = .74, p = .46; \beta = .12$). Boys within the low EC group tended to be born earlier and weigh less than boys within the high EC group. All other tested associations were consistent across boys and girls. The addition of family SES (Table 3, Total Behavior Problems Model 4^c) to the gender model revealed a robust association between SES and EC for girls ($z = 2.79, p < .01, \beta = .44$) but not for boys ($z = .62, p = .53, \beta = -.09$). Girls within the high EC group had more socioeconomic assets than girls in the low EC group.

3.3.2. Internalizing behavior problems—The base model contained a moderate association between gender and internalizing behavior problems ($z = 1.88, p = .06, \beta = .18$). Consistent with previous research, parents of girls tended to report higher internalizing problems than parents of boys. No additional paths of interest (e.g., EC with internalizing behavior problems) were significant (Table 3, Internalizing Behavior Problems Base Model). The addition of family SES to the base model (Table 3, Internalizing Behavior Problems Model 2^a) revealed a robust association between family SES and internalizing problems ($z = -3.48, p < .01, \beta = -.32$). Children from homes with more SES assets had fewer internalizing problems. As reported above, family SES continued to predict EC.

Within the gender models, family SES predicted internalizing behavior problems for both boys ($z = -2.13, p < .05, \beta = -.26$) and girls ($z = -2.57, p < .05, \beta = -.36$). Children from families with more socioeconomic assets had fewer parent-reported internalizing problems. As noted above, high EC was associated with lower levels of positive emotion expression for boys but not girls, and more family SES assets were associated with high EC for girls but not boys.

3.3.3. Externalizing behavior problems—In the base model, externalizing behavior problems were not associated with EC or positive emotion expression. The addition of family SES revealed a robust association between family SES and externalizing behavior problems ($z = -3.94, p < .01, \beta = -.36$), and a small association between infant prematurity and externalizing behavior problems ($z = 1.85, p = .06, \beta = .16$). Infants born later and heavier tended to have higher parent-reported externalizing behavior problems. As described above, more family SES assets continued to predict higher EC.

The gender models for externalizing behavior problems echoed those of the total behavior problem models with one exception. For boys, infant prematurity was associated with parent-reports of externalizing behavior problems ($z = 1.90, p = .06, \beta = .25$). Boys who were born later and heavier had higher externalizing behavior problems. This was not true for girls (Table 3, Externalizing Behavior Problems Models 4^c).

4. Discussion

The study examined whether high effortful control was associated with less positive emotional expression and higher internalizing problems in children born preterm, and if these associations differed between girls and boys. The data provided limited support for our hypotheses, suggesting that fewer expressions of positive emotions were associated with high EC for boys only. Moreover, high EC was associated with fewer total behavior problems.

The finding that high EC related to low positive emotion expression for boys born preterm is partially consistent with previous research with healthy full-term children. Kochanska and Knaack (2003) found that parent-reported and observed joy showed a negative association with EC at 33 and 45 months and Kochanska et al. (2001) found that children who exhibited less intense joy displays had higher EC scores at 22 and 33 months. However, although both of the Kochanska studies controlled for gender, neither one tested interaction effects by gender. Effortful control may serve to modulate intense emotions, and therefore a stronger EC system is thought to be associated with less intense emotional displays. However, in this sample of young children born preterm, such modulation appeared to occur only in boys. Additional research with high risk children is needed to replicate this finding and examine possible implications for interventions seeking to increase EC skills in preterm boys. Gender-specific socialization and reactive temperament may influence how EC and emotion expression function in preterm boys and girls, especially in the context of biological vulnerabilities.

Although girls were more likely than boys to exhibit internalizing problems in this sample of children born preterm, very high EC was not associated with higher internalizing problems in girls or boys. Although additional longitudinal follow-up is needed as children grow older, it does not appear that high EC has negative implications for young preterm children. Rather, children with high EC had fewer total behavior problems. This finding is consistent with previous conclusions regarding the potential protective effects of high EC in the development of inattention and ADHD symptoms in children born preterm (Poehlmann et al., 2010). In addition, we found that the association between EC and total behavior problems in preterm children, when present, was linear and not curvilinear, consistent with Eisenberg et al. (2009). Given these findings, it will be important to study interventions designed to increase EC in children born preterm, particularly as a means to decrease attention problems and difficulties related to disinhibition.

