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Abstract: Even after evidence-based treatment, Attention-Deficit/Hyperactivity Disorder (ADHD) is associated with poor long-term outcomes. These outcomes may be partly explained by difficulties in peer functioning, which are common among children with ADHD and which do not respond optimally to standard ADHD treatments. We examined whether peer rejection and lack of dyadic friendships experienced by children with ADHD after treatment contribute to long-term emotional and behavioral problems and global impairment, and whether having a reciprocal friend buffers the negative effects of peer rejection. Children with Combined type ADHD (*N*=300) enrolled in the Multimodal Treatment Study of Children with ADHD (MTA) were followed for 8 years. Peer rejection and dyadic friendships were measured with sociometric assessments after the active treatment period (14 or 24 months after baseline; M ages 9.7 and 10.5 years, respectively). Outcomes included delinquency, depression, anxiety, substance use, and general impairment at 6 and 8 years after baseline (Mean ages 14.9 and 16.8 years, respectively). With inclusion of key covariates, including demographics, symptoms of ADHD, ODD, and CD, and level of the outcome variable at 24 months, peer rejection predicted cigarette smoking, delinquency, anxiety, and global impairment at 6 years and global impairment at 8 years after baseline. Having a reciprocal friend was not, however, uniquely predictive of any outcomes and did not reduce the negative effects of peer rejection. Evaluating and addressing peer rejection in treatment planning may be necessary to improve long-term outcomes in children with ADHD.

Keywords: ADHD, Peer rejection, Outcomes, Impairment, Externalizing, Internalizing

Children with Attention-Deficit/Hyperactivity Disorder (ADHD) experience multiple negative outcomes as adolescents and adults. A large literature points to ADHD as a risk factor for later delinquency (Barkley et al. 2004; Mannuzza et al. 2008; Molina et al. 2009) as well as substance use and abuse (Biederman et al. 2006; King et al. 2004; Molina and Pelham 2003). Some studies have also linked childhood

ADHD with subsequent depression and anxiety (Chronis-Tuscano et al. 2010; Lahey et al. 2007; Lee et al. 2008), although others have not replicated these associations (Bagwell et al. 2006; Mannuzza et al. 1993). In addition to these externalizing and internalizing problems, childhood ADHD is associated with global impairment (i.e., difficulty in child's overall functioning) that persists over time (Molina et al. 2009).

Although evidence-based treatments improve functioning in children with ADHD, they fail to normalize long-term outcomes. For instance, in the largest randomized clinical trial for ADHD to date, the Multimodal Treatment Study of Children with ADHD (MTA), 14 months of intensive medication management, behavior therapy, their combination, or community care resulted in substantial improvements in symptoms of ADHD, severity of associated disorders, and multiple aspects of functional impairments (MTA Cooperative Group 1999). Treatment group differences that emerged at the end of the active treatment period, spanning symptoms and several domains of impairment, dissipated within 2 years post-treatment (Jensen et al. 2007). At long-term follow-up 6 and 8 years after baseline, all groups maintained some of the treatment gains from the post-treatment assessment. However, all groups also continued to demonstrate substantial impairment relative to classmates without ADHD (Molina et al. 2009).

The continued presence of impairment is not surprising given that ADHD is a persistent neurodevelopmental disorder and the active treatment period in the MTA was limited to 14 months. However, the enduring impairment despite successful treatment response could also be partly explained by factors related to ADHD that are critical for long-term functioning but that do not respond optimally to treatment. Peer relationship problems, such as peer rejection and lack of close friendships, may function as such factors. First, many children with ADHD are rejected by peers and lack reciprocal friends (Bagwell et al. 2001; Hinshaw and Melnick 1995; Hodgens et al. 2000). At the baseline (pre-treatment) assessment in the MTA study, 52% of the children with ADHD were rejected by peers, compared to only 14% of randomly selected classmates. Similarly, 56% of children with ADHD did not have reciprocal friends (defined as having at least one of their top two friendship nominations reciprocated), compared to 32% of classmates (Hoza, Mrug, et al. 2005). Second, peer difficulties in this

population are highly stable over time (Johnston et al. 1985), often persisting into adolescence (Bagwell et al. 2001). Peer problems of children with ADHD also do not improve considerably after pharmacotherapy and/or psychosocial treatment, despite the interventions' effectiveness in improving ADHD symptoms and social behavior (Hoza, Gerdes, et al. 2005; Pelham et al. 1988; Whalen et al. 1989). In the MTA study's 14-month (end of treatment) assessment, the MTA medication algorithm was associated with better parent and teacher-rated social skills and with higher peer liking (although not significant after Bonferroni correction; MTA Cooperative Group 1999), but there were no treatment-related differences with respect to peer rejection and dyadic friendships, and all treatment groups were substantially more rejected and had fewer friends than randomly selected classmates (Hoza, Gerdes, et al. 2005). Finally, childhood experiences of peer rejection, independent of ADHD, have been linked with long-term problems observed in ADHD populations, including antisocial behavior (Laird et al. 2001), substance use (Fite et al. 2007), depression (Pedersen et al. 2007), and anxiety (Mayeux et al. 2007). Independent of peer rejection, a lack of reciprocal friendships in childhood also predicts poorer adjustment in adulthood, including lower self-worth, more depressive symptoms, and poorer family relationships (Bagwell et al. 1998).

Peer rejection and lack of friendships can contribute to subsequent adjustment through several mechanisms. Of course, there is the distinct possibility of selection: those youth likely to be rejected or who fail to form friendships may have many of the same underlying characteristics or risk factors that place them at long-term risk for impairments. But there could also be active contributions from the peer/social difficulties. First, rejected and friendless children are more likely to be excluded from social activities with peers (Buhs and Ladd 2001) and, as a result, deprived of important socialization experiences, opportunities to develop and refine their social skills, and important sources of social support (Parker et al. 2006). Over time, this process spirals into restriction in social activities, even more relationship problems, and internalizing distress. Second, peer rejection and friendlessness place children at risk for peer victimization (Hodges et al. 1999; Mayeux et al. 2007), a well-established contributor to internalizing and externalizing problems (Hanish and Guerra 2002). Third, because peer rejected and friendless children have fewer

opportunities to form friendships with more popular, prosocial peers, they may later gravitate to other rejected youth who are more likely to engage in antisocial behavior (Laird et al. 2001). These friendships may then foster development or escalation of antisocial behavior and substance use (Monahan et al. 2009; Wills and Cleary 1999). Although the positive qualities of these friendships may somewhat compensate for the peer rejection and friendlessness these youngsters had experienced, friendships of antisocial youth are also marked by high levels of conflict (Poulin et al. 1999) and are associated with increased depressive symptoms over time (Mrug et al. 2004). Over time, repeated experiences of peer exclusion and victimization, compounding social skills deficits, and restricted social activities and relationship problems are likely to translate into global impairment in functioning across multiple life domains.

Although both peer rejection and friendlessness contribute to poor outcomes over time, good functioning in one of these domains may buffer children from the negative impact of the other type of peer problems. Indeed, peer rejection and friendships are theoretically and empirically distinct (Bukowski and Hoza 1989) and make unique contributions to adjustment (Bagwell et al. 1998; Parker and Asher 1993). Moreover, having reciprocal friends appears to prevent the development of internalizing and externalizing problems among children who are rejected by peers (Laursen et al. 2007). Similarly, having friends protects children from peer victimization and mitigates the negative impact of peer victimization on adjustment (Hodges et al. 1999; Hodges et al. 1997). Thus, it is possible that children with ADHD who are rejected by peers but have reciprocal friends may be protected from long-term negative outcomes typically associated with peer rejection (for concurrent data in this regard, see Cardoos and Hinshaw 2011).

Only a handful of prospective studies to date evaluated the role of peer problems in long-term functioning of children with ADHD. Two studies linked both childhood ADHD and peer problems with adolescent externalizing and internalizing problems (Greene et al. 1997; Mikami and Hinshaw 2006), although another study implicated only peer problems, but not ADHD, in internalizing outcomes (Bagwell et al. 2006). A fourth study linked peer rejection with externalizing problems indirectly through increased deficits in social skills (Murray-Close et al.

