Predictors of Longitudinal Growth in Inhibitory Control in Early Childhood

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ABSTRACT

In the current study, we examined latent growth in young children's inhibitory control (IC) from ages 2 to 4, and whether demographic characteristics or parenting behaviors were related to intercept and growth in IC. As part of an ongoing longitudinal evaluation of the Family Check-Up (FCU), children's inhibitory control was assessed yearly at ages 2, 3, and 4. Children's growth started low and increased linearly to age 4. High levels of harsh parenting and male gender were associated with low initial status in IC. High levels of supportive parenting were associated with faster growth in IC. African-American children's growth in IC was slower than White children's growth. Results suggest that different factors predict initial status and longitudinal change in IC during early childhood. Keywords: inhibitory control, self-regulation, latent growth modeling, parenting, early childhood

Self-regulation is known to play an important role in preventing maladjustment (e.g., externalizing problems: Gilliom, Shaw, Beck, Schoenberg, & Lukon, 2002; internalizing problems: Silk, Steinberg, & Morris, 2003) and promoting well-being across the lifespan (e.g., Mischel, Shoda, & Rodriguez, 1989). An early form of self-regulation is inhibitory control (IC), which involves young children's abilities to prevent or inhibit behaviors in response to adults' instructions (Rothbart, Ahadi, Hershey, & Fisher, 2001). Relatively few studies have examined the longitudinal stability and growth of any dimension of self-regulation, but this is particularly true for the element of IC during early childhood. Additionally, existing research on the development of self-regulation points to parenting as an important correlate during early childhood (e.g., Kopp, 1987); however, the majority of longitudinal research has been conducted over a shorter time span and has included just two assessments of self-regulation. In addition, few studies have examined the course of IC in early childhood using samples of children at high risk for poor socioemotional outcomes. Information on longer-term change during early childhood is essential to advance our understanding of how dimensions of both positive (e.g., responsive) and negative (e.g., rejecting) aspects of parenting may contribute to initial levels and growth in IC. Thus, the current study sought to advance our current understanding of IC and specifically for children at high risk for early problem behavior by examining its stability and growth from ages 2 to 4 years with a large sample of children screened on the basis of sociodemographic, family, and child risk factors. A second goal was to investigate the contributions of supportive and harsh parenting to initial levels and growth in IC.

Researchers and theorists agree that optimal levels of self-regulation are desirable for success in multiple domains of functioning across the lifespan. However, as there is little consensus on how best to define and measure self-regulation within any given developmental period, below we review the literature on the growth and the correlates of several dimensions of self-regulation in early childhood, including IC.

The Development of Inhibitory Control

Theoretical and empirical works illustrate the timing and appearance of specific changes in children's emerging regulatory abilities (e.g., Bronson, 2000; Kopp, 1982) that precede or accompany the emergence of IC (Rothbart, 1989). A body of literature identifies many substantial changes in self-regulatory strate-
gies and abilities that occur between a child’s birth and their second birthday. Infants initially rely upon caregivers to physically modulate their internal states and environment to meet their needs (e.g., by soothing the infant in response to emotional upsets: Kopp, 1982; Committee on Integrating the Science of Early Childhood Development, Shonkoff, & Phillips, 2000). Internally-based co-regulation begins in toddlerhood (Kopp, 1987) when toddlers become capable of complying with caretaker instructions (Stifter, Spinrad, & Braungart-Rieker, 1999) and of exercising independent self-control with parental supervision and support (Maccoby, 1984). IC begins to emerge after the second birthday (Rothbart, 1989) and continues to develop throughout toddlerhood and the preschool years. As children’s abilities improve (i.e., by using language to regulate themselves independently and to obtain caretaker regulatory support: Diaz & Berk, 1992), caretakers gradually decrease their active participation in the co-regulation process (Kopp, 1987). This leaves the child increasingly responsible to regulate in response to direction from internal cues, situational demands, environmental stimuli, and feedback from others (Kochanska, Coy & Murray, 2001; Kopp, 1982). These and other changes set the stage for continued development beyond early childhood.