Bhutta and colleagues (2002) have suggested that, as children grow older, the family socioeconomic context becomes increasingly important for the development of behavior

problems in infants born preterm. Consistent with an emphasis on family resources, this study found that more SES assets robustly predicted fewer behavior problems across gender and broadband behavior problem scales. Socioeconomic assets may be an important source of resilience for children born preterm with respect to emerging behavior problems. Previous research has suggested that experiences and advantages linked with SES assets, such as medical care, quality early education, and positive parenting, outweigh the effects of prematurity on developmental and behavioral competencies in children born preterm (Msall, Sullivan, & Park, 2010). Therefore, enhancing families' SES assets, including promoting access to medical care, high quality education, and parenting support, may be a particularly important area of intervention efforts to build resilience processes in children born preterm.

The addition of family SES also attenuated the association between EC and behavior problems. For girls in particular, more SES assets were associated with higher EC, whereas for boys, more prematurity was associated with lower EC (at a trend level). One possible explanation for these findings is that, for boys born preterm, EC may be slightly more influenced by biologically-based factors, such as degree of prematurity and temperament (i.e., positive emotional expression), whereas for girls born preterm, EC may be more influenced by environmental factors such as SES. This suggestion is consistent with research that has found more detrimental effects of prematurity for boys than girls (Kesler et al., 2008). Further longitudinal research is needed to explore the implications of these findings regarding gender differences in preterm children. It is particularly important to know whether interventions targeting children born preterm may benefit from considering infant gender when attempting to promote the development of early self-regulation or reduce emerging behavior problems.

There are several limitations to this study. Families lost to attrition had lower maternal and paternal education, had mothers who were younger and more likely to be single, and infants who were less likely to be Caucasian. This may limit generalizability of the results. The sample of preterm infants included in this study experienced a wide range of medical risk factors and therefore may constitute a heterogeneous group. However, infant gestational age and birthweight were included as covariates in order to address this limitation. In addition, missing data on the positive emotion expression composite was present, which was estimated using FIML for use in the analysis. Future research with preterm infants could also incorporate parent-ratings of positive emotionality and EC, which would provide an additional source of information as well as reduce the possibility that behavior during the laboratory task was unrepresentative of children's typical behavior. However, the longitudinal design affords multiple measures of EC and behavior problems across time, which is a strength of the study.

Future research should examine gender differences in the association between EC and behavior problems in children born preterm, especially what factors may be influential in the development of cognition and emerging self-regulation for boys and girls. Research with clinically-referred children, not just children at risk for developmental and behavioral problems as the result of prematurity, should further investigate whether there potential downsides of very high EC for children born preterm, including less positive emotionality or higher internalizing behavior problems.

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- Less positive emotion is associated with higher effortful control in preterm boys.
- Higher SES is associated with fewer behavior problems in preterm boys and girls.
- Higher SES is associated with higher effortful control for preterm girls.
- Effortful control was positively associated with total behavior problems.
- SES attenuated the association between effortful control and behavior problems.

Figure 1.

The base specified model for effortful control (EC), behavior problems, as indexed by the Child Behavior Checklist (CBCL), and positive emotional expression. Additional models included estimates across gender and the addition of family socioeconomic assets.

Table 1

Sample Demographic and Neonatal Characteristics at NICU Discharge (n = 173)

Variables		Range or Frequency (%)	<i>M</i>	<i>SD</i>
Maternal Age		17 – 42	29.54	6.26
Maternal Education (years)		8 – 21	14.25	2.69
Annual Family Income		0 – 500,000	59,076	52,837
Infant Gender (% Male)		92 (53%)		
Infant Race	African American	24 (14%)		
	Asian	1 (<1%)		
	Caucasian	114 (66%)		
	Latino	3 (2%)		
	Multiracial	31 (17%)		
Infant Gestational Age (weeks)		23 – 36	31.34	3.03
Infant Birthweight (grams)		490 – 3328	1712	577
	Extremely Low (< 1000g)	28 (16%)		
	Very Low (< 1500g)	37 (21%)		
	Low (< 2500g)	95 (55%)		
	Normal (> 2500g)	13 (8%)		
Size for Gestational Age	Small	20 (12%)		
	Appropriate	145 (84%)		
	Large	8 (%)		
Days in Hospital		2 – 136	33.27	27.92
Multiple Birth		33 (19%)		

