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The Association between Temperament and Cognitive Ability in Early Childhood and
Internalizing Symptoms in Adolescence

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Abstract

Internalizing disorders refer to a range of anxious and depressive behaviors in which individuals direct their feelings and emotions inward. Nearly 10% of children meet the diagnostic criteria for at least one internalizing disorder by age 16. Given that symptoms of depression and anxiety in childhood are predictors of a full diagnosis of depression or anxiety disorders in adulthood, it is important to examine the etiology of internalizing behavior. This prospective study examined three temperamental constructs (i.e. negative emotionality, behavioral inhibition, and empathy) and cognitive ability in early childhood (ages 14 to 36 months) as predictors of internalizing symptoms in adolescence (ages 9 to 16 years) using data from the Longitudinal Twin Study (LTS). In addition, growth models were conducted to assess the trajectories of each temperament and cognitive ability. Results indicate that higher levels of negative emotionality and behavioral inhibition in early childhood are associated with a greater number of internalizing symptoms in adolescence. In contrast, higher levels of empathy and cognitive ability in early childhood are associated with a fewer number of internalizing symptoms in adolescence.

Keywords: temperament, negative emotionality, behavioral inhibition, empathy, cognitive ability, internalizing

The Association between Temperament and Cognitive Ability in Early Childhood and
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Mental disorders are often classified in two broad classes: internalizing disorders and externalizing disorders. Externalizing behavior is conceptualized as an individual's conflict with the environment, whereas internalizing behavior refers to a range of anxious and depressive behaviors in which individuals direct their feelings and emotions inward (Achenbach, 1966). Internalizing symptoms manifest in negatively-biased thinking (Kendall & Dobson, 1993), maladjusted mood and emotion, and overcontrol (Kovacs & Devlin, 1998). Internalizing behavior is relatively stable over time (Zahn-Waxler, Cole, & Caplovitz Barrett, 1991). It is estimated that 9.5% of children meet the diagnostic criteria for a depressive disorder and 9.9% meet the diagnostic criteria for an anxiety disorder by age 16 (Costello, Mustillo, Erkanli, Keller, & Angold, 2003). Only a small portion of children with mental disorders are treated and those with internalizing symptoms are most likely to be untreated; given the withdrawing and inhibited nature of the disorders, their symptoms are more likely to be unnoticed (Champion, Goodall, & Rutter, 1995). Symptoms of depression and anxiety in childhood are robust predictors of a full diagnosis of a depression or anxiety disorders in adulthood, making the etiology of internalizing disorders important to research (Rubin et al., 2006). The etiology of childhood internalizing disorders is complex with influences from biological, psychological, and social mechanisms (Vasey & Dadds, 2001). The goal of the present study was to examine early childhood predictors of internalizing behaviors using a prospective design. We examined three temperamental constructs (i.e. negative emotionality, behavioral inhibition, and empathy) and cognitive ability in early childhood (ages 14 to 36 months) as predictors of internalizing symptoms in adolescence

(ages 9 to 16 years). This study is the first to examine these predictors at ages as young as 14 months.

Temperament is defined as biologically influenced individual differences in the regulation of emotion and tendency to respond in predictable ways to particular events (Rothbart, 2007). Temperamental constructs are considered building blocks of personality (Rothbart & Bates, 2006) that emerge early in life and tend to be stable through time and situations (Bates, 1987). In infancy, temperament is measured by observing dimensions of child behavior such as typical mood, regularity or of biological functions such as feeding and sleeping habits, tendency to approach new stimuli, intensity of emotional reactions, and adaptability to new experiences and changes in routine (Thomas & Chess, 1986). Temperament plays an important role in the etiology, manifestation, and management of emotional and behavioral disorders (Muris & Ollendick, 2005).

One temperamental construct that has received a great deal of attention in the literature on internalizing disorders is negative emotionality. Individuals rated high in negative emotionality often experience distress and unpleasant affective states, even in the absence of imminent stressors (Watson & Clark, 1984). In childhood, negative emotionality manifests in behaviors such as irritability, fussiness, anger and crying (Buss & Plomin, 1984). Importantly, evidence suggests that high negative emotionality is a risk factor for developing internalizing disorders (Lilienfeld, 2003). For example, Rubin et al. (1995) found that preschoolers who regulated their emotions poorly displayed low social interaction with other children, were more wary and anxious, and had more internalizing problems. Similarly, Keiley et al. (2003) found that child unadaptability, a characteristic observed in children with high negative affect, is significantly related to internalizing symptoms. Clark and Watson (1991) also found that

individuals with comorbid anxiety and depression score significantly higher on a measure of negative affectivity.

Behavioral inhibition may also increase risk for internalizing disorders (Fox, Henderson, Marshall, Nichols, & Ghera, 2005). This temperamental construct is characterized by caution, sensitivity, and shyness in response to unfamiliar persons or situations (Kagan, Reznick, Clarke, Snidman, & Garcia-Coll, 1984), and is largely stable from early childhood through adolescence (Gest, 1997; Rubin, Hymel, & Mills, 2006). Behavioral inhibition is considered to be a response to situations that serves to alert an individual to the possibility of danger or punishment, which may cause avoidance behavior (Gray, 1991). Highly inhibited individuals often withdraw from social situations that they interpret as dangerous or that encompass a change. During toddlerhood, inhibited children take a long time to warm up to strange examiners, retreat from unfamiliar objects, and cling to their mothers, and in childhood, they are shy around unknown peers (Kagan, 1994). Data from longitudinal studies show that social withdrawal in early childhood may be a risk-factor for internalizing problems in later childhood (Rubin et al., 2006.) Similarly, Prior et al. (2000) found that 42% of children rated as shy in childhood had anxiety problems in adolescence, and that persistence of shyness and shyness into middle school increased risk for anxiety. Furthermore, Gest's (1997) longitudinal study showed that high behavioral inhibition in childhood is associated with a less active social life, emotional distress, and negative emotionality in adulthood.