Such discontinuity in the development of self-regulation during early childhood undoubtedly challenges efforts to study its latent growth. For example, it is not possible to model latent growth with fewer than three longitudinal assessments using the same measure (Singer & Willett, 2003), which can be entirely unfeasible when examining aspects of development that are fully transformed over a short period of time. Perhaps due largely to this reason, much of what is known about change in self-regulation abilities during early childhood is based on studies with two timepoints and/or shorter-term longitudinal designs. For example, in a small, middle-class sample of young children, Kochanska and colleagues (Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996) revealed longitudinal stability in IC from approximate ages 2-3.5 to 3.5-4.5 years. In another short-term longitudinal study, preschoolers’ effortful control improved during the 6-month period between study visits (Lengua, Honorado, & Bush, 2007). Furthermore, initial effortful control was the strongest predictor of subsequent effortful control in the same study. Individual children’s abilities to delay gratification improved between ages 2-4 and the 16-month follow-up assessment conducted in a large, low-SES sample (Li-Grining, 2007). These and other studies indicate that positive growth is typical during early childhood. Similar findings of improvements in self regulation also are evident in the few studies that have tracked change in self-regulation across three or more timepoints. One such study using a large, socioeconomically-diverse national dataset revealed improvements in regulation between children’s ages 4-5 and 8-9, but no subsequent increases between ages 8-9 and 12-13 (Raffaelli, Crockett, & Shen, 2005). Another study conducted with a mid-sized, predominantly middle-class sample revealed significant linear growth in effortful control between children’s ages 9-11 and 12-14 (Lengua, 2006). The one known study conducted in early childhood revealed positive, linear latent growth in Head Start toddlers’ regulation between 14 and 36 months (Raikes, Robinson, Bradley, Raikes, & Ayoub, 2007). These studies focused on different developmental periods and dimensions of regulation than those examined in the current study and with the exception of the Raikes and colleagues’ (2007) study, tended to use lower-risk middle-class samples. Although these studies do indicate that IC improves during early childhood, clearly more research is needed on this topic, particularly for children at high risk for demonstrating poor socio-emotional functioning during the school-age years. Thus, the first goal of the study was to examine the developmental course of IC at three assessment points from ages 2 to 4 using a sample of children identified on the basis of multiple domains of risk.

The Role of Parenting

As evidenced by the description of initial self-regulatory development in the previous section, children’s early abilities to self-regulate are limited. Consequently, research and theory on the development of self-regulation emphasize the role of caregiving in fostering individual differences in self-regulatory abilities and strategies (see Cassidy, 1994; Thompson, 1994). These fundamental dyadic regulatory processes in infancy are thought to underlie individual differences in self-regulation in the toddler years and early childhood (e.g., Stansbury & Zimmerman, 1999). Parent-child co-regulation is one context of parental socialization, which is the process through which individuals adopt and internalize a group’s shared beliefs, worldviews, and behaviors consistent with these values (Jones & Gerard, 1967). The co-regulatory process gradually increases children’s awareness of the need to adjust in accordance with the expectations of parents and other adult caregivers.

A variety of parenting dimensions are believed to support the development of self-regulation during childhood. Unfortunately, much of what is known about associations between dimensions of parenting and self-regulation is based on cross-sectional or short-term longitudinal studies (e.g., Dennis, 2006), in reference to global dimensions of parenting style (e.g., observed “teaching-based” v.s. “power-based”
of gratification 16 months later (Li-Grining, 2007). Finally, a meta-analysis of cross-sectional studies on parenting and self-regulation in preschool-aged children revealed small effects of positive parental control (i.e., behavioral support) on children's compliance (Karremans, van Tuijl, van Aken, & Dekovič, 2006). Overall, high levels of parental support have been correlated with high levels of children's regulation, although research using samples of children at higher-risk of early socioemotional adjustment is wanting.

