Peer Relationships among Children with Symptoms of Attention-Deficit/Hyperactivity

Disorder: A Developmental Psychopathology Perspective

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Abstract

The goals of the present study were to (1) systematically examine aspects of peer functioning that are *concurrently* and *longitudinally* associated with ADHD symptoms; (2) investigate differential and independent effects of inattention and hyperactivity/ impulsivity on peer functioning; (3) examine potential mechanisms and processes involved; (4) study longitudinal effects of ADHD symptoms as well as the dynamic interplay between ADHD symptoms and their associated peer impairment over time; (5) explore potential risk and protective factors underlying the link between ADHD symptoms and peer problems; (6) explore the effect of gender; and (7) expand the current literature in this area of research to a non-Western culture (i.e., Taiwan). The sample of this study consisted of 739 preadolescents (239 fourth graders and 500 fifth graders) from northern Taiwan who participated in a short-term longitudinal study across three time points, six months apart. Overall, results indicated that inattention and hyperactivity/impulsivity each showed *unique* and *independent* (both concurrent and longitudinal) associations with a variety of peer relationship problems. Moreover, each core domain of ADHD was associated with different patterns of social behaviors (i.e., relational aggression, physical aggression, prosocial behavior), conferring differential pathways and mechanisms underlying peer impairment. Findings also showed a vicious cycle in which ADHD symptoms predicted later peer impairment, which in turn lead to increases in ADHD symptoms. This study further revealed some potential protective factors (e.g., high levels of prosocial behavior and low levels of physical aggression, relational aggression, and depressive symptoms) that may buffer against peer dislike in

youth with ADHD symptoms. In addition, ADHD symptoms may affect girls' peer

functioning to a greater extent than boys'. Taken together, the present findings from a

Taiwanese sample, in comparison to the Western literature, demonstrated both

similarities and differences in the associations between children's ADHD symptoms and

their peer functioning as well as the mechanisms and the effect of gender involved.

Implications of the present findings are discussed from a developmental psychopathology

perspective.

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Introduction

Overview

Social competence has been emphasized in the conceptual and empirical work of

developmental psychopathology as the indicator of optimal developmental outcomes in

both the short run and the long run (Sroufe & Rutter, 1984). A considerable body of

research has demonstrated the link between early peer difficulties and a wide variety of

later maladaptive outcomes, including anxiety, depression, delinquency, dropping out of

school, and substance abuse (e.g., Craig, 1998; Parker & Asher, 1987; Parker, Rubin,

Erath, Wojslawowicz, & Buskirk, 2006; Pedersen, Vitaro, Barker, & Borge, 2007). In

fact, rejection by peers in childhood has been shown to be one of the strongest predictors

of current and future adjustment problems (Bagwell, Newcomb, & Bukowski, 1998;

Kupersmidt, Coie, & Dodge, 1990; O'Neil, Welsh, Parke, Wang, & Strand, 1997). One

group of children that is at significantly higher risk for peer difficulties, thereby being

more likely to experience negative developmental outcomes, however, are those with

Attention-Deficit/Hyperactivity Disorder (ADHD).

ADHD, characterized by core symptoms of inattention, hyperactivity, and

impulsivity, is among the most common childhood neurodevelopmental disorders,

affecting 5-10% of children in Western countries (American Psychiatric Association

[APA], 2000; Faraone, Sergeant, Gillberg, & Biederman, 2003) and 5.3 % of school-aged

children worldwide (Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007). According

to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text

Revision (DSM-IV-TR; APA, 2000), ADHD can be further differentiated into three

subtypes: the predominantly inattentive type (ADHD-I), the predominantly hyperactive-

impulsive type (ADHD-HI), and the combined type (ADHD-C). Although social

difficulties are not one of the diagnostic criteria of ADHD, they are a central and

prominent impairment among children with ADHD (Whalen & Henker, 1985; Wheeler &

Carlson, 1994). Interpersonal difficulties and problems getting along with peers are often

one of the top reasons that parents and teachers refer children with ADHD symptoms to

clinics (Whalen & Henker, 1985).

Indeed, it has been widely documented that children with ADHD symptoms,

whether they are clinically diagnosed or not, are more likely to have problematic peer

relationships and to display social adjustment problems (e.g., Diamantopoulou,

Henricsson, & Rydell, 2005; Hoza, Mrug, et al., 2005; Hoza, 2007; Kawabata, Tseng, &

Gau, 2012; Tseng et al., 2012). Attention problems may limit these children's

opportunities to acquire social skills through observational learning (Cunningham, Siegel,

& Offord, 1985) and may impede their ability to attend to social cues that are important

for effective social interactions or to adjust their behaviors in response to changing social

situations (Landau & Milich, 1988). In contrast, hyperactivity and impulsivity often lead

to socially inappropriate, irritating, and aversive behaviors that are annoying to peers

(Whalen & Henker, 1985). As described earlier, social problems or peer difficulties, in

turn, may compromise many aspects of children's development and lead to a wide variety

of maladaptive outcomes (e.g., anxiety, depression, delinquency, substance abuse) and

various adult mental health problems (e.g., Craig, 1998; Parker & Asher, 1987; Parker et al., 2006). In fact, in youth with ADHD, those with peer relationship problems, in comparison to those without peer problems, were more likely to develop various long-term negative outcomes including conduct problems, substance use, anxiety, and depression (Greene, Biederman, Faraone, Sienna, & Garcia-Jetton, 1997). Moreover, childhood peer rejection was found to predict low academic achievement (Mikami & Hinshaw, 2006), cigarette smoking (Mrug et al., 2012), delinquency (Mrug et al., 2012), anxiety (Mrug et al., 2012), and global impairment (Mrug et al., 2012) four to five years later in adolescence, above and beyond the effect of ADHD diagnosis.

Although the link between ADHD symptoms and impaired peer functioning has been well established, a number of limitations in the literature remain. First, relatively little is known regarding the unique, predictive effect of each core symptom (i.e., inattention and hyperactivity/impulsivity) on children's peer functioning. This is an important gap to fill because increasing evidence suggests that inattention and hyperactivity/impulsivity may each be associated with unique and specific social deficits (Maedgen & Carlson, 2000; Wheeler & Carlson, 1994), which may then result in peer difficulties in different aspects (e.g., active peer rejection versus peer neglect) or with differential degrees of impairment (e.g., high levels versus medium level of peer rejection).

Second, the processes and mechanisms mediating peer difficulties among children with ADHD symptoms remain unclear (Hoza, Gerdes, et al., 2005; Hoza, 2007). Several factors have been proposed to explain peer relationship problems that are often faced by

youth with ADHD. However, more research is clearly needed to directly and explicitly examine potential mechanisms, especially at multiple levels of analysis (e.g., behavioral, cognitive, environmental, neurobiological, etc.). Once such knowledge is available, it holds great promise to inform more effective and evidence-based intervention programs for youth with ADHD in the hopes of derailing the developmental pathways leading to undesirable peer outcomes.

Third, the vast majority of research in this area has primarily focused on Western samples. It is well-demonstrated that culture or cultural beliefs and values play a crucial role in the development of psychopathology (e.g., García Coll, Akerman, & Cicchetti, 2000). Behaviors or symptoms that constitute mental disorders may not have the same degree of "maladaptiveness" across cultures; instead, the degree of "maladaptiveness" may depend on the extent of deviations from the social norms in the given societies. Therefore, consideration of the broader social and cultural context of psychopathology and maladjustment must be incorporated into research on the development of psychopathology and maladjustment (Sameroff, 2000).

Fourth, a lack of longitudinal studies on this topic prevents us from drawing conclusions pertaining to the long-term effects of ADHD symptoms on children's peer functioning, as well as the dynamic interplay between ADHD symptoms and peer functioning over time. The few existing longitudinal studies suggest that some youth may no longer meet the criteria for ADHD as they reach adolescence; however, they continue to struggle in the domain of peer relationships (e.g., Bagwell, Molina, Pelham, & Hoza, 2001; Lee, Lahey, Owens, & Hinshaw, 2008). Findings like these highlight the

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persistent nature of peer impairment in youth with ADHD and underscore the importance

of longitudinal designs in uncovering the continuous peer difficulties and the lingering,

negative effects of ADHD symptoms over time.