A third temperamental construct that may be related to internalizing behavior is empathy. Empathy is a personality dimension that refers to the ability of an individual to comprehend and experience another's emotional distress as if it were their own (Knafo, Zahn-Waxler, Van Hule, Robinson, & Rhee, 2008). This trait is expressed by behaviors such as showing concern for the

victim and prosocial behaviors such as responding to their needs by helping, providing support, and sympathizing with them. Guilt is often accompanied with empathy, and is associated with depression and anxiety in children (Achenbach, 1993). Zahn-Waxler et al.'s (1995) results indicate that overreceptivity to the plight of others and reluctance to assert one's own needs in situations involving conflict and distress may increase risk for developing internalizing disorders. However, Duchesne et al.'s (2010) study found that low prosociality in kindergarten is associated with anxiety later in childhood. These studies suggest an unclear relationship between empathy and internalizing.

Although evidence suggests that cognitive ability is associated with psychopathology, the relationship between cognitive ability and internalizing behavior is not well understood. Cognitive ability refers to an individual's intellectual ability or intelligence quotient. Hatch et al. (2007) found that high cognitive ability in childhood was associated with fewer symptoms of anxiety and depression in adulthood. Gale et al. (2008) found that a low cognitive ability in late adolescence and early adulthood is associated with an increased risk of depression and general anxiety disorder. One theory for these results suggests that being low on the dimension may create stress itself by pressuring individuals to achieve in education (Gale, Hatch, Batty, & Deary, 2009). However, Block and Gjerde (1990) study found that high cognitive ability is associated with depressed affect. These inconsistencies in the literature indicate that more research needs to increase understanding regarding the association between cognitive ability and internalizing behavior.

This prospective study examined negative emotionality, behavioral inhibition, empathy, and cognitive ability in early childhood (ages 14 to 36 months) as predictors of internalizing symptoms in adolescence (ages 9 to 16 years). We tested the hypotheses that high negative

emotionality and behavioral inhibition in early childhood are temperamental risk factors for internalizing symptoms in adolescence. No specific hypotheses were made regarding the association between empathy and cognitive ability and internalizing symptoms due to the inconsistency in the literature. We examined the influence of each construct independent of the influence of others constructs. Data from a longitudinal study was analyzed to assess the four constructs in children from age 14 to 36 months and internalizing symptoms assessed from age 9 to 16 years old. Multiple assessments allowed growth modeling to examine associations between initial levels and change in predictors and internalizing problems.

Method

Participants

The Longitudinal Twin Study (LTS) is an ongoing, prospective study designed to investigate the genetic and environmental influences on individual differences in psychological development. The LTS is a sample of same-sex twin pairs recruited at infancy by the Colorado Department of Health born between 1986 and 1990 in Colorado. The participants were required to live within a three-hour driving distance of Boulder, Colorado, and the twins' birth weight was required to be at least 1000 grams. Of the families initially contacted to participate, over 50% enrolled in the study. This study analyzed available data from 790 participants. The racial and ethnic distribution of the participants corresponds well with the results of the 1990 Boulder County, Colorado Census. Additional information regarding the LTS is available in Rhea et al. (2006).

Procedure

Participants were interviewed during home and lab visits conducted at the Institute of Behavioral Genetics at the University of Colorado at Boulder. Parent-reports and observational

measures that assessed the early childhood predictors were administered when the twins were ages 14, 20, 24, and 36 months. Parent-, teacher-, and self-reports of internalizing symptoms were administered annually when the twins were ages 9 to 16 years.

Measures

Negative Emotionality

Observations of negative emotionality were assessed using two coding schemes: Frustration and Negative Hedonic Tone. In the Frustration coding scheme, two procedures were used to assess the child's expressivity, protest strength, and distress. In the first procedure called the Restraint procedure, children were restrained as an examiner put an identifying vest or bib on the child and he/she was instructed to lie still for up to twenty seconds. In the second procedure called the Toy Removal procedure, a toy was abruptly taken away from the child after he/she was intently involved with the toy for two minutes. In the Negative Hedonic Tone coding scheme (Emde & Easterbrooks, 1983), the child's strongest negative affect was recorded during the administration of Bayley Scales of Infant Development (1-minute intervals during four 5-minute segments). The Bayley Scales of Infant Development (Bayley, 1976) assess aspects of cognitive ability including problem solving, fine motor coordination, and language skills. The frustration score for Restraint and Toy Removal was the sum of expressivity, protest strength, and distress strength scores during each task. The Negative Hedonic Tone score for Bayley Scales was the average negative affect scores across all intervals coded.

Parent reports of negative emotionality were assessed using the "mood" scale of the Toddler Temperament Survey (TTS; Carey & McDevitt, 1978), the "negative mood" scale of the Differential Emotions Scale (DES; Izzard, Huebner, Risser, McGinnes, & Dougherty, 1980), and

the “emotionality” scale of the Colorado Childhood Temperament Inventory (CCTI; Rowe & Plomin, 1977). These surveys ask questions regarding the child’s distress, anger, and crying.

