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### Permalink

<https://escholarship.org/uc/item/9g178907>

### Journal

Aggressive Behavior, 47(6)

### ISSN

0096-140X

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### Publication Date

2021-11-01

### DOI

10.1002/ab.21991

Peer reviewed



Published in final edited form as:

*Aggress Behav.* 2021 November ; 47(6): 659–671. doi:10.1002/ab.21991.

## Social skills moderate the time-varying association between aggression and peer rejection among children with and without ADHD

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### Abstract

Although childhood aggression is typically associated with peer rejection, some children concurrently employ coercive and socially skilled behavior and successfully avoid negative peer outcomes. However, research on children's dual use of coercive and social behavior has largely employed cross-sectional designs with non-clinical populations and, as a result, little is known about the covariation of aggression with social skills, particularly among high-risk samples. We directly addressed this limitation by testing childhood aggression and social skills as separate time-varying predictors of prospective change in peer rejection in a sample of children with and without attention-deficit/hyperactivity disorder (ADHD). Two hundred and two 5–10-year-old children ( $M = 7.9$  years,  $SD = 1.2$ ) with and without ADHD were followed prospectively for six years. Key constructs, including children's overt aggression, social skills, and peer rejection, were collected at each of the three waves using multiple methods and informants. Controlling for demographic factors and time-varying ADHD symptoms, longitudinal change in child-, parent-, and teacher-reported aggression positively predicted prospective change in parent- and teacher-reported peer rejection. Importantly, predictions were moderated by parent- and teacher-reported social skills, such that aggression *inversely* predicted peer rejection for children with high social skills. These results demonstrate that social skills meaningfully alter trajectories of peer rejection predicted from cross-time variation in aggression. We discuss the theoretical and empirical implications of these findings within a developmental psychopathology framework, including recommendations for directions for future research.

### Keywords

peer rejection; aggression; social skills; attention-deficit/hyperactivity disorder; longitudinal studies

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Conflict of Interest Statement

All authors report no biomedical financial interests or potential conflicts of interest.

## Introduction

Childhood aggression reliably predicts peer rejection (Coie & Dodge, 1998; Bierman, 2004) and rejected children with elevated aggression are at greater risk for future chronic antisocial behavior than those with only one of these risk factors (Coie et al., 1992; Ladd, 2006). Yet notably, aggressive behavior is not equally maladaptive (Bagwell & Coie, 2004; Brendgen et al., 2002; McDonald et al., 2011; Roseth et al., 2011) suggesting potentially important moderating factors. Some aggressive children display competencies that are valued by their peers and these characteristics moderate the link between aggression and peer status (Vaillancourt & Hymel, 2006). For example, children who employ both aggressive and prosocial behavior are able to enhance influence and popularity among peers and are less rejected than aggressive children with poor social skills (Hawley et al., 2002, 2008; Rodkin et al., 2000). However, it is unclear whether these successful peer relations are maintained over time, given that outcomes of children who employ both prosocial and aggressive behavior are based largely on cross-sectional designs. Further, it remains unknown whether concurrent aggression and social skills are associated with similar social outcomes, specifically among children with attention-deficit/hyperactivity disorder (ADHD), a group with elevated risk for aggression (Connor et al., 2010; Mannuzza & Klein, 2000), impaired social functioning (see Nijmeijer et al., 2008; Nixon, 2001 for reviews), and greater peer rejection (Grygiel et al., 2018; Hoza et al., 2005). To address these important gaps in the literature, we utilized time-varying predictive models to assess the relation between multi-informant ratings of childhood aggression and social skills with peer rejection in a sample of school-aged children with and without ADHD followed prospectively into early adolescence. Specifically, we tested (1) whether time-varying aggression predicted longitudinal change in peer rejection across six years and (2) whether social skills moderated predictive models. Because training social skills may reduce antisocial behavior and produce gains in prosocial behavior (Beelmann & Lösel, 2020), identifying whether social skills moderate predictions of peer rejection from early aggression may improve traction on prevention-focused intervention, especially for high-risk groups like children with ADHD.

Although naturalistic and experimental evidence suggests that childhood aggression putatively predicts peer rejection (Boivin et al., 2005; Coie et al., 1990; Rubin et al., 1998) and peer victimization (Schwartz, 2000), some evidence disputes this directly (Bagwell & Coie, 2004; Brendgen et al., 2002), including that only about half of all aggressive children are rejected by their peers (Coie et al., 1991). Thus, there are likely important differences in how children of varying peer status use aggression. For example, some aggressive children may possess other competencies that promote successful development and maintenance of social relationships in ways that reduce poor outcomes. Some children may leverage social skills (e.g., helping, persuading, cooperating) to minimize the sequelae of their aggressive behavior (Hawley, 1999, 2003, 2014; Hawley et al., 2002, 2007; McDonald et al., 2011; Roseth et al., 2011; Wurster & Xie, 2014). Hawley's (1999) Resource Control Theory posits that some children, termed "bistrategic controllers," strategically use coercive behavior (e.g., aggression, insults, threats) in tandem with prosocial strategies to gain influence and access to resources. Coercive behavior enables children to access resources without regard for peer evaluation or social relationships. These tactics can include overtly hostile or aggressive

behavior as well as more subtle, nonverbal forms of social dominance (Keating & Heltman, 1994). Overt aggression, which includes direct physical or verbal attacks, is one common type of coercive control behavior leveraged by bistrategic controllers (Hawley, 2003; Vaughn et al., 2003). It is therefore plausible that children who concurrently employ prosocial and overtly aggressive behavior may develop better emotional adjustment and peer relationships than children who exhibit aggression without concomitant prosocial behavior. Behavior like cooperating with peers, initiating friendships, and giving compliments enable a child to create and maintain positive peer relationships (Stormshak & Webster-Stratton, 1999). Further, social incompetence leads to peer rejection and poor friendship quality even in the absence of aggression (Parker & Seal, 1996; Pedersen et al., 2007) further underscoring that social skills support healthy peer relations.