The same contention has been supported in longitudinal studies on supportive parenting with respect to change or growth in child self-regulation, although these studies are even fewer in number. One short-term longitudinal study revealed that parental limit-setting and scaffolding (but not parental warmth) at children's ages 33 to 40 months were related to improvements in effortful control observed six months later (Lengua et al., 2007). In another study, while controlling for children’s initial levels of observed effortful control, high levels of maternal responsiveness at 22 months predicted high levels of effortful control observed at 33 months (Kochanska, Murray, & Harlan, 2000). Likewise, another study indicated that high levels of maternal responsiveness at 13 and 24 months were associated with children's better delay of gratification and task-focusing at 24 months (Olson et al., 1990). Overall, there is some initial support for the notion that supportive parenting promotes the growth of self-regulation in early childhood, but again these studies have been primarily conducted with lower-risk, predominantly middle-class samples.

Harsh parenting. Empirical evidence also indicates that harsh parenting serves to undermine the development of self-regulation. In keeping with our conceptualization of supportive parenting, harsh parenting was operationalized as a multi-dimensional factor that tapped both general parenting qualities (i.e., overall harshness) and specific parental behaviors (i.e., parents’ negative verbal comments, physical behaviors, and the use of negative directives during parent-child interactions). Harsh parental behavior may frighten children into suppressing displays of negative emotion (Sroufe, 1996) and in the short-term quickly stop children's misbehavior (Coplan, Hastings, Lagacé-Séguin, & Moulton, 2002). However, demanding and obtaining instant compliance has its costs. As specified by the Early Childhood Coercion Model (e.g., Scaramella & Leve, 2004), such unpleasant interactions are thought to deprive children of opportunities to practice controlling emotion or behavior in a supportive context (Colman, Hardy, Albert, Raffaelli, & Crockett, 2006). Simultaneously, harsh parenting is postulated to elevate children’s levels of negative affect, which also increases the need for effective regu-
It may also shift children’s attention from the parenting message to their feelings, which reduces the likelihood that children will internalize parental expectations and children’s subsequent willingness to comply with parental directions (Grusec & Goodnow, 1994).

In fact, there is empirical evidence to support negative associations between high levels of harsh parenting and lower levels of self-regulation; however, both the number of studies on this topic and effect sizes of harsh parenting tend to be modest. For example, a meta-analysis of cross-sectional studies on parenting and self-regulation in preschool-aged children revealed small negative effects of negative parental control (e.g., parental hostility, criticism) on children’s compliance with adult directives (Karremann et al., 2006). Another study linking parenting processes and self-regulation in early adolescence revealed modest, negative associations between high levels of conflictual-harsh parenting and children’s contemporaneous self-regulation (Brody & Ge, 2001). The few longitudinal studies exploring change in self-regulation in relation to harsh parenting show a similar pattern, although it should be pointed out that most of these studies were conducted using samples of older children. In one study examining parallel growth models of parenting and effortful control during the transition to adolescence, initial levels of parental rejection and inconsistency were linked only to initial levels and not growth of children’s effortful control (Lengua, 2006). In another study, physically punitive discipline in early childhood made a small, negative contribution to change in self-regulation between early and middle childhood (Colman et al., 2006). In sum, there is limited evidence to suggest that harsh parenting undermines self-regulatory development during childhood. As with supportive parenting, however, more information is needed about the role of harsh parenting in the development of IC in early childhood, especially for children at risk for poor developmental trajectories of socioemotional adjustment.

**Influences of Children’s Other Characteristics on Inhibitory Control**

We also considered the influence of children’s sex and ethnicity on IC. The broader literature on self-regulation has repeatedly revealed effects of child sex on self-regulation, indicating that girls demonstrate better regulation than boys during and after infancy (Li-Grining, 2007; Raikes et al., 2007; Weinberg, Tronick, Cohn, & Olson, 1999). Conversely, little research has satisfactorily explored or revealed meaningful ethnic differences in self-regulation at any point in childhood (Li-Grining, 2007; Raver, 2004), an issue we explored in the current study but without any a priori hypotheses.

We also considered the possibility that associations between parenting and IC may be moderated by ethnicity. Many studies have documented distinct associations between parenting and child behavior for specific ethnic groups. For example, high levels of harsh parenting have previously been linked to low levels of child compliance in European American (EA) but not African American (AA) children (Whiteside-Mansell, Bradley, Owen, Randolph, & Cauce, 2003). Consequently, we examined whether ethnic differences in self-regulation may be attributable to variations in early parenting, specifically whether low levels of harsh parenting were more strongly associated with higher levels of IC among EA versus AA children.