Behavioral Inhibition

Observational measures of behavioral inhibition were assessed during home visits in which an examiner videotaped the first 5 minutes of the session while another examiner interacted with the mother and the twins. After introducing themselves, the examiners presented one toy to each twin and placed identifying vests on them. The videos were later rated to assess each twin’s level of shyness to the examiners and inhibition to research equipment. The outcome factor scores refer to two traits of inhibition: to approach novelty scored by their approach to the toy and/or examiner, and the tendency to cling to their mother. Following this procedure, each twin was assigned to work with a separate examiner and worked in separate rooms for the majority of the procedures. Examiners observed each twin’s behaviors in a playroom to assess their reactions to novel items and strangers. The measures included latency to leave parent upon entering the playroom, latency to approach toys, latency to approach a novel object, and time spent close to mother during each phase. The items included a balance beam, a box, a mattress, and a scary mask. A composite score called “BI Task” was created from the standardized scores of the variables. At the end of the lab visits, examiners rated the overall shyness of each twin during the lab assessments on a four-point ordinal scale called “Lab Visit Shyness.” This variable was not assessed during the 36-month lab visit.

Parent ratings of behavioral inhibition were assessed using questionnaires that measured each twin’s shyness (“CCTI Shy”), fearfulness (“DES Fear”), and approach (“TTS Approach”). Shyness was determined using the average of the mother and father ratings on the Colorado Childhood Temperament Inventory (CCTI; Rowe & Plomin, 1977). Fearfulness was measured

by mother ratings on the Differential Emotions Scale (DES; Izzard, Huebner, Risser, McGinnes, & Dougherty, 1980). Approach was assessed using the average of mother and father ratings on the Toddler Temperament Scale (TTS; Carey & McDevitt, 1978). Averages of parent ratings were used to reduce measurement error.

Empathy

Measures of empathy were assessed by observations of each twin's reaction to empathy probes and mother interviews. During the home visit, the mother pretended to hurt her knee as she got up from the floor, and the experimenter pretended to close a finger in a suitcase containing the testing materials. At the lab visit, the mother pretended to catch her finger in a clipboard and the examiner pretended to bump into a chair. In each of these procedures, the experimenter and the mother were instructed to vocalize pain at low to moderate volume, simulate pained facial expression for 30 seconds, and then simulate gradual subsiding of distress during the next 30 seconds following each accident. In another procedure, a tape recording of an infant crying broadcast from a speaker on the wall in a room containing 10 toys on the floor including a baby doll (this procedure was not conducted at the 36 month visit). Codes from the observational measures included "concern for victim," "helps victim," "proximity to victim," "hypothesis testing," "anger," "hits offending object," "and hostility" and were coded once per enactment.

In the mother interview, mothers were asked questions regarding twins' empathic behavior. The first item included is "helps"; mothers were asked questions regarding twins' tendency to help each other in situations that included pick up things, getting dressed, and offering toy. The possible responses were "almost never," "hardly ever," "occasionally—less than once a week," and "regularly—several times a day." Items 2 to 6 assessed whether each

twin shows a particular response when either the co-twin or mother is distressed. The responses included “approaches,” “comforts,” “hits,” “runs,” and “laughs.” Mothers were instructed to answer “yes” or “no” to the possible responses shown by their children. Items across situations were averaged. The averages were transformed into ordinal variables with four to six categories for “helps,” “approaches” and “comforts” and four categories for “hits,” “runs,” and “laughs,” with the number of categories chosen to maximize variability while avoiding small cell sizes.

Cognitive Ability

General cognitive ability was assessed using the Mental Developmental Index of the Bayley Scales of Infant Development (Bayley, 1969) and at 36 months using the intelligence quotient score from the Stanford-Binet, form L-M (Terman & Merrill, 1973). These examinations assess a wide range of cognitive abilities that include visual discrimination, memory, and problem solving. In addition, the examinations include assessments of language skills, including verbal comprehension and expression.

Internalizing Symptoms

Internalizing symptoms were assessed annually from ages 9 to 16 years using parent, teacher and self-report measures. The Child Behavior Checklist (CBCL; Achenbach, 1991) is a parent questionnaire designed to assess 8 problem behavior scales. This study used the Anxious/Depressed scale of the CBCL that examines symptoms of anxiety and depression. Studies indicate that the CBCL performs adequately in predicting DSM-IV diagnoses (Kasius, Ferdinand, van den Berg, & Verhulst, 1997).

The Teacher’s Report Form (TRF; Achenbach, 1991) is a teacher questionnaire similar to the CBCL that also assesses 8 problem behavior scales and the Internalizing and Externalizing broadband scales. Ordinal variables were created with the number of categories chosen to avoid

small cell sizes. The CBCL and the TRF were binned into ordinal variables as follows: 0 symptoms=0, 1 to 4 symptoms=1, 5 or more symptoms=2.

The Kandel Depressive Mood Inventory (KDMI; Kandel & Davies, 1982) is a six-item self-report questionnaire that assesses symptoms of depression. The questionnaire asks participants to indicate the extent to which each item was true or untrue of their experience from a 1 to 5 scale with 1 indicating not true at all and 5 indicating really true, with total scores ranging from 6 to 30. An example of an item from the KDMI is “I feel hopeless about the future.”