Aggressive behavior can be divided into proactive and reactive subtypes, which have differential but overlapping behavioral correlates (Raine et al., 2006; Waschbusch & Willoughby, 1998). Proactive aggression is characterized as instrumental, planful, and with low autonomic arousal (Dodge, 1991; Mirsky & Siegel, 1994). It can sometimes be deployed as a self-serving means of obtaining resources from others or dominating them (Little et al., 2003a, 2003b; Prinstein & Cillessen, 2003; Vitaro et al., 2006). On the other hand, reactive aggression tends to be an impulsive, immediate response to provocation or frustration (Berkowitz, 1993), with the defensive goal of hurting the perpetrator of the provocation (Little et al., 2003b; Vitaro et al., 2006). Both reactive and proactive aggression are associated with poor peer relationships in childhood (Card & Little, 2006; Dodge et al., 1990; Raine et al., 2006). However, children who display proactive aggression can sometimes be popular among peers (Dodge & Coie, 1987; Stoltz et al., 2016), though this is usually short-lived (Poulin & Boivin, 1999). By contrast, children who are reactively aggressive may be at a higher risk for experiencing peer victimization than proactively aggressive children (Schwartz et al., 1998). Notably, despite these differential outcomes, most studies find that proactive and reactive aggression are moderately to strongly correlated, especially in community samples (Brown et al., 1996; Poulin et al., 1997; Raine et al., 2006, though see Little et al., 2003b). For this reason, to reduce multicollinearity in our analyses and because our primary goal was to examine the moderating effect of social behavior on the relation between overt aggression and peer status, we tested whether total overt aggression score interacts with social skills to predict peer rejection. To complement these analyses, exploratory analyses testing interactions between social skills and each aggression subtype are included in the Supplementary Materials.

Understanding social correlates of aggressive children who are not peer rejected, including their potential unique competencies, may provide important insights about peer processes and reveal potential intervention targets. Aggressive behavior is among the most common reasons for mental health referrals (Dean et al., 2006; Petti et al., 2001) and it confers a significant burden for children, their families, and society (Fergusson et al., 2005; Foster & Jones, 2005). Unfortunately, childhood aggression is often resistant to intervention and, when effective, effect sizes are small and short-lived (Hendriks et al., 2018). This has led to the development of alternative interventions for aggressive children, such as social skills training, a behavioral intervention which increases children's ability to perform key social behavior like asking questions and offering support to peers. Meta-analytic evidence

suggests that social skills training reduces antisocial behavior among aggressive, rejected children, though these gains may be modest and short-lived (Beelmann & Lösel, 2020). Because peer rejection is bidirectionally associated with poor social skills (Buhs & Ladd, 2001; Parker et al., 2006), improving peer relationships could further bolster children's social skills by providing them more opportunities to practice social behavior with peers and to engage in more normative socialization. However, more work is needed to understand the peer competencies of children who are both aggressive and socially skilled to generate effective interventions.

Despite improved understanding of the dynamics of childhood peer relations among non-clinical community samples, several important limitations remain. First, previous work has largely employed cross-sectional designs, which are limited in scope (Hawley et al., 2002, 2007, 2008; Rodkin et al., 2000; Wurster & Xie, 2014). Cross-sectional work suggests that coercion may be less effective as children age. For instance, first-graders who demonstrated dominant or aggressive behavior were well-liked among peers, but this was not an effective strategy for third-graders (Pettit et al. 1990; Dodge et al. 1990). Later in elementary school, children still prefer influential peers, but they tend to dislike those who employ aggressive tactics (Coie & Dodge, 1983; Coie et al., 1982; Newcomb et al., 1993), likely due to children's emerging abilities to assess character. However, longitudinal studies are less conclusive. Longitudinal studies permit the examination of developmental change in children's use of bistrategic control strategies, including strengthening directional inferences. Of note, the few longitudinal studies in this area have yielded mixed findings with respect to peer correlates of concurrent aggressive and socially skilled behavior. Whereas several studies have found that peer acceptance did not differ longitudinally among aggressive youth with and without positive social behavior (Hartl et al., 2020; Reijntjes et al., 2018), others have observed that these strategies may become less effective among opposite-sex peers with age (Ciarrochi et al. 2019). Such mixed findings may reflect the relatively short assessment periods (i.e., fewer than three years). Further, none of these studies characterized peer relationships during transition between schools (e.g., middle to high school), a crucial consideration given that social hierarchies may be disrupted during this type of transition. Because altering peer dynamics becomes increasingly difficult as children grow older (Hymel, Wagner, & Butler, 1990), the change in friendship groups that often accompanies school transitions may provide opportunities for children to form new friendships and generate new impressions on classmates. Alternatively, aggressive children may join deviant peer groups (e.g., Dishion et al., 1991). The current six-year longitudinal study addressed this gap by predicting longitudinal variation in peer rejection, across three waves, from time-varying aggression and social skills, including their interaction. For many children in the sample ( $n = 76$ ), this timespan includes a transition from elementary to secondary school, a developmental period marked by growth of intimacy and complexity in peer relationships (Hartup & Stevens, 1997), as well as increased peer-related stressors (Ladd & Troop-Gordon, 2003). Studying cross-time covariation of aggression and social skills, across important developmental transitions, with respect to peer rejection will improve traction on putative longitudinal effects and bear important implications for the timing of interventions.

In addition to the frequent use of cross-sectional designs, the current literature typically relies on children's self- and peer-report. Peer ratings are a valuable tool for assessing children's social status and they reliably predict important outcomes like internalizing and externalizing disorders (Coie et al., 1992; Hanish & Guerra, 2002). However, psychosocial outcomes can also be predicted by parent-reported (Sakyi et al., 2015) and teacher-reported (Lee & Hinshaw, 2006) peer status. A meta-analysis by Renk and Phares (2004) found that parent, teacher, and peer ratings of social competence are moderately correlated, with the largest correspondence between peer and teacher ratings, likely due to their shared environment. Ratings of problem behavior from multiple informants who interact with the child in different settings can provide a more complete picture than any one measure alone (Dirks et al., 2012; Hunsley & Mash, 2007; Renk & Phares, 2004). We therefore build upon prior work by leveraging parent-, teacher-, and child self-report on comprehensive measures of aggression and social skills with strong psychometric properties (e.g., normative data). Similarly, the use of normative community samples (Hawley et al., 2002, 2007, 2008; Rodkin et al., 2000; Wurster & Xie, 2014), critically ignores children at high risk for psychopathology like children with ADHD, a group for whom poor socio-emotional and behavioral outcomes are too common (Bagwell et al., 2001; Connor et al., 2010; Falk et al., 2017; Nijmeijer et al., 2008; Nixon, 2001). Thus, aggression-related peer-rejection may be acutely relevant to the negative psychosocial outcomes associated with ADHD. The ethnically-diverse sample of children on a range of ADHD severity is well positioned to test whether the relation between aggression and social skills with peer rejection is independent of ADHD symptoms.