**The Current Study**

The current study was executed with three goals in mind. First, we sought to examine the stability and growth in IC during the transition from the toddler to preschool period among a large sample of families facing high levels of socioeconomic, family, and child risk. Second, we also examined the associations between observed parenting and initial levels and growth in IC. Finally, we investigated potential interactive effects between child ethnicity and harsh parenting on observed IC, specifically whether negative associations between harsh parenting and IC would be stronger in EA versus AA families.

In comparison to prior studies, this study is particularly well-suited for examining latent growth and parenting correlates of IC in early childhood. Data for the current study were collected as part of the Early Steps Multisite Project, which includes a large, ethnically diverse sample of children at high risk for clinically-meaningful levels of problem behavior. This is an improvement over existing studies not specifically designed to examine change in self-regulation (e.g., by having two or fewer timepoints, or by not controlling for prior self-regulation when multiple assessments were available), and/or the use of small-sized, predominantly middle-class samples. Furthermore, this study also employed two multi-factor observation-based indices of parenting and a widely-used maternal-report questionnaire of children’s IC (i.e., the inhibitory control subscale from the Child Behavior Questionnaire; Rothbart et al., 2001).

In terms of specific hypotheses, we anticipated that children’s IC would increase between ages 2 and 4 based on prior studies’ results indicating positive change or growth in other dimensions of self-regulation during childhood (e.g., Raikes et al., 2007). Also in keeping with previous studies, we anticipated that high levels of supportive parenting (e.g., Kochanska et al., 2000) and low levels of harsh parenting (e.g.,
would be related to high initial status and faster growth in IC.

Methods

Participants
Participants included 731 families recruited between 2002 and 2003 from WIC Programs in the metropolitan areas of Pittsburgh, PA, and Eugene, OR, and within and outside the town of Charlottesville, VA (for more details about recruitment procedures, please see Dishion et al., 2007). Families were approached at WIC sites and invited to participate if they had a son or daughter between 2 years 0 months and 2 years 11 months of age, following a screen to ensure that they met the study criteria by having socioeconomic, family, and/or child risk factors for future behavior problems. Of the 1666 parents who were approached at WIC sites and had children in the appropriate age range, 731 of these families (83.2%) met the eligibility requirements and agreed to participate (88% in Pittsburgh, 84% in Eugene, 76% in Charlottesville). The final study sample consisted of 272 (37%) families in Pittsburgh, 271 (37%) in Eugene, and 188 (26%) in Charlottesville. More participants were recruited in Pittsburgh and Eugene because of the larger population of eligible families in these regions relative to Charlottesville.

Children in the sample (49% female) had a mean age of 29.9 months (SD = 3.2) at the time of the age 2 assessment. Across sites, the children were reported to belong to the following racial groups: 27.9% African American (AA), 50.1% European American (EA), 13.0% Biracial, and 8.9% other races (e.g., American Indian, Native Hawaiian). In terms of ethnicity, 13.4% of the sample reported being Hispanic American (HA). During the period of screening from 2002 to 2003, more than two-thirds of those families enrolled in the project had an annual income of less than $20,000, and the average number of family members per household was 4.5 (SD = 1.63). Most children lived with two biological parents (37%), or with a cohabiting single parent (21%). Forty-one percent of the population had a high school diploma or GED equivalency, and an additional 32% had one to two years of post-high school training. For a more detailed breakdown of recruitment and participation demographic data by site, please see Dishion et al. (2007).

Retention. Of the 731 families who initially participated, 659 (90%) were available at the one-year follow-up and 619 (85%) participated at the two-year follow-up when children were between 4 and 4 years 11 months old. At ages 3 and 4, selective attrition analyses revealed no significant differences in project site, children’s race, ethnicity, or gender, levels of maternal depression, or children’s externalizing behaviors (parent reports). Furthermore, no differences were found in the number of participants who were not retained in the control versus the intervention groups at both ages 3 (n = 40 and n = 32, respectively) and 4 (n = 58 and n = 53), respectively. 720 children had sufficient data to be included in growth modeling analyses (i.e., the participating child had at least one report of IC at any timepoint).