Analyses

Analyses were conducted in Mplus (Muthen & Muthen, 1998-2010). Data were treated as non-independent when calculating standard errors and model fit, given that the data were drawn from a twin sample. The distribution of parent- and teacher-reports of internalizing symptoms and empathy were highly skewed, violating the assumption of a normal distribution. Therefore, these data were transformed into ordinal variables with the number of categories chosen to avoid small cell sizes. This method retains the statistical advantages of the normality assumptions and underlying liability and correctly recovers the underlying correlations and parameter estimates (Derks, Dolan, & Boomsma, 2004; Stallings et al., 2001). When this approach was used, data were analyzed using the weighted least squares, mean and variance (WLSMV) adjusted estimation method with which pairwise deletion is used to manage missing data. The *p*-values are ratios of parameter estimates to its standard error, yielding a z-statistic, which was used to determine statistical significance. Given that the chi square is sensitive to sample size, the Tucker-Lewis Index (TLI) and the root mean square error of approximation (RMSEA; Bentler, 1990; Browne & Cudeck, 1993) was also used to examine model fit. A good model fit is

indicated if the TLI is greater than 0.95 and the RMSEA was less than 0.06 (Hu & Bentler, 1998). All models fit the data well (all CFIs and TFIs > 0.96; all RMSEAs < .025).

Results

Descriptive Statistics

Table 1 provides the descriptive statistics for the potential predictors of internalizing symptoms assessed between ages 14 and 36 months. The percentages of the sample in each bin are shown for the ordinal binned variables. The mean and standard deviation are shown for the continuous variables. Table 2 provides the descriptive results for internalizing symptoms assessed annually from age 9 through 16 years. The percentages of the sample in each bin are shown for ordinal variables. The mean and standard deviation are shown for the continuous variables.

Latent variables were created for each of the predictors and internalizing symptoms to create a reliable variable for each construct, and to examine all of the available data. All latent predictor and internalizing variables had statistically significant loadings on the predictor and internalizing variables at each time point. The correlations between the parent- and teacher-reports ($r = .51, p < .01$), parent- and self-reports ($r = .29, p < .01$), and teacher- and self-reports ($r = .33, p < .01$) of internalizing symptoms were all positive and significant, suggesting evidence of validity of these reports of internalizing symptoms. Table 3 shows the polychoric or polyserial correlations between each of the latent early childhood predictors. The correlations indicate that parent-reports and observations of each temperamental construct are significantly correlated. These results also indicate significant correlations between each of the early childhood predictors.

Correlations between Early Childhood Predictors and Internalizing Symptoms in Adolescence

Table 4 presents the correlations from structural equation models examining the associations between each of the observed and parent-reported latent early childhood predictors and parent-, teacher-, and self-reported latent internalizing symptoms. In general, these results indicate that negative emotionality and behavioral inhibition are positively correlated with internalizing symptoms, suggesting that higher ratings of these temperament constructs in early childhood are predictors of a greater number of internalizing symptoms in adolescence. In contrast, cognitive ability and empathy are negatively correlated with internalizing symptoms, suggesting that lower ratings of these constructs in early childhood predict fewer internalizing symptoms in adolescence. However, it is important to note that results are not consistent or statistically significant across informants.

Growth Modeling

Figure 1 presents the results of growth models for early childhood predictors. The loadings on the latent intercept was set to 1.0 at each time point, reflecting the assumption that the latent intercept reflects the variance of each variable that is stable across time. The latent slope has loadings fixed to zero at 14 months, 1.0 for the last time point, and freed loadings for the intermediate time points. The latent slope path reflects the cumulative portion of total change that has occurred from the initial level of the variable over time.

Table 5 presents the parameters from the growth models. These analyses assess individual trajectories of each predictor and whether there is variation in individual trajectories. In the growth models, the variances of the intercept for negative emotionality, behavioral inhibition, empathy, and cognitive ability were significantly greater than zero, indicating

significant individual differences in the intercept of these constructs. The means of the slope for behavioral inhibition, empathy, and cognitive ability were positive and significantly greater than zero, and the variances of the slope were also significant. These results indicate that these constructs increased significantly with time and that there were individual differences in rates of change. The mean of the slope was significant and positive for parent-reported negative emotionality, but significant and negative for observations, indicating inconsistencies in the direction of change of negative emotionality depending on the informant. The correlations between the intercept and slope for negative emotionality, behavioral inhibition, and empathy were significant and negative, indicating that individuals with higher initial rates of these constructs had greater decreases in them over time. In contrast, the correlation between the intercept and slope for cognitive ability was significant and positive, suggesting that individuals with higher initial rates had greater increases in cognitive ability over time.

Growth Model Correlations between Early Childhood Predictors and Internalizing Symptoms.