The present study leveraged multi-informant data across a six-year prospective longitudinal period to test the independent and interactive associations of childhood aggression and social skills with respect to trajectories of peer rejection among children with and without ADHD. Our goals were two-fold. We tested (1) aggression and social skills as unique time-varying predictors of childhood peer rejection, and (2) whether aggression x social skills interactions similarly predicted the trajectories of peer rejection. Social skills assessments consisted of children's responsibility, cooperation, assertion, and self-control. We predicted that escalating aggression would positively predict prospective changes in peer rejection and escalating social skills would inversely predict changes in peer rejection. Further, we predicted that social skills would moderate the relation between aggression and peer rejection, such that aggression would positively predict peer rejection among children with low social skills and inversely predict peer rejection among children with high social skills. We also tested the effects of age and ADHD status, but due to limited longitudinal data with clinical populations, we remained agnostic about the directional influence of age and ADHD status on the relation between aggression, social skills, and peer rejection. Finally, as overt aggression is more commonly used by boys than by girls (Card et al., 2008), we included sex as a covariate in the model, alongside age and race-ethnicity.

## Methods

### Participants

Two hundred and twenty-seven ethnically diverse 5- to 10-year-old youth ( $M_{age} = 7.4$ ,  $SD = 1.1$ ) with ( $n = 109$ ) and without ( $n = 118$ ) ADHD were recruited to participate in a laboratory-based study. Participants were recruited from mental health centers, pediatric offices, and flyers posted in local elementary schools and other public areas. Children's ADHD diagnosis was obtained through parent report on the Diagnostic Interview Schedule for Children, 4th edition (DISC-IV; Shaffer et al., 2000), a fully structured diagnostic interview of Diagnostic and Statistical Manual of Mental Disorders (4th ed.) criteria. Children without an ADHD diagnosis who met diagnostic criteria for other disorders were placed into the non-ADHD group to avoid recruiting a high functioning comparison sample that would exaggerate diagnostic group differences. Data in this report are part of a larger longitudinal study and although portions of data characterizing children's peer ratings and social skills have previously been examined in other ways (e.g., Fenesy & Lee, 2018; Lee, Falk, & Aguirre, 2012; Moroney et al., 2017; Tung & Lee, 2014), the current study combines these data with unpublished data on children's aggression and reports novel analyses for all data. Further details regarding recruitment, screening, and assessment procedures are reported in Supplementary Materials.

All families were invited to participate in a second (Wave 2) and third (Wave 3) assessment approximately two years and four years after Wave 1, respectively. Waves 2 and 3 consisted of laboratory-based assessments of child psychopathology and family functioning that paralleled procedures in Wave 1. Eighty-eight percent of families that participated at Wave 1 returned for Wave 2 ( $n = 201$ ) and 79% returned for Wave 3 ( $n = 180$ ). Children who met exclusionary criteria at Wave 2 ( $n = 1$ ) or Wave 3 ( $n = 4$ ) were included in analyses prior to exclusion. As a result of the data analytic techniques employed (see Data Analysis), only waves with missing or incomplete data were excluded from analyses ( $n_{Wave1} = 125$ ,  $n_{Wave2} = 29$ ,  $n_{Wave3} = 29$ ), leaving a final sample of 202 children; 96 were non-ADHD comparison youth (36 girls;  $M_{age} = 8.08$  years,  $SD = 1.08$ ) and 106 were ADHD probands (28 girls;  $M_{age} = 7.78$  years,  $SD = 1.17$ ). See Table 1 for participants' demographic characteristics, and descriptive statistics.

### Measures

**Aggression**—Children's total aggression was assessed at all three waves using parent-, teacher-, and child self-report on the Reactive-Proactive Aggression Questionnaire (RPQ; Raine et al., 2006). The RPQ consists of 23 items measuring proactive (12 items) and reactive (11 items) aggression rated on a three-point Likert scale. Ratings on proactive and reactive subscales were summed to create a total aggression score for each informant. Parents and teachers completed the parent version (RPQ-P) and children completed the child version (RPQ-C). Parent-, teacher-, and child self-reported aggression were averaged to create a composite score. Composite scores were chosen because research has shown that inter-rater agreement tends to be higher for externalizing than other behavior, as externalizing problems are more likely to be directly observed by outside informants (Grills & Ollendick, 2002). Further, child, teacher, and caregiver ratings of antisocial behavior load

on to a latent phenotype reflecting information shared by multiple informants (Baker et al., 2007, see De Los Reyes, 2011 for counterpoint). Teachers were not administered the RPQ at Wave 3 so Wave 3 scores are a composite of parent- and child self-report. Across Waves 1 and 2, teacher report was significantly correlated with parent report,  $r = .42$ ,  $p < .001$ , and child report,  $r = .20$ ,  $p = .01$ . For this reason, we included teacher report in Wave 1 and Wave 2 composite scores. Composite aggression scores were significantly correlated from Wave 1 to Wave 2,  $r = .51$ ,  $p < .001$ , from Wave 2 to Wave 3,  $r = .53$ ,  $p < .001$ , and from Wave 1 to Wave 3,  $r = .38$ ,  $p < .001$ . Aggression ratings had a slight positive skew of 1.01. Aggression ratings were log-transformed to test for outliers ( $+3$  SD;  $n = 0$ ), but raw ratings were used in the final analyses. A Generalized Estimating Equation (GEE) was employed in the final analyses because of its appropriate use with skewed distributions (see Data Analysis).