Design and Procedure
Mothers and, if available, AGs such as fathers or grandmothers, who agreed to participate in the study were scheduled for a 2.5-hour home visit when children were between 2 years and 2 years 11 months old. Caregivers completed several questionnaires at each assessment, which also involved a series of interactive tasks. The home visit protocol was repeated at ages 3 and 4 for both the control and intervention groups. Families received $100, $120, and $140 for their participation in the age 2, 3 and 4 assessments, respectively. Families randomly assigned to the intervention condition received additional remuneration after each study-related visit. Randomization to treatment was balanced on gender to assure an equal number of males and females in the control and intervention sub-sample. To ensure blindness, the examiner opened a sealed envelope, revealing the family’s group assignment only after the assessment was completed, and shared this information with the family. Examiners carrying out follow-up assessments were not informed of the family’s assigned condition. For a detailed description of the intervention, see Dishion et al. (2007). For the purposes of the current study, treatment group status was used as a covariate in all analyses.

Measures
For all study variables, descriptive statistics and correlations are presented in Table 1.

Inhibitory control. The 13-item inhibitory control subscale of the Child Behavior Questionnaire (CBQ; Rothbart et. al., 2001) was used to assess behavioral self-regulation at children’s ages 2, 3 and 4. This sub-scale includes items such as, “Has difficulty waiting in line for something,” and “Can easily stop an activity when s/he is told ‘no.’” Mothers responded to each item on a 7-point scale, ranging from 1 (extremely untrue of child) to 7 (extremely true of child). The scale demonstrated adequate internal consistency at each timepoint, with Cronbach’s alphas ranging from .59 to .75.

Supportive parenting. Four observational measures of parenting in the home were used to create a supportive parenting composite at age 2 (for more detail,
Harsh parenting. Five items from the COIMP and three duration proportions from the RPC (Jabson et al., 2004) were used to create a composite index of observed harsh parenting at age 2. COIMP items tapped parents’ provision of developmentally-inappropriate reasons for children’s behavior change, displays of anger or annoyance with the child, criticizing or blaming the child for family problems, use of physical discipline, ignoring/rejecting the child, and messages about the child’s worthlessness. RPC codes included duration proportions of parental negative verbal, directive, and physical behavior. These individual items were standardized and summed in order to create a composite index of parental harshness (α = .75).

Missing Data
We examined patterns of missing data before addressing substantive research questions. This revealed that between 10 to 16% of cases were missing IC data at any study wave. Further examination revealed that AA children were disproportionately more likely than non-AA children (13% vs. 8%) to be missing age 2 IC data. Conversely, Hispanic children were less likely than non-Hispanic children (2% vs. 10%) to be missing IC data at age 2. Children missing age 4 IC data also tended to come from families reporting lower annual incomes at age 2 (M = 3.39, SD = 2.10, which corresponds to annual incomes ranging from $10,000 to $14,999). No other study variables or sample characteristics were associated with missing IC data at any wave. As this suggested data were missing at ran-

Figure 1. Estimated linear growth in inhibitory control.

Table 1
Scale Description & Correlations

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<thead>
<tr>
<th>Scale Description</th>
<th>Scale Intercorrelations</th>
<th>Correlation</th>
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<tbody>
<tr>
<td>1. Threatening Group</td>
<td>1.00</td>
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<tr>
<td>2. Child Gender</td>
<td>.00</td>
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<td>3. RA</td>
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<td>4. AA</td>
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<tr>
<td>5. Ethnicity</td>
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<tr>
<td>6. Proactive Parenting</td>
<td>.37</td>
<td>.27</td>
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<tr>
<td>7. Supportive Parenting</td>
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<td>.27</td>
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<tr>
<td>8. Harsh Parenting</td>
<td>.00</td>
<td>.51</td>
</tr>
<tr>
<td>9. IC Age 2</td>
<td>.04</td>
<td>.24</td>
</tr>
<tr>
<td>10. IC Age 3</td>
<td>.43</td>
<td>.27</td>
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<tr>
<td>11. IC Age 4</td>
<td>.41</td>
<td>.27</td>
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Note: RA = Race/ethnicity, AA = African American, IC = Inhibitory Control. *p < .05, **p < .01 (2-tailed).
to calculate interactions.