2010). Adolescent substance use or abuse was predicted only by peer problems in one study (Greene et al. 1997) and only by ADHD in another study (Mikami and Hinshaw 2006). Although these studies suggest that both ADHD and peer problems make independent contributions to long-term problems, this literature presents several limitations. First, some of these studies evaluated overall social problems, not distinguishing between different types of peer problems, such as peer rejection versus lack of friendships. Other studies only examined the impact of peer rejection alone, thus providing no information about the unique contributions of peer rejection and friendships and the possible buffering effect of friendships for later outcomes. Also, few of these studies controlled for comorbid oppositional or conduct problems, which are present in more than half of children with combined-type ADHD (MTA Cooperative Group 1999) and are known to exacerbate long-term negative outcomes (August et al. 2006; Biederman et al. 2008). Finally, none of these studies evaluated peer problems through peer reports gathered in the children's natural environment (e.g., regular classroom), the most predictive measure of peer difficulties (Cowen et al. 1973).

In this report, we evaluate whether peer rejection and friendships of children with ADHD contribute to externalizing and internalizing problems and global impairment in adolescence using prospective data from the MTA. Because we aimed to explain poor long-term functioning following treatment, we tested the effects of peer rejection and friendships assessed after treatment (at 14 or 24 months post-baseline) on 6 and 8 year outcomes, controlling for ADHD symptoms persisting after treatment (at 24 months). We hypothesized that both peer rejection and lack of friendships would be uniquely associated with poorer functioning in adolescence and that having friends would attenuate the negative impact of peer rejection on later outcomes. This study makes novel contributions to the literature by evaluating the combined effects of peer rejection and dyadic friendships for long-term outcomes of children with ADHD across middle and late adolescence. Unique methodological strengths of the study include assessing peer rejection and friendships with peer reports gathered in the children's regular classrooms and controlling for a number of potentially confounding covariates, including continuity in adjustment over time, severity of ADHD symptoms, and comorbid oppositional and conduct problems. By focusing on a well-defined

clinical group of children with Combined type ADHD, the present study will also help determine whether the long-term effects of peer rejection and lack of friendship observed in community samples apply to this special population of youth.

Methods

Participants

This study involves a subset of participants from the Multiomodal Treatment Study of ADHD (the MTA) (MTA Cooperative Group 1999), a six site study conducted in the United States and Canada with 579 children with ADHD selected through a multiple gating and assessment procedure (Hinshaw et al. 1997). Inclusion criteria involved a DSM-IV diagnosis of ADHD, Combined Type based on the Diagnostic Interview Schedule for Children–Parent Report (DISC-P), supplemented with up to two symptoms identified by children's teachers. At baseline, participants were between 7.0 and 9.9 years old, attended the 1st through 4th grades, and lived with primary caretakers for at least 6 months. All participants provided informed consent or assent. Participants were reassessed at completion of the 14-month treatment phase, at 24 and 36 months, and again at 6 and 8 years after baseline. Participation rates were 97%, 93%, 84%, 78%, and 75% of the baseline sample at each of these time points, respectively. Participants lost to the 8-year follow-up, compared with those retained, were more likely to be male and from lower SES families (Molina et al. 2009).

This study includes those MTA participants who had peer rejection data at 14 or 24 months (N=362; 63% of the original sample) and any outcome data at 6 or 8 years, for a total analytic sample of 300 participants. Factors contributing to lack of sociometric data included individual school or teacher refusal of the sociometric procedures, the school's having ended the spring term, insufficient numbers of classmates consenting to the sociometric procedures, and staffing limitations. MTA participants with peer rejection data at 14 or 24 months were more likely to be Non-Hispanic White than those without such data (65% vs. 54%, $p<0.05$), but these two groups did not differ in sex, age, or family SES.

Measures

Peer rejection

At 14 and 24 months, sociometric data were gathered from MTA probands attending regular education classrooms and same-sex classmates with parental informed consent (with the exception of one site where the school board deemed parental consent unnecessary) using standard sociometric procedures (Coie et al. 1982). Within each class (mostly 2nd–6th grade), children were given a list of all participating children and asked to circle the names of all peers they "DO NOT want to be friends with". Thus, non-participants were not included on the nomination rosters, nor did they nominate others. The number of nominations each participating child received was standardized within each class to account for class size differences and used as a continuous measure of peer rejection. On average, 9 children per class (range 5–22) participated, representing 72% (range 28%–100%) of eligible children. As recently shown by McKown et al. (2011), participation rates as low as 30% yield valid and reliable measures of peer rejection. Of the 362 MTA cases with any sociometric data, 174 (48%) had these data at both 14 and 24 months, 111 (31%) had only 14-month data, and 77 (21%) had only 24-month data. Because peer rejection is reasonably stable over time (Bagwell et al. 2001) (r= 0.33, p<0.001 in this sample) and in order to increase stability of measurement (Mayeux et al. 2007), 14 and 24 month peer rejection data were averaged if both were available.

Friendship

As a part of the sociometric assessment, children were asked to indicate their first and second best friend on the list of participating same-sex classmates. Following existing procedures to determine friendships (Hoza, Mrug, et al. 2005), friendship was coded as present when at least one of those two peers reciprocated the child's friendship choice, listing the target child among his or her two best friends. For children who had data at both 14 and 24 months, friendship was coded as present if they had a reciprocal friend at one or both of the assessment points. Children whose top two friendship choices were not reciprocated were coded as not having a friend.

ADHD symptoms

At 24 months, parents and teachers rated the severity of the 18 DSM-IV ADHD symptoms using the Swanson, Nolan, and Pelham Rating Scale (SNAP; adhd. net) on a 4-point scale (0='not at all' to 3='very much'). The number of symptoms endorsed as 'pretty much' or 'very much' by either informant was utilized.

Oppositional Defiant Disorder (ODD) symptoms

At 24 months, parents and teachers rated the 8 DSM-IV ODD symptoms on the SNAP using the same response scale described above. The number of symptoms endorsed as 'pretty ' or much 'very much' by either informant was used.

Conduct Disorder (CD) symptoms

At 24 months, parents rated 18 DSM-IV based symptoms of CD using the Conduct Disorder subscale of the Aggression and Conduct Problem Scale – Parent version (American Psychiatric Association 1994) on a 4-point scale (1='never' to 4='often'). The number of items rated as 'occasionally' or 'often' by either parent was utilized.

Delinquency

The seriousness of the youths' delinquent behavior at 24 months, 6 years, and 8 years was coded on an ordinal scale using information gathered from the following measures: 1) parent reports on the Diagnostic Interview Schedule for Children IV-CD Module; 2) parent report on the DSM-IV Aggression and Conduct Disorder Rating Scale (American Psychiatric Association 1994); and 3) youth report on the Self-Reported Antisocial Behavior questionnaire (Loeber et al. 1989) (at 24 months) or the Self-Reported Delinquency questionnaire (Elliott et al. 1985) (at 6 and 8 years). Following procedures used in the Pittsburgh Youth Study (Loeber et al. 1998) and previously in the MTA (Molina et al. 2009), delinquency seriousness was coded into 1 of 5 categories based on the most serious act committed during the past 6 months: 0='no delinquency'; 1='minor delinquency only at home'; 2='minor delinquency outside of the home'; 3='moderately serious delinquency'; 4='serious delinquency'.

Alcohol use

At 24 months, 6 years, and 8 years, adolescents reported their alcohol use using the validated Substance Use Questionnaire (Molina and Pelham 2003). Three items inquired about the frequency of drinking alcohol, binge drinking (5 or more drinks in a row), and getting drunk or "very very high" on alcohol during the last 6 months. The items were scored on a 9-point scale from 1='never' to 9='everyday' (drinking) or 9='more than twice a week' (binge drinking and getting drunk). Those who reported on a prior question that they never had a drink in their lives were coded 0 on all three questions. The three items were averaged (a=0.87–0.94).

