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Abstract

The majority of studies of preschool-aged children's self-regulation presume that their higher levels of self-regulation are concurrently and prospectively associated with fewer externalizing and internalizing problems. This assumes their relations are only linear in form and negative, but studies with community samples of mostly non-Hispanic White children have found curvilinear or positive relations between self-regulation and socioemotional problems in early childhood. This cross-sectional study tests linear and quadratic relations between children's behavioral battery assessed effortful control and parent rated externalizing and internalizing problems, and whether their functional forms differ across racial-ethnic groups in a diverse sample of 2.5- to 3.5-years-olds (N = 72) from highly educated two-parent households. Child effortful control was negatively related to externalizing, quadratically related to internalizing (albeit marginally), and an interaction between effortful control and race-ethnicity indicated opposite linear relations between effortful control and internalizing problems for different racial-ethnic groups. By integrating tests of curvilinearity and interactions, this study builds on theoretical and empirical work indicating complex relations between the development of self-regulation and psychopathology.

Keywords: Curvilinear, effortful control, externalizing, internalizing, self-regulation

Curvilinear Relations between Preschool-Aged Children's Effortful Control and Socioemotional Problems: Racial-Ethnic Differences in Functional Form

The emergence of self-regulation is a critical developmental milestone of early childhood [1, 2], and it is widely reported that children's self-regulatory competence is negatively related in linear form to their risk of various adjustment problems across the lifespan [3, 4, 5]. Self-regulation improves rapidly during early childhood and its individual differences remain moderately stable across development [1, 6, 7, 8]. Consequently, young children's difficulties regulating their attention, emotions, and behavior are related to early socioemotional problems preceding more severe forms of maladjustment in middle childhood and beyond [2, 3, 5, 9, 10].

Effortful control (EC) is the self-regulatory dimension of temperament responsible for voluntary suppression of dominant responses, initiation of subdominant responses, planning, and error detection [1, 7, 10, 11, 12]. Children with low EC are reported to show greater impulsivity [13], inattention [14], and general externalizing problems in both clinical [9, 15] and community samples [16, 17]. Negative relations between children's EC and internalizing problems are also reported but are less consistently replicated or weaker than evidence linking child EC and externalizing [18, 19]. Thus, children's EC and internalizing may be more complexly related, and their mixed evidence may partly stem from studies' methodological differences [20, 21].

Though child EC is most often assessed with parent report [22, 23] in relation to ratings of socioemotional problems in middle childhood and adolescence [13, 24, 25], behavioral measures of EC in early childhood also predict problems across development [26, 27, 28]. Most studies of child EC and socioemotional problems solely test for their linear relations. Several studies, however, using behavioral batteries of developmentally appropriate and sensitive tasks with preschool-aged samples of mostly non-Hispanic White children report that EC is positively

or quadratically related to internalizing symptoms [e.g., 21, 29]. Compared to single measures, behavioral batteries yield a more coherent, unitary EC factor for diverse racial-ethnic groups of preschool-aged children [30]. A positive or quadratic relation between behavioral battery assessed EC and internalizing symptoms has yet to be tested for or reported in minority children.

Children's racial-ethnic minority status is related to increased risks of self-regulatory and socioemotional problems [27, 31, 32, 33], and stressors related to poverty and disadvantage [34]. Children's race-ethnicity also moderates relations between EC, mental health problems, and their shared risk factors, such that minority children are more vulnerable to their negative effects [33, 35]. Evidence of racial-ethnic differences in young children's EC remains mixed [27, 36, 37]; however, the functional form of relations between EC and internalizing problems could differ between racial-ethnic groups. Minority children may require higher levels of EC to protect them from their relatively greater risk factors and to maintain the same level of internalizing behavior as their non-Hispanic White peers [17, 34, 36]. No study of preschool-aged children has tested race-ethnicity as a moderator of relations between EC and mental health. This cross-sectional study tests linear and curvilinear relations between children's behavioral battery assessed EC and parent rated externalizing and internalizing problems in a low-risk, diverse community sample. It then tests whether the functional forms of their relations differ across racial-ethnic groups.

Many constructs related to self-regulation overlap in behavioral measurement with EC, such as executive functions, which are a set of top-down control processes needed to override automatic or less effortful responses for internal goal-directed behavior and cognition [6, 10, 22]. As they all emphasize top-down self-regulation, in this study the terms "self-regulation" and "EC" are used interchangeably but "executive functions" is used for specific empirical studies.

Effortful Control, Externalizing Behavior, and Internalizing Behavior in Early Childhood

A key feature of EC is its voluntary top-down control of attention and emotion to inhibit automatic responding in favor of more reflective goal-directed behavior [1, 7, 10, 11, 12]. Inhibitory skills needed to quickly and effectively choose a course of action under conditions of conflict or delay support adaptive functioning across a myriad of situations and contexts [10, 12, 22]. Improvements in children's EC reflect their increasing flexibility in modulating attention, emotions, and impulses in response to situational demands as needed to show socially appropriate behavior [1, 11, 38]. Children's EC is critical to their early socialization, particularly internalization of norms, and development of personality and psychopathology [1, 10, 38, 39].

Young children's EC is negatively related to their externalizing behavior across settings and relationships using informant ratings, behavioral measures, or both [16, 17, 40]. Early externalizing behavior subsequently predicts poor school-age outcomes such as peer rejection, underachievement, and antisocial behavior [31, 32, 41, 42]. Most young children with externalizing problems gradually show fewer symptoms from toddlerhood through middle childhood, especially after school entry [28, 32, 42], coinciding with major advances in EC [1, 6, 7, 8]. Longitudinal evidence of negative bidirectional links between EC and externalizing behavior in early childhood further suggests that decreases in externalizing beginning in toddlerhood are related to the typical development of self-regulation [43, 44]. Thus, substantial evidence supports a negative linear relation between externalizing behavior and self-regulation, and the possibility that early problems with one slows improvement in the other.

Literature relating young children's self-regulation to internalizing behavior is decidedly mixed compared to studies linking EC to externalizing. Negative relations between parent rated EC and internalizing behavior are consistently found in clinical [15] and community samples of young children [18, 40, 45], school-aged children, and adolescents [24, 25]. These relations,

however, are relatively weak or inconsistently replicated when EC is assessed with a behavioral battery of tasks or a single behavioral measure. For example, Eisenberg and colleagues [40] found parent and caregiver ratings of children's EC were each negatively related to concurrent internalizing problems at ages 18, 30, and 42 months. In contrast, children's EC assessed with a single delay task at each age was sparingly related to their internalizing problems, and not at all longitudinally. Once measures of EC were combined and examined with internalizing and externalizing across early childhood, from 30 to 42 months, externalizing problems negatively predicted EC, and internalizing problems positively predicted EC. Thus, multimethod measures indicated the reverse direction of effect than typically reported, suggesting evocative effects from socioemotional problems to EC and a positive relation between EC and internalizing problems.

In support of curvilinear relations between self-regulation and socioemotional problems in early childhood, Murray and Kochanska [21] found a U-shaped relation between behavioral battery assessed EC and total problems in mainly White preschool-aged children. After splitting total problems into externalizing and internalizing scores, they found that compared to children with intermediate levels of EC, children with low EC had more attention problems and children with high EC had more internalizing problems. Carlson and Wang [46] similarly found 4- and 5-year-olds' emotion regulation was most effective in suppressing negative affect in response to a disappointing gift when children had intermediate levels of inhibitory control. Inhibitory control is a core component of EC and executive functions that is responsible for suppressing dominant responses in lieu of initiating subdominant responses [10, 22]. Intermediate levels of preschool-aged children's cardiac vagal tone and withdrawal, markers of physiological self-regulation, have also been linked to the most prosocial behavior [47] and best executive function performance [48]. The findings suggest both cognitive and biological mechanisms underlie

curvilinear relations between self-regulation and socioemotional functioning.

Recently, Liu and colleagues [29] found that behavioral battery assessed EC at age 3.5 was negatively related to parent rated externalizing at ages 3.5, 6, and 8.5, and positively related to internalizing at age 3.5 in a community sample of mostly White Canadian children. In fact, child EC was only related to internalizing symptoms during the preschool years. These studies collectively show that while low levels of EC is consistently linked to more externalizing across childhood, high EC is sometimes linked to more internalizing in low-risk community samples of White preschool-aged children. This is often found when children's self-regulation is assessed with a battery of tasks or combined tasks and ratings. In some cases, intermediate levels of EC yield the best socioemotional outcomes. Studies rarely test for curvilinearity to detect non-linear relations between children's EC and socioemotional problems, especially with racially diverse samples to clarify how generalizable functional forms of these relations are in early childhood.