The minimal requirements for adequate model fit were a non-significant chi-square statistic ($\chi^2$), and a Root Mean Squared Error of Approximation (RMSEA) ranging from .05 to .10, and smaller-sized Akaike Information Criterion (AIC) and sample-sized adjusted Bayesian Information Criterion (BIC) values (Bollen & Curran, 2006; Singer & Willett, 2003).

Results

Estimating Unconditional Growth in Inhibitory Control

The first research question, whether there was growth in IC, was addressed through the estimation and examination of a linear unconditional latent growth model. Fit statistics suggested that the linear model provided acceptable fit to the data, $\chi^2$ fit (3) = 2.22, $p > .05$, RMSEA = .00, RMSEA 90% C.I. = .00 -.06, AIC = 4058.21, BIC = 4066.63.

Means estimated in the linear model are depicted in Figure 1. On average, initial status in IC was relatively low (intercept = 3.94, $p < .001$). This was followed by gradual and positive linear growth in IC from ages 2 to 4 (slope = .24, $p < .001$). There was significant individual variability in intercepts ($\sigma^2 = .34$, $p < .001$) and in slopes ($\sigma^2 = .05$, $p < .01$), which suggests that children differed in terms of their age-2 levels of IC and in their rates of growth over time. Intercept and slope terms were negatively correlated ($r = -.31$, $p < .05$), indicating that higher levels of IC at age 2 were predictive of slower growth to age 4.

Factors Associated with Initial Levels and Growth in Inhibitory Control

In this section, we focus on the patterns of associations between predictors and growth parameters, which are evaluated in conditional latent growth models (i.e., models with predictors). As a consequence of using centered predictor variables, the unstandardized regression weights were used to interpret the results of these analyses. In any conditional model, with all other predictors in the model held constant, every 1-unit change in the predictor corresponds to a change in IC equal to the unstandardized regression weight for that predictor.

Each of the following predictor variables was initially examined within a univariate framework to examine associations with initial status (i.e., IC at age 2) and growth of IC from ages 2 to 4: treatment group status, child gender, ethnicity, family income, positive parenting, and negative parenting. When analyses revealed associations between a growth parameter and a predictor, we plotted the regression line for growth in IC at one standard deviation above and below that predictor’s mean.

Univariate conditional analyses. Preliminary conditional analyses revealed significant associations between some predictors and model growth components (see Table 2 for regression weights). Two factors were independently linked to intercept. Initial status was associated with gender, such that girls’ levels of IC were reportedly higher than boys’ levels at age 2 (see Figure 2a). Negative parenting was also predictive of initial status, such that high levels of negative parenting were linked to low levels of IC at age 2 (see Figure 2d). Three factors were linked to linear growth in IC. Specifically, ethnicity was associated with slope, such that African American children’s growth in IC was slower than other children’s growth (see Figure 2b). Family income was predictive of growth, indicating
that IC increased faster for children living in higher-SES families (Figure 2e). Finally, positive parenting was also linked to growth, such that high levels of positive parenting corresponded to faster growth in IC (see Figure 2c).

**Multivariate conditional analysis.** In the multivariate context, all effects observed in the univariate models were still present, except for family income (see Table 2 for regression weights). High initial status continued to be associated with female gender and lower levels of negative parenting. African American status continued to be linked to less rapid linear growth, and positive parenting was still related to more rapid linear growth in IC.

**Conditional analyses of moderation.** Two final conditional models were estimated in order to explore whether the effects of parenting on IC were moderated by ethnicity (see Table 3). In both models, the independent effect of AA race was maintained, such that regardless of levels of supportive or harsh parenting, AA children’s growth in IC was slower than the growth exhibited by children of EA or other races.