Cigarette smoking

At 24 months, 6 years, and 8 years, youth reported their smoking quantity using one item from the Substance Use Questionnaire (Molina and Pelham 2003). The questions asked about the number of cigarettes smoked on an average day in the past month and responses ranged from 1='about 2 packs or more a day' to 7='none at all'. The item was reverse-scored for analysis (1='none at all'; 7='about 2 packs or more a day'). Those who reported on a prior question that they smoked only once or never in their lives were coded 0 for past month smoking.

Marijuana use

At 24 months, 6 years, and 8 years, adolescents reported on their marijuana use frequency using the Substance Use Questionnaire (Molina and Pelham 2003). One items asked how often they used marijuana in the past 6 months, with response options ranging from 1='never' to 9='more than twice a week'. Those who reported on a prior question that they never tried marijuana were coded 0.

Depression

At 24 months, 6 years, and 8 years, adolescents self-reported depressive symptoms on the Children's Depression Inventory (CDI; Kovacs 1992) or, for those over 18 years old (37 participants at 8 years), on the Beck Depression Inventory (BDI; Beck 1987). Both

measures have been used extensively in research and have good psychometric properties ([Myers and Winters 2002](#)). Consistent with prior literature ([Hoza et al. 1993](#)), seven items from the 27-item CDI were excluded because they referred to behavioral problems common in ADHD (e.g., noncompliance). Total depression scores were computed as the average of 20 CDI items (rated 0–2) or 21 BDI items (rescaled from 0 to 3 to 0–2) (a=0.84–0.89).

Anxiety

At 24 months, 6 years, and 8 years, youth reported their anxiety symptoms on the Multidimensional Anxiety Scale for Children (MASC; [March et al. 1997](#)) or, if over 18 years old, the Beck Anxiety Inventory (BAI; [Beck et al. 1988](#)). Both measures have been extensively validated and have excellent psychometric properties ([Myers and Winters 2002](#)). Total anxiety scores were computed as the average of the 45 MASC items or the 21 BAI items (a=0.87–0.92). Both measures used a 4-point rating scale (1='never true/no problem' to 4='often true/severe problem ').

Global impairment

At 24 months, 6 years, and 8 years, parents rated adolescents' impairment using the Columbia Impairment Scale – Parent version (CIS; [Bird et al. 1993](#)). The CIS assesses impairment in behavioral, emotional, interpersonal, and task-related functioning. Behavioral functioning includes problems with behavior at home and school; emotional impairment involves feeling nervous or sad; interpersonal impairment taps problems in relationships with peers, siblings, parents, and other adults; and task-related functioning includes problems with schoolwork and involvement in leisure activities. The 13 items, rated 0='no problem' to 4='a very bad problem', were averaged (a=0.74–0.76).

Demographics

Child's age at 24 months, sex, race/ethnicity, and family SES served as demographic covariates. Race/ethnicity was coded as Non-Hispanic White (0) vs. minority (1). Parental education and income were reported by parents on ordinal scales at study entry. To derive an

index of family SES, parental education (averaged across mother and father if both were available) and family income were standardized and averaged. Higher values indicate higher SES.

Data Analysis

First, descriptive statistics and bivariate associations among variables were examined. The long-term effects of peer rejection and friendships were tested with a series of hierarchical multiple linear regressions predicting delinquency, alcohol use, cigarette smoking, marijuana use, depressive symptoms, anxiety symptoms, and global impairment at 6 and 8 years. All analyses adjusted for site (5 dichotomous contrasts) at Step 1. At Step 2, the following covariates were entered: the outcome variable assessed at 24 months, age at 24 months, sex, racial/ethnic minority status, family SES, and ADHD, ODD, and CD symptoms at 24 months. Because levels of substance use were very low at 24 months, delinquency at 24 months was used instead because it is closely related to substance use in early adolescence (Jessor et al. 1991). However, the results were identical regardless of whether 24-month delinquency or substance use was used. Peer rejection and friendship were entered at Step 3, and their interaction (testing the buffering role of friendship) was added at Step 4. MTA treatment group was not used as a covariate because it had no significant effect on peer rejection (Hoza, Gerdes, et al. 2005) or any 6- and 8-year outcomes (Molina et al. 2009).

Results

Descriptive statistics, listed in Table 1, indicated that after treatment, MTA participants were more rejected by peers than the average classmate (i.e., standardized score of 0; $t= 11.70$, $p<0.001$), but 60% of them had a reciprocal friend. MTA participants exhibited, on average, 10 ADHD symptoms, 3 ODD symptoms, and 2 CD symptoms, with substantial inter-individual variation. Consistent with existing research, delinquency peaked in middle adolescence (6 years past baseline), whereas substance use steadily increased. Anxiety symptoms decreased over time, but little change was observed in depressive symptoms and general impairment. Zero-order correlations and independent samples t-tests examined bivariate relationships

among variables. Friended children were less rejected (0.33 vs. 1.26, *t*= 8.54, *p*<0.001). ADHD and ODD symptoms (but not CD symptoms) were associated with greater peer rejection (both *r*=0.12, *p*=0.04 and 0.03), but neither symptom dimension was associated with having a reciprocal friend (*t*=1.11–1.46, *p*>0.10). ADHD, ODD, and CD symptoms were moderately intercorrelated (*r*=0.33–0.54, *p*<0.001). Correlations among the different outcome variables were weak to moderate (range 0.02–0.57), and stability correlations within each outcome (between 24 months, 6 years, and 8 years) were all below 0.60.

Table 2 shows the correlations of post-treatment peer rejection, friendship, and ADHD, ODD, and CD symptoms with all outcome variables measured at 24 months and 6 and 8 years. Peer rejection was positively associated with 24-month and 6-year delinquency, 6-year smoking, 6- and 8-year anxiety, and impairment at all three time points. Friendship was associated with lower concurrent (24 months) delinquency and depressive symptoms, but with none of the 6 and 8 year outcomes. ADHD, ODD, and CD symptoms were positively related to delinquency and impairment at all three time points. Both ADHD and ODD symptoms were also associated with higher levels of substance use at 6 years and depressive symptoms at 24 months and 8 years. Finally, ODD symptoms were linked with concurrent (24 month) substance use and CD symptoms were associated with 8-year depressive symptoms.

Table 2. Correlations of predictors and outcomes

	Peer rejection	Friendship	ADHD symptoms	ODD symptoms	CD symptoms
Delinquency					
24 months	0.12*	−0.13*	0.41*	0.47*	0.44*
6 years	0.13*	−0.07	0.22*	0.24*	0.25*
8 years	0.03	−0.05	0.21*	0.25*	0.20*
Alcohol use					
24 months	−0.01	0.06	0.05	0.13*	0.04
6 years	0.07	0.02	0.14*	0.16*	0.05
8 years	−0.06	0.09	0.03	0.02	0.09
Cigarette smoking					
24 months	0.06	−0.02	0.02	0.13*	0.09
6 years	0.12*	−0.04	0.12*	0.10	0.08
8 years	0.08	−0.02	0.08	0.08	0.04
Marijuana use					
24 months	0.04	0.08	0.09	0.13*	0.07

	Peer rejection	Friendship	ADHD symptoms	ODD symptoms	CD symptoms
6 years	−0.06	0.05	0.17*	0.14*	0.02
8 years	−0.04	0.01	−0.00	0.05	0.03
Depression					
24 months	0.11	−0.16*	0.12*	0.16*	0.12
6 years	0.05	−0.02	0.07	−0.00	−0.02
8 years	0.04	0.01	0.15*	0.22*	0.17*
Anxiety					
24 months	0.11	−0.10	0.03	−0.01	−0.12
6 years	0.20*	−0.11	0.05	0.00	−0.01
8 years	0.12*	−0.07	0.02	0.07	0.08
Impairment					
24 months	0.12*	−0.02	0.41*	0.53*	0.43*
6 years	0.19*	−0.05	0.23*	0.28*	0.31*
8 years	0.19*	−0.03	0.19*	0.27*	0.32*

*$p < 0.05$ or lower

The results of the multiple regressions are shown in Tables 3 and and4.4. After adjusting for site, the level of each outcome variable at 24 months, sociodemographics, and ADHD, ODD, and CD symptoms, peer rejection made independent contributions to delinquency, cigarette smoking, anxiety symptoms, and global impairment at 6 years. At 8 years, peer rejection independently predicted only global impairment. Consistent with the bivariate relationships reported earlier, friendship was not predictive of any outcomes at either 6 or 8 years. The interaction of peer rejection and friendship was significant only for cigarette smoking at 6 years. Follow-up analyses of simple slopes (Aiken & West, 1991) revealed that peer rejection was significantly associated with higher smoking quantity for youth who had a friend at 14 or 24 months ($\beta=0.27$, $p<0.01$), but not those who were friendless ($\beta=-0.01$, $p>0.10$).