Table 6 presents the correlations between the intercepts and slopes of observed and parent-reported early childhood predictors and parent-, teacher-, and self-reported latent internalizing symptoms in adolescence from the growth models. All growth models fit the data well (all CFIs and TFIs > 0.97 ; all RMSEAs $< .022$). This analysis allowed us to examine the association between both the initial rates and changes in predictors and internalizing symptoms in adolescence. In general, results indicate a positive association between the intercepts of negative emotionality and behavioral inhibition and internalizing symptoms, indicating that high initial rates of these constructs are associated with a greater level of internalizing symptoms in adolescence. In contrast, the correlations between the intercepts of empathy and cognitive ability

and reports of internalizing symptoms are negative, suggesting that higher initial rates of empathy and cognitive ability in early childhood predict fewer internalizing symptoms in adolescence. The slopes of negative emotionality and behavioral inhibition were positively associated with internalizing symptoms. These results suggest that increases (or less decrease) in negative emotionality and behavioral inhibition in early childhood predict a level of internalizing symptoms in adolescence. In contrast, the correlation between the slope of cognitive ability and internalizing symptoms was negative suggesting that increases in cognitive ability in early childhood predicts fewer internalizing symptoms in adolescence. Again, it is important to note that results are not consistent or statistically significant across informants.

Multiple Regression Analysis Examining Early Childhood Predictors and Internalizing Symptoms in Adolescence

The polychoric and polyserial correlations between the latent early childhood predictors indicate significant associations among them (shown in Table 3). Multiple regression analyses allowed us to examine whether each latent early childhood predictor had an influence on parent-, teacher-, and self-reported internalizing symptoms independent of the influence of other constructs. Results indicate a significant and positive independent correlation between parent-reported negative emotionality and parent-reported internalizing symptoms ($\beta = 0.04$, $SE = 0.08$, $p < .001$), and parent-reported negative emotionality and self-reported internalizing symptoms ($\beta = 0.20$, $SE = 0.07$, $p < .01$). These results indicate that high negative emotionality in early childhood is a predictor of internalizing symptoms in adolescence. There was also a significant and negative independent association between cognitive ability and self-reported internalizing symptoms ($\beta = -0.22$, $SE = 0.06$, $p < .001$), and cognitive ability and teacher-reported internalizing symptoms ($\beta = -0.191$, $SE = 0.08$, $p = 0.01$). These results indicate that high

cognitive ability in early childhood is a predictor of fewer internalizing symptoms in adolescence. In contrast to other results which found a positive correlation between behavioral inhibition and internalizing symptoms, the correlation between parent-reported behavioral inhibition and parent-reported internalizing symptoms was moderately negative and significant which may be due to multicollinearity.

Discussion

The present prospective study examined negative emotionality, behavioral inhibition, empathy, and cognitive ability from ages 14 to 36 months as predictors of internalizing symptoms from ages 9 to 16 years. This study is unique given that it is the first study to analyze predictors of adolescent internalizing symptoms at ages as young as 14 months, and examine whether these predictors are independently associated with internalizing symptoms. Results from structural equation models indicate that higher negative emotionality and behavioral inhibition in early childhood are associated with a greater number of internalizing symptoms in adolescence. In contrast, higher rates of empathy and cognitive ability are associated with fewer internalizing symptoms in adolescence. Results from latent growth models showed similar results. Higher initial levels of negative emotionality and behavioral inhibition and increases (or lack of decreases) in these constructs through early childhood were associated with a greater internalizing symptoms in adolescence. High initial rates of empathy and cognitive ability and increases in cognitive ability in early childhood were associated with fewer internalizing symptoms in adolescence.

Results indicated that each of the early childhood predictors were significantly correlated with each other. Given this overlap, we conducted multiple regression analyses to estimate the influence of each construct on internalizing symptoms independent of the influence of other

predictors. These results also indicated that higher rates of negative emotionality in early childhood are predictors of a greater amount of internalizing symptoms in adolescence, and higher cognitive ability in early childhood is a predictor of fewer internalizing symptoms.

The results of this study support our hypothesis that higher rates of negative emotionality and behavioral inhibition in early childhood are predictors of internalizing symptoms in adolescence which is consistent with the literature (Keiley, Lofthouse, & Bates, 2003; Lilienfeld, 2003; Prior, Smart, Sanson, & Oberkland, 2000; Rubin, Coplan, Fox, & Calkins, 1995). This study addressed some inconsistencies in the literature regarding the relationship between empathy and cognitive ability and internalizing symptoms.

Results indicate that higher empathy in early childhood predict fewer internalizing symptoms in adolescence. These results oppose Achenbach's (1993) and Zahn-Waxler et al.'s (1995) results which indicated that high empathy increases risk for internalizing disorders. However, one potential explanation for our results is that high empathy may enable children to learn coping skills for dealing with their own distress through empathizing and prosociality, or expressing helping behavior towards peers. Duchesne et al.'s (2010) study indicated that low prosociality in kindergarten is associated with anxiety in adulthood. It may be that children with low empathy and prosocial behavior lack the social interaction with peers that enables them to learn coping skills for dealing with their own distress.

The results of this study illustrate that higher cognitive ability in early childhood decreases risk for internalizing symptoms in adolescence, consistent with Hatch et al.'s (2007) results. Gale et al. (2008) speculates that having lower cognitive ability increases risk for anxiety and depression by creating stress and pressure to achieve in education whereas children with high cognitive ability may not face pressure to achieve in education.