Fifth, mixed findings exist with regards to gender differences in the associations

between symptoms of ADHD and peer functioning. It is unclear yet whether inattention

and hyperactivity/impulsivity affect boys and girls equally or affect a specific gender to a

greater extent. This limitation is largely due to a small amount of research with large

enough samples of girls (Arnold, 1996; Rielly, Craig, & Parker, 2006). Increasing

evidence from recent studies, however, point to a possibility that ADHD symptoms may

have a greater impact on girls' social functioning than on boys' (Elkins, Malone, Keyes,

Iacono, & McGue, 2011; Mikami, Jack, & Lerner, 2009). This may be because core

ADHD symptoms, either inattention or hyperactivity, are considered gender non-

normative for girls (Diamantopoulou et al., 2005; Elkins et al., 2011; Mikami et al., 2009)

and may be more disruptive within females' intimate, close, and small-sized social

networks (Mikami et al., 2009).

Finally, more research has been called for to identify factors and characteristics

that predict positive peer relationships in youth with ADHD (Hoza, 2007). One way to

achieve this is to study youth with ADHD who, despite their ADHD symptoms, still

manage to maintain good peer relationships. Children with ADHD who show few peer

difficulties have rarely been studied in the past (Greene et al., 1996, 1997) presumably

because they are less represented in the ADHD population. Inclusion of this group of

youth in the study design may shed light on crucial protective factors capable of buffering

the negative impact of ADHD symptoms on peer relationships and may provide important insights into the nature and processes underlying peer problems that are commonly experienced in this population.

Taken together, although the field has made important progress in demonstrating the link between ADHD symptoms and impaired peer functioning, more research is warranted to address the limitations in the literature and to advance our understanding and knowledge of peer functioning among children with symptoms of ADHD. The present study was designed to do so from a developmental psychopathology perspective. A developmental psychopathology perspective is relevant and useful to the present work because it recognizes the complex nature of children's development. As Cicchetti (1990) noted, children's developmental status, their developmental contexts, and the dynamic organization of behaviors (i.e., integration and reorganizations within and among multiple levels of development; Cicchetti & Rogosch, 2002) are critical factors to be taken into account in order to gain a complete picture of children's behaviors. In addition, the developmental psychopathology perspective emphasizes that consideration of both normal and abnormal, and adaptive and maladaptive, developmental processes is essential to understanding the emergence of disorder, associated impairments, and accumulating comorbidities over the life course (Cicchetti & Rogosch, 2002; Cicchetti & Toth, 2009; Sroufe & Rutter, 1984). Attention to normative developmental processes and the way in which children with ADHD symptoms struggle to negotiate important developmental tasks may yield a fruitful and comprehensive understanding of peer functioning in youth with ADHD symptoms (Murray-Close et al., 2010). Thus,

integrative research conducted within a developmental psychopathology framework may

better explicate the nature and mechanisms underlying the link between ADHD

symptoms and peer problems.

ADHD Symptoms and Peer Functioning

Children with ADHD symptoms are at an increased risk of peer relationship

difficulties in comparison to typically-developing children without these symptoms (e.g.,

for reviews, see Hoza, 2007; McQuade & Hoza, 2008; Nijmeijer et al., 2008). A large

body of research has consistently documented that children with ADHD symptoms are

significantly impaired in their peer functioning (Hodgens, Cole, & Boldizar, 2000; Hoza,

Mrug, et al., 2005; Hoza, 2007; Landau & Moore, 1991; Mrug, Hoza, & Gerdes, 2001;

Mrug et al., 2009). According to early narrative reviews, children with ADHD symptoms

display more social skill deficits and are often viewed as intrusive, loud, annoying, and

aversive by their peers (e.g., Landau & Moore, 1991; Whalen & Henker, 1985).

Empirical research in the past decade has demonstrated that children with ADHD are

often rejected by their peers (Hoza, Mrug, et al., 2005; Hoza, 2007; Mrug et al., 2001;

Mrug et al., 2009). For example, the Multimodal Treatment Study of Children with

ADHD (MTA Cooperative Group, 1999) indicated that children with ADHD tended to be

more rejected and less accepted by peers, and had fewer mutual friendships than children

without ADHD symptoms (Hoza, Mrug, et al., 2005; Mrug et al., 2009). It was estimated

that over half or more of children with ADHD were rejected by peers as compared to 10-

15% of comparison children (Hoza, Mrug, et al., 2005). These children were rejected

even within the first few hours of meeting with unfamiliar peers (Bickett & Milich, 1990;

Erhardt & Hinshaw, 1994; Hodgens et al., 2000; Pelham & Bender, 1982). Impairment

in this group of children is evident not only in peer relationships but also in other

relationship contexts such as relationships with siblings (Greene et al., 2001; Mikami &

Pfiffner, 2008), mothers (Gerdes, Hoza, & Pelham, 2003; Johnston & Mash, 2001), and

fathers (Gerdes et al., 2003; Johnston, 1996). It is clear that the interpersonal relationship

difficulties faced by children with symptoms of ADHD are substantial.

What exactly is problematic in the peer relationships among children with ADHD

symptoms? The majority of research in this field of inquiry has focused on peer rejection

(i.e., the degree to which a child is disliked by his or her peers) or peer acceptance (i.e.,

the degree to which a child is liked by his or her peers; Hoza, Mrug, et al., 2005). Some

argue that it is important to include other constructs in peer relations research (e.g.,

dyadic friendship) and to distinguish between different constructs (Asher, Parker, &

Walker, 1996; Hoza, Mrug, et al., 2005; Mikami, 2010), given that there may be distinct

aspects to peer ecology, and each aspect may contribute uniquely to understanding

children's relationship with one another (Asher et al., 1996; Hoza, Mrug, et al., 2005). It

is especially important to distinguish between the constructs that are pertinent to the

larger peer group and peer reputations (i.e., group level) and those that are pertinent to

smaller peer groups or dyads such as friendships (i.e., dyadic level; Asher et al., 1996;

Mikami, 2010). Friendship, defined as an equal and reciprocal relationship between two

children, has been shown to be independent of peer acceptance, both conceptually and

empirically (Bukowski & Hoza, 1989; Parker & Asher, 1993). For example, achieving

the overall positive regard of the peer group at large is necessary for peer acceptance but

not as pertinent for establishing friendships. In contrast, self-disclosure and intimacy are essential to fostering close friendship but are not necessary for peer acceptance (Asher et al., 1996; Buhrmester, 1990; Schneider, Wiener, & Murphy, 1994). As such, a brief review of past literature on ADHD symptoms and peer functioning in multiple facets of peer relations (at both peer group level and dyadic friendship level) is provided below. Specific peer constructs that are covered in this paper include: peer rejection, peer acceptance, popularity or unpopularity, peer victimization, numbers of reciprocated friendships, and the quality of friendships.

Peer rejection. Peer rejection is one of the most traditionally studied variables in peer relationship research in normative samples (Bukowski, Newcomb, & Hartup, 1996; Nangle & Erdley, 2001) and in children with symptoms of ADHD (Hoza, Mrug, et al., 2005). A sociometric instrument (Coie, Dodge, & Coppotelli, 1982) is usually used to generate the peer rejection variable; this sociometric procedure involves asking all children in a classroom to nominate a number of their classmates who best fit the behavioral descriptions using both positive and negative nominations (e.g., "Who do you like the most?" and "who do you like the least?"). The number of negative nominations a child receives from their peers can then be totaled to generate a dimensional measure of *peer rejection* while the number of positive nominations is used to generate the measure of *peer acceptance*. Sometimes social preference scores are calculated by subtracting rejection from acceptance to indicate the degree to which children are well-liked by their peers.