Theoretical Justification for Testing Curvilinear Relations of Self-Regulation

Curvilinear and positive relations between preschool-aged children's self-regulation and internalizing problems suggest potential costs to self-regulatory competence. Though self-regulation promotes adaptation, extremely low or high self-regulation can be detrimental to health when behavioral propensities for undercontrol or overcontrol respectively increase risk of externalizing or internalizing disorders [49, 50]. Exercising self-regulation is not always positively adaptive, such as when children's excessive suppression of emotional affect exacerbates their mental health [51]. Further, top-down control does not promote one's best cognitive performance after learning has occurred and automatic responding would be faster, more efficient, or less costly [10, 22]. Cultural differences in the instrumental value of control highlight why studying EC's potential costs in a diverse sample of children is needed [52].

Despite Rothbart and Bates' [1] call for studies to test the limits of self-regulation's contributions to positive outcomes, tests of curvilinearity are rare in studies of child EC and socioemotional problems. Most studies of child temperament and adjustment focus on direct linear relations [1].

Although some researchers have tested for and not found curvilinear relations between self-regulation and socioemotional problems [15, 53, 54], their analytic approaches, methods, and sample sociodemographic characteristics may explain their null findings. According to Ganzach [55], including interaction terms when testing for curvilinearity can safeguard against misleading evidence of linear and non-linear relations or interactions, especially with correlated predictors. A lack of interaction terms when testing for curvilinearity can result in nonsignificant quadratic terms when quadratic relations are present, or finding a concave relation (i.e., upside-down U) when it is truly convex (i.e., U-shaped) or a convex relation when it is really concave. Integrated tests of curvilinearity and interactions can therefore yield less biased estimates of non-linear relations and moderation [55] involving child temperament and mental health problems.

It remains unclear whether relations between EC and socioemotional problems differ across racial-ethnic groups. Most studies simply control for race-ethnicity rather than test for its moderating effects to clarify differences in the functional form of relations between EC and socioemotional problems among different sociodemographic groups of young children.

The Current Study

This cross-sectional study tests linear and quadratic relations between EC and socioemotional problems in a racially diverse sample of preschool-aged children from mostly highly educated two-parent households. The sample represents a population considered to be at low risk for psychopathology and less likely to be referred to or receive clinical services [56, 57]. The first hypothesis is children's EC will be negatively related to externalizing in linear form in

this low-risk sample. The second hypothesis is children's EC will be quadratically related to internalizing, consistent with mixed evidence that low or high levels of EC are associated with the most internalizing problems for White preschool-aged children [15, 18, 21, 29]. Thus, it is assumed these relations are specific to young children at low risk for psychopathology. Interactions between children's EC and race-ethnicity will test whether relations between EC and socioemotional problems differ across racial-ethnic groups and safeguard against misleading evidence of linear and curvilinear relations [55]. Given the lack of prior tests of race-ethnicity as a moderator of these relations, there are no hypotheses regarding the interaction of child EC and race-ethnicity, but minority children are expected to have more socioemotional problems. Many sociodemographic correlates of early EC and socioemotional problems have been reported, so the following are controlled for in main analyses: child age [7, 36], gender [8, 37], parent educational attainment [8, 17], and annual household income [5, 27]. Clarifying the functional forms of relations between self-regulation and socioemotional problems in a racially diverse sample of preschool-aged children can extend evidence with more homogenous samples linking children's temperament and psychopathology.

Method

Participants

Seventy-three children (M_{age} = 38.01 months, SD = 4.48, range: 31.74–46.72 months; 54.8% girls) and at least one of their parents (M_{age} = 36.61 years, SD = 3.84, range: 29.59–46.03 years; 85.3% mothers) participated. Most parents were employed (61.8%) and married to the child's other biological parent (92.6%). About 33.8% of parents had up to a master's degree, 30.9% had a doctoral or professional degree, 29.4% had only a college degree, and 5.9% had some post-secondary education or did not report their educational attainment. For gross annual

household income: 55.9% of parents reported over $100,000; 14.7% reported $80,000–$100,000; 13.2% reported $60,000–$80,000; 7.4% reported $40,000–$60,000; 1.5% reported $20,000–$40,000; 7.4% did not answer. Most parents spoke English as their primary language at home (77.9%), 8.8% spoke multiple languages, and remaining spoke a language that was not English.

Children were excluded from recruitment if they were not native English speakers or if they had developmental disabilities, serious health conditions, physical disabilities, or cognitive deficits. One child's data were excluded from analyses because they failed to meet these criteria. The final sample included 72 preschool-aged children (M_{age} = 38.02 months, SD = 4.51, range: 31.74–46.72 months; 55.6% girls). Parents identified 13.9% of children as being of Hispanic or Latino ethnicity, 61.1% as White, 26.4% as Biracial/Multiracial, 6.9% as Asian/Asian American, 2.8% as African American/Black, and 2.8% as another racial-ethnic group. Overall, 52.8% were non-Hispanic White and 47.2% were considered racial-ethnic minorities, because the population in which families were recruited was 55.7% non-Hispanic White [58]. There were four pairs of twin siblings and one pair of non-twin siblings, so 67 unique families were in the final sample. Fifteen children (20.8%) were not in preschool, 26 children (36.1%) attended an on-campus early childhood lab school part-time, and 31 children (43.1%) attended other preschools.

An ideal sample size was estimated with a power analyses in G*Power 3.1 [59]. A medium effect size of 0.23 was derived from research [16] using similar behavioral measures of child EC and parent ratings of externalizing problems as this study. A sample of 74 participants yielded 80.4% power to detect this effect size at a 0.05 significance level in a multiple regression with eight predictors (i.e., four covariates, child race-ethnicity, EC, EC's quadratic term, and an interaction). Thus, the current study was underpowered to detect curvilinearity and interactions; however, adding a quadratic term with an interaction contributes to a negligible loss in statistical

power and can safeguard against misleading evidence of an interaction or lack thereof [60].

Procedure

Families with a 32- to 47-month-old child were recruited from preschools, daycares, local events, and flyers throughout a suburban city with a large university from July 2016 to January 2019. Parents were screened for eligibility by email or phone, and scheduled for 90-min visits at an on-campus lab. Upon arrival, a researcher established rapport with the child through play, while another researcher reviewed study documents with the parent(s). After obtaining parent consent and child assent, the researcher invited the child to play games in a game room, while the other researcher asked the parent(s) to complete questionnaires in a family room or separate rooms if two parents attended. The child was video recorded in the game room for later scoring of their performance on behavioral tasks. To ensure the child was comfortable participating, 15 parents accompanied their child for all or part of their assessment; these children did not differ in their overall performance from children who completed assessments alone. Breaks were offered to limit fatigue, boredom, and other issues that could yield data inconsistent with their true self-regulatory ability. The study was conducted in compliance with APA ethical standards and with IRB approval. Parents were compensated $25 gift cards and children received toy prizes.

Measures

Effortful control behavioral battery. Children were administered a 10-task behavioral battery for 38-month-olds adapted from Kochanska's [61] Family Study EC Batteries. Tasks were administered as games in a set order, typically while the child was seated at a small table, unless otherwise noted. Tasks usually began with instructions and repeated practice to ensure children understood what they needed to do to perform well. Reminders of instructions were provided midway through each task with multiple scored trials. The researcher working with the

child, called the *examiner*, rated each task with a 0–3 global score reflecting the trustworthiness of a child's data: zero or one meant the data were compromised by motivational issues, lack of comprehension of instructions, or both; two indicated some issues but the data were reasonable to use; and three meant the data were a valid indication of the child's effort and skill. Child task scores with global scores of zero or one were excluded from further calculation.

Snow/Grass and Day/Night. Two Stroop-like tasks assessed inhibitory control under conditions of conflict, in which the examiner showed the child two pieces of laminated paper. In *Snow/Grass*, papers were all green or all white, and the child was instructed to point to the green paper when the examiner said "snow" and to the white paper when the examiner said "grass" [62]. In *Day/Night*, papers had a light blue sky with a sun or a dark sky with a moon, and the child was instructed to point to the day sky when the examiner said "night" and to the night sky when the examiner said "day" [63]. Each task required the child to inhibit a learned association between a concept and its visual image, and instead point to the opposite image. Following administration and scoring guidelines [61], each task included 10 scored trials in which the child earned zero to three points per trial: zero indicated failure to point to either paper; one indicated an incorrect response; two indicated a self-corrected response; and three indicated a correct response. Total scores were sums of all 10 trial scores for *Snow/Grass* ($\alpha = 0.86$) and *Day/Night* ($\alpha = 0.74$). Of the final sample, 24 children (33.3%) received poor global scores on both tasks and five more had poor global scores for just *Snow/Grass* or just *Day/Night*. Children with good global scores for *Snow/Grass* had slightly more educated parents than children with poor global scores, $p = 0.004$. Children with good global scores for *Day/Night* were older than children with poor global scores by over two months, $p = 0.043$, and had more educated parents, $p = 0.035$.