It is possible that each of the predictors examined may have a significant influence on social interaction, which may in turn influence the development of internalizing symptoms; that is, social interaction may be a mediator in the association between temperament and internalizing symptoms. Higher negative emotionality and behavioral inhibition are associated with less social interaction and greater withdrawal, which in turn is associated with a greater number of internalizing symptoms (Rubin, Coplan, Fox, & Calkins, 1995; Rubin et al., 2006). Caspi et al.'s (2003) results indicated that individuals that were inhibited, shy, and fearful in toddlerhood were cautious and unassertive in adolescence, and had little social interaction and showed symptoms of depression in young adulthood. Similarly, negative emotionality is related to neuroticism and behavioral inhibition in preschool and low extraversion in middle school (Hagekull & Bohlin, 1998; Shiner, 2006). In contrast, empathy and cognitive ability are related to a greater amount of social interaction (Zahn-Waxler, Cole, Welsh, & Fox, 1995; Guay, Marsh, & Boivon, 2003). It is hypothesized that the prosocial component of empathy protects individuals from developing internalizing symptoms. Cognitive ability is also associated with positive social interactions, which is in turn related to a positive self-concept (Guay, Marsh, & Boivon, 2003), and in contrast, children with lower academic achievement than their classmates fare worse in social interaction, and tend to have a negative self-concept (Seaton, Marsh, & Craven, 2009). These studies suggest that social interaction may be a mediator in the association between the early childhood predictors and internalizing symptoms later in life.

Implications

Although the results of the present study showed some positive and significant correlations between predictors in early childhood and internalizing symptoms in adolescence, it is important to note that the correlations were not consistent across informants, and were modest.

Furthermore, although risky temperament in early childhood may be associated with internalizing symptoms in adolescence, evidence suggests that positive parent-child relationships might protect children with risky temperament from developing internalizing symptoms (Sanson, Hemphill, & Smart, 2004). For example, van den Boom (1995) found that training parents to respond appropriately to their irritable infants can have long-term effects in influencing them to cry and become less irritable; it is possible that such training may lead to lower risk of later internalizing problems as well. These results suggest that risky temperament is only one of many factors in the prediction of internalizing symptoms.

Strengths and Limitations

The results of the present study should be considered with the following limitations in mind. First, given that data were longitudinal, most participants were missing data at some time points. In addition, we were unable to use 36-month data for observations of negative emotionality, observed behavioral inhibition, and cognitive ability as different assessments were used to measure these variables at 36 months. Another potential limitation may stem from the fact that the data are from a twin sample. The influence of having a same-age sibling or twin on developing internalizing symptoms is unclear. Furthermore, a limitation of conducting multiple analyses is that it allows greater opportunity to find statistically significant results.

Although a strength of the present study was that there were multiple informants for both early predictors (parents and observers) and internalizing symptoms (parents, teachers, and self), results were inconsistent across informants. There are several possible reasons for the inconsistent results. It is possible that when the same informant is used to assess each of predictors and internalizing behavior (e.g. parent-reported predictors and parent-reported internalizing symptoms), the covariance between predictors and internalizing may be due to

method covariance. Some of the significant results may reflect a context specific association; that is, the association may be valid, but specific to certain contexts (e.g. negative emotionality and internalizing behavior that is expressed only in the context of the relationship between the parent and child). Reports of predictors or internalizing symptoms may be influenced by rater bias, or the characteristic of the rater. Another issue is validity of the reports. For example, teacher reports of internalizing symptoms may be more valid at earlier ages, given that they spend more time with the students in elementary school than middle and high school. Finally, particular informants may report internalizing symptoms that may be specific to particular situations. For example, self-reports of internalizing symptoms may capture symptoms that are outside the awareness of teachers and parents. Similarly, teacher-reports may recognize internalizing problems that are specific to the school settings, but parents may not. Finally, the parent and teacher assessments of internalizing symptoms were designed to be more similar to each other (Achenbach et al., 1991) than the self-report of internalizing symptoms.

The present study also has several strengths. First, this was a prospective, longitudinal study. Second, early childhood predictors were examined at multiple time points, allowing us to conduct growth analyses to examine whether initial levels or change in the levels of the predictors from 14 to 36 months was associated with internalizing symptoms in adolescence. Internalizing symptoms were also assessed at multiple time points, which allowed us to examine a more reliable latent internalizing variable. Third, data from multiple informants (i.e. observations and parent-reports for the early childhood predictors and parent-, teacher-, and self-reports for internalizing symptoms) were available. The availability of data with multiple predictors allowed us to conduct a multiple regression analysis assessing the influence of each construct on internalizing symptoms independent of the influence of other predictors.

Future Directions

Further research should be conducted regarding the relationship between temperament and cognitive ability and internalizing symptoms to build on the results of the present study. First, analyses examining potential sex differences in the association between the predictors and internalizing symptoms should be conducted. Another potential data analytic approach is to examine the association between predictors and a latent internalizing variable with loadings from each of the internalizing reports (i.e. parent, teacher, and self reports). In addition, it may be beneficial to assess the trajectories of internalizing symptoms throughout adolescence by conducting growth analyses on data on internalizing reports. Furthermore, given that the results from growth analyses indicated some significant correlations between the intercept and slope of the predictors, multiple regression analyses should be conducted to assess whether the slope has a significant influence on internalizing symptoms independent of the influence of the intercept.

Conclusion

The present study contributes to the literature on risk for internalizing symptoms as it is the first study to examine these predictors together, examine them at ages as young as 14 months, and examined the influence of each of the predictors independent on one another. These results were important as they indicated temperament and cognitive ability measured at 14 months is significantly associated with internalizing symptoms in adolescence. Overall, results indicate that higher rates of negative emotionality and behavioral inhibition in early childhood are associated with greater internalizing symptoms in adolescence. In contrast, higher rates of empathy and cognitive ability may be protective factors for developing internalizing symptoms in adolescence. The results of this study are important in understanding the development of internalizing disorders.