Existing studies on peer rejection associated with ADHD symptoms indicate that children with ADHD symptoms are more likely to experience peer rejection than comparison children without these symptoms (Erhardt & Hinshaw, 1994; Hinshaw, Zupan, Simmel, Nigg, & Melnick, 1997; Hoza, Mrug, et al., 2005; Mrug et al., 2009; Pelham & Bender, 1982). Pelham and Bender (1982) reported that 82% of children with ADHD had peer rejection scores one *SD* or more above the mean and 60% were two *SD*s or more above the mean. In the MTA study where 165 children with ADHD and 165 comparison children were assessed, 52% of children with ADHD were rejected as compared to 14% of normal controls (Hoza, Mrug, et al., 2005). Relatedly, using the same sample, Mrug and colleagues (2009) found that peer rejection was one of the best variables in discriminating between those with ADHD and those without – it discriminated better than other peer variables such as the number of dyadic friendships and peer liking (Mrug et al., 2009). In a summer program setting, boys with ADHD were more rejected than comparison boys after only three days of interactions (Erhardt & Hinshaw, 1994) and continued to be disliked by peers at the end of the six-week summer program (Hinshaw et al., 1997).

In a community sample of 635 children in Sweden, children with higher levels of ADHD symptoms were more likely to be rejected by peers than those with lower levels of ADHD symptoms (Diamantopoulou et al., 2005). In another population-based sample, Rielly and colleagues (2006) identified 109 students in Grades 5-8 who had attention problems and another 109 students, age-matched, without attention problems. They

found that those who had attention problems were more rejected than those without

attention problems (Rielly et al., 2006).

Peer acceptance. Consistent with the findings on peer rejection, children with

ADHD symptoms are often less accepted by their peers and are less likely to be

nominated by peers as preferred playmates. In the MTA study described earlier, relative

to comparison controls, children with ADHD were less liked by their peers (as indexed

by social preference scores; Hoza, Mrug, et al., 2005). In a summer camp setting, boys

with ADHD were less accepted and received lower liking ratings than the comparison

boys (Erhardt & Hinshaw, 1994; Hinshaw et al., 1997). Moreover, in a community

sample of 387 children, Bellanti, Bierman, and the Conduct Problems Prevention

Research Group (2000) reported that inattention was negatively related to peer

acceptance starting as early as the time of school entry (e.g., first grade; Bellanti et al.,

2000). However, the previously-mentioned population-based study by Rielly and

colleagues (2006) found that children and adolescents who had attention problems were

not less liked by peers compared to those without attention problems (Rielly et al., 2006).

Perceived Popularity. Measured by asking children to nominate who is

"popular," perceived popularity is another indicator of peer status and peer reputations

(Cillessen & Rose, 2005; Parkhurst & Hopmeyer, 1998). Although modestly correlated

with peer acceptance, perceived popularity is not necessarily equivalent to likeability

(Cillessen & Mayeux, 2004). Instead, children who are perceived as popular are socially

prominent, influential, and powerful in the peer group. Often emulated by their peers,

popular children display a mixture of prosocial and aggressive traits (Puckett, Aikens, &

Cillessen, 2008), in addition to other peer-valued characteristics (e.g., humor, athleticism, attractiveness; Vaillancourt & Hymel, 2006). Relative to the amount of studies that have been conducted on peer acceptance and peer rejection, empirical work on popularity in children with symptoms of ADHD is limited. In the MTA study, children with ADHD, as compared to control children, were less often classified as being popular (3% versus 23%; Hoza, Mrug, et al., 2005). Hinshaw and Melnick (1995) used mother and teacher reports on a 5-point rating scale of children's popularity and found that boys with ADHD were reported by mothers and teachers as significantly less popular compared to control children (Hinshaw & Melnick, 1995). Elkins et al. (2011), in their recent study in a community-based sample of 998 11-year-old children, found that children with ADHD symptoms (especially girls with ADHD-I) were reported by teachers and themselves as less popular than children without ADHD symptoms.

Peer victimization. Peer victimization refers to chronic or frequent receipt of aggression from peers (Ostrov, 2010); it can take on a physical form (e.g., hitting, kicking, pushing) or a relational form (e.g., ignoring, excluding, spreading rumors; Crick & Grotpeter, 1996). Although considerable research has documented the significant impact of peer victimization on children's development (e.g., Hanish & Guerra, 2002; for a review, see Hawker & Boulton, 2000), this line of research in youth with ADHD is still in its infancy. Some earlier studies in this area reported that ADHD status or ADHD symptoms were associated with a higher rate of being victims of bullying (Holmberg & Hjern, 2008; Taylor, Saylor, Twyman, & Macias, 2010; Unnever & Cornell, 2003; Wiener & Mak, 2009). For example, in a Swedish sample of 516 fourth graders,

Holmberg and Hjern (2008) found that children diagnosed with situational or pervasive

ADHD (symptoms present in one versus two settings/contexts) reported being bullied 10

times as often as other children. Two recent studies in girls with and without ADHD

found that adolescent girls with ADHD experienced more relational and overt

victimization than adolescent girls without ADHD (Cardoos & Hinshaw, 2011; Sciberras,

Ohan, & Anderson, 2012). It may be that children with ADHD are more vulnerable to

the attention of bullies because they tend to suffer from poor peer status and have fewer

friends (Unnever & Cornell, 2003).

Number of dyadic friendships. Trouble with dyadic friendships among youth

with symptoms of ADHD is another understudied area. Although relatively few studies

have examined the dyadic friendships in children with ADHD symptoms, results from

these studies indicated that children who showed symptoms of ADHD had fewer dyadic

friendships than their typically-developing peers (for a review, see Mikami, 2010). Even

when children with ADHD symptoms do have friends, they tend to experience

difficulties maintaining friendships (Mikami, 2010).

Friendships are usually assessed by sociometric nominations in which both the

child and the peer mutually nominate one another as friends. In the MTA study, it was

reported that 56% of children with ADHD had no reciprocated friends, 33% had one

friend, and 9% had two friends. By contrast, 32% of comparison children had no

reciprocated friends, 39% had one friend, and 22% had two friends (Hoza, Mrug, et al.,

2005). In a sample of girls with and without ADHD, Cardoos and Hinshaw (2011)

reported that girls with ADHD had fewer friends than girls without ADHD; 35% of girls

with ADHD had no friends, while 22% of girls without ADHD had no friends. Similarly, Blachman and Hinshaw (2002) found that preadolescent girls with ADHD had fewer mutual friends and were more likely to have no friends. Further, girls with ADHD-C demonstrated initial difficulty in establishing friendships, while girls with both ADHD-C and ADHD-I had more difficulties than comparison girls in maintaining stable friendships over a six-week summer camp period (Blachman & Hinshaw, 2002). Erhardt and Hinshaw (1994) reported that youth with ADHD had fewer friendships after even only three days interacting with unfamiliar peers. In two other studies of clinical samples of children with ADHD, no self-reported differences in the number of mutual friends were found between children with ADHD and the comparison controls; parents, however, reported fewer friends for their children with ADHD (Bagwell et al., 2001; Heiman, 2005).

Findings from community-based samples are similar to those from clinical samples. For example, Gresham et al. (1998) reported that 76% of third-grade children with ADHD symptoms plus conduct problems had no reciprocated friends in their classrooms, relative to 42% of children with elevated internalizing and externalizing symptoms (but not ADHD), and 30% of control children; this pattern persisted one year later (Gresham, MacMillan, Bocian, Ward, & Forness, 1998). Similarly, Rielly and colleagues (2006) found that children and adolescents with attention problems had fewer reciprocal friends than those without attention problems (Rielly et al., 2006). In summary, it appears that children with ADHD symptoms have fewer reciprocated friendships relative to typically-developing children (Blachman & Hinshaw, 2002;

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Gresham et al., 1998; Hoza, Mrug, et al., 2005; Mikami, 2010) and that the friendships they have are less stable over time than those of comparison children (Blachman & Hinshaw, 2002; Gresham et al., 1998; Mikami, 2010).

Friendship qualities. Quantity of mutual friends is the most common indicator in friendship research; however, "quality matters." Literature suggests that the advantage of friendship does not reside merely in having friends but also in having socially competent and well-adjusted friends, and in having friendships that are of high quality (Hartup, 1996; Hartup & Stevens, 1997). High quality friendship (i.e., high in intimacy, closeness, and support, and low in conflict) has been positively connected to developmental outcomes such as self-esteem, school and social adjustment, self-perceived competence, and positive social reputation; and negatively connected to psychological problems, school difficulties, depression and anxiety, and negative social reputation (Hartup, 1996; Hartup & Stevens, 1997; Tomada, Schneider, de Domini, Greenman, & Fonzi, 2005).