Tower. This task assessed the child's ability to suppress and initiate activity according to

signal [61, 64]. While seated at a table, the examiner allowed the child to select a preferred color of blocks (16 red or 16 green) and established that the game was to take turns stacking blocks to make a tower, followed by practice. Once it was clear the child understood the instructions, they both sat on the floor for two scored trials during which the examiner moved slowly and methodically when stacking blocks to create opportunities for the child to act out of turn. Trials ended when the tower fell over, but if all 32 blocks were stacked, the child was permitted to knock it over. Ratio scores for each trial were calculated by dividing the number of blocks placed by the examiner by the total number of blocks placed by both child and examiner, so lower values reflected less turn taking. Five points were deducted or added to ratio scores respectively when the child knocked over the tower prematurely or when the child removed a block at the top to stabilize the tower. The total score for *Tower* was a mean of its two trials (α = 0.42) or only trial if the child refused to build another tower. Global scores for both trials were poor for two children (2.8%), while another 16 children (22.2%) had poor global scores for the second trial. Children with poor global scores did not differ from those with good global scores.

Whisper. This task assessed the child's ability to lower their voice and only whisper the names of popular cartoon characters [61, 64]. The examiner started the task by stating the rule of the game was to only whisper throughout and to whisper "I don't know" when the child did not know a character's name. The child was shown a sequence of 15 cards each with a unique cartoon character. Scoring of each trial was done live by the examiner and verified later by video coders using a 4-point scale: zero indicated a shout; one indicated a normal tone or mix of volumes; two indicated no verbal response; and three indicated a whisper. The total score was the average of all 15 items (α = 0.96), such that higher scores indicated greater vocal volume control. Only four children (5.6%) had poor global scores for Whisper and their families had a

lower average annual household income than children with good global scores, $p = 0.007$.

Walk-a-Line Slowly. This task assessed the child's ability to slow their gross motor activity [61, 64]. The examiner demonstrated before each trial walking along a straight line on the floor constructed with a six-foot strip of ribbon with cartoon animals walking in one direction. Three timed trials included a baseline trial at normal speed and two trials at slow speeds, in which the child was instructed to walk as slowly as possible. The total score for *Walk-a-Line Slowly* was calculated by subtracting the time of the baseline trial from the average time of the slow trials ($\alpha = 0.78$), such that higher scores indicated greater gross motor control. Only four children (5.6%) had poor global scores, and these children were all boys, $p = 0.021$, and about five-and-a-half months younger than children with good global scores, $p = 0.002$.

Drawing. This task assessed the child's ability to control the speed of their fine motor activity [61, 64]. The examiner brought out sheets of paper with cartoon trees on each end and a squirrel in one tree. The examiner instructed the child to help the squirrel get from one tree to another by drawing a line connecting the trees with a marker. Three timed trials included a baseline trial at normal speed, a fast trial, and a slow trial. The total score for *Drawing* was calculated by subtracting the time of the fast trial from the slow trial ($\alpha = 0.14$), such that higher scores indicated greater fine motor control. Seven children (9.7%) had poor global scores, and they were on average about three-and-a-half months younger than children with good global scores, $p = 0.015$, and their participating parents were all employed, $p = 0.032$.

Turtle/Rabbit. This task assessed the child's ability to control the speed of their fine motor activity following examiner instructions [61, 64]. The examiner set up a poster board with a winding path to the open doors of a toy barn. The child was instructed to stand and move a child figurine into the barn from a starting spot on the other end of the board while staying within

the path. After two baseline trials, the examiner replaced the child figurine with a rabbit figurine described as "the fastest bunny in the world" for two fast trials. They then replaced the rabbit figurine with a turtle figurine described as "the slowest turtle in the world" for two slow trials. The five curves in the winding path each received a 0–2 curve score: zero meant the child missed a curve completely; one meant they generally followed the curve but at least 50% of the figurine fell outside of it; and two meant the figurine was mostly within the curve. A curve score of zero for a trial meant the child missed all curves, whereas a score of 10 meant they mostly stayed within the entire path. A slow-down score was calculated by subtracting the average time of fast trials by average time of slow trials. The total score was the average of the standardized curve and slow-down scores ($\alpha = 0.58$). One child received a poor global score.

Dinky Toys. This task assessed the child's ability to inhibit a dominant response to grab a toy and instead delay gratification [61, 64]. The examiner set a placemat with two handprints in front of the child and instructed them to keep their hands on the handprints while the examiner opened the lid of a small container with small animal figurine toys inside. The examiner instructed the child to tell them which toy they wanted and offered reminders throughout to keep their hands on the handprints. Once the child appeared to understand the instructions, the examiner resealed the container and started a scored trial in which the child earned a 0–5 strategy score: zero meant the child grabbed the toy; one meant they touched but did not remove the toy from the container; two meant they pointed to but did not touch the toy; three meant they removed their hands from the mat but did not point to, touch, or grab the toy; four meant they moved their hands while staying on the mat; and five meant the child kept their hands on the handprints for the full trial. The length of time it took the child to choose a toy was recorded as a latency score. Latency and strategy scores were unrelated ($r = -0.09$, $p = 0.462$), so only the

strategy score was used as the total score. Only one child received a poor global score.

Gift Wrap and Gift Delay. The final task had two parts that assessed the child's ability to inhibit a dominant response to peek at or touch a gift [61, 64]. The examiner told the child they had a gift for them in *Gift Wrap* but they needed to wrap it first to keep it a surprise. The examiner instructed the child to remain seated and to not peek as the examiner sat behind the child to wrap the gift. For 60 sec, the examiner noisily crinkled tissue paper around a small container of Play-Doh into a gift bag and offered the child up to two reminders not to peek. Scoring consisted of latencies for the child to peek over their shoulder and turn their body over 90 degrees, as well as a 1–5 peek score: one indicated the child turned around and never fully returned forward; two indicated they turned around but returned forward; three indicated they peeked enough to see wrapping but did not turn their body; four indicated they turned their head to peek but less than 90 degrees; and five indicated the child did not try to peek for the entire 60-sec task. The total score for *Gift Wrap* was calculated by averaging standardized latencies to peek and to turn, as well as the peek score ($\alpha = 0.83$). No children had poor global scores.

Gift Delay started right after with the examiner placing the gift bag at the table's center in arm's reach of the child, who was instructed to not touch the gift until the examiner returned with a bow left in another room. The examiner waited 3 min to return or returned immediately if the child showed distress or began exiting the room. Scoring considered the child's latencies to touch, lift, open the gift, and leave their seat. The child also received a 1–4 touch score: one indicated they opened the gift; two meant they picked up the gift; three meant they only touched but did not lift the gift; and four meant the child never touched the gift. The child also received a 1–4 seat score: one indicated they sat in their seat for less than 30 sec total; two meant they were seated for 30–59 sec; three indicated they stayed seated for 60–119 sec; and four indicated they

stayed seated for over 120 sec total. A half point was added to the seat score for each minute the child was not seated but within reach of the table, but only if they did not already have a perfect seat score. The total score for *Gift Delay* was calculated by averaging standardized seat and touch scores and all four latencies ($\alpha = 0.69$). One child had a poor global score for this task.

Effortful control behavioral battery score. All assessments were coded by at least two trained research assistants and one graduate student who was master coder. Interrater reliability was calculated for all tasks or portions of tasks with timed parts ($\kappa = 0.87$) and tasks or portions of tasks with scored parts ($\kappa = 0.88$). Overall, there was high interrater reliability (avg. $\kappa = 0.87$). Total scores' distributions were inspected for signs of non-normality. *Drawing*'s high skewness (> 4) and kurtosis (> 27) values were addressed with a log10 transformation. No other total scores had skewness or kurtosis values suggesting non-normality. A *Snack Delay* task was administered after *Dinky Toys* but was excluded from further analysis as it showed evidence of ceiling effects with half the sample earning the maximum score. Following Kochanska and colleagues' [64] approach, total scores for all other tasks were standardized and averaged to create EC behavioral battery scores ($\alpha = 0.71$). A principal component analysis showed that the first component included all nine tasks and explained 30% of the variance ($\lambda = 0.47$ to 0.77).