**Social Skills**—Children’s social skills at each wave were estimated from a composite of teacher- and parent-report versions of the Social Skills Rating System (SSRS; Gresham & Elliott, 1990). The SSRS is a standardized, norm-referenced assessment of social skills for children in preschool through 12th grade with parallel parent (SSRS-P) and teacher (SSRS-T) versions. The SSRS has adequate-to-strong psychometrics (Gresham & Elliott, 1990; Ogden, 2010) and consists of items pertaining to children’s cooperation, assertion, self-control, and responsibility (SSRS-P only). Parents and teachers rated the frequency of children’s behavior across these subscales on a three-point Likert scale, where higher scores indicated better skills. Total raw scores were constructed by summing scores across all subscales for each informant. Following the scoring guidelines by Gresham and Elliot (1990), if one or two responses were missing, missing values were scored as 1. If more than two responses were missing, the scale was excluded from analyses. At Wave 3, 11 participants received SSRS-T scores from two teachers. These participants’ raw SSRS-T scores were computed by averaging both teachers’ raw scores.

Raw social skills scores were standardized based on child age and sex to create a standardized SSRS score for each informant (Gresham & Elliot, 1990). To minimize informant discrepancies, parent- and teacher-reported standardized scores were averaged to create a composite standardized score. Composite social skills scores were moderately correlated from Wave 1 to Wave 2,  $r = .65$ ,  $p < .001$ , from Wave 2 to Wave 3,  $r = .61$ ,  $p < .001$ , and from Wave 1 to Wave 3,  $r = .55$ ,  $p < .001$ . Standardized social skills scores were normally distributed (skew = 0.12) and no outliers were observed ( $+3$  SD).

**Peer Rejection Ratings**—Children’s peer rejection ratings were assessed at each wave using parent- and teacher-report on the Dishion Social Preference Scale (Dishion, 1990). This is a three-item measure of the proportion of peers who accept, reject, and ignore the target child. Informants rated each item on a 5-point scale: 1 (none or 0% of peers), 2 (some or 25%), 3 (half or 50%), 4 (most or 75%), and 5 (almost all or 100%). Parent- and teacher-reported peer rejection scores were averaged at each wave. Composite peer rejection scores were significantly correlated from Wave 1 to Wave 2,  $r = .31$ ,  $p < .001$ , from Wave 2 to Wave 3,  $r = .37$ ,  $p < .001$ , and from Wave 1 to Wave 3,  $r = .17$ ,  $p = .034$ . Peer rejection ratings had a skew of 2.33. Peer rejection ratings were log-transformed to test for outliers ( $+3$  SD;  $n = 5$ ). Due to the skew and limited range of possible scores, outliers included



scores of 4.5 or 5. Thus, to maximize variability in our outcome measure, these scores were not removed from the dataset or manipulated. A Poisson distribution was specified in GEE analyses to accommodate the skewed distribution (see Data Analysis).

**ADHD Symptoms**—At each wave, child ADHD was estimated from the ADHD module of the DISC-IV-P (Shaffer et al., 2000). The DISC-IV-P is a fully structured diagnostic interview with the parent that assesses full DSM-IV criteria for child psychopathology including symptom count, age of onset, duration, and impairment. The DISC-IV-P possesses strong psychometric properties (Shaffer et al., 2000). The total number of ADHD symptoms at each wave was included as a covariate in the analyses to strengthen inferences that the association between aggression, social skills, and peer rejection was independent of intercorrelations with the number of ADHD symptoms in children. ADHD symptom count was strongly correlated from Wave 1 to Wave 2,  $r = .76, p < .001$ , from Wave 2 to Wave 3,  $r = .79, p < .001$ , and from Wave 1 to Wave 3,  $r = .71, p < .001$ . ADHD symptoms were normally distributed (skew = 0.35) and no outliers were observed (+3 SD).

### Data Analysis

To examine childhood aggression and social skills as independent and interactive predictors of peer rejection, we employed GEE analyses in Stata (Version 16.0). GEE is well-suited for repeated measures designs because it extends the general linear model to account for intra-individual correlation across time points. By accounting for correlated observations across waves, GEE increases statistical power and minimizes Type I error relative to other methods of longitudinal data analysis (e.g., repeated measures ANOVA). GEE is also less restricted by distributional assumptions because it estimates averages rather than the entire distribution of values. This is an important benefit, as data from clinical samples often yield non-normal distributions. We specified a Poisson distribution and an exchangeable working correlation matrix with robust Sandwich estimators. Specifically, we tested aggression and social skills over six years as both independent and interactive time-varying predictors of six-year change in peer rejection (Hardin & Hilbe, 2003). Given the substantial overlap between aggression and ADHD (Connor et al., 2010; Mannuzza & Klein, 2000), to improve specificity of inferences, we controlled for time-varying ADHD symptoms as well as sex, race-ethnicity, and age. For completeness, a follow-up contrast analysis of race-ethnicity was also performed, though we did not hypothesize associations to vary by race-ethnicity. To probe significant interactions, simple slopes were examined to assess predictions of prospective change in peer rejection from aggression across three levels of social skills (−1 SD, 0 SD, +1 SD).

Finally, we conducted several post hoc, exploratory analyses to examine the interactive effects of sex and age on predictions of peer rejection from aggression and social skills. To avoid overspecification of the model, these interactive effects were not included in the original analyses. However, because sex and age are robust correlates of aggression (Archer, 2004; Campbell, Shirley, & Caygill, 2002) and social skills (Fabes & Eisenberg, 1998; Michalska, Kinzler, & Decety, 2013; Van der Graaff et al., 2018), we tested them as possible moderators. First, we conducted a GEE analysis testing separate Sex x Aggression, Sex x Social Skills, and Sex x Aggression x Social Skills interactions as predictors of peer

rejection, controlling for time-varying ADHD symptoms, race-ethnicity, and age. Next, we performed a second, parallel GEE analysis consisting of separate Age x Aggression, Age x Social Skills, and Age x Aggression x Social Skills interactions as predictors of peer rejection, controlling for ADHD symptoms, race-ethnicity, and sex. For both models, we specified a Poisson distribution and an exchangeable working correlation matrix with robust Sandwich estimators.