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Appendix

Table 1
Descriptive Statistics For Early Childhood Predictors

Predictor	14 months	20 months	24 months	36 months
<u>EMP</u>				
Parent report				
1	35.5%	7.2%	5.4%	2.1%
2	29.9%	24.6%	16.0%	13.8%
3	24.5%	44.4%	42.1%	47.1%
4	10.1%	23.8%	36.5%	37.0%
Total N	746	694	680	660
Observed				
1	30.4%	13.8%	8.4%	10.3%
2	41.1%	36.3%	26.3%	19.8%
3	19.8%	27.0%	27.6%	25.8%
4	8.7%	22.9%	37.7%	44.1%
Total N	789	708	714	687
<u>NE M (SD)</u>				
Parent report	.56 (.10)	.57 (.10)	.56 (.11)	.56 (.11)
Total N	727	644	676	623
Observed	.42 (.14)	.39 (.17)	.31 (.14)	N/A
Total N	788	708	704	N/A
<u>BI M (SD)</u>				
Parent report	.48 (.13)	.50 (.14)	.50 (.13)	.50 (.13)
Total N	725	644	676	470
Observed	1.89 (.50)	1.92 (.52)	1.93 (.51)	N/A
Total N	790	713	714	725
<u>CA M(SD)</u>				
Total N	112.43 (5.50)	136.06 (8.54)	148.78 (8.30)	103.12 (17.70)
Total N	783	690	696	667

Note. EMP = empathy; NE = negative emotionality; BI = behavioral inhibition; CA = cognitive ability

Table 2
Descriptive Statistics For Internalizing Symptoms

Internalizing Report	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16
<u>Parent</u>								
0	31.8%	28.4%	33.7%	29.1%	31.4%	35.4%	38.7%	33.7%
1	45.5%	52.2%	48.8%	49.7%	50.0%	44.9%	49.0%	46.0%
2	22.7%	19.4%	17.5%	21.2%	18.6%	19.7%	12.3%	20.3%
Total N	638	578	492	652	506	483	351	635
<u>Teacher</u>								
0	29.5%	29.2%	30.5%	28.5%	27.2%	34.1%	41.4%	N/A
1	41.7%	42.9%	45.3%	49.8%	52.3%	45.1%	42.2%	N/A
2	28.9%	28.0%	24.2%	21.7%	20.5%	20.8%	16.4%	N/A
Total N	509	511	501	438	375	355	256	N/A
<u>Self <i>M(SD)</i></u>								
	14.91 (4.46)	13.89 (4.95)	12.71 (5.27)	11.96 (4.23)	11.28 (4.30)	11.39 (4.25)	11.31 (3.98)	11.45 (4.29)
Total N	769	741	707	755	710	617	526	806

Table 3
Polychoric or Polyserial Correlations For Early Childhood Predictors

Variable	NE-O	NE-P	BI-O	BI-P	EMP-O	EMP-P	CA
NE-O	1						
NE-P	.20*	1					
BI-O	.37*	.30*	1				
BI-P	.23*	.66*	.69*	1			
EMP-O	-.21*	-.17*	-.23*	-.29*	1		
EMP-P	-.12	-.25*	.02	-.16*	.47*	1	
CA	-.27*	-.12*	.02	-.10*	.38*	.31*	1

Note. NE = negative emotionality; BI = behavioral inhibition; EMP = empathy; CA = cognitive ability; O = observed; P = parent report

* $p < .05$

Table 4
Correlations Between Early Childhood Predictors and Adolescent Internalizing Symptoms

Variable	Parent report	Teacher report	Self report
<u>Negative emotionality</u>			
Observed	.00	.15	.03
Parent report	.30*	.11	.22*
<u>Behavioral inhibition</u>			
Observed	-.02	.04	.10
Parent report	.11*	.03	.15*
<u>Empathy</u>			
Observed	.10	-.14	-.20*
Parent report	-.01	-.06	-.04
<u>Cognitive ability</u>			
	.04	-.18*	-.27*

Note. * $p < .05$

Table 5
Results from Growth Models

Predictor	Variance of intercept	Mean of slope	Variance of slope	Correlation between intercept and slope
<u>Negative Emotionality</u>				
Observed	.01*	-.12*	.02 *	-.32*
Parent report	.01*	.02*	0	N/A
<u>Behavioral Inhibition</u>				
Observed	.12	.05†	.10	-.38
Parent report	.02*	.02*	.01*	-.55*
<u>Empathy</u>				
Observed	.14	1.19*	.12	.76
Parent report	.61*	1.08	.42*	-.86*
<u>Cognitive Ability</u>				
	29.20*	36.34*	56.75*	.25*