It has been shown that when children with ADHD have friends, the quality of their friendships tends to be less positive and more negative compared to the friendships of children without ADHD (Blachman & Hinshaw, 2002; Heiman, 2005; Normand et al., 2011; Rielly et al., 2006). For example, Blachman and Hinshaw (2002) found that girls with ADHD self-reported more conflict and relational aggression in their friendships than did comparison girls; however, no group differences were found in positive friendship features (e.g., caring, companionship, help, and intimate exchange). A recent study conducted by Normand et al. (2011) showed that children with ADHD reported lower

quality friendships (e.g., more negative features and less positive features) and were less

satisfied in their friendships than comparison children. In another study with a small

sample (39 ADHD and 17 controls), children with ADHD reported lower levels of

emotional support in their friendships than comparison controls (Heiman, 2005).

Evidence from a population-based sample of youth with attention problems (Rielly et al.,

2006) also indicated that the friendships of youth with attention problems were of lower

qualities (i.e., lower intimate exchange, lower validation and caring, lower

companionship, poorer conflict resolution, and more conflict and betrayal) than those of

youth without attention problems. Taken together, the existing few studies on friendships

among children with ADHD symptoms suggest that relative to comparison peers,

children with ADHD symptoms tend to have friendships of lower quality.

Mechanisms Underlying Peer Difficulties Associated with ADHD Symptoms

In spite of the well-documented connection between ADHD and peer relationship

problems, the underlying mechanisms and mediating processes are still poorly

understood (Hoza, Gerdes, et al., 2005; Hoza, 2007). Given the severe and prevailing

peer problems evident among children with ADHD, it is important to identify the

processes and mechanisms that account for ADHD children's risk for poor relationships

with peers. There is mounting evidence suggesting that, as found in normative samples

(Coie, 1990), multiple pathways to peer problems (e.g., peer rejection) exist for children

with ADHD (e.g., Hinshaw & Melnick, 1995). In light of this, in the following

discussion, I present several potential mediating factors and pathways that may explain

the mechanisms by which symptoms of ADHD are related to peer problems.

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Aggression.

Physical aggression. Developmental research has clearly delineated aggression as a common correlate of peer relationship problems such as peer rejection and lack of friendships (for reviews, see Coie, Dodge, & Kupersmidt, 1990; Newcomb, Bukowski, & Pattee, 1993). Also evidenced is an association between ADHD and heightened levels of physically aggressive behavior with peers (Abikoff et al., 2002; Erhardt & Hinshaw, 1994; Hinshaw & Melnick, 1995; Hodgens et al., 2000; Maedgen & Carlson, 2000; Ohan & Johnston, 2007; Pelham & Bender, 1982). Hyperactivity/impulsivity, in particular, appears to be significantly correlated with aggressive behavior. Parents and teachers rate children with ADHD-C as more aggressive than children with ADHD-I (Hodgens et al., 2000; Maedgen & Carlson, 2000). Similarly, peers nominate children with ADHD-C as more likely to start fights than children with ADHD-I (e.g., Hodgens et al., 2000). This association with aggression has deleterious social consequences as aggression is a robust predictor of peer rejection (Coie et al., 1990; Newcomb et al., 1993).

In a summer camp setting, it has been found that boys with ADHD were overwhelmingly rejected by their peers within the first day of meeting (Erhardt & Hinshaw, 1994) and that an interactive style marked by aggression most strongly accounted for peer rebuff (Erhardt & Hinshaw, 1994; Hinshaw et al., 1997). In a clinical sample of 379 children and adolescents with ADHD, aggression was found to be associated with social problems (i.e., peer rejection and social immaturity), and hyperactivity was associated with social immaturity (Rich, Loo, Yang, Dang, & Smalley, 2009). A longitudinal study in a sample of 111 ADHD youth indicated that childhood

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aggression was inversely related to self-reported social acceptance in adolescence five years later (Bagwell et al., 2001).

Only a few studies explicitly investigated the mediating role of physical aggression in the link between ADHD symptoms and peer relationships. For instance, in a community-based study, aggressive behavior was found to mediate the association between inattention and low social preference (Bellanti et al., 2000). A recent study by Tseng and colleagues (2012) found that physical aggression in girls mediated the relation between hyperactivity and poor peer functioning in Taiwanese children. In summary, these findings suggest that physically aggressive behavior may be an explanatory factor in the association between ADHD and poor peer relationships.

Physically aggressive behavior has been observed among children displaying both hyperactive/impulsive and inattentive behavior, but not among children who have attention problems in the absence of excessive hyperactivity/impulsivity (Gaub & Carlson, 1997; Hodgens et al., 2000; Maedgen & Carlson, 2000; Zalecki & Hinshaw, 2004). Rather, children with ADHD-I show a unique pattern of social deficits marked by lower levels of aggression and higher levels of passive and withdrawn behavior (Hinshaw, 2002; Hinshaw & Melnick, 1995; Hodgens et al., 2000; Maedgen & Carlson, 2000; Wheeler & Carlson, 1994). Similar to aggressive ADHD youngsters, nonaggressive children with ADHD, who are usually the inattentive type, also face a high risk of peer problems (Hinshaw & Melnick, 1995; Wheeler & Carlson, 1994). Thus, aggression is not the sole predictor of peer rejection in children with ADHD symptoms. Other factors such as social passivity and withdrawal or lack of prosocial behavior may

likewise engender active peer rejection. Hence, it is likely that children with ADHD-C and children with ADHD-I may follow different pathways to the same negative social outcome (Hinshaw & Melnick, 1995).

  Relational aggression. Although past research has successfully demonstrated the association between ADHD symptomatology and aggressive behavior, the majority of these investigations assessed only physical forms of aggression in exclusively male samples (Gaub & Carlson, 1997). As recent research has indicated, girls with ADHD may differentially manifest aggressive behavior. In particular, girls with ADHD exhibit heightened levels of relational aggression, inflicting harm via the manipulation of peer relationships (Ohan & Johnston, 2007; Zalecki & Hinshaw, 2004). In a summer camp setting, Zalecki and Hinshaw (2004) reported that girls with ADHD-C exhibited higher levels of relational and overt aggression than girls with ADHD-I, who in turn exhibited higher levels than comparison girls. Moreover, results suggested that relational aggression uniquely contributed to negative peer regard among girls with ADHD, above and beyond the effect of overt aggression (Zalecki & Hinshaw, 2004).

  Subsequent research by Ohan & Johnston (2007) showed that the association between ADHD and relational aggression was more complex, depending on the specific act of relational aggression utilized. In a computer-simulated chat room paradigm, girls with ADHD sent more relationally aggressive messages, but their messages were less severe in content, and they were less likely to engage in rumor-spreading compared to girls in the control group (Ohan & Johnston, 2007). Therefore, it appears that girls with ADHD engage in more rash and direct forms of relational aggression (e.g., overt

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exclusion or threatening to end a friendship), as opposed to more covert and planned

forms (e.g., rumor-spreading, forming alliances with the intent to exclude; Ohan &

Johnston, 2007).

Hostile Attribution Bias. Hostile attribution bias (HAB) refers to a tendency to

infer hostile intent under ambiguous circumstances (Crick & Dodge, 1994; Dodge,

Murphy, & Buchsbaum, 1984). It can be further differentiated into HAB in response to

instrumental provocations (HAB – Ins; e.g., "a peer spills drinks all over your back") and

HAB in response to relational provocations (HAB – Rel; e.g., "two classmates look at

you, whisper something to each other and then laugh as they walk by"). The link

between ADHD symptoms and aggressive behavior may be further mediated by these

HABs. Specifically, inattention and hyperactivity may be associated with HAB – Ins and

HAB – Rel which, in turn, may increase the likelihood of engaging in physical aggression

and relational aggression, respectively.