Child socioemotional problems. Parents (86.3% mothers) rated children on a 3-point scale [0 = Not True, 2 = Very True or Often True] on the Child Behavior Checklist Ages 1.5–5 [65]. Attention Problems and Aggressive Behavior syndrome scale items were summed into an Externalizing broadband scale (24-item $\alpha = 0.89$). Syndrome scale items for Emotionally Reactive, Anxious/Depressed, Somatic Complaints, and Withdrawn were summed into an Internalizing broadband scale (35-item $\alpha = 0.88$). Raw scores were converted to gender-normed *T*-scores with borderline ($T > 59$ and < 64) and clinical ranges ($T > 63$). Similar to preschool

rates [66], 4.2% and 5.6% of children were respectively rated in borderline and clinical ranges of externalizing scores, whereas 4.2% and 12.5% of children were rated in borderline and clinical ranges of internalizing scores. Externalizing and internalizing scores were positively related (r = 0.58, $p < 0.001$), but only three children were in the elevated ranges for both broadband scales.

Sociodemographic covariates. Parents reported children's age in months, gender (-1 = girls, 1 = boys), and race-ethnicity (-1 = non-Hispanic White, 1 = racial-ethnic minority). Parents also reported their level of educational attainment [1 = partial high school, 8 = doctoral or professional degree] and annual household income [1 = under $20,000, 6 = over $100,000].

Data Analysis Plan

Analyses were conducted in SPSS 25, beginning with missing data, descriptive statistics, and correlations. *T*-tests and χ^2 tests examined relations with categorical variables. Hypotheses were tested with externalizing and internalizing *T*-scores as the dependent variable in separate hierarchical regressions. Following recommendations [55, 60], eight predictors were entered in four steps: 1) Four covariates and child race-ethnicity; 2) child EC behavioral battery score; 3) EC^2, which tests quadratic relations; and 4) the interaction between child EC and race-ethnicity. Because externalizing and internalizing scores were strongly related, post-hoc analyses tested whether including one broadband scale as a predictor of the other in a fifth regression step would alter results but these tests are briefly reported as they were not considered in the power analysis. Dawson's [67, 68] guidelines were followed to test simple slopes of quadratic and interaction terms, and Preacher, Curran, and Bauer's [69] online calculators were used to conduct regions of significance analyses and to obtain confidence bands. Predictors were mean centered to limit problems with multicollinearity, and no signs of multicollinearity were evident from variance inflation factors or tolerance values. Effect size estimates are reported as unstandardized

regression coefficients with standard errors, standardized coefficients, and using R^2 values [70].

Results

Preliminary Analyses

Little's [71] missing completely at random test with expectation maximization was marginally significant, $\chi^2(16) = 24.82$, $p = 0.073$. Most variables were not missing data or only one value, but six parents did not report their household income; they were less educated and their children had lower EC scores and were all girls, ps < 0.05. Table 1 shows descriptive statistics and intercorrelations of study variables. Consistent with hypothesis 1 that EC will be negatively and linearly related to externalizing, child EC was negatively related to externalizing problems. In mixed support of hypothesis 2 that child EC will be quadratically related to internalizing, the quadratic term EC^2 was significant and negative, which suggests a concave, inverted U-shaped relation between child EC and internalizing scores. Child EC and age were positively correlated. Boys had higher externalizing ratings ($M = 49.50$, $SD = 8.41$) than girls ($M = 45.05$, $SD = 9.56$), $p = 0.043$. Girls were older ($M = 39.34$, $SD = 4.56$) than boys ($M = 36.36$, $SD = 3.91$), $p = 0.004$, and had marginally better EC ($M = 0.09$, $SD = 0.55$) than boys ($M = -0.15$, $SD = 0.46$), $p = 0.059$. Children identified as racial-ethnic minorities had higher internalizing ratings ($M = 51.21$, $SD = 11.93$) than non-Hispanic White children ($M = 44.41$, $SD = 9.08$), $p = 0.009$. Within groups, more racial-ethnic minorities had borderline or clinical range internalizing scores (26.5%) than non-Hispanic White children (7.9%), and among all children in these ranges, more were children of color (75.0%) than non-Hispanic White (25.0%), ps < 0.05.

H1: Effortful Control Will Be Negatively and Linearly Related to Externalizing Problems

Supporting hypothesis 1, child EC was negatively related to externalizing scores in linear form. Table 2 summarizes hierarchical regression results: Step 1 with covariates and child race-

ethnicity did not explain externalizing scores, $F(5, 60) = 1.69$, $p = 0.151$, $R^2 = 0.12$. Step 2 added child EC and was a significant improvement over Step 1, $\Delta R^2 = 0.06$, $p = 0.040$. Child EC negatively predicted externalizing scores ($B = -4.72$, $SE = 2.25$, $\beta = -0.27$, $p = 0.040$); however, the overall regression was only marginally significant, $F(6, 59) = 2.22$, $p = 0.053$, $R^2 = 0.18$. Step 3 added EC^2 but was not an improvement over Step 2, $\Delta R^2 = 0.00$, $p = 0.602$, and EC^2 did not predict externalizing scores ($B = -1.80$, $SE = 3.43$, $\beta = -0.07$, $p = 0.602$), $F(7, 58) = 1.92$, $p = 0.083$, $R^2 = 0.19$. Child race-ethnicity was unrelated to externalizing scores across all steps.

To test whether the relation between child EC and externalizing differed across racial-ethnic groups, an interaction between child EC and race-ethnicity was entered in the regression's last step. Table 2 shows adding an interaction between child EC and race-ethnicity in Step 4 was not an improvement over Step 3, $\Delta R^2 = 0.02$, $p = 0.219$. The interaction between child EC and race-ethnicity did not predict externalizing scores ($B = -2.83$, $SE = 2.28$, $\beta = -0.16$, $p = 0.219$), $F(8, 57) = 1.89$, $p = 0.079$, $R^2 = 0.21$. Cohen's f^2 (1988) effect size measure of R^2 indicated that child EC had a small effect size of 0.08 and Step 2's regression had a medium effect size of 0.23.

In a post-hoc test, child internalizing *T*-scores were entered as a predictor in Step 5 of the regression, improving upon Step 4, $\Delta R^2 = 0.21$, $p < 0.001$. Internalizing significantly predicted externalizing scores ($B = 0.46$, $SE = 0.10$, $\beta = 0.55$, $p < 0.001$) and child EC was no longer significant ($B = -3.02$, $SE = 2.02$, $\beta = -0.17$, $p = 0.141$), $F(9, 56) = 4.41$, $p < 0.001$, $R^2 = 0.42$.

H2: Effortful Control Will Be Quadratically Related to Internalizing Problems

In modest support of hypothesis 2, there was a curvilinear relation between child EC and internalizing scores, albeit marginally significant. Table 3 summarizes hierarchical regression results: Step 1 with covariates and child race-ethnicity did not significantly explain internalizing, $F(5, 60) = 1.83$, $p = 0.120$, $R^2 = 0.13$, but child racial-ethnic minority status predicted greater

internalizing scores (B = 3.27, SE = 1.35, β = 0.30, p = 0.018). Step 2 added child EC and was not an improvement over Step 1, ΔR^2 = 0.03, p = 0.128, and child EC did not predict internalizing scores (B = -4.18, SE = 2.71, β = -0.20, p = 0.128), F(6, 59) = 1.96, p = 0.086, R^2 = 0.17. Step 3 added EC^2 and was a marginally significant improvement over Step 2, ΔR^2 = 0.05, p = 0.070, and EC^2 was a marginally significant predictor of internalizing scores (B = -7.40, SE = 4.01, β = -0.23, p = 0.070), F(7, 58) = 2.23, p = 0.044, R^2 = 0.21. Figure 1 illustrates the modest quadratic relation between child EC and internalizing scores appearing as a concave, inverted U-shape while accounting for covariates and child race-ethnicity. Across all steps, child EC was unrelated to internalizing and child race-ethnicity significantly predicted internalizing scores.

To test whether relations between child EC and internalizing differed across racial-ethnic groups and to verify a curvilinear relation, an interaction between child EC and race-ethnicity was entered in the regression. Table 3 shows adding an interaction between child EC and race-ethnicity in Step 4 was a significant improvement over Step 3, ΔR^2 = 0.10, p = 0.005. In Step 4, child EC (B = -3.10, SE = 2.54, β = -0.15, p = 0.227) and EC^2 (B = -5.84, SE = 3.81, β = -0.18, p = 0.130) were unrelated to internalizing. Child race-ethnicity (B = 2.98, SE = 1.24, β = 0.27, p = 0.019), household income (B = 2.48, SE = 1.19, β = 0.24, p = 0.041), and the interaction between child EC and race-ethnicity predicted internalizing (B = -7.43, SE = 2.52, β = -0.35, p = 0.005), F(8, 57) = 3.30, p = 0.004, R^2 = 0.32. Child racial-ethnic minority status and greater household income predicted more internalizing problems with the two-way linear interaction. Cohen's f^2 (1988) effect size measure indicated that significant predictors had small-to-medium effect sizes of 0.07 to 0.15 and Step 4's regression had a large effect size of 0.46. Child externalizing T-scores were entered as a predictor in Step 5, improving upon Step 4, ΔR^2 = 0.18, p < 0.001. Externalizing scores significantly predicted internalizing scores (B = 0.56, SE = 0.13, β = 0.47, p

< 0.001), and of all predictors, only the interaction between child EC and race-ethnicity remained significant (B = -5.83, SE = 2.22, β = -0.28, p = 0.011), $F(9, 56) = 6.08$, $p < 0.001$, $R^2 = 0.49$.