Table 3. Standardized regression coefficients from multiple regressions predicting 6-year outcomes from post-treatment (24 month) functioning

	Delinquency		Alcohol use		Cigarette smoking		Marijuana use		Depression		Anxiety		Impairment	
	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β
Step 2	0.11***		0.12***		0.09		0.09		0.11***		0.12***		0.20***	
Outcome variable at 24 months		0.07		0.14+		0.09		0.09		0.27***		0.32***		0.26***

14

	Delinquency		Alcohol use		Cigarette smoking		Marijuana use		Depression		Anxiety		Impairment	
	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β
Age		−0.02		0.26***		0.21**		0.14*		0.03		−0.02		−0.06
Female		−0.06		−0.05		−0.08		−0.12+		0.11+		0.02		0.09+
Racial/Ethnic minority		0.17**		0.01		−0.05		0.06		0.08		0.01		0.15*
Family SES		−0.03		−0.04		−0.12+		−0.08		−0.06		0.11+		0.04
ADHD symptoms		0.08		0.07		0.09		0.13+		0.10		0.05		0.09
ODD symptoms		0.04		0.06		−0.02		0.03		−0.11		−0.04		0.02
CD symptoms		0.14*		−0.08		−0.01		−0.11		−0.03		0.06		0.18*
Step 3	0.02*		0.01		0.02+		0.01		0.00		0.03*		0.02*	
Peer rejection		0.16*		0.07		0.16*		−0.06		0.02		0.19*		0.16*
Friendship		0.01		0.09		0.06		0.06		0.05		0.03		0.07
Step 4	0.00		0.01+		0.02*		0.00		0.00		0.01		0.00	
Rejection X Friendship		0.06		0.18+		0.20*		0.09		0.02		−0.13		−0.11

All analyses control for site at Step 1. N ranges from 263 to 278
*p<.05;
**p<.01;
***p<.001

Table 4. Standardized regression coefficients from multiple regressions predicting 8-year outcomes from post-treatment (24 month) functioning

	Delinquency		Alcohol use		Cigarette smoking		Marijuana use		Depression		Anxiety		Impairment	
	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β
Step 2	0.10***		0.12***		0.10**		0.11**		0.10**		0.07**		0.19**	
Outcome variable at 24 months		0.17*		0.05		0.07		0.15*		0.21***		0.17**		0.26
Age		−0.03		0.28***		0.24***		0.29***		−0.07		−0.11		−0.07

	Delinquency		Alcohol use		Cigarette smoking		Marijuana use		Depression		Anxiety		Impairment	
	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β	ΔR²	β
Female		−0.03		−0.12+		−0.05		−0.10		0.11		0.15**		0.05
Racial/Ethnic minority		0.05		−0.11		−0.11		0.03		0.04		−0.11+		0.17
Family SES		−0.12+		−0.03		−0.16*		−0.05		0.05		0.00		0.03
ADHD symptoms		0.07		0.05		0.05		−0.05		0.01		0.05		0.08
ODD symptoms		0.06		0.09		0.00		−0.05		0.13		0.04		−0.01
CD symptoms		0.04		0.10		−0.02		−0.01		0.06		0.06		0.18
Step 3	0.00		0.01		0.01		0.00		0.01		0.01		0.03*	
Peer rejection		0.00		−0.01		0.13+		0.00		−0.02		0.09		0.20**
Friendship		0.00		0.07		0.05		0.00		0.10		0.00		0.12
Step 4	0.00		0.00		0.01+		0.00		0.00		0.00		0.00	
Rejection X Friendship		−0.09		0.01		0.20+		0.04		0.03		−0.05		−0.04

All analyses control for site at Step 1. N ranges from 213 to 263
*p<.05;
**p<.01;
***p<.001

Discussion

This prospective study suggests that peer rejection of children with ADHD predicts a number of later negative outcomes, particularly during middle adolescence. Specifically, children with ADHD who were more rejected by peers when they were on average 10 years old engaged in more serious delinquency, smoked more heavily, and experienced more anxiety and general impairment 4 to 5 years later, in middle adolescence (average age 14–15). Although most of these effects dissipated by late adolescence (average age 16–17), childhood peer rejection continued to predict general impairment. Unlike peer rejection, having a reciprocal friend in childhood was not associated with later outcomes, and reciprocal friendships did not appear to buffer the detrimental effects of peer rejection. On the contrary, peer

rejection was predictive of later heavier smoking only among youth who had a reciprocal friend in childhood, but not among those who were friendless. It is notable that the long-term negative sequelae of peer rejection were observed even after accounting for a large number of covariates. In particular, because continuity in the outcome variables over time was accounted for, the results suggest that peer rejection contributes to an increase (or reduces a normative decrease) in delinquency, smoking, anxiety, and impairment from childhood to adolescence. Likewise, the impact of peer rejection was independent of the long-term effects of ADHD, ODD, and CD symptoms experienced by the children, which were also included as covariates. Thus, although externalizing psychopathology typically leads to peer rejection in the first place (Mrug et al. 2001), peer rejection further aggravates the poor outcomes these children experience.

How does peer rejection contribute to these outcomes? The distress resulting from social exclusion and increased victimization that peer rejected children often experience, coupled with lack of social support from peers, may over time translate into increased symptoms of anxiety (Grills and Ollendick 2002; Mayeux et al. 2007). MacDonald and Leary (2005) elucidate the physiological mechanisms responsible for these effects by explaining how the painful perception of social exclusion triggers a physiological defense system that leads to fear, avoidance, and panic response in social situations. This increased anxiety is likely to further compound difficulties in peer interactions and relationships (LaGreca and Lopez 1998). Interestingly, peer rejection was correlated with anxiety symptoms experienced 4–5 years later but not concurrently at 14 and 24 months, suggesting that this process whereby peer rejection increases anxiety evolves over extended periods of time. However, it is also possible that peer rejection and anxiety share common underlying causes, but differ in developmental timing of manifestation.

Although depressive symptoms typically co-occur with anxiety ($r=0.29–0.38$, $p<0.001$ in the present study), a different pattern of results was obtained for these two types of internalizing distress. Specifically, peer rejection was related to anxiety, but not to depressive symptoms at any of the three time points (24 months, 6 and 8 years). This finding appears to contradict the well-established association of peer rejection with depressive symptoms in normative

samples (e.g., Boivin et al. 1994; Panak and Garber 1992). However, it is consistent with studies failing to find a link between childhood ADHD and depression (Bagwell et al. 2006; Mannuzza et al. 1993). Several lines of research offer clues explaining this apparent contradiction. When peer-rejected children are classified into different subtypes, elevated depressive symptoms are observed only among those *without* externalizing behavior problems (Coie et al. 1992). This suggests that externalizing problems may protect peer-rejected youth from experiencing depression, perhaps due to inaccurate appraisal of their social functioning. Indeed, *perceived* rejection mediates the effect of actual peer rejection on depression (Panak and Garber 1992), and children with ADHD view themselves as socially competent despite their overwhelming social failure (Hoza et al. 2002; Hoza et al. 2000). Thus, rejected children with ADHD may be protected from developing depressive symptoms by their overly positive appraisal of their peer status, a speculation that awaits empirical verification.