Note. † $p < .10$, * $p < .05$

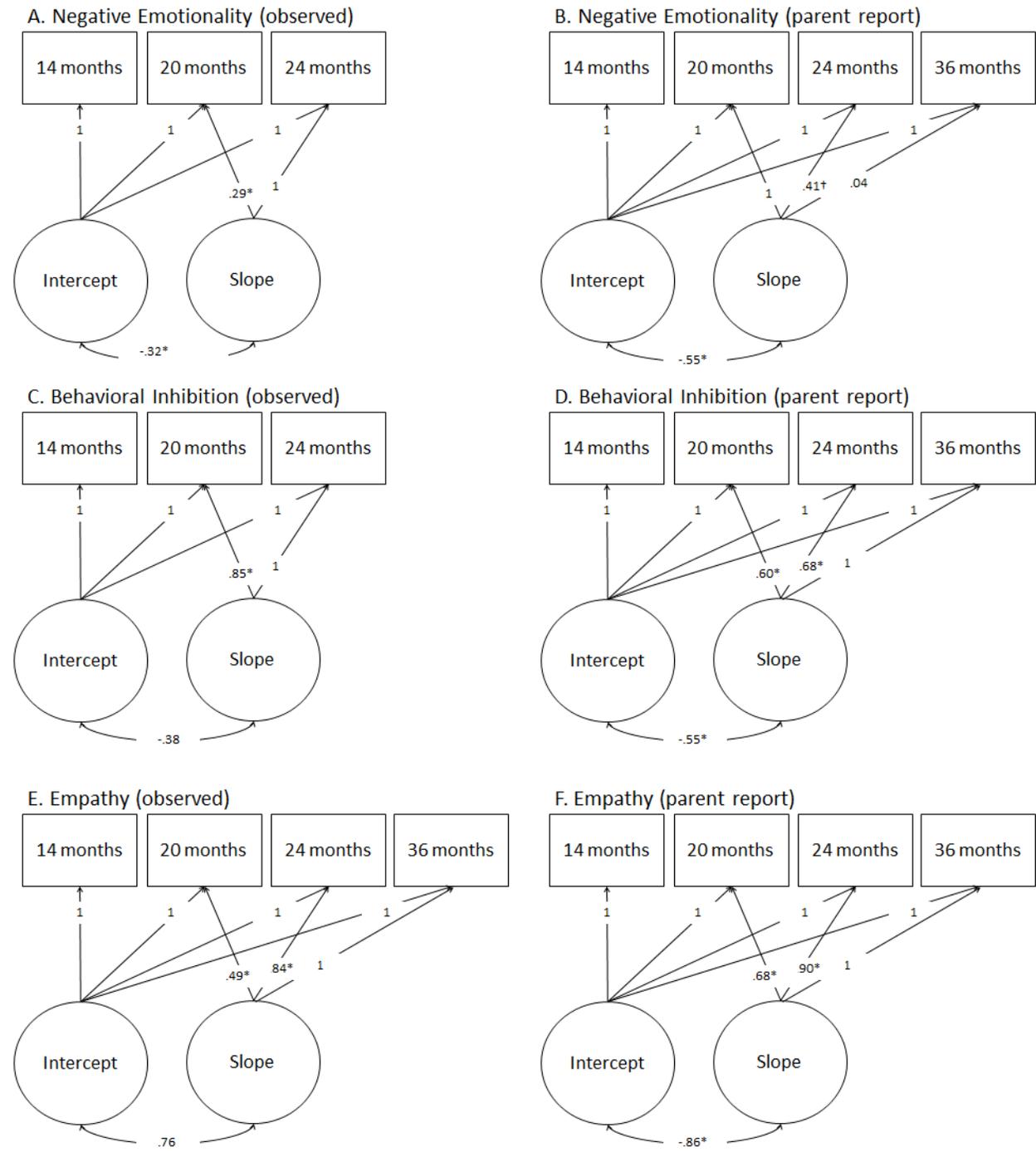
Table 6
Growth Model Correlations between Early Childhood Predictors and Internalizing Symptoms

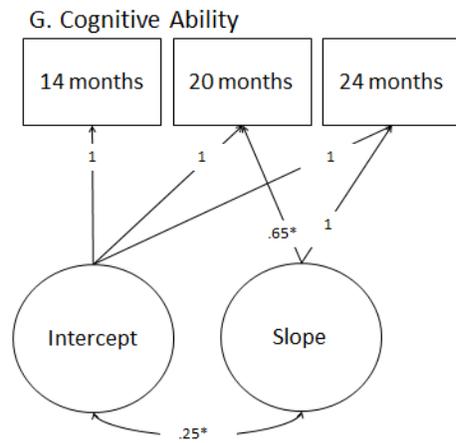
Variable	Parent-report	Teacher-report	Self-report
<u>Negative</u>			
<u>Emotionality</u>			
Parent report			
Intercept	.30*	.11	.22*
Slope	N/A	N/A	N/A
Observed			
Intercept	-.03	.05	-.05
Slope	.05	.12†	.12*
<u>Behavioral Inhibition</u>			
Parent report			
Intercept	.07	-.09	.14*
Slope	.04	.22*	-.05
Observed			
Intercept	-.07	-.17	.12
Slope	.09	.28	-.06
<u>Empathy</u>			
Parent report			
Intercept	.02	-.09	-.07
Slope	-.05	.10	.09
Observed			
Intercept	-.01	-.09	-.31*
Slope	.054	-.215	.035
<u>Cognitive Ability</u>			
Intercept	.00	-.08	-.12*
Slope	.04	-.19*	-.20*

Note. NE = negative emotionality; BI = behavioral inhibition; EMP = empathy; CA = cognitive ability; O = observed; P = parent-report

† $p < .10$, * $p < .05$

Figure 1
Growth Models for Early Childhood Predictors





Note. unstandardized parameters are shown with the exception of standardized correlations between intercept and slope

† $p < .10$, * $p < .05$