Figure 2 shows the plotted two-way linear interaction between child EC and race-ethnicity predicting internalizing *T*-scores. Tests of simple slopes showed a positive linear relation between EC and internalizing for non-Hispanic White children with significantly more internalizing problems at high (+1 *SD*) than low (-1 *SD*) levels of EC (B = 3.92, t = 5.24, $p <$ 0.001). There was a negative linear relation for racial-ethnic minority children with significantly more internalizing problems at low than high levels of EC (B = -10.94, t = -15.03, $p < 0.001$). Racial-ethnic groups of children showed opposite linear relations between their EC and internalizing problems, as internalizing ratings differed by over a standard deviation at a low level of EC, and no evidence of a curvilinear relation between EC and internalizing remained.

To further probe the interaction, online calculators [69] were used to test simple slopes with child EC as the moderator and race-ethnicity as the predictor, as well as to estimate regions of significance and obtain confidence bands for simple slopes across the range of EC values. Figure 3 shows an alternative test of simple slopes indicating that non-Hispanic White children had fewer internalizing problems than racial-ethnic minority children at low (-1 *SD*, B = 6.87, t = 3.75, $p < 0.001$) and mean levels of EC (B = 2.98, t = 2.42, p = 0.019) but not at high levels of EC (+1 *SD*, B = 0.91, t = -0.51, p = 0.612). Figure 4 shows lower and upper bounds (0.07 – 1.39) of the confidence band of child EC scores with a region of significance from just above the mean to past EC's highest possible value. Simple slopes of child internalizing scores regressed on race-ethnicity were significantly different from zero for values of EC below 0.07, so racial-ethnic groups only differed in internalizing problems at average and lower levels of EC.

Discussion

This cross-sectional study of a low-risk, racially diverse community sample of young preschool-aged children tested linear and curvilinear functional forms of relations between their EC and externalizing and internalizing problems. Bivariate and multivariate analyses yielded evidence supporting the hypothesized negative linear relation between EC and externalizing problems and a modest quadratic relation between EC and internalizing problems. Refuting the second hypothesis, the curvilinear relation between EC and internalizing was no longer even marginally significant after an interaction between EC and race-ethnicity revealed that linear relations between EC and internalizing differed across racial-ethnic groups. The findings ultimately suggest evidence of curvilinear relations between preschool-aged children's self-regulation and internalizing problems reflected their opposite linear relations among distinct demographic subgroups within the sample. It appeared that greater self-regulation was positively adaptive for racial-ethnic minority children's socioemotional functioning and modestly disruptive for non-Hispanic White children's socioemotional functioning.

Linear Relations between Children's Effortful Control and Externalizing Problems

Study findings supported a negative linear relation between young children's EC and externalizing problems, as reported using a variety of measurement methods in cross-sectional [9, 15, 16] and longitudinal studies [19, 26, 28, 40, 45]. Young children's self-regulation was negatively related to externalizing problems, while accounting for their age, gender, parental education, household income, and race-ethnicity. Similar to prior studies, older preschool-aged children and girls had higher EC [7, 28, 36, 37], whereas boys had higher externalizing ratings [17, 31, 43]. Only EC initially predicted externalizing problems in these children from mostly highly educated two-parent households with high incomes. The overrepresentation of high education and income levels may explain why they did not predict externalizing, even though

they often are significant predictors as components of socioeconomic status (SES) [17, 31, 41].

Frequent comorbidity between young children's externalizing and internalizing problems [e.g., 66] further complicates their relations to self-regulation, as their pure expressions have been differentially linked to EC [19, 20]. Sometimes relations between children's self-regulation and internalizing problems disappear once externalizing symptoms are controlled for [3, 40]. In this low-risk sample, however, preschool-aged children 's EC was no longer related to their externalizing problems when considered alongside their internalizing problems. Thus, parents' ratings of children's externalizing problems were more strongly related to their internalizing problems than children's performance on a behavioral battery of self-regulatory tasks.

Curvilinear Relations and Interactions between Children's Effortful Control, Internalizing Problems, and Race-Ethnicity

As hypothesized, children's self-regulation and parent rated internalizing problems were initially found to be curvilinearly related, albeit in an unexpected inverted U-shape such that children with intermediate levels of EC had the highest internalizing ratings. Prior studies that tested for and did not find curvilinear relations between preschool-aged EC and socioemotional problems differed from this study in their analyses and sample risk levels [15, 53]. Burnson and colleagues [53], for example, found negative linear relations between EC and total problems in children born premature, but they did not test for separate curvilinear relations with internalizing or externalizing problems. Self-regulatory deficits, psychopathology, and prematurity are so intertwined that preterm children's EC and socioemotional problems may only be linearly related because higher EC continues to reap benefits for high-risk samples, such as clinically referred children [15]. Nevertheless, evidence of curvilinearity was modest in the present study, and only racial-ethnic minority status consistently predicted higher internalizing ratings. Over 25% of

minority children received internalizing scores of clinical concern, exceeding 9%–15% rates of anxiety and emotional disorders reported in preschool-aged community samples in the US [66].

A linear interaction between EC and race-ethnicity further indicated that non-Hispanic White children with high EC had higher internalizing ratings than those with low EC. This is consistent with positive relations between EC and internalizing behavior reported in community samples of mainly White preschool-aged children [20, 21, 29, 40, 72). In contrast, racial-ethnic minority children with low EC had higher internalizing ratings than those with high EC. These differences were independent of the predictive relations of racial-ethnic minority status, high household income, and high externalizing problems on internalizing problems. Despite no racial-ethnic differences in EC, externalizing, income, or any other covariate, differences in internalizing ratings were greatest at low levels of EC, such that minority children had the most symptoms while non-Hispanic White children had the fewest symptoms. Further analyses showed that racial-ethnic differences in internalizing ratings were also present for children with average levels of EC within the sample. Thus, only among children scoring above average on EC were internalizing ratings at a similar level across racial-ethnic majority and minority groups.

Studies of low-income preschool-aged children also found no racial-ethnic differences in EC [36, 37] or inhibitory control, especially when accounting for SES [73]. A study with a broader sampling of family incomes found White preschool-aged children showed better EC and fewer internalizing symptoms than racial-ethnic minority children, but interactions between EC and race-ethnicity were not tested [27]. The racial-ethnic heterogeneity of the present sample's minority group precluded within-group analysis of its elevated risk for internalizing disorders. It is notable, however, that a negative linear relation between EC and internalizing only applied to children of color who did not appear to be at risk in terms of SES or externalizing problems.

The greater cumulative risk faced by young minority children [27, 36] may explain their higher risk of internalizing disorders and why racial-ethnic differences were largest at low levels of EC. Discrimination and acculturation pressures are salient stressors for minority parents that can directly and indirectly harm their young children [74, 75]. These risk factors may have in turn exacerbated internalizing symptoms for children of color with low EC, who tend to be more vulnerable to contextual stressors [17, 76]. Without contextual variables related to child EC, such as parenting [13, 18, 28, 29], these explanations for why linear relations between EC and internalizing varied across racial-ethnic groups are all speculative. Examining the fit between children's sociocultural affordances for self-regulation and their control-related motivations, beliefs, and abilities [52] may identify mediators of interactions between EC and race-ethnicity.

Though evidence of curvilinearity was weak, a positive relation between White children's EC and internalizing problems does not reject evidence that moderate levels of EC promote optimal emotion regulation and health [46]. Highly inhibited or overcontrolled children are thought to have a rigid and suppressed personality type that increases their risk for internalizing disorders [13, 49, 50]. A recent study of 8- to 12-year-olds found that younger children showed more overcontrol (i.e., inflexibility, frustration with change, social concern, perfectionism) and that overcontrol was linked to greater anxiety symptoms and rates of diagnosis [77]. While controlling for age and anxiety, overcontrol was related to smaller differences in neural activity during error versus correct responses in the bilateral insula and dorsal anterior cingulate cortex, brain regions involved in error detection and performance monitoring [77]. Thus, high EC may be related to internalizing symptoms due to overcontrol tendencies and their neural mechanisms.