Among externalizing outcomes, peer rejection was uniquely predictive of more serious delinquency and heavier smoking in middle adolescence. It is possible that children with ADHD who were rejected by peers later gravitated to other rejected youth who were more likely to smoke and engage in delinquency, thus facilitating these behaviors through modeling, provision of opportunities, and positive reinforcement (Berndt 1999). Alternatively, these children with ADHD and their rejected friends may have initiated delinquency and smoking together as attempts to "retaliate" against or differentiate themselves from conventional peers. The interaction of friendship with peer rejection, indicating increased risk of smoking only for peer-rejected youth who also had a reciprocal friend, is consistent with this presumed key role of friends in the promotion of antisocial behavior. It is unclear why peer rejection was predictive of delinquency and smoking, but not of alcohol and marijuana use. All of these externalizing behaviors typically cluster together (Jessor et al. 1991) and were weakly to moderately intercorrelated in the present study (at 6 years: r=0.19–0.57, p<0.001). However, neither alcohol nor marijuana use was related to peer rejection. It is possible that the normatively high levels of alcohol use and low levels of marijuana use in middle adolescence (Johnston et al. 2009) attenuated any individual differences due to peer rejection.

One of the strongest effects of peer rejection, and the only effect that endured from middle to late adolescence, was for global impairment. The Columbia Impairment Scale used in the present study taps impairment across several domains, including behavior, emotions, social relationships, and involvement in activities. In order to pinpoint the main areas of impairment associated with childhood peer rejection, we examined the correlations of childhood peer rejection with parent ratings of individual impairment items at 6 and 8 years. A clear pattern emerged, with childhood peer rejection being consistently associated with problems in relationships (with peers, siblings, and adults other than parents), emotions (feeling unhappy or sad, not having fun, feeling nervous or afraid), behavior at home, and low involvement in activities (e.g., sports and hobbies). By contrast, peer rejection was not significantly related to impairments in child–parent relationships, behavior at school, schoolwork, and "getting into trouble." Because impairment in peer relationships might indicate continued peer rejection rather than a separate outcome, we reanalyzed the effects of peer functioning on impairment after excluding the one CIS item addressing difficulties in peer relationships. Peer rejection remained a significant predictor of impairment throughout adolescence, with its coefficients not decreasing in magnitude (β=0.16, p<05, at 6 years; β=0.21, p<0.01, at 8 years). These results were consistent with the correlations reported above, indicating that the long-term effects of peer rejection generalize to other areas of impairment beyond peer relationships. Although the widespread relationship problems experienced by peer-rejected children with ADHD may partly result from the same deficits that earlier contributed to peer rejection, it is still likely that peer rejection further compounded these deficits by depriving the youth of important opportunities to learn and refine their social skills (Murray-Close et al. 2010) and by facilitating the development of maladaptive social cognitions and behaviors (e.g., hostile attribution bias, aggression; Lansford et al. 2010). It is likely that these long-term, generalized relationship problems were at least partly responsible for impairments reported in the other domains, such as restricted leisure activities, emotional problems, and problem behavior at home.

Another interesting aspect of the present results is the developmental timing of the long-term effects of peer rejection. Apart from global impairment, peer rejection predicted other negative

outcomes only in middle adolescence, but not in late adolescence. One possible explanation is that despite the continuity in individual differences in peer relationship problems, these problems have generally lessened from middle to late adolescence. Indeed, paired samples t-tests of averaged CIS relationship impairment items indicated a significant decrease between these two time points ($M_{6yr}=$ 1.05 vs. $M_{8yr}=0.85$, $t=4.12$, $p<0.001$). Thus, improvement in relationships by late adolescence may have contributed to a decreased effect of previous peer rejection on functioning. Possibly the transition from middle school to high school with a new set of peers attenuated the original peer rejection and/or gave the individuals a second chance at peer acceptance. Another explanation is that the general decrease in anxiety and delinquency and the overall increase in smoking observed in the sample from middle to late adolescence (paired samples t-tests $p<0.05$) attenuated the effects of childhood predictors, including peer rejection, on functioning. Except for anxiety, which is typically stable or increases during this developmental period (Van Oort et al. 2009), these changes are consistent with normative trends observed in community samples (Johnston et al. 2009; Moffitt 1993). Thus, although not explicitly investigated in other studies, it is possible that the lower predictive utility of peer rejection for late (vs. middle) adolescent outcomes may be present in normative populations as well.

Although having a reciprocal friend was associated with fewer depressive symptoms and lower delinquency in childhood, it was not related to any adolescent outcomes. Additionally, having a friend did not protect children from the negative long-term effects of peer rejection. On the contrary, peer rejection predicted middle adolescent smoking only for children who had a reciprocal friend. These results are inconsistent with existing literature on the protective function of friendships for rejected and victimized children (e.g., Hodges et al. 1999; Laursen et al. 2007). However, studies also show that the ability of friendships to protect children from negative outcomes depends on the quality of the friendships and characteristics of the friends. For instance, close friendships are related to better emotional adjustment, whereas friendships high in conflict increase disruptive behavior (Ciairano et al. 2007; Dishion et al. 1996). Likewise, friendships with aggressive peers predict more externalizing and internalizing problems over time (Mrug et al. 2004). Thus, the failure of friendships to protect children with ADHD from long-term negative outcomes may be

explained by generally lower quality of their friendships and more deviant behavior of their friends demonstrated by multiple studies ([Blachman and Hinshaw 2002](#); [Bagwell et al. 2001](#); [Heiman 2005](#); [Marshal et al. 2003](#)). Another reason for the lower predictive utility of friendship is lower stability of friendship compared to peer rejection. In the subsample of children who had sociometric data at both 14 and 24 months, the stability of having a reciprocal friend was only .17 ($p<0.05$) compared to .33 ($p<0.001$) for peer rejection. Thus, peer rejection may have stronger effects on later outcomes because it is more enduring, whereas friendlessness may not be associated with long-term outcomes because it is more likely to change over time. Finally, it is possible that the definition of friendship used in this study (one of top two friendship nominations having to be reciprocated) was too restrictive and that having any friendships (i.e., not just with the two best liked peers) may be protective. To address the possibility, we reanalyzed the data using reciprocal friendships based on unlimited nominations (i.e., whether any of the child friendship nominations were reciprocated). The results remained identical. It will be important for future research to address whether friendships with certain characteristics (e.g., high stability, high quality, with well-behaved friends) are protective for this vulnerable population of children.

This work has important implications for clinicians assessing and treating children with ADHD. Because peer rejection is prognostic of long-term negative outcomes and is highly prevalent in this population ([Hoza, Mrug, et al. 2005](#)), peer relationship problems should be routinely assessed when considering a diagnosis of ADHD. Although the gold standard of measuring peer rejection with peer reports in the children's classrooms is clearly not feasible for most clinicians, useful approximation can be obtained from teacher and parent report. A number of existing questionnaires (e.g., the Child Behavior Checklist; [Achenbach and Rescorla 2001](#); or teacher report of social preference; [Dishion et al. 1995](#)) include questions or scales that evaluate peer relationship problems. Even simply asking whether the child gets along with peers, gets invited to birthday parties, or has a best friend with whom they visit each other's homes may yield useful insights. Indeed, a recent study showed that teacher reports of children's social status are not as efficient as peer reports, but they are in moderate agreement with peer measures ([McKown et al. 2011](#)).