To date, little research has examined HAB in children with ADHD symptoms; the

research that did either focused primarily on HAB – Ins or did not distinguish between

HAB – Ins and HAB – Rel. In a sample of school-age boys referred to a child psychiatric

clinic, Milich and Dodge (1984) found that hyperactive and aggressive boys were more

likely to show HAB in response to instrumental provocation and to react aggressively

than normal controls. A recent study by Andrade et al. (2012) further demonstrated that

children with ADHD encoded fewer social cues and attributed more negative intent to

peers than comparison children, independent of the effects of conduct problems. HAB

(especially HAB – Ins), in turn, has been shown to predict later development of

aggressive behavior (Dodge, Bates, & Peitit, 1990). Collectively, it seems possible that

aggressive behaviors that are often co-occurring in children with ADHD symptoms,

especially those who show hyperactivity/impulsivity (or ADHD-HI and ADHD-C;

Melnick & Hinshaw, 1996), may result from cognitive biases in attributions regarding

others' intents. In other words, children with ADHD symptoms (especially

hyperactivity) may be more likely to appraise an ambiguous act as maliciously motivated

and thus may be more likely to react accordingly in an aggressive way. This aggression

may, in turn, lead youth with ADHD to be viewed by peers as aberrant and noxious

(Whalen & Henker, 1985).

Nonetheless, other research did not find significant differences in HAB between

children with and without ADHD (King et al., 2009; Matthys, Cuperus, & Van Engeland,

1999; Mikami, Hinshaw, Lee, & Mullin, 2008), although children with ADHD generated

more aggressive responses to provocation than controls (King et al., 2009). Given the

limited research and the mixed findings, more studies are needed to test the possibility

that children with ADHD symptoms, relative to those without, may be more likely to

possess HAB and thus to behave aggressively.

Positive and prosocial behaviors. In order to understand the full range of social

functioning among children with ADHD symptoms, it is important to assess prosocial

behavior in conjunction with aggressive behavior. Prosocial behavior refers to voluntary

actions that help or benefit others (Eisenberg & Mussen, 1989); it is comprised of

positive behaviors such as caring, sharing, helping, and cooperation, etc. Research

suggests that success in the peer domain depends not only on the absence of aggression,

but the presence of prosociality (Crick, 1996; Hartup, 1983). Prosocial behavior is important as it promotes the formation and stability of friendships among school-aged children (Hartup & Stevens, 1997). Children who do not have the skills to positively interact with others will be more likely to experience greater peer rejection (Asher & Renshaw, 1981). Indeed, prosocial behavior has been linked with peer acceptance in normative samples (Coie et al., 1990; Newcomb et al., 1993), while lack of prosocial behavior is predictive of peer rejection and low peer acceptance (Crick, 1996).

In the ADHD population, research to date indicates that ADHD symptoms are negatively correlated with prosocial behavior and social skills in both community samples (Diamantopoulou et al., 2005; Diamantopoulou, Rydell, Thorell, & Bohlin, 2007; Gau et al., 2010; Tseng et al., 2012) and clinical samples of ADHD (Gau et al., 2010; Murray-Close et al., 2010; Ohan & Johnston, 2007; Zalecki & Hinshaw, 2004). Impaired social skills, in turn, predict peer rejection (Murray-Close et al., 2010). In a previous study that explicitly tested a mediation model, Bellanti et al. (2000) found that deficits in prosocial behavior mediated the association between inattention and low social preference. Similar findings were reported in a sample of Taiwanese youth; that is, inattention predicted fewer prosocial behaviors which, in turn, predicted impaired peer functioning (i.e., fewer friends and lower peer acceptance; Tseng et al., 2012). Evidence from a summer intervention program for children with ADHD indicated that prosocial behaviors (e.g., helping others and sharing) was associated with higher peer acceptance and that increases in helping behaviors predicted positive changes in peer status among children with ADHD eight weeks later (Mrug, Hoza, Pelham, Gnagy, & Greiner, 2007).

Collectively, these findings suggest that low levels of prosocial behavior may be another candidate mediator underlying the link between ADHD symptoms and impaired peer functioning.

Differential Effects of Inattention and Hyperactivity on Peer Functioning

The associations between ADHD symptoms and impaired peer functioning have been well established. Nevertheless, the majority of past studies in this area have not explicitly differentiated between the two core domains of ADHD (i.e., inattention versus hyperactivity/impulsivity; Hodgens et al., 2000; Wheeler & Carlson, 1994). This is problematic given that inattention and hyperactivity/impulsivity seem to be related to different kinds of social deficits (Maedgen & Carlson, 2000; Wheeler & Carlson, 1994), which may result in differential effects of these ADHD symptoms on peer adjustment.

Indeed, some evidence suggests that children with ADHD-C may be more actively rejected than children with ADHD-I (Carlson, Lahey, Frame, Walker, & Hynd, 1987, 1989), whereas children with ADHD-I may be more likely to be neglected by peers than children with ADHD-C (Carlson & Mann, 2000). Moreover, Maedgen and Carlson (2000) found that children with either ADHD-C or ADHD-I both suffer difficulties in social functioning; however, poor peer functioning in children with ADHD-C was characterized by aggressive behavior, whereas the peer impairment in children with ADHD-I was characterized by passivity and deficiency in social knowledge (Maedgen & Carlson, 2000). Similarly, inattentive children without hyperactivity were found to exhibit more shyness, anxiety, and withdrawal, which was more typical of neglected children (Wheeler & Carlson, 1994). Maedgen and Carlson (2000) concluded that

impulsivity and hyperactivity in children with ADHD-C may prevent these children from performing social behaviors appropriately, whereas anxiety and disorganization in children with ADHD-I may limit their social interaction, thereby restricting acquisition of social knowledge (Maedgen & Carlson, 2000).

In the same vein, Hodgens et al. (2000) observed boys with ADHD-I and boys with ADHD-C interacting with newly acquainted peers who were nonclinical controls in a laboratory setting. They found that boys with ADHD-I spent more time engaging in solitary behavior and less time in sustained interaction than either boys with ADHD-C or nonclinical controls (Hodgens et al., 2000). In the classroom setting, boys with ADHD-I were much more likely than the ADHD-C and the nonclinical groups to be nominated by peers as being very shy, and boys with ADHD-I were also nominated by peers more often as being teased and left out by peers (Hodgens et al., 2000). These findings suggest that the pathway from inattention to peer rejection may be dissimilar from the pathway from hyperactivity to peer rejection and that different social behavior patterns may be involved (Hodgens et al., 2000).

Using a computerized chat-room paradigm, Mikami et al. (2007) found that relative to comparison children, children with ADHD-C made more off-topic and hostile responses, while children with ADHD-I not only were more likely to be off-topic, but also made fewer responses and showed poor memory for the conversation (Mikami, Huang-Pollock, Pfiffner, McBurnett, & Hangai, 2007). These findings showed that children with ADHD-I may be more socially withdrawn and less attentive in social interactions, whereas children with ADHD-C may be not only inattentive but also hostile

or aggressive in their interactions with peers (Mikami et al., 2007), lending further support for the differential patterns of social deficits associated with inattention versus hyperactivity/impulsivity (Hodgens et al., 2000; Maedgen & Carlson, 2000; Wheeler & Carlson, 1994).

Moreover, in a recent study, Tseng et al. (2012) found that inattention was directly and indirectly (through less prosocial behavior) associated with poor peer functioning (i.e., low peer acceptance and few numbers of friends), while hyperactivity was indirectly (through more physical aggression) associated with poor peer functioning. In another recent study, Scholtens et al. (in press) showed that inattention, but not hyperactivity/impulsivity, was strongly and consistently associated with lower social acceptance reported by parents and teachers (Scholtens, Diamantopoulou, Tillman, & Rydell, in press), further supporting the independent contribution of each ADHD domain to children's social functioning. Jointly, these findings illustrate the importance of differentiating between the two core domains of ADHD symptoms while investigating their effects on children's peer functioning and also point to some differential pathways and mechanisms by which each core domain of ADHD may be linked to distinct peer outcomes.