## Results

To review, we predicted six-year change in aggression and social skills as predictors of prospective change in childhood peer rejection, including their interaction. First, we calculated bivariate longitudinal associations between all study variables. Second, we used GEE to examine change in aggression and social skills as time-varying predictors of prospective change in children's peer rejection, across three waves. Third, we used GEE to test whether children's social skills moderated predictions of peer rejection from aggression. To enhance specificity, we included sex, race-ethnicity, age, and time-varying ADHD symptoms as covariates.

Means and standard deviations for all study variables are presented in Table 1. Correlations among predictors, covariates, and outcomes are listed in Table S2 in Supplementary Materials. Paired samples t-tests revealed children had more composite aggression at Wave 1 compared to Wave 2,  $t(93) = 3.97, p < .001, d = .41$ , and Wave 3,  $t(75) = 3.24, p = .002, d = .37$ . Parents reported more ADHD symptoms at Wave 1 than Wave 2,  $t(187) = 4.44, p < .001, d = .32$  and Wave 3,  $t(159) = 7.15, p < .001, d = .57$ . Wave 2 ADHD scores were also higher than at Wave 3,  $t(157) = 3.74, p < .001, d = .30$ . Aggression scores at Wave 2 and Wave 3 did not significantly differ,  $t(154) = -.03, p = .98, d = -.003$ . In addition, children's overall social skills scores were lower at Wave 1 than at Wave 2,  $t(160) = -3.38, p = .001, d = -.27$ , and Wave 3,  $t(152) = -4.62, p < .001, d = -.37$ , but they did not significantly differ between Waves 2 and 3 ( $p = .11$ ). No significant changes in peer rejection scores were observed across waves ( $ps > .18$ ).

## Missing Data

In GEE analyses, all nonmissing pairs of data are used to estimate the working correlation parameters so only waves for which a participant was missing data were excluded from analyses. For all waves, scores for participants' missing self-, parent-, or teacher-report consisted of the available informant reports (see Table 2 for missing informant data). At Wave 1, six and four participants were excluded due to missing social skill and peer rejection scores, respectively. The RPQ was added to the protocol mid-way through Wave 1 data collection, so aggression scores were missing for 111 triads at Wave 1. However, participants missing W1 aggression data did not significantly differ in any of the demographic variables or Wave 1 variables included in the GEE analysis ( $ps > .24$ ) nor did they differ on aggression scores at Waves 2 or 3 ( $ps > .60$ ). To ensure that the missing aggression data at Wave 1 did not systematically affect the results, the primary GEE model was reproduced excluding all participants with incomplete Wave 1 data (see Supplementary Materials). All significant results that were observed in the original model

were maintained even when participants with incomplete Wave 1 data were excluded. At Wave 2, 56 participants were excluded due to absence ( $n = 26$ ), autism spectrum disorder (ASD) diagnosis ( $n = 1$ ), or missing data for aggression ( $n = 1$ ), social skills ( $n = 14$ ), peer rejection ( $n = 13$ ), or ADHD ( $n = 1$ ) measures. At Wave 3, 80 participants were excluded due to absence ( $n = 47$ ), ASD diagnosis ( $n = 4$ ), or missing data for aggression ( $n = 10$ ), social skills ( $n = 7$ ), peer rejection ( $n = 10$ ), or ADHD ( $n = 2$ ) measures.

### Aggression and Social Skills Interact to Predict Peer Rejection

With control of sex, race-ethnicity, age, and time-varying ADHD symptoms, GEE analyses showed that escalating childhood aggression positively predicted escalating peer rejection,  $\beta = .10$ ,  $z = 2.63$ ,  $p = .008$ . However, neither social skills,  $\beta = -.004$ ,  $z = -1.10$ ,  $p = .27$ , ADHD symptoms,  $\beta = .01$ ,  $z = 1.94$ ,  $p = .053$ , sex,  $\beta = .06$ ,  $z = 1.09$ ,  $p = .28$ , age,  $\beta = .02$ ,  $z = .84$ ,  $p = .40$ , nor race-ethnicity,  $\chi^2(4) = 0.89$ ,  $p = .92$ , predicted change in peer rejection. GEE model summaries are presented in Table 3. In line with predictions, the aggression x social skills interaction predicted longitudinal change in peer rejection,  $\beta = -.001$ ,  $z = -2.71$ ,  $p = .007$ . Simple slopes revealed that children's aggression was associated with reduced peer rejection at high levels of social skills,  $\beta = -.02$ ,  $z = -2.15$ ,  $p = .03$  and unrelated to peer rejection at mean levels of social skills,  $\beta = -.002$ ,  $z = -.24$ ,  $p = .81$ , and low levels of social skills,  $\beta = .02$ ,  $z = 1.80$ ,  $p = .07$  (Figure 1). In other words, for children with high social skills, aggression inversely predicted peer rejection.

### Exploratory Moderation Analyses

**Sex.**—When sex was included as an interaction term alongside aggression and social skills to predict peer rejection, a main effect of sex emerged,  $\beta = 1.50$ ,  $z = .742$ ,  $p = .045$ , with boys exhibiting greater peer rejection than girls ( $M_{\text{girls}} = 1.37$ ,  $SD_{\text{girls}} = .85$  vs  $M_{\text{boys}} = 1.43$ ,  $SD_{\text{boys}} = .77$ ). We also observed that aggression and peer rejection were positively associated,  $\beta = .20$ ,  $z = 3.88$ ,  $p < .001$ . This model also revealed several additional interactions: an Aggression x Social Skills interaction significantly predicted peer rejection,  $\beta = -.002$ ,  $z = -3.55$ ,  $p < .001$ . As in the original model, for children with high social skills, aggression inversely predicted peer rejection,  $\beta = -.02$ ,  $z = -2.03$ ,  $p = .043$ , whereas rejection and social skills were unrelated at moderate and low levels of social skills ( $ps > .15$ ). We also observed a Sex x Aggression interaction such that aggression was more strongly inversely associated with peer rejection among girls than boys,  $\beta = -.16$ ,  $z = -2.23$ ,  $p = .026$ . Finally, a three-way Sex x Aggression x Social Skills interaction was observed: specifically, among girls with low social skills, aggression was positively related to peer rejection,  $\beta = .05$ ,  $z = 3.70$ ,  $p < .001$ , whereas aggression was unrelated to peer rejection at moderate and high levels of social skill ( $ps > .09$ ). In boys, aggression was unrelated to peer rejection at any social skill level ( $ps > .17$ ).