High EC helps preschoolers inhibit positive *and* negative affect, except for fear which can support EC [39]. Kochanska and colleagues [7] found high EC was related to better anger

regulation at 22 months and better regulated anger *and* joy at 33 months, showing that inhibition of positive affect increases up to the preschool years. Liew, Eisenberg, and Reiser [78] found preschoolers rated by parents and teachers as having high EC were more socially competent and well-adjusted, and showed fewer negative verbal and gestural responses to a disappointing gift. Further, preschoolers with high EC showed fewer positive but not negative affective expressions. Preterm boys with high EC also showed fewer positive emotions during an exciting task [53].

The findings suggest EC supports *expressive suppression*, an emotion regulation strategy whereby children conceal overt displays of emotion, which is related to favorable or negative socioemotional outcomes depending on the social-cultural context [51]. As children's EC improves they engage in more expressive suppression, which facilitates their socially appropriate interactions, but children's overuse of expressive suppression may prevent parents from noticing their negative emotions and comforting them as needed. In the context of risk, parents may not rely on their observations of children's sadness or withdrawn behavior to provide them warmth and support as much as parents in low-risk contexts. In the absence of noticeable risks such as poverty and discrimination, children's internalizing symptoms may worsen over time if they are insufficiently comforted by caregivers because of their excessive use of expressive suppression.

Limitations, Strengths, and Future Directions

This study's findings should be interpreted cautiously because of its small sample size, cross-sectional design, and reliance on one informant per child and one method of measuring EC. Testing curvilinearity in the presence of an interaction leads to a negligible loss of power [60] and helps ensure the accuracy of an interaction [55, 60]. Though field studies are often underpowered to detect interactions when compared to experiments, loss of power is minimized when there are jointly extreme values (e.g., racial-ethnic differences in internalizing) and

predictors with symmetrical distributions (e.g., EC)[79]. Though underpowered to detect both curvilinear and interaction effects, the sample size yielded small-to-large effect sizes with a battery of tasks to yield a coherent EC score with diverse samples of preschoolers [30].

Performance-based tasks capture children's processing efficiency of cognitive abilities in objective, supervised, and structured conditions, whereas questionnaires capture goal-driven behavior when facing daily challenges [80]. Though behavioral tasks may be less ecologically valid than questionnaires, EC ratings can be conflated by idiosyncratic situations and settings in which children are observed [1], a criticism that also applies to ratings of socioemotional problems. This may explain why internalizing ratings are often related to ratings of EC but not its behavioral measures [25, 40]. This study used two age-appropriate parent report measures of child temperament because the sample was split almost evenly across 2- (44%) and 3-year-olds (56%). This precluded their use in analyses, but the modest convergent validity of behavioral tasks and questionnaires [81] suggests the findings would not replicate with these data.

Multimethod studies assessing multiple facets of children's temperament can replicate and extend this study's findings with comprehensive measures of self-regulation and reactivity [1]. Testing for curvilinearity and interactions between these orthogonal temperament dimensions can clarify how they operate independently of each other and in coordination to shape development [12, 45]. Reactivity includes reactive control processes that work alongside EC, such as impulsivity and *behavioral inhibition*, a reactive tendency to withdraw from novel or otherwise fear-inducing stimuli [10, 12, 82]. Inhibitory control has been found to moderate risk of preschool-aged anxiety for children high in behavioral inhibition [72]. By testing interactions between temperament variables, high inhibitory control was shown to increase risk of anxiety for behaviorally inhibited children, but curvilinear relations were not tested [72]. Because high

behavioral inhibition predicts greater internalizing behavior [29] and better EC across early childhood [39], behaviorally inhibited children can have high EC and still be at increased risk for internalizing disorders. Though often interrelated, low impulsivity and high EC have both predicted higher internalizing ratings [19, 21]. Eisenberg and colleagues [20] found when compared to children high in externalizing, children high in internalizing received higher ratings of attentional and inhibitory control and lower ratings of impulsivity, but they also had lower impulsivity than a control group. Psychophysiological measures of autonomic reactivity and regulation, such as cardiac pre-ejection period and vagal tone, can further elucidate the interplay between reactive control, EC, and psychopathology when paired with other methods [48, 83].

Longitudinal studies of more economically diverse samples are also needed to test the external validity of these findings. Affluent children are believed to be at risk for internalizing and substance use disorders because of isolation from their parents and high demands placed on them to achieve academically [56, 57]. The present study extends this literature and its focus on school-aged children and adolescents [84], as it shows that high family income is related to greater internalizing problems in preschool-aged children from socioeconomically advantaged families. Curvilinear relations between EC and socioemotional problems have yet to be tested in low-income children, so it is important to recruit samples that represent the full socioeconomic spectrum and to attain longitudinal data to strengthen inferences of true directions of effects. Future studies should also test indices of SES and psychophysiological markers of self-regulation and reactivity as moderators [47, 48, 83] in relation to health outcomes, as exerting self-control often supports mental health but can be costly to physical health in disadvantaged contexts [85].

Summary

Though self-regulation is widely assumed to support positive adaptation, curvilinear and positive relations between self-regulation and socioemotional problems have been found in community samples of mostly non-Hispanic White preschool-aged children. Presuming that children's EC is negatively related to their mental health problems may overgeneralize prior evidence and perpetuate the idea that greater self-regulation is only for the better, regardless of context or individual differences. Such assumptions are commonly made when researchers solely test for linear relations between self-regulation and socioemotional problems or fail to test for group differences in their associations. This cross-sectional study tests linear and quadratic relations between children's behavioral battery assessed EC and parent rated externalizing and internalizing problems in a diverse sample of 2.5- to 3.5-years-olds (N = 72) from mainly highly educated two-parent households. This study also tests whether the functional form of relations between EC and socioemotional problems differ across racial-ethnic groups. Child EC was negatively related to externalizing and quadratically related to internalizing, albeit modestly, but an interaction indicated opposite linear relations between EC and internalizing problems for racial-ethnic minority and majority group children. Future studies should examine potential costs to enacting self-regulation and whether relations differ among subgroups as their distinct functional forms may be conflated as evidence of curvilinearity within a sample. This study integrates tests of curvilinearity and interactions in a manner simple enough for future studies to follow to further clarify the complex associations between self-regulation and psychopathology.

Compliance with Ethical Standards

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study. All child participants provided their verbal assent before any data were collected.

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Table 1

Descriptive Statistics, Item Reliability, and Intercorrelations of Continuous-Scaled Study Variables

Variables	1	2	3	4	5	6	7
1. Child effortful control	–						
2. Child effortful control^2	.21†	–					
3. Child age in months	**.36****	.06	–				
4. Parental education	.02	-.07	.01	–			
5. Household income	.01	.18	.04	.13	–		
6. Externalizing problems	**-.32****	-.14	-.16	.05	.14	–	
7. Internalizing problems	-.21†	**-.24***	-.04	-.05	.19	**.58*****	–
M	-.02	.27	38.02	6.86	5.27	47.06	47.66
SD	.52	.34	4.51	1.05	1.07	9.27	11.01
Cronbach's α	.71	–	–	–	–	.89	.88
N	72	72	72	71	67	71	71

Note: Bold values are statistically significant at the .05 level. †$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 2

Hierarchical Regression Predicting Child Externalizing Problems with Interaction between Child Effortful Control (EC) and Race-Ethnicity

	Step 1		Step 2		Step 3		Step 4	
Variable	*B (SE)*	*β*	*B (SE)*	*β*	*B (SE)*	*β*	*B (SE)*	*β*
Child age in months	-.26 (.27)	-.12	-.08 (.27)	-.04	-.08 (.27)	-.04	-.20 (.29)	-.10
Child gender	1.87 (1.20)	.20	1.56 (1.17)	.17	1.50 (1.19)	.16	1.45 (1.18)	.16
Parental education	.38 (1.10)	.04	.41 (1.07)	.05	.35 (1.08)	.04	.30 (1.07)	.03
Household income	.88 (1.07)	.10	.92 (1.04)	.11	1.04 (1.07)	.12	1.17 (1.08)	.14
Child race-ethnicity	1.90 (1.14)	.21	1.73 (1.11)	.19	1.68 (1.12)	.18	1.72 (1.12)	.19
Child EC			**-4.72 (2.25)**	**-.27***	-4.49 (2.31)	-.25†	-4.45 (2.30)	-.25†
Child EC^2					-1.80 (3.43)	-.07	-1.21 (3.45)	-.04
EC* Race-ethnicity							-2.83 (2.28)	-.16
R^2	.12		**.18**		.19		.21	
F for change in R^2	1.69		**4.40***		.28		1.54	