Because peer rejection appears to contribute to long-term problems but does not respond optimally to standard ADHD treatments (i.e., medication and behavior therapy) (Hoza, Gerdes, et al. 2005), additional interventions are needed to lessen its negative impact. In addition to standard ADHD interventions, one or more of the following approaches may be considered for improving the outcomes of peer-rejected children with ADHD: 1) Improving underlying social skills deficits (e.g., through cognitive-behavioral social skills training), combined with structured, positive interactions with peers in the natural peer environment (Mrug et al. 2001); 2) Compensating for peer relationship difficulties in the primary peer setting (e.g., school) by promoting supportive relationships with peers or adults in other settings (e.g., structured after-school activities, church-based youth groups); 3) Regular monitoring of negative outcomes commonly associated with peer rejection (e.g., peer victimization, affiliation with deviant peers, delinquency, smoking, anxiety); and 4) Preventing these outcomes or intervening immediately once they are detected. Given the salient and pervasive nature of peer rejection, it is likely that multiple strategies will be necessary to improve long-term functioning of these children. Additionally, more research is needed to develop interventions that would help alleviate peer rejection in this population or help protect these children from the negative effects of peer rejection. Although some authors have speculated that helping children with ADHD develop friendships may compensate for the negative impact of peer rejection (Mikami 2010; Mrug et al. 2001), the present results cast doubt on the ability of friendships to provide long-term protection. However, it is possible that friendship interventions could be effective if they succeeded in helping these children develop stable, high quality friendships that are low in conflict and involve non-deviant peers. The extent to which this is possible and whether such friendships have protective effects in this population remains to be determined.

Although this study has multiple strengths including a large, multi-site sample of rigorously diagnosed children with ADHD Combined type who were followed over time; multi-informant assessment that included peer reports of peer rejection; and statistical adjustments for a number of potentially confounding variables, there are also limitations. Limitations include focus on only the Combined subtype of ADHD, attrition in the MTA study over time, and exclusion

of children who did not have sociometric data at 14 or 24 months. Hence, the present findings may not generalize to other ADHD subtypes and to children who were less likely to have complete data for this report (e.g., racial minorities, girls, those in special education classes). Another limitation of the study is the absence of information on autistic symptoms which are highly prevalent among children with Combined type ADHD ([Clark et al. 1999](); [Reiersen et al. 2007]()). Because social impairment is a core symptom dimension of Autistic Spectrum Disorders and these disorders are highly persistent and impairing, it is possible that some of the present results may be explained by persistent autistic-like social deficits and their impact on functioning. However, entry screens included clinical evaluation by a doctoral-level clinician who applied all 5 DSM-IV criteria, including the exclusion for pervasive developmental disorder, so autistic symptoms were not likely to be prominent in this sample. Clearly, studying social impairment and its long-term effects in "pure" vs. "autistic" ADHD is an important priority for future research.

In summary, this report identifies peer rejection as an important factor that helps explain long-term impairments in children with ADHD that persist despite treatment. Childhood peer rejection was uniquely predictive of delinquency, smoking, anxiety, and global impairment in middle adolescence. Although the more specific effects of peer rejection dissipated by late adolescence, peer rejection continued to predict global impairment. Although many children with ADHD had a reciprocal friend in childhood, friendships did not protect them against the negative effects of peer rejection. These findings highlight the need to routinely assess peer problems in children with ADHD and to address these problems and associated risks as an integral part of treatment.

[Table 1](). Descriptive statistics

	24 months 6 years M (SD) M (SD)	8 years M (SD)	Range (all time points)
Predictors			
Age at 24 months	10.35 (0.84)		8.80–12.40
Female, N (%)	59 (20%)		
Racial/ethnic minority, N (%)	102 (34%)		
Family SES[a]	−0.09 (0.85)		−2.06–1.67
Peer rejection	0.70 (1.04)		−1.70–3.25
Friendship, N (%)	179 (60%)		

	24 months M (SD)	6 years M (SD)	8 years M (SD)	Range (all time points)
ADHD symptoms	10.57 (5.47)			0–18
ODD symptoms	3.39 (2.88)			0–8
CD symptoms	2.39 (2.39)			0–13
Outcomes				
Delinquency	1.91 (1.55)	2.05 (1.59)	1.80 (1.57)	0–4
Alcohol use	0.07 (0.34)	0.76 (1.36)	1.60 (2.01)	0–8.33
Cigarette smoking	0.05 (0.30)	0.51 (1.16)	0.88 (1.50)	0–7
Marijuana use	0.01 (0.10)	0.83 (2.01)	1.68 (2.80)	0–9
Depression	0.22 (0.23)	0.19 (0.22)	0.22 (0.27)	0–1.40
Anxiety	2.27 (0.46)	1.91 (0.41)	1.75 (0.43)	1–3.67
Impairment	1.08 (0.62)	1.18 (0.64)	1.07 (0.68)	0–3.31

[a]Average of two z-scores

Acknowledgments

Karen C. Wells, Ph.D., Jeffery Epstein, Ph.D.; previous Duke contributors to early phases: C. Keith Conners, Ph.D. (former PI); John March, M.D., M.P.H.; University of California, Irvine: James Swanson, Ph.D., Timothy Wigal, Ph.D.; previous contributor from UCLA to the early phases: Dennis P. Cantwell, M.D. (deceased); Long Island Jewish Medical Center/New York University: Howard B. Abikoff, Ph.D.; Montreal Children's Hospital/McGill University: Lily Hechtman, M.D.; New York State Psychiatric Institute/Columbia University/Mount Sinai Medical Center: Laurence L. Greenhill, M.D. (Columbia), Jeffrey H. Newcorn, M.D. (Mount Sinai School of Medicine). University of Pittsburgh: Brooke Molina, Ph.D., Betsy Hoza, Ph.D. (currently at University of Vermont), William E. Pelham, Ph.D. (PI for early phases, currently at Florida International University). Follow-up phase statistical collaborators: Robert D. Gibbons, Ph.D. (University of Illinois, Chicago); Sue Marcus, Ph.D (Mt. Sinai College of Medicine); Kwan Hur, Ph.D. (University of Illinois, Chicago). Original study statistical and design consultant: Helena C. Kraemer, Ph.D. (Stanford University). Collaborator from the Office of Special Education Programs/US Department of Education: Thomas Hanley, Ed.D. Collaborator from Office of Juvenile Justice and Delinquency Prevention/Department of Justice: Karen Stern, Ph.D.

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References

Achenbach TM, Rescorla LA. Manual for the ASEBA school-age forms and profiles: An integrated system of multi-informant

assessment. Burlington, VT: Research Center for Children, Youth, and Families; 2001.

Aiken LS, West SG. Multiple regression: Testing and interpreting interactions. London: Sage; 1991.

American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4. Washington, DC: American Psychiatric Association; 1994. (DSM-IV)

August GJ, Winters KC, Realmuto GM, Fahnhorst T, Botzet A, Lee S. Prospective study of adolescent drug use among community samples of ADHD and non-ADHD participants. Journal of the American Academy of Child and Adolescent Psychiatry. 2006;45:824–832.

Bagwell CL, Molina BS, Kashdan TB, Pelham WE, Hoza B. Anxiety and mood disorders in adolescents with childhood attention-deficit/hyperactivity disorder. Journal of Emotional and Behavioral Disorders. 2006;14:178–187.

Bagwell CL, Molina BS, Pelham WE, Hoza B. Attention-deficit hyperactivity disorder and problems in peer relations: predictions from childhood to adolescence. Journal of the American Academy of Child and Adolescent Psychiatry. 2001;40:1285–1292.

Bagwell CL, Newcomb AF, Bukowski WM. Preadolescent friendship and peer rejection as predictors of adult adjustment. Child Development. 1998;69:140–153.

Barkley RA, Fischer M, Smallish L, Fletcher K. Young adult follow-up of hyperactive children: antisocial activities and drug use. Journal of Child Psychology and Psychiatry. 2004;45:195–211.

Beck AT. Beck depression inventory: manual. San Antonio: Psychological Corporation; 1987.

Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. Journal of Consulting and Clinical Psychology. 1988;56:893–897.

Berndt TJ. Friends' influence on students' adjustment to school. Educational Psychologist. 1999;34:15–28.

Biederman J, Monuteaux MC, Mick E, Wilens TE, Fontanella JA, Poetzl KM, Kirk T, Masse J, Faraone SV. Is cigarette smoking a gateway to alcohol and illicit drug use disorders? A study of youths with and without attention deficit hyperactivity disorder. Biological Psychiatry. 2006;59:258–264.