**Discussion**

The current study was executed to address three research goals. First, we examined growth in young children’s IC between ages 2 and 4. Our results indicated that growth in IC during early childhood is linear and positive, such that children’s improvements in IC occurred at consistent speeds between ages 2 and 3 and ages 3 and 4. Second, we also examined the roles of demographic characteristics and observed parenting at age 2. Results revealed that girls and children experiencing low levels of harsh parenting had high initial levels of IC. Furthermore, faster growth in IC between ages 2 and 4 was linked to high levels of observed supportive parenting at age 2. In addition, AA children evidenced slower growth than non-AA children. Third, we also explored whether child race/ethnicity moderated parenting’s associations with initial status and growth in inhibitory control. No support for moderation was found.

**Contributions**

*Describing growth in inhibitory control during early childhood.* This is the first known study to examine latent growth in IC during early childhood. Consistent with prior research on growth in other dimensions of self-regulation (e.g., Raikes et al., 2007), the unconditional model of IC revealed that there was significant linear change from ages 2 to 4. On average, children’s initial levels of IC were moderately low and increased gradually over time. The current study’s findings provide further empirical support for the notion that self-regulation improves gradually throughout childhood (e.g., Lengua et al., 2007; Li-Grining, 2007), and that the component of IC in particular improves during children’s early years (e.g., Kochanska et al., 1996).

**Child gender and ethnicity.** Consistent with hypotheses and existing research, child gender covaried significantly with initial status in IC. As demonstrated by previous studies, girls had higher initial levels of IC than boys (Li-Grining, 2007), but did not differ from boys in terms of growth rates (Raikes et al., 2007). This provides additional evidence that gender differences in level of self-regulation are maintained in the interim between infancy (Weinberg et al., 1999) and middle childhood (Colman et al., 2006), but that gender does not associated with the speed at which self-regulation develops.

In addition to differences in initial levels of IC for child gender, AA children’s growth in IC was found to occur at a slower rate than EA children’s growth. Racial/ethnic differences in self-regulation have rarely been examined, particularly in the few studies using samples appropriate for studying the confounded effects of race/ethnicity and socioeconomic status.
When race/ethnicity has been examined, few if any differences have been found (Li-Grining, 2007; NICHD Early Child Care Research Network, 2004). We explored this unexpected finding in subsequent analyses evaluating whether the effects of parenting were mediated by race, but revealed no evidence for mediation. Three possible explanations for these results are possible, two related to how IC was measured in the current study. In terms of measurement, first it is possible that the inhibitory control scale of the CBQ may not function equivalently across ethnic groups, and this scale’s measurement equivalence should be examined before this effect is accepted at face value. On a related note, parents’ perceptions of or expectations for their children’s IC may vary across ethnic groups. Either way, no definitive conclusion about this result’s validity can be made at this time, and we encourage researchers to consider the role of race/ethnicity in future studies on the development of self-regulation. Third and unrelated to measurement but differences in the living conditions of AA versus other children in the sample, past research using similar samples of low-income AA and EA children reveal that AA families live in significantly more adverse neighborhoods than EA families even within a studies of predominantly low-income children (Shaw, Criss, Schonberg, & Beck, 2004). For example, in a previous study using WIC participants at the Pittsburgh site, during the first six years of sample children’s lives, there was a 40% versus a 0.7% probability of living in project communities for AA and EA families, respectively, with 98% of families living in project neighborhoods AA (Winslow, 2001). Thus, ethnic differences in rates of growth in IC may also be at least partially attributable to differences in rates of neighborhood adversity. Neighborhood effects might take their toll directly on children’s developing IC gradually and cumulatively rather than initially (i.e., no effects at age 2 with children’s increasing exposure to extrafamilial contexts, or indirectly as they compromise parental well being and caregiving quality during the toddler and preschool periods.