Note: Child gender: -1 = girls, 1 = boys. Child race-ethnicity: -1 = non-Hispanic White, 1 = racial-ethnic minority. Bold values are statistically significant at the .05 level. †$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Table 3

Hierarchical Regression Predicting Child Internalizing Problems with Interaction between Child Effortful Control (EC) and Race-Ethnicity

	Step 1		Step 2		Step 3		Step 4	
Variable	*B (SE)*	*β*	*B (SE)*	*β*	*B (SE)*	*β*	*B (SE)*	*β*
Child age in months	-.11 (.31)	-.05	.04 (.33)	.02	.02 (.32)	.01	-.30 (.32)	-.12
Child gender	.90 (1.41)	.08	.63 (1.41)	.06	.37 (1.39)	.03	.23 (1.31)	.02
Parental education	-.46 (1.29)	-.04	-.43 (1.28)	-.04	-.67 (1.26)	-.06	-.81 (1.19)	-.08
Household income	1.60 (1.27)	.16	1.63 (1.25)	.16	2.13 (1.26)	.21†	**2.48 (1.19)**	**.24***
Child race-ethnicity	**3.27 (1.35)**	**.30***	**3.12 (1.33)**	**.29***	**2.87 (1.31)**	**.26***	**2.98 (1.24)**	**.27***
Child EC			-4.18 (2.71)	-.20	-3.22 (2.70)	-.15	-3.10 (2.54)	-.15
Child EC^2					-7.40 (4.01)	-.23†	-5.84 (3.81)	-.18
EC*Race-ethnicity							**-7.43 (2.52)**	**-.35****
R^2	.13		.17		.21		**.32**	
F for change in R^2	1.83		2.38		3.40†		**8.70****	

Note: Child gender: -1 = girls, 1 = boys. Child race-ethnicity: -1 = non-Hispanic White, 1 = racial-ethnic minority. Bold values are statistically significant at the .05 level. †$p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

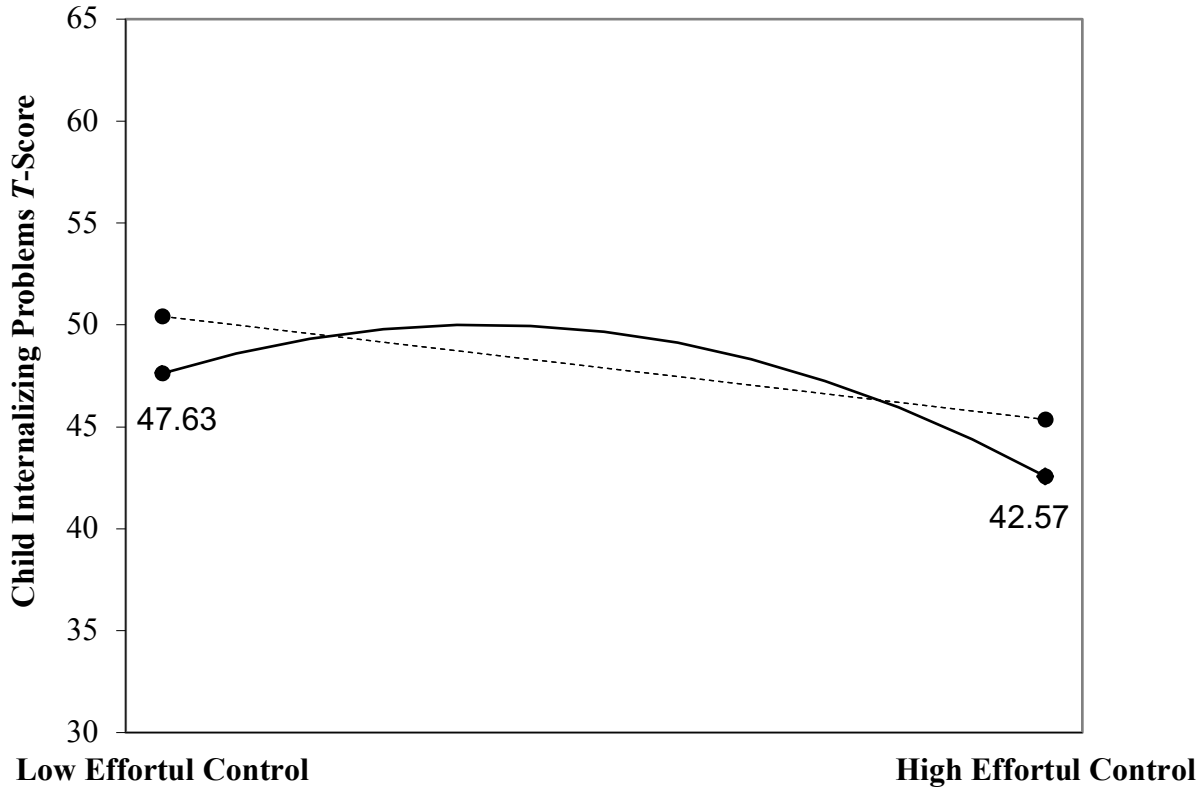

Figure 1. The plotted quadratic (solid line) and linear (dashed line) relations between child effortful control and internalizing problems, accounting for child age, gender, parent educational attainment, family income, and child race-ethnicity. High (+1 *SD*) and low (-1 *SD*) levels of child effortful control are related to fewer internalizing problems than are intermediate levels of effortful control, illustrating a concave functional form of relation.

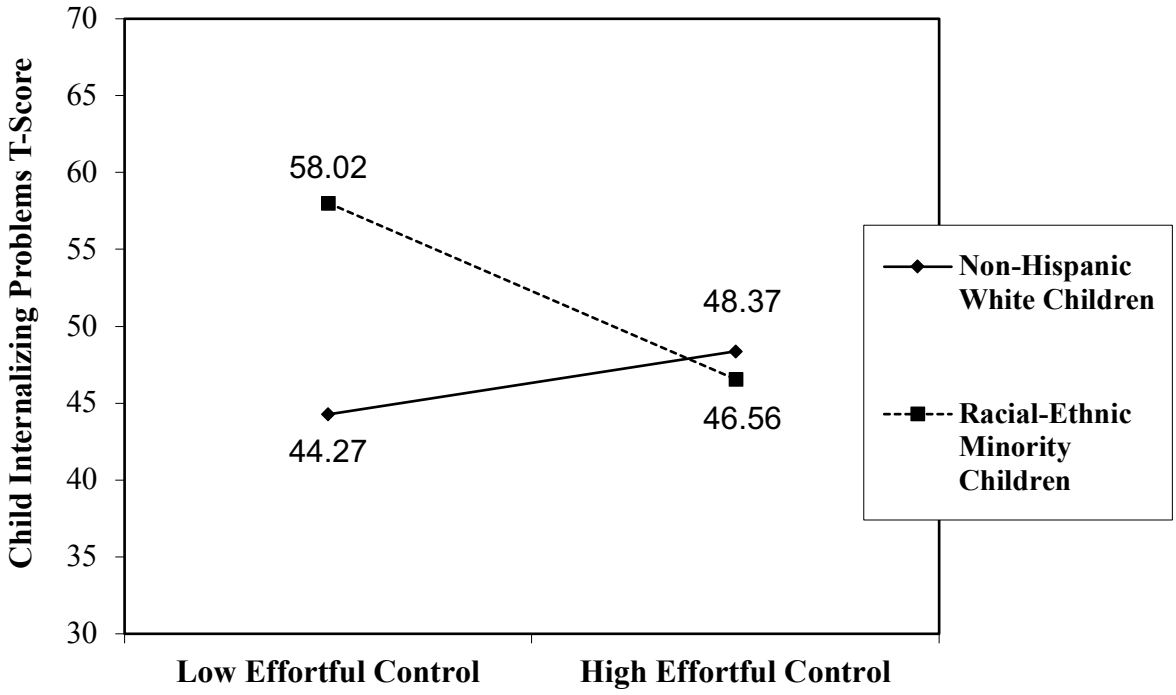

Figure 2. The plotted two-way linear interaction between child effortful control and race-ethnicity predicting internalizing problems. Direct tests of simple slopes show that non-Hispanic White children's internalizing problems are greater at a high (+1 *SD*) level of effortful control than at a low (-1 *SD*) level of effortful control ($B = 3.92$, $t = 5.24$, $p < .001$), whereas racial-ethnic minority children's internalizing problems are greater at a low (-1 *SD*) level of effortful control than at a high (+1 *SD*) level of effortful control ($B = -10.94$, $t = -15.03$, $p < .001$).