Biederman J, Petty CR, Dolan C, Hughes S, Mick E, Monuteaux MC, Faraone SV. The long-term longitudinal course of oppositional defiant disorder and conduct disorder in ADHD boys: findings from a controlled 10-year prospective longitudinal follow-up study. Psychological Medicine. 2008;38:1027–1036.

Bird HR, Shaffer D, Fisher P, Gould MS, Staghezza B, Chen JY, Hoven C. The Columbia Impairment Scale (CIS): pilot findings on a measure of global impairment for children and adolescents. International Journal of Methods in Psychiatric Research. 1993;3:167–176.

Blachman DR, Hinshaw SP. Patterns of friendship among girls with and without attention-deficit/hyperactivity disorder. Journal of Abnormal Child Psychology. 2002;30:625–640.

Boivin M, Poulin F, Vitaro F. Depressed mood and peer rejection in childhood. Development and Psychopathology. 1994;6:483–498.

Buhs ES, Ladd GW. Peer rejection as an antecedent of young children's school adjustment: an examination of mediating process. Developmental Psychology. 2001;37:550–560.

Bukowski WM, Hoza B. Popularity and friendship: Issues in theory, measurement, and outcome. In: Berndt TJ, Ladd GW, editors. Peer relationships in child development. New York: Wiley; 1989. pp. 15–45.

Cardoos S, Hinshaw SP. Friendship as protection from peer victimization for girls with and without ADHD. Journal of Abnormal Child Psychology. 2011;39:1035–1045.

Chronis-Tuscano A, Molina BS, Pelham WE, Applegate B, Dahlke A, Overmyer M, Lahey BB. Very early predictors of adolescent depression and suicide attempts in children with attention-deficit/hyperactivity disorder. Archives of General Psychiatry. 2010;67:1044–1051.

Ciairano S, Rabaglietti E, Roggero A, Bonino S, Beyers W. Patterns of adolescent friendships, psychological adjustment and antisocial behavior: The moderating role of family stress and friendship reciprocity. International Journal of Behavioral Development. 2007;31:539–548.

Clark T, Feehan C, Tinline C, Vostanis P. Autistic symptoms in children with attention deficit-hyperactivity disorder. European Child & Adolescent Psychiatry. 1999;8:50–55.

Coie JD, Dodge KA, Coppotelli H. Dimensions and types of social status: a crossage perspective. Developmental Psychology. 1982;18:557–571.

Coie JD, Lochman JE, Terry R, Hyman C. Predicting early adolescent disorder from childhood aggression and peer rejection. Journal of Consulting and Clinical Psychology. 1992;60:783–792.

Cowen EL, Pederson A, Babigian H, Izzo LD, Trost MA. Long-term follow-up of early detected vulnerable children. Journal of Consulting and Clinical Psychology. 1973;41:438–446.

Dishion TJ, Andrews DW, Crosby L. Antisocial boys and their friends in early adolescence: relationship characteristics, quality, and interactional process. Child Development. 1995;66:139–151.

Dishion TJ, Spracklen KM, Andrews DW, Patterson GR. Deviancy training in male adolescent friendships. Behavior Therapy. 1996;27:373–390.

Elliott D, Huizinga D, Ageton S. Explaining delinquency and drug use. Beverly Hills: Sage; 1985.

Fite PJ, Colder CR, Lochman JE, Wells KC. Pathways from proactive and reactive aggression to substance use. Psychology of Addictive Behaviors. 2007;21:355–364.

Greene RW, Biederman J, Faraone SV, Sienna M, Garcia-Jetton J. Adolescent outcome of boys with attention-deficit/hyperactivity disorder and social disability: results from a 4-year longitudinal follow-up study. Journal of Consulting and Clinical Psychology. 1997;65:758–767.

Grills AE, Ollendick TH. Peer victimization, global self-worth, and anxiety in middle school children. Journal of Clinical Child and Adolescent Psychology. 2002;31:59–68.

Hanish LD, Guerra NG. A longitudinal analysis of patterns of adjustment following peer victimization. Development and Psychopathology. 2002;14:69–89.

Heiman T. An examination of peer relationships of children with and without attention deficit hyperactivity disorder. School Psychology International. 2005;26:330–339.

Hinshaw SP, March JS, Abikoff H, Arnold LE, Cantwell DP, Conners CK, Elliott GR, Halperin J, Greenhill LL, Hechtman LT, Hoza B, Jensen PS, Newcorn JH, Mcburnett K, Pelham WE, Richters JE, Severe JB, Schiller E, Swanson JM, Vereen D, Wells KC. Comprehensive assessment of childhood attention-deficit

hyperactivity disorder in the context of a multisite, multimodal clinical trial. Journal of Attention Disorders. 1997;1:217–234.

Hinshaw SP, Melnick S. Peer relationships in children with attention-deficit hyperactivity disorder with and without comorbid aggression. Development and Psychopathology. 1995;7:627–647.

Hodgens JB, Cole J, Boldizar J. Peer-based differences among boys with ADHD. Journal of Clinical Child Psychology. 2000;29:443–452.

Hodges EVE, Boivin M, Vitaro F, Bukowski WM. The power of friendship: protection against an escalating cycle of peer victimization. Developmental Psychology. 1999;35:94–101.

Hodges EVE, Malone MJ, Perry DG. Individual risk and social risk as interacting determinants of victimization in the peer group. Developmental Psychology. 1997;33:1032–1039.

Hoza B, Gerdes AC, Mrug S, Hinshaw SP, Bukowski WM, Gold JA, Arnold LE, Abikoff HB, Conners CK, Elliott GR, Greenhill LL, Hechtman L, Jensen PS, Kraemer HC, March JS, Newcorn JH, Severe JB, Swanson JM, Vitiello B, Wells KC, Wigal T. Peer-assessed outcomes in the multimodal treatment study of children with attention deficit hyperactivity disorder. Journal of Clinical Child and Adolescent Psychology. 2005;34:74–86.

Hoza B, Mrug S, Gerdes AC, Hinshaw SP, Bukowski WM, Gold JA, Kraemer HC, Pelham WE, Jr, Wigal T, Arnold LE. What aspects of peer relationships are impaired in children with attention-deficit/hyperactivity disorder? Journal of Consulting and Clinical Psychology. 2005;73:411–423.

Hoza B, Pelham WE, Dobbs J, Owens JS, Pillow DR. Do boys with attention-deficit/hyperactivity disorder have positive illusory self concepts? Journal of Abnormal Psychology. 2002;111:268–278.

Hoza B, Pelham WE, Milich R, Pillow D, Mcbride K. The self-perceptions and attributions of attention deficit hyperactivity disordered and nonreferred boys. Journal of Abnormal Child Psychology. 1993;21:271–286.

Hoza B, Waschbusch DA, Pelham WE, Molina BSG, Milich R. Attention-deficit/hyperactivity disordered and control boys' responses to social success and failure. Child Development. 2000;71:432–446.

Jensen PS, Arnold LE, Swanson JM, Vitiello B, Abikoff HB, Greenhill LL, Hechtman L, Hinshaw SP, Pelham WE, Wells KC, Conners CK, Elliott GR, Epstein JN, Hoza B, March JS, Molina BS, Newcorn JH, Severe JB, Wigal T, Gibbons RD, Hur K. 3-year follow-up of the NIMH MTA study. Journal of the American Academy of Child and Adolescent Psychiatry. 2007;46:989–1002.

Jessor R, Donovan JE, Costa FM. Beyond adolescence: problem behavior and young adult development. Cambridge: Cambridge University Press; 1991.

Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. Secondary school students (NIH Publication No 09–7402) I. Bethesda: National Institute on Drug Abuse; 2009. Monitoring the future national survey results on drug use, 1975–2008.

Johnston C, Pelham WE, Murphy HA. Peer relationships in ADDH and normal children: a developmental analysis of peer and teacher ratings. Journal of Abnormal Child Psychology. 1985;13:89–100.

King SM, Iacono WG, McGue M. Childhood externalizing and internalizing psychopathology in the prediction of early substance use. Addiction. 2004;99:1548–1559.