Long-term Effects of ADHD on Peer Functioning

Despite the well-documented link between ADHD symptoms and peer difficulties (for reviews, see Hoza, 2007; Nijmeijer et al., 2008) and the well-established adverse outcomes resulting from childhood peer rejection (e.g., Mrug et al., 2012; Parker & Asher, 1987; Parker et al., 2006), we know little about the long-term peer impairment

associated with ADHD symptoms (Bagwell et al., 2001; Klein & Mannuzza, 1991). In a recent paper, findings from the MTA study that followed a large sample of 820 children (536 ADHD and 284 controls) over six years were reported (Murray-Close et al., 2010). Murray-Close and colleagues (2010) found that children with ADHD showed impairment in multiple domains at the initial assessment (middle childhood), including overly positive self-perceptions, elevated levels of aggression, poor social skills, and peer rejection and that problems in each of the areas showed cascading effects into other areas over a six year period. For example, peer rejection subsequently predicted lower social skills which, in turn, predicted later peer rejection (Murray-Close et al., 2010).

In a retrospective study, Bagwell and colleagues (2001) interviewed 111 adolescents with childhood ADHD and compared them to 100 adolescents without a history of ADHD. They found that impairment in peer relationships for ADHD youths, known to be common in childhood, also existed in adolescence and that the long-term effect of ADHD on peer functioning was more pronounced for those with persistent ADHD or conduct disorder in adolescence (Bagwell et al., 2001). The authors argued that even those youths who no longer met diagnostic criteria of ADHD in adolescence showed impairment in peer relationships (Bagwell et al., 2001).

In a 7-8 year longitudinal study of a predominately-male sample of preschool children (96 ADHD and 126 controls), Lee and colleagues (2008) found that relative to normal controls, those with childhood ADHD had lower teacher-reported social preference in adolescence (Lee et al., 2008). This fining was replicated by Owens and colleagues (2009) using an all-female sample of ADHD and controls (Owens, Hinshaw,

Lee, & Lahey, 2009). In another longitudinal study of 140 girls with ADHD and 88 comparison girls, Lee and Hinshaw (2006) reported that childhood inattention and hyperactivity did not predict social preference in adolescence, after childhood social preference and antisocial behaviors were controlled; however, childhood social preference significantly predicted social preference in adolescence. Although findings from Lee and Hinshaw's study (2006) did not provide evidence for the negative, long-term effect of ADHD symptoms on peer relationships, the finding that childhood social preference was the only significant predictor for negative social preference five years later (Lee & Hinshaw, 2006) underscored the stability and continuity of negative peer status over time (Coie & Dodge, 1983). Given that peer rejection is pervasive among children with ADHD symptoms (Hoza, Mrug, et al., 2005), tends to be stable and resistant to change over time (Bierman, 2004; Hoza, Gerdes, et al., 2005; Lee & Hinshaw, 2006; Mrug et al., 2007), and is predictive of various concurrent and longitudinal psychosocial adjustment problems (Craig, 1998; Parker & Asher, 1987; Parker et al., 2006; Rubin, Bukowski, & Parker, 1998), more longitudinal research is needed to better understand long-term effects of ADHD symptoms on children's peer functioning.

Bidirectional Effects of ADHD Symptoms and Peer Relationship Problems

In developmental research, bidirectional or reciprocal effects between two constructs or psychological phenomena are likely to occur. From a developmental psychopathology perspective, psychopathologies are better conceptualized in a dynamic fashion that reflects the bidirectional and transactional nature of multiple levels of

influences over time (Cicchetti & Toth, 2009). Therefore, another goal of this study was to investigate the bidirectional and transactional influences between ADHD symptoms and peer relationship problems over time.

Past research has clearly demonstrated the effect of ADHD symptoms on children's peer relationships. What remains unknown is the reciprocal influences that peer functioning can have on children's development or maintenance of ADHD symptoms. As Mikami, Jack, and Lerner (2009) pointed out, a vicious cycle is likely to occur in which "the child's negative behaviors evoke peer dislike, which in turn further encourages an increase in the rejected child's dysfunctional behavior." It seems plausible that inattention and hyperactivity/impulsivity may result in rejection or low acceptance from peers. Conversely, peer problems may give rise to more inattentive or hyperactive/impulsive behaviors or may exacerbate symptoms of ADHD. On the other hand, from a positive perspective, good peer functioning (e.g., having reciprocated friendships or high peer acceptance) may ameliorate the severity of ADHD symptoms. Thus far, the possibilities that peer problems may result in more ADHD symptoms (or even the development of ADHD symptoms) and that positive peer relationships may alleviate ADHD symptoms have not been tested. The only relevant past research was conducted by Greene et al. (1997). These authors found that boys with ADHD who had social disability, defined by a significant standardized discrepancy between observed social functioning (measured by the Social Adjustment Inventory for Children and Adolescents; Biederman, Faraone, & Chen, 1993) and expected social functioning (derived from the child's IQ), exhibited more attention problems four years later (Greene

et al., 1997). Thus, I attempted to use cross-lagged panel models to examine the

bidirectional and transactional effects between ADHD symptoms and peer relationships.

Risk and Protective Factors for Peer Relationship Problems in Children with

ADHD Symptoms

Despite the heightened risk for peer difficulties associated with ADHD, not all

children with ADHD symptoms suffer peer relationship problems. It is unclear why

some youth with ADHD, overcoming the odds, manage to maintain good peer

relationships. This subgroup of children with ADHD has never been studied in the past

research, except in the study by Greene et al. (1996).   Greene and colleagues (1996)

found that a subgroup of boys with ADHD and social disability had higher rates of

clinical diagnoses of depression and CD, and externalizing and internalizing problems

than boys with ADHD without social disability. The two ADHD groups did not differ in

age, SES, IQ, or family functioning (i.e., cohesion, expression, and conflict; Greene et al.,

1996). These findings suggest that the presence of depression, conduct problems, and

comorbidities of internalizing and externalizing problems may serve as potential risk

factors that increase the likelihood that a child with ADHD symptoms may suffer from

peer difficulties. In contrast, the absence of these problems may serve as protective

factors that reduce the likelihood of peer relationships problems in youth with ADHD

symptoms. Therefore, in the present study, I attempted to identify a group of youth with

elevated ADHD symptoms who, however, were well-liked by peers and compared them

to a group of ADHD youth who were disliked by peers. In doing so, I hoped to identify

some characteristics and factors that discriminate the two ADHD groups. Potential

characteristics and factors that were considered in this study include (1) behavioral

factors such as aggression, prosocial behavior, and internalizing and externalizing

problem; (2) nonbehavioral factors such as academic performance and HAB; and (3)

familial factors such as parent-child relationships and parenting.

Aggression and prosocial behavior were chosen because these behaviors can

function as risk factors or protective factors, in addition to mediators as described earlier.

Imagine, for example, that aggression or lack of prosocial behavior fully mediates the

association between ADHD symptoms and peer relationship problems. If this is the case,

the presence of aggression (or the lack of prosocial behavior) may then serve as a risk

factor that will likely lead to peer relationships problems. In contrast, the absence of

aggression may serve as a protective factor that buffers against poor peer functioning. In

a similar vein, having HAB may be a risk factor in the sense that it may increase a child's

likelihood to engage in aggressive behavior which, in turn, results in problematic peer

relationships. In contrast, the absence of HAB may serve as a protective factor that

reduces a child's likelihood to engage in aggressive behavior, thereby protecting him or

her from experiening peer relationships problems.

Internalizing problems (e.g., anxiety, depression) and externalizing problems

(e.g., delinquency, CD, ODD) are also potential candidates under consideration. This is

because past research, although limited, has shown that relative to children with ADHD

only, children with ADHD *and* anxiety disorders had fewer dyadic friendships (before

Bonferroni correction; Hoza, Mrug, et al., 2005), and children with ADHD *and*

depression showed more impaired social competence (Blackman, Ostrander, & Herman,

2005). Likewise, comorbidity of ODD or CD seems to add more risks and additionally contribute to social difficulties in children with ADHD (Greene et al., 2001; Kuhne, Schachar, & Tannock, 1997).

Academic performance is another potential risk or protective factor for several reasons. First, academic underachievement is a common correlate of ADHD (Hinshaw, 1992). Second, academic problems have been demonstrated to be associated with peer rejection in normative samples (Newcomb et al., 1993). Third, for children with ADHD, boys with both learning disabilities (LD) and ADHD experienced greater peer rejection and less popularity than boys with ADHD or LD only (Flicek, 1992; Flicek & Landau, 1985). Finally, academic performance may be particularly relevant for the Taiwanese sample of this study because academic achievement is highly emphasized from the early school years onward in Chinese culture (Chen, Chang, & He, 2003). Hence, academic performance may play a salient role in influencing peer functioning in youth with ADHD symptoms in Chinese culture.