**Age.**—First, age positively predicted peer rejection,  $\beta = .33$ ,  $z = 2.51$ ,  $p = .012$ , aggression,  $\beta = .44$ ,  $z = 2.80$ ,  $p = .005$ , and social skills,  $\beta = .03$ ,  $z = 2.17$ ,  $p = .030$ . Second, we tested separate age x aggression and age x social skills interactions as predictors of peer rejection. As with the primary analyses, the aggression x social skills interaction significantly predicted peer rejection,  $\beta = -.004$ ,  $z = -2.51$ ,  $p = .012$ . Simple slopes revealed that for children with high social skills (+2 SD), aggression was negatively related to peer

rejection,  $\beta = -.03$ ,  $z = -2.24$ ,  $p = .025$ . For children with low social skills ( $-2$  SD), aggression was positively related to peer rejection,  $\beta = .06$ ,  $z = 2.11$ ,  $p = .035$ . Aggression and peer rejection were unrelated for children with moderate social skills (0 SD;  $p = .92$ ). No significant simple slopes emerged at  $+1$  SD. A significant Age x Social Skills interaction also emerged,  $\beta = -.003$ ,  $z = -2.44$ ,  $p = .012$ , such that across all age groups, social skills were inversely associated with peer rejection ( $ps < .001$ ). Finally, although the age x aggression interaction significantly predicted peer rejection,  $\beta = -.03$ ,  $z = -2.12$ ,  $p = .034$ , significant simple slopes were not identified, even at the extreme values of aggression and age ( $ps > .18$ ). No other main effects or interactions emerged ( $ps > .05$ ).

## Discussion

We prospectively followed an ethnically diverse sample of children ( $n = 202$ ) on a range of ADHD symptoms for six years across three waves to test aggression and social skills as time-varying, independent and interactive predictors of trajectories of peer rejection from childhood to early adolescence. Controlling for key demographics and ADHD symptoms, several important findings emerged: (1) longitudinal change in composite parent-, teacher-, and self-reported childhood aggression significantly predicted prospective change in parent- and teacher-rated peer rejection; (2) change in parent- and teacher-reported social skills moderated this effect, such that aggression *inversely* predicted peer rejection for children with high social skills. Together, these results suggest that positive social skills may buffer aggressive children from negative social repercussions (i.e., peer rejection) of their aggression.

Our first objective was to capitalize on this three-wave, six-year longitudinal design by examining the time-varying association between aggression and peer rejection. We observed that longitudinal change in children's aggression was positively associated with prospective change in peer rejection. One quasi-experimental method of testing whether a risk factor is causally associated with an outcome is by examining their time-varying association (Shadish et al., 2002). Thus, that prospective change in childhood aggression prospectively predicted increased peer rejection is consistent with (but does not prove) aggression being a causal risk factor for peer rejection. This echoes prior work (for reviews, see Boivin et al., 2005; Coie et al., 1990; Rubin et al., 1998) and further underscores that for most children, aggressive behavior is viewed undesirably by peers. It should be noted, however, that longitudinal change in social skills was unrelated to prospective change in peer rejection, which diverges from previous studies that find popular children tend to demonstrate positive social traits, including being cooperative, helpful, and outgoing (Coie et al., 1983, 1990; Newcomb et al., 1993). This may reflect differences in the assessment of social skills: many items on the SSRS reflect general social skills, rather than peer-specific social skills and may therefore obscure children's social skills directed specifically toward peers. Alternatively, there may be aspects of peer interactions which are not readily observed by parents or teachers. In this case, the use of parent- and teacher-reported social skills may not include certain important behavior for navigating children's peer relationships. Additional work on specific social skills that elicit different peer effects could improve understanding of the relation between social skill and peer status. Finally, social skills not predicting peer rejection may be attributable to the fact that we controlled for time-varying ADHD and aggression in the

present sample, which may eclipse social skills as predictors of peer outcomes. Future work should compare the association between social skills and peer rejection in children on a range of externalizing symptoms.

Our second aim was to probe potential interactive associations between aggression and social skills across six years with respect to prospective change in peer rejection. In line with our prediction, we found that social skills moderated this interaction such that, for children with high social skills, increased aggression predicted *declines* in peer rejection. This finding is partially congruent with the “resource control” conceptualization of peer relationships, whereby children who employ both coercive and prosocial behavior are not rejected by peers but are, in fact, considered popular (Hawley, 1999, 2014; Hawley et al., 2007, 2002; McDonald et al., 2011; Roseth et al., 2011; Wurster & Xie, 2014) as they dually use prosocial and coercive control tactics including physical aggression to enhance their status and gain access to social and material resources. We extend this work by addressing several important gaps. First, we leveraged comprehensive, multi-informant assessments of aggression and social skills, thereby assessing school and home environments. Second, we examined concurrent aggressive and prosocial behavior across a longer developmental period than previously tested. Although age was unrelated to trajectories of peer rejection, moderation by social skills from predictions from aggression across middle childhood and early adolescence suggests that social skills interventions may endure across key developmental stages. Finally, to our knowledge, this is the first study to examine how concurrent aggressive and socially skilled behavior related to peer outcomes among children with ADHD. Because children with ADHD have elevated aggression (Connor et al., 2010; Mannuzza & Klein, 2000) and impaired social functioning (Nijmeijer et al., 2008; Nixon, 2001), they are at an especially high risk for negative peer outcomes (Grygiel et al., 2018; Hoza et al., 2005). Finding that, even among this clinical sample, aggressive children with elevated social skills were less rejected by peers suggests that social skills intervention may be an effective way to reduce negative peer outcomes among aggressive children with ADHD.