Kovacs M. Children's Depression Inventory (CDI) New York: Multi-health Systems, Inc; 1992.

LaGreca AM, Lopez N. Social anxiety among adolescents: linkages with peer relations and friendships. Journal of Abnormal Child Psychology. 1998;26:83–94.

Lahey BB, Hartung CM, Loney J, Pelham WE, Chronis AM, Lee SS. Are there sex differences in the predictive validity of DSM-IV ADHD among younger children? Journal of Clinical Child and Adolescent Psychology. 2007;36:113–126.

Laird RD, Jordan KY, Dodge KA, Pettit GS, Bates JE. Peer rejection in childhood, involvement with antisocial peers in early adolescence, and the development of externalizing behavior problems. Development and Psychopathology. 2001;13:337–354.

Lansford JE, Malone PS, Dodge KA, Pettit GS, Bates JE. Developmental cascades of peer rejection, social information processing biases, and aggression during middle childhood. Development and Psychopathology. 2010;22:593–602.

Laursen B, Bukowski WM, Aunola K, Nurmi JE. Friendship moderates prospective associations between social isolation and

adjustment problems in young children. Child Development. 2007;78:1395–1404.

Lee SS, Lahey BB, Owens EB, Hinshaw SP. Few preschool boys and girls with ADHD are well-adjusted during adolescence. Journal of Abnormal Child Psychology. 2008;36:373–383.

Loeber R, Farrington DP, Stouthamer-Loeber M, Van Kammen WB. Antisocial behavior and mental health problems. Explanatory factors in childhood and adolescence. Mahwah: Erlbaum; 1998.

Loeber R, Stouthamer-Loeber M, Van Kammen WB, Farrnington DP. Development of a new measure of self-reported antisocial behavior for young children: prevalence and reliability. In: Klein MW, editor. Cross-national research in self-reported crime and delinquency. Boston: Kluwer; 1989. pp. 203–225.

MacDonald G, Leary MR. Why does social exclusion hurt? The relationship between social and physical pain. Psychological Bulletin. 2005;131:202–223.

Mannuzza S, Klein RG, Bessler A, Malloy P, LaPadula M. Adult outcome of hyperactive boys. Educational achievement, occupational rank, and psychiatric status. Archives of General Psychiatry. 1993;50:565–576.

Mannuzza S, Klein RG, Moulton JL. Lifetime criminality among boys with attention deficit hyperactivity disorder: a prospective follow-up study into adulthood using official arrest records. Psychiatry Research. 2008;160:237–246.

March JS, Parker JDA, Sullivan K, Stallings P, Conners CK. The Multidimensional Anxiety Scale for Children (MASC): Factor structure, reliability, and validity. Journal of the American Academy of Child and Adolescent Psychiatry. 1997;36:554–565.

Marshal MP, Molina BSG, Pelham WE. Childhood ADHD and adolescent substance use: an examination of deviant peer group affiliation as a risk factor. Psychology of Addictive Behaviors. 2003;17:293–302.

Mayeux L, Bellmore AD, Cillessen AH. Predicting changes in adjustment using repeated measures of sociometric status. Journal of Genetic Psychology. 2007;168:401–424.

McKown C, Gumbiner LM, Johnson J. Diagnostic efficiency of several methods of identifying socially rejected children and effect of participation rate on classification accuracy. Journal of School Psychology. 2011;49:573–595.

Mikami AY. The importance of friendship for youth with attention-deficit/hyperactivity disorder. Clinical Child and Family Psychology Review. 2010;13:181–198.

Mikami AY, Hinshaw SP. Resilient adolescent adjustment among girls: buffers of childhood peer rejection and attention-deficit/hyperactivity disorder. Journal of Abnormal Child Psychology. 2006;34:825–839.

Moffitt TE. Adolescence-limited and life-course-persistent antisocial behavior: a developmental taxonomy. Psychological Review. 1993;100:674–701.

Molina BS, Hinshaw SP, Swanson JM, Arnold LE, Vitiello B, Jensen PS, Epstein JN, Hoza B, Hechtman L, Abikoff HB, Elliott GR, Greenhill LL, Newcorn JH, Wells KC, Wigal T, Gibbons RD, Hur K, Houck PR. The MTA at 8 years: prospective follow-up of children treated for combined-type ADHD in a multisite study. Journal of the American Academy of Child and Adolescent Psychiatry. 2009;48:484–500.

Molina BSG, Pelham WE. Childhood predictors of adolescent substance use in a longitudinal study of children with ADHD. Journal of Abnormal Psychology. 2003;112:497–507.

Monahan KC, Steinberg L, Cauffman E. Affiliation with antisocial peers, susceptibility to peer influence, and antisocial behavior during the transition to adulthood. Developmental Psychology. 2009;45:1520–1530.

Mrug S, Hoza B, Bukowski WM. Choosing or being chosen by aggressive– disruptive peers. Do they contribute to children's externalizing and internalizing problems? Journal of Abnormal Child Psychology. 2004;32:53–65.

Mrug S, Hoza B, Gerdes AC. Children with attention-deficit/hyperactivity disorder: peer relationships and peer-oriented interventions. New Directions in Child and Adolescent Development. 2001:51–77.

MTA Cooperative Group. A 14-month randomized clinical trial of treatment strategies for attention-deficit/hyperactivity disorder. Archives of General Psychiatry. 1999;56:1073–1086.

Murray-Close D, Hoza B, Hinshaw SP, Arnold LE, Swanson J, Jensen PS, Hechtman L, Wells K. Developmental processes in peer problems of children with attention-deficit/hyperactivity disorder in the multimodal treatment study of children with ADHD:

developmental cascades and vicious cycles. Development and Psychopathology. 2010;22:785–802.

Myers K, Winters NC. Ten-year review of rating scales: II. Scores for internalizing disorders. Journal of the American Academy of Child and Adolescent Psychiatry. 2002;41:634–659.

Panak WF, Garber J. Role of aggression, rejection, and attributions in the prediction of depression in children. Development and Psychopathology. 1992;4:145–165.

Parker JG, Asher SR. Friendship and friendship quality in middle childhood: links with peer group acceptance and feelings of loneliness and social dissatisfaction. Developmental Psychology. 1993;29:611–621.

Parker J, Rubin KH, Erath S, Wojslawowicz JC, Buskirk AA. Peer relationships and developmental psychopathology. In: Cicchetti D, Cohen D, editors. Developmental psychopathology: risk, disorder, and adaptation. 2. New York: Wiley; 2006. pp. 419–493.

Pedersen S, Vitaro F, Barker ED, Borge AI. The timing of middle-childhood peer rejection and friendship: linking early behavior to early-adolescent adjustment. Child Development. 2007;78:1037–1051.

Pelham WE, Schnedler RW, Bender ME, Miller J, Nilsson D, Budrow M, et al. The combination of behavior therapy and methylphenidate in the treatment of hyperactivity: A therapy outcome study. In: Bloomingdale L, editor. Attention deficit disorders. London: Pergamon; 1988. pp. 29–48.

Poulin F, Dishion TJ, Haas E. The peer influence paradox: friendship quality and deviancy training within male adolescent friendships. Merrill-Palmer Quarterly. 1999;45:42–61.

Reiersen AM, Constantino JN, Volk HE, Todd RD. Autistic traits in a population-based ADHD twin sample. Journal of Child Psychology and Psychiatry. 2007;48:464–472.

Van Oort FV, Greaves-Lord K, Verhulst FC, Ormel J, Huizink AC. The developmental course of anxiety symptoms during adolescence: the TRAILS study. Journal of Child Psychology and Psychiatry. 2009;50:1209–1217.

Whalen CK, Henker B, Buhrmester D, Hinshaw SP, Huber A, Laski K. Does stimulant medication improve the peer status of

hyperactive children? Journal of Consulting and Clinical Psychology. 1989;57:545–549.

Wills TA, Cleary SD. Peer and adolescent substance use among 6th–9th graders: latent growth analyses of influence versus selection mechanisms. Health Psychology. 1999;18:453–463.