Effects of parenting. Consistent with hypotheses, supportive parenting was associated with growth in IC, such that high levels of observed positive parenting at child’s age 2 were indicative of subsequent growth in IC between ages 2 and 4. This provides direct support for the hypothesis that supportive, involved parenting promotes the development of self-regulation in early childhood (Kochanska & Aksan, 1995; Kopp, 1989). These results confirm and replicate previous findings of supportive parenting’s association with self-regulation (Davidov & Grusec, 2006; Murry & Brody, 1999) and extend existing knowledge about shorter-term change in children’s regulatory capacities (Kochanska et al., 2000; Lengua et al., 2007).

Somewhat counter to expectations, harsh parenting was associated only with initial levels but not growth in IC. In this case, high levels of harsh parenting observed at age 2 were associated with low initial levels of IC. Previous studies involving harsh parenting (e.g., Brody & Ge, 2001; Lengua, 2006) have reported conflicting results, with no clear pattern across studies. On one hand, this finding is consistent with one existing study, in which high levels of parental rejection and inconsistency were linked to initial status but not growth in effortful control during the transition to adolescence (Lengua, 2006). On the other hand, however, another study examining change in self-regulation between early and middle childhood suggested that early physically-punitive discipline impeded subsequent change in self-regulation (Colman et al., 2006).

In the absence of direct support for the influence of harsh parenting on growth in IC, two complex explanations deserve investigation in future longitudinal investigations. One explanation is that parenting and self-regulation are transactional processes, as specified in the ECCM (Scaramella & Leve, 2004). Specifically, children’s dysregulated behavior or emotion may elicit harsh parenting, which increases children’s levels of hard-to-manage negative affect, and so on. Coercive cycles such as these may slow children’s development of self-regulatory skills (Kopp, 1989). Another explanation is that the experience of harsh parenting delays children’s early IC development, as suggested by the association with initial status in this study. Regardless of the stability of parental harshness, early developmental delays might persist over time unless delayed children manage to “catch up.” The current results are consistent with this explanation, as on average children at lower initial levels of IC grew more rapidly between ages 2 and 4 than children at higher initial levels. Full understanding of the role of parental harshness will not be reached without additional research, and as these effects are generally quite small in size (Karremans et al., 2006), it is imperative that these explorations use large samples whenever possible.

Limitations & Future Directions

Despite advancing our understanding of the course of IC during the early childhood and providing novel data on precursors of such patterns, the study has several notable methodological limitations. First, a single informant provided questionnaire-based reports of children’s IC. The CBQ (Rothbart et al., 2001) is a well-validated and widely-used questionnaire (e.g., Komsi et al., 2006; Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999); however, confidence in these findings...
could be increased if additional informants had completed this questionnaire. Likewise, observed indices of children’s IC is also desirable. Future studies should include multiple informants and methodologies for assessing children’s IC.

Another limitation was in regard to the broad parenting factors included as predictors. Although this study was strengthened by the use of observational measures of parenting, including relatively expansive dimensions prohibited the identification of precise mechanisms by which parental harshness and support may influence the development of IC. Researchers may wish to study on more specific elements of parenting in order to elucidate these mechanisms in future studies of longitudinal growth in IC.

Finally, this study is also limited in that it included only three timepoints and could thus consider only linear models of IC growth during early childhood. Researchers interested in longitudinal growth should consider examining growth spanning more than 3 timepoints and beyond age 4, as was the case in this study. From a practical standpoint, including a greater number of timepoints would permit explorations of non-linear growth. It is possible that the speed of growth in IC changes over time, and any accelerations or decelerations in speed cannot be captured by linear models. Additionally, from a conceptual standpoint, IC continues to grow through mid-childhood. As this study focused only on early childhood, the course and influences on continued growth beyond age 4 remain unknown.

The current findings indicated that growth in self-regulation evidenced in older, more normative, middle-class samples was also evident in a younger, at-risk, more diverse sample. Furthermore, this study also revealed novel information regarding the roles of supportive and harsh parenting, supporting theoretical assertions that aspects of positive parenting support positive growth (Kochanska & Aksan, 1995) and parental harshness impedes growth in regulation (Scaramella & Leve, 2004). Information gleaned from these pursuits may highlight targets for early interventions focused on parenting, in the hopes of promoting early gains in IC, and consequently, decreased risk of adverse outcomes.

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