Our third objective consisted of post hoc, exploratory tests of interactive effects of age and sex with aggression and social skills with respect to peer rejection. Specifically, although boys were more likely to be rejected overall, aggression was more predictive of peer rejection among girls, particularly when accompanied by low social skills, thus demarcating a subgroup of youth who may benefit from targeted interventions. One reason for this result may be that we measured overt aggressive behavior, which are more often employed by boys, whereas indirect aggression (e.g., excluding peers and spreading gossip) is more commonly used by girls (Björkqvist, 2018; Card et al., 2008; Kistner et al., 2010). Thus, girls who reported gender-nonconforming types of aggression may be at an increased risk for peer rejection or for increased negative repercussions of rejection (Krygsman & Vaillancourt, 2018), especially in the absence of social skills to offset the social cost of their aggression. Indirect aggression, characterized by behavior like excluding peers and spreading gossip, is more normative among youth (Vaillancourt & Farrell, 2021; Vaillancourt & Krems, 2018) and is linked to high social status among peers (Houser et al., 2015; Kraft & Mayeux, 2016; Vaillancourt & Hymel, 2006). Whereas overt aggression is associated with reduced prosocial behavior, indirect aggression is associated with increased

prosocial behavior (Card et al., 2008). This may be because indirect aggression often requires the participation of peers (e.g., to aid in rumor spreading or exclusion) so social skills may be necessary to implement such strategies. Thus, interactive influences of aggression and social skills on peer status may be even stronger for indirect than for overt aggression. Future work should compare sex differences in the influence of overt and indirect aggression on peer status, as well as their interaction with social skills.

Finally, when age was included as a moderator in post hoc analyses, age positively predicted peer rejection, perhaps reflecting increasing rates of rejection as children develop (Stenseng et al., 2016). Alternatively, children may be more sensitive to rejection as they age (Davey et al., 2008; Prinstein & Aikins, 2004), thus potentiating adult ratings of peer rejection. The model also revealed, across all age groups, that social skills were inversely related to peer rejection. This suggests that, although there may be age differences in the association between social skills and peer status that our simple slopes analyses did not detect, social skills are a robust buffer against peer rejection across middle childhood and early adolescence. Finally, we observed that the Age x Aggression interaction predicted peer rejection, although the simple slopes analyses were not significant even at the most extreme values of aggression and age. This pattern may reflect the relatively restricted age range in this sample, possible sex differences in predictions of peer rejection, or interactive effects between age, sex, and aggression in predicting peer rejection. As children get older and transition to new schools, it may place children who are using gender-nonconforming aggression at a higher risk for peer victimization and for negative outcomes associated with victimization (Krygsman & Vaillancourt, 2018). Future work should examine how age and sex interact to predict outcomes of aggression in high-risk groups like children with ADHD.

### Limitations and Future Directions

Although these findings are promising, we note several limitations of the current study and possible avenues for future research. First, as mentioned previously, we utilized parent and teacher ratings to assess children's peer rejection. Including peer-reports or employing peer sociometrics may have provided a different or more precise characterization of children's peer status. However, because teacher-report of peer rejection is concordant with children's self- and peer-report and holds distinct information from parent-report (Ladd & Kochenderfer-Ladd, 2002), our composite likely captures key information about children's peer relationships across school and home environments. Second, rather than specifically assessing prosocial control strategies, this study measured children's overall social skills. Hawley (2014) asserts that bistrategic controllers leverage prosocial (reciprocative and cooperative) and coercive (aggressive) control to gain social capital. Although prosocial control or popularity were not directly assessed, these findings are generally consistent with this formulation insofar as aggressive children with strong social skills may be buffered from the negative effects of aggression due to social adeptness alone, and not the intention to utilize these skills for their own benefit. Third, by only testing peer rejection, we did not capture whether peer victimization is similarly predicted by children's aggression and social skills. Children who are both aggressive and victimized show social and behavioral maladjustment, including academic failure, peer rejection, and emotional distress (Schwartz, 2000). An important direction for future research will be to determine

whether peer victimized children are afforded the same positive outcomes as peer-accepted children. Fourth, because the RPQ was added to the protocol mid-way through Wave 1 data collection, many of our participants did not have complete data from all three waves. To ensure that our findings were not influenced by data loss, we re-analyzed our data excluding participants without complete Wave 1 data and all effects remained significant (see Supplementary Materials). Although this does not resolve the limitation of missing data from individual informants, it does suggest that including participants who were missing composite RPQ scores at Wave 1 did not significantly influence our observed results. Replication of the observed results is warranted to reduce the risk of spurious effects. Finally, it should be noted that using multiple informant measures, and particularly parent vs teacher, requires some consideration. On one hand, by using a composite score rather than including each rater independently, we may have lost context-dependent information about children's aggressive behavior (De Los Reyes, 2011; Smith, 2007). On the other hand, because externalizing problems are more likely to be directly observed by outside informants, inter-rater agreement is high for externalizing behavior (Grills & Ollendick, 2002) ratings of antisocial behavior load on to a single latent phenotype (Baker et al., 2007). Although parent and teacher ratings of peer rejection, social skills, and aggression were moderately intercorrelated, future research should employ diverse designs and methods to discern variable responses across key constructs to ultimately improve traction about the complex relationship between aggression and peer status.

### Implications

These preliminary findings that children who employed high levels of aggressive and socially skilled behavior were not rejected by peers may have important implications for the treatment of childhood aggression. This is in line with current interventions for aggression like social skills training, which assume that negative behavior like aggression often result from poor social skills needed to appropriately negotiate conflict and influence peers. Our finding that children who were both aggressive and socially skilled were less rejected by peers suggests that targeting the development of social skills may indirectly contribute to the reduction of antisocial behavior through improvements in peer relationships. However, more longitudinal work is needed to understand the causal associations between these variables.

### Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

### Acknowledgments

We thank the participants and families, as well as the research staff. We are also grateful to Isabel Krein, Elizabeth Moroney, Irene Tung, and Kelsey Stiles for their valuable contributions. This research was supported by NIH grant 1R03AA020186-01 to Steve S. Lee.

### Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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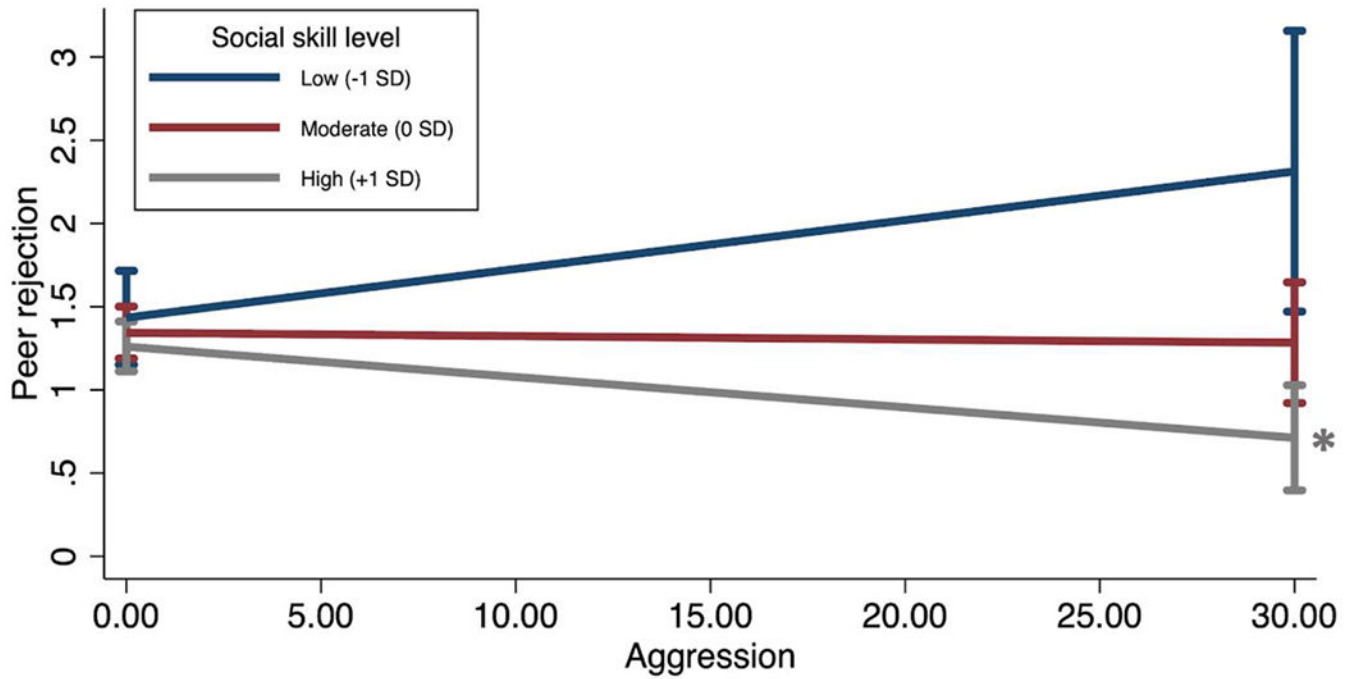
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**Figure 1. Simple Slopes for Aggression Predicting Peer Rejection Among Children with Low (1 SD Below Mean), Moderate (Mean), and High (1 SD Above Mean) Levels of Social Skills**  
*Note:* Child aggression is a composite of child, parent, and teacher ratings on the Reactive–Proactive Aggression Questionnaire. Peer rejection is a composite of parent and teacher ratings on the Dishion Social Preference Scale. Social skills level is a composite of parent and teacher standardized score on the Social Skills Rating System. \* $p < .05$

**Table 1**

Demographic Characteristics of Participants and Descriptive Statistics for Study Variables Across Waves

Wave	Variable	<i>M</i>	<i>SD</i>
Wave 1 ( <i>n</i> = 102)			
	Girls ( <i>n</i> , %)	38.00	0.37
	Age	7.88	1.20
	Social skills	93.21	15.88
	Aggression	8.90	5.21
	Peer rejection	1.41	0.75
	ADHD symptoms	7.57	5.37
Wave 2 ( <i>n</i> = 171)			
	Girls ( <i>n</i> , %)	50.00	0.29
	Age	10.15	1.27
	Social skills	96.35	16.04
	Aggression	7.38	4.09
	Peer rejection	1.42	0.83
	ADHD symptoms	6.80	5.53
Wave 3 ( <i>n</i> = 147)			
	Girls ( <i>n</i> , %)	48.00	0.33
	Age	12.51	1.25
	Social skills	99.08	15.63
	Aggression	7.00	4.35
	Peer rejection	1.40	0.80
	ADHD symptoms	5.77	5.29

*Note:* ADHD = attention-deficit/hyperactivity disorder. Social skills, aggression, and peer rejection are composite scores (see Methods for details).



**Table 2**

Missing informant reports from composite scores of participants included in analyses

Measure	Wave 1	Wave 2	Wave 3
Aggression (RPQ)			
Child	10	10	16
Parent	3	14	4
Teacher	31	81	N/A
Social Skills (SSRS)			
Parent	3	15	8
Teacher	45	81	93
Peer Rejection (DSPS)			
Parent	2	9	6
Teacher	21	80	85

*Note:* RPQ = Reactive-Proactive Aggression Questionnaire; SSRS = Social Skills Rating System; DSPS = Dishion Social Preference Scale.

**Table 3**

## Predicting Childhood Peer Rejection

Predictors	$\beta$	z	Wald $\chi^2$	p
Covariates				
Time (Wave)	0.008	0.17		.87
Age	0.02	0.84		.40
Sex	0.06	1.09		.28
Race/Ethnicity			0.89	.92
Black	-0.02	-0.17		.87
Latinx	0.03	0.73		.47
Asian	-0.03	-0.24		.81
Mixed/Other	-0.03	-0.42		.67
ADHD Symptoms	0.01	1.94		.05
Independent Variables				
Aggression	0.10	2.63		.008
Social Skills	-0.004	-1.10		.27
Aggression x Social Skills	-0.001	-2.71		.007
Overall Model			472.78	< .001

Note: ADHD = attention-deficit/hyperactivity disorder. Social skills, aggression, and peer rejection are composite scores (see Methods for details).