Associations of parent-child relationships or parenting with peer functioning have not been systematically investigated in youth with ADHD (Hinshaw et al., 1997). In a sample of children with and without ADHD, Mikami, Jack, Emeh, and Stephens (2010) found that parental warmth observed during parent-child interaction in a laboratory setting was associated with more friendship nominations of the child, whereas observed parental criticism was associated with poorer parent-reported social skills of the child (Mikami, Jack, Emeh, & Stephens, 2010). With respect to parenting, research has shown that in children with ADHD, mothers' responsiveness was positively associated with

hyperactive boys' positive social behavior and peer acceptance (Keown & Woodward, 2006). Moreover, maternal authoritative parenting was associated with more positive peer nominations, fewer negative peer nominations, and higher social preference in a group of boys with ADHD and normal controls (Hinshaw et al., 1997); maternal authoritative parenting had a stronger positive effect on negative peer nomination and social preference in the ADHD than in the comparison groups (Hinshaw et al., 1997). In a sample of Taiwanese children, Kawabata, Tseng, and Gau (2012) found that maternal overprotection moderated the association between hyperactivity and difficulties forming and maintaining friendships, such that this association was stronger for children who experienced higher levels of overprotection than those who did not. Maternal warmth and affection, in contrast, was a buffer against social problems with peers (e.g., bullying and peer rejection) resulting from inattention for children in middle childhood (Kawabata et al., 2012). Therefore, there are reasons to believe that dimensions of parent-child relationships (e.g., closeness, conflict) and parenting behaviors may serve as potential risk and protective factors that impact peer functioning in youth with ADHD symptoms.

Culture as the Developmental Context

One of the limitations in the literature is the dearth of knowledge concerning how culture as a developmental context plays a role in the associations between ADHD symptoms and impaired peer functioning. The vast majority of the previous studies in this area have been conducted in Western cultures. Much less is known regarding the impact of having ADHD symptoms on children's peer relationships in non-Western cultures. An overfocus on ADHD symptoms and peer relationships among Western

children may lead researchers to neglect potential cross-cultural differences in this area of research. Literature has indicated that peer acceptance, peer rejection, and the formation of friendships may be associated with culturally valued behaviors (Chen & French, 2008; Chen, French, & Schneider, 2006). Characteristics of children who are accepted by peers and who form many friendships tend to reflect cultural beliefs and values that are emphasized in their respective societies (Chen & French, 2008; Chen et al., 2006). In other words, children's behaviors that are correlated with negative social outcomes such as peer rejection are likely to be those that are incongruent with local cultural norms (Chen & French, 2008; Chen et al., 2006).

In line with the above views, Chang (2004) posited that the meaning or social impact of a behavior depends on the norm of the behavior or the extent to which the behavior is commonly observed in a given social context. Chang proposed a social context model in which he examined the degree to which children's acceptance of prosocial-leadership, aggression, and social withdrawal was a function of the contextual norms of these behaviors in a Chinese culture. He found that the relation between a behavior and peer acceptance differed as a function of the group norm of the behavior or of the extent to which group members engaged in the behavior (Chang, 2004). For example, aggressive children from high-aggression classes were more accepted than aggressive children from low-aggression classes (Chang, 2004). Therefore, it seems possible that there might be variations in the relations of children's ADHD symptoms and aggressive or prosocial behaviors with peer acceptance/rejection across cultural contexts. Given that culture is an important social context in developmental research, it is crucial to

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take into account the role that cultures play in the associations between ADHD symptoms and peer relationships.

In Western societies, generally speaking, individual freedom of choice, self-expression, and independence/autonomy are often highly valued (Miller, 1994). In contrast, in the relationship-oriented Chinese cultures, responsiveness to others' needs over self-interests, cooperation (i.e., effort to avoid interpersonal conflict), and the maintenance of group harmony are an important part of the socialization process of children (Bond, 1996). In these relationship-oriented cultures, children grow up in an environment in which they are expected to be cooperative and compliant, and to maintain interpersonal and group harmony when interacting with peers and others around them (Chen & French, 2008). In order to meet the expectations of people around them and to avoid violating social norms, children in such societies need to restrain their personal desires in an effort to address the needs, interests, and goals of others (Chen & French, 2008). Therefore, it is plausible that in Chinese culture, disruptive behaviors including hyperactivity/impulsivity and aggression that seem to violate these cultural norms may place children at particularly high risk for peer rejection. On the other hand, Chinese children who show behaviors that support or foster harmonious interpersonal relationships may be better accepted by their peers than children who show behaviors that interrupt group activities. Chinese children who behave in a nonprosocial manner may be especially prone to peer problems because behaviors that favor self-interests over group interests are generally discouraged in Chinese culture where interdependence and relationships are highly valued (Bond, 1996; Chen, Li, Li, Li, & Liu, 2000).

Indeed, aggression in Chinese culture has been reported as a robust predictor of peer rejection (Chang, 2004; Xu, Farver, Schwartz, & Chang, 2003), while a lack of prosocial behavior was predictive of peer victimization in a Chinese culture (e.g., (Schwartz, Chang, & Farver, 2001). Hyperactive and impulsive behaviors in Chinese cultures have also been shown to be related to peer victimization (Xu et al., 2003), peer rejection, and difficulties forming and maintaining friendships (Kawabata, Tseng, & Gau, 2012; Tseng, Kawabata, & Gau, 2011). Furthermore, in another study, Tseng et al. (2012) found that in Taiwanese children, inattention was related to impaired peer functioning (i.e., fewer friends and low peer acceptance) through lack of prosocial behavior; hyperactivity was related to more physical aggression in girls, which in turn was related to poor peer functioning. Gau and her colleagues (2010) also found that both clinic- and community-based samples of children with ADHD in Taiwan were reported by teachers as showing more peer relationship problems (e.g., picked on or bullied, not liked by other children, or friendless) than controls without ADHD. In fact, teacher-reported peer relationship problems were one of the top reasons for clinical referral of children with ADHD in Taiwan (Gau et al., 2010). In summary, relative to the considerable amount of research in the Western cultures, research on peer functioning associated with ADHD symptoms in non-Western cultures (e.g., Chinese culture) is scare. Clearly more research from diverse cultures is needed.

Gender as the Developmental Context

Gender, in addition to being a personal attribute, can be considered a part of the developmental context within which gender-based norms and behaviors develop. Boys

and girls grow up influenced by different norms and cultures through differential socialization (Maccoby, 1998). In regards to peer relationships and friendships, girls tend to have smaller-sized peer groups than boys do; girls also place more emphasis on intimacy, self-disclosure, emotional closeness, and verbal social conversation within friendships, while boys focus on shared activities, competition, and rough and tumble play (Rose & Rudolph, 2006). It is not difficult to imagine that due to gender differences in the nature and characteristics of peer networks, the relations between disruptive behaviors (e.g. ADHD symptoms and aggression) and peer problems may differ by gender.

However, findings have been inconclusive with regard to whether boys and girls with ADHD symptoms show similar or varying degrees of peer impairment (Hoza, 2007). The literature on ADHD and associated social deficits has largely been dominated by male samples due to the higher prevalence of ADHD in boys (APA, 2000; Arnold, 1996). Relatively little is known about peer functioning of girls with ADHD symptoms (Diamantopoulou et al., 2005; Greene et al., 2001; Hinshaw, 2002; Mikami & Lorenzi, 2011; Rielly et al., 2006). Especially needed is research that directly compares boys and girls with ADHD in their social functioning (Rielly et al., 2006). All available evidence thus far suggests that girls with ADHD, like their male counterparts, are also likely to experience difficulties in peer relationships (Gaub & Carlson, 1997; Mikami & Hinshaw, 2003; Mikami & Lorenzi, 2011; Ohan & Johnston, 2007).