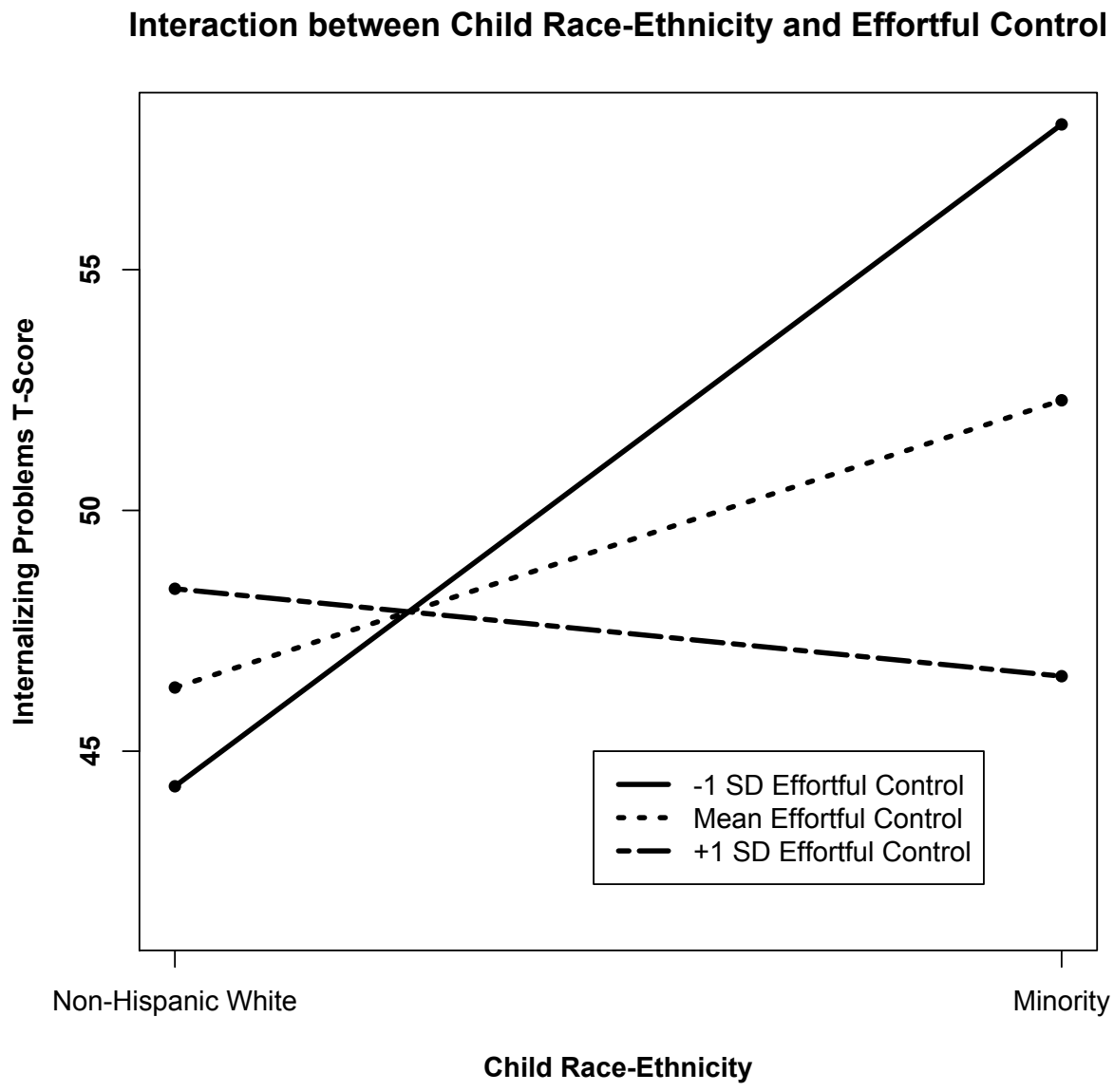

Figure 3. The plotted two-way linear interaction between child race-ethnicity and effortful control predicting internalizing problems. Direct tests of simple slopes show that non-Hispanic White children had fewer internalizing problems than racial-ethnic minority children at low (-1 *SD*, $B = 6.87$, $t = 3.75$, $p < 0.001$) and mean levels of effortful control ($B = 2.98$, $t = 2.42$, $p = 0.019$), but not at high levels of effortful control (+1 *SD*, $B = 0.91$, $t = -0.51$, $p = 0.612$).

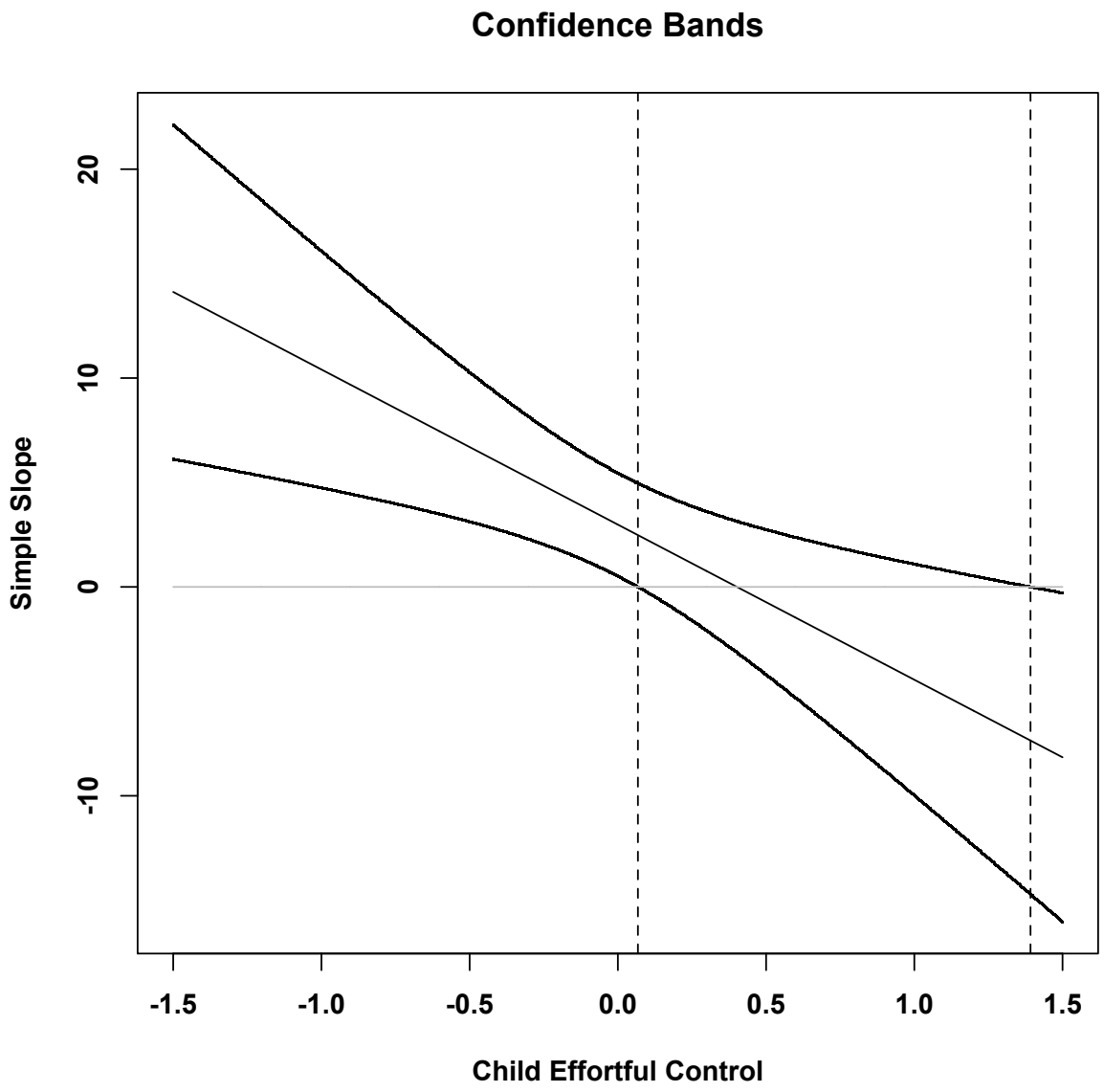

Figure 4. The dashed lower and upper bounds (0.07 – 1.39) of the confidence band of child effortful control scores show a region of significance from just above the mean to past the highest possible value of effortful control. Simple slopes of child internalizing regressed on race-ethnicity are significantly different from zero for values of effortful control below 0.07.