Table 2

Curve Estimations between Effortful Control and Total Behavior Problems

	Linear	β^I	Quadratic	β^I
24 month EC with behavior problems				
All children	$F(1,145) = 1.37$	-.12	$F(2, 144) = 1.23$	.09
Male	$F(1, 72) = .23$	-.06	$F(2, 71) = .19$	.05
Female	$F(1,71) = 1.54$	-.23	$F(2, 70) = 1.78$	.18
36 month EC with behavior problems				
All children	$F(1, 136)$	-.08	$F(2, 135) = .39$	.04
Male	$F(1, 67) = .09$	-.04	$F(2, 66) = .05$	.01
Female	$F(1,67) = .71$	-.15	$F(2, 66) = .58$	.10
Latent EC with behavior problems				
All Children	$F(1, 171) = 5.11^*$	-.21 [*]	$F(2, 170) = 2.73$	.06
Male	$F(1, 90) = 1.57$	-.12	$F(2, 89) = .78$	-.02
Female	$F(1, 79) = 4.14^*$	-.37 [*]	$F(2, 78) = 2.67$	.19

Note. EC = effortful control composite,

**
 $p < .01$,*
 $p < .05$,^I
standardized beta coefficient

Table 3
Structural Equation Model Estimates for Total, Internalizing, and Externalizing Behavior Problems

Model	Total Behavior Problems						Internalizing Behavior Problems						Externalizing Behavior Problems					
	Base	2 ^a	3 ^b	4 ^c			Base	2 ^a	3 ^b	4 ^c			Base	2 ^a	3 ^b	4 ^c		
			M	F	M	F			M	F	M	F			M	F	M	F
Behav Prob by 24 month CBCL	.86**	.85**	.91**	.83**	.89**	.83**	.87**	.90**	.99**	.81**	.99**	.84**	.80**	.89**	.83**	.85**	.89**	.93**
Behav Prob by 36 month CBCL	.90**	.90**	.86**	.92**	.87**	.92**	.82**	.80**	.76**	.86**	.75**	.82**	.92**	.83**	.85**	.90**	.80**	.83**
Behav Prob on																		
Infant Prematurity	.10	.14	.06	.14	.12	.15	.10	.13	.01	.17	.05	.18	.13	.16 ^I	.19	.09	.25 ^I	.09
Gender	.08	.03					.18 ^I	.14					.02	-.03				
Family SES		-.39**			-.34*	-.42**		-.32**			-.26*	-.36*		-.36**		-.36**		-.37**
Pos. Emotion on																		
Infant Prematurity	.07	.06	.05	.09	.04	.09	.07	.06	.05	.09	.04	.09	.07	.06	.05	.09	.04	.09
Gender	-.13	-.13					-.13	-.13					-.13	-.13				
Family SES		.06			.03	.11		.06			.03	.11		.06		.03		.11
EC Groups on																		
Infant Prematurity	.20 ^a	.17	.29 ^I	.12	.28	.09	.20 ^I	.17	.29 ^I	.12	.28	.09	.20 ^I	.17	.29 ^I	.12	.28	.09
Gender	.14	.15					.14	.15					.14	.15				
Family SES		.26*			-.09	.44**		.26*			.09	.44**		.26*		.09	.44**	
EC Groups with Behav Prob	-.22*	-.13	-.19	-.24	-.15	-.08	-.17	-.09	-.10	-.19	-.07	-.06	-.17	-.08	-.17	-.19	-.12	-.03
Pos. Emotion with Behav Prob	.04	.07	.09	-.03	.10	.03	.02	.00	-.02	-.01	-.02	.04	.09	.13	.14	.05	.16	.11
Pos. Emotion with EC Groups	-.10	-.12	-.32*	.16	-.32*	.14	-.10	-.12	-.32*	-.16	-.32*	.14	-.10	-.12	-.32*	.16	-.32*	.14

Note.

* $p < .05$,

** $p < .01$,

^I $p < .07$,

^a the base model with family socioeconomic assets (SES) added,

^b the base model estimated across gender,

^c the gender model with family SES added,

M = male, F = female, Behav Prob = behavioral problems latent construct, CBCL = Child Behavior Checklist, Pos. Emotion = positive emotion expression composite, EC Groups = low, average, and high effortful control groups