Nevertheless, it is conceivable that symptoms of ADHD, especially those that violate gender norms, may carry different social consequences for girls and boys. Some

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evidence suggests that girls with ADHD exhibit lower levels of symptom severity yet suffer a higher risk of social rejection than boys (Carlson, Tamm, & Gaub, 1997; Diamantopoulou et al., 2005; Gaub & Carlson, 1997). For example, Berry et al. (1985) reported more peer disapproval for girls than boys with ADHD (Berry, Shaywitz, & Shaywitz, 1985). In a recent study, Elkins et al. (2011) also reported that children with ADHD symptoms, especially girls with ADHD-I, were less popular among peers than those without ADHD symptoms. This may be because peers are more willing to tolerate higher levels of inattention and hyperactivity in boys than in girls perhaps because these behaviors are more common among boys than among girls (Diamantopoulou et al., 2005).

In contrast, some other researchers reported greater peer problems in boys than in girls with ADHD symptoms (Pelham & Bender, 1982; Thorell & Rydell, 2008) or different patterns of peer relationship problems between boys and girls. For example, one interesting finding from a past study (Bacchini, Affuso, & Trotta, 2008) indicated that boys with ADHD symptoms were at increased risk of being the bully, whereas girls with ADHD symptoms were at increased risk of being the victim of bullying. Likewise, Wiener and Mak (2009) found that children with ADHD were more likely to be victimized by peers than comparison children, especially for girls with ADHD. These findings highlight the possibility that ADHD symptoms may have differential impacts on boys' and girls' social adjustment.

Still others found that ADHD symptoms affected peer functioning equivalently for both boys and girls (Cunningham et al., 1985; DeHaas, 1986; Greene et al., 2001;

Hoza, Mrug, et al., 2005), including a recent work by Mikami and Lorenzi (2011) and a community-based study of youth with attention problems (Rielly et al., 2006). The association between symptoms of ADHD and lower peer acceptance or fewer dyadic friendships appears to hold regardless of gender (Hoza, Mrug, et al., 2005). Similarly, a recent study by Normand and colleagues (2011) indicated that boys and girls with ADHD did not differ from each other in friendship qualities and friendship satisfaction. Findings from a meta-analysis also reported no mean differences in peer problems between girls and boys with ADHD (Gershon, 2002).

To complicate the picture even more, the effect of gender on the association between ADHD symptoms and peer functioning may be further moderated by the source of the sample (i.e., clinical versus nonclinical or community-based). In a previous meta-analytic study, Gaub and Carlson (1997) reported that in nonreferred samples, girls with ADHD showd less peer disliking than boys with ADHD; however, there were no such gender differences in clinic-referred samples of ADHD.

In addition to experiencing varying types and degrees of social ramifications, girls and boys with ADHD may traverse gender-specific pathways to poor peer functioning. For example, girls with ADHD are more likely to be classified as ADHD-I, as opposed to ADHD-C or ADHD-HI (Gaub & Carlson, 1997). Therefore, girls may be more likely to follow a route to peer rejection marked by social withdrawal and passivity, whereas boys, who are more likely to exhibit externalizing symptoms, may experience rejection as the result of hyperactive and aggressive behavior. On the other hand, if the "gender non-normative hypothesis" is true, given a relatively low base rate of hyperactivity/

impulsivity and physical aggression for girls, peers may be less tolerant of these behaviors that violate gender norms (Crick, 1997; Mikami & Lorenzi, 2011). Thus, girls with hyperactivity/impulsivity and physical aggression may be perceived as more gender non-normative and, accordingly, suffer greater peer impairment (Crick, 1997; Mikami & Lorenzi, 2011). In summary, findings have been mixed with regard to gender differences or the effect of gender in this area of research. Hence, another goal of this study is to explore the role that gender plays in the associations between ADHD and peer functioning.

The Present Study

Based on my literature review, it is clear that this field has made important progress in demonstrating the link between ADHD symptoms and peer relationship problems. However, several limitations need to be addressed to move this area of research forward. Therefore, the overarching goal of this study was to address some of the gaps in the literature in the hopes of advancing our knowledge and understanding of peer functioning among children with ADHD symptoms. I attempted to do so by using a study design that was guided by developmental psychopathology framework (e.g., longitudinal design, dynamic organization and reorganization of behaviors overtime, multi-faceted assessment, and multiple levels of analysis) and focused on a non-Western sample from Taiwan. Specific goals of the present study were to: (1) examine the aspects of peer functioning (i.e., peer acceptance, peer rejection, popularity, peer victimization, the number of reciprocated friendships, and the quality of friendship) that are impaired in children with ADHD symptoms and the differential concurrent and longitudinal effects of

inattention and hyperactivity/impulsivity on peer functioning; (2) investigate potential

mechanisms underlying ADHD-related peer relationship problems; (3) study longitudinal

effects of ADHD symptoms as well as the dynamic interplay between ADHD symptoms

and associated peer impairment over time; (4) explore potential risk and protective

factors against peer problems in youth with ADHD symptoms; and (5) explore the effect

of gender on the associations between ADHD symptoms and peer functioning.

Hypotheses

The following goals and hypotheses were generated on the basis of the literature

review and were tested in the present study:

(1) a. Inattention and hyperactivity/impulsivity would be *concurrently* associated with

more peer relationship problems including less peer acceptance, more peer

rejection, lower popularity, more peer victimization, fewer reciprocated

friendships, poorer quality of friendship (i.e., low companionship, low help, low

closeness, low intimacy, high exclusivity, and more conflicts), more relational and

physical aggression, and less prosocial behavior.

b. Inattention and hyperactivity/impulsivity would be *longitudinally* associated with

more peer relationship problems including less peer acceptance, more peer

rejection, lower popularity, more peer victimization, fewer reciprocated

friendships, poorer quality of friendship (i.e., low companionship, low help, low

closeness, low intimacy, high exclusivity, and more conflicts), more relational and

physical aggression, and less prosocial behavior.

(2) Inattention and hyperactivity/impulsivity would be associated with poor peer

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functioning (i.e., peer rejection, peer acceptance, and the number of friendships) one year later (see Figure 1). These associations would be mediated by HABs and physical and relational aggression such that inattention and/or hyperactivity/impulsivity would be related to HABs, which in turn would predict more relational and physical aggression (Figure 1). Relational and physical aggression, in turn, would predict poor peer functioning (Figure 1). Furthermore, inattention and hyperactivity would predict less prosocial behavior, which in turn would predict poor peer functioning (see Figure 1). However, the mechanisms and intermediate factors involved might be different, depending on the core symptom domains. For example:

a. Inattention may be more likely to be associated with prosocial behavior, which then leads to poor peer relationships.

b. Hyperactivity, on the other hand, may be more likely to be associated with more HABs, which in turn predicts more relational and physical aggression, and then leads to poor peer functioning.

(3) ADHD symptoms (i.e., inattention and hyperactivity) and peer rejection would be stable across time; peer acceptance and the number of friendships would also be stable across time, but to a lesser degree (Figure 2). Further, within the framework of a cross-lagged panel model, I hypothesized that ADHD symptoms at Time 1 would predict peer rejection, peer acceptance, and the number of friendships at Time 2, which in turn would predict later ADHD symptoms at Time 3 (Figure 2). Likewise, peer rejection, peer acceptance, and the number of friendships at Time 1 would

predict ADHD symptoms at Time 2, which in turn would predict peer rejection, peer acceptance, and the number of friendships at Time 3 (Figure 2).

(4) To explore potential risk and protective factors for the link between ADHD and peer functioning, analyses were conducted in four groups of children: ADHD youth with higher peer acceptance ("liked ADHD"), ADHD youth with lower peer acceptance ("disliked ADHD"), controls with higher peer acceptance ("liked controls"), and controls with lower peer acceptance ("disliked controls").

   a. In general, I expect that "disliked ADHD," relative to the other three groups, would be more likely to have psychosocial adjustment problems in multiple aspects including more relational and physical aggression, less prosocial behaviors, more internalizing and externalizing problems, more ADHD symptoms, more HABs, and lower academic achievement. However, given the limited research on ADHD youth with good peer functioning (e.g., "liked ADHD"), no specific a priori hypotheses were made with regard to the group differences involving this group of youth.

   b. Further, "disliked ADHD," relative to the other three groups, would be more likely to have poor parent-child relationships (i.e., more conflicts and less closeness) and have parents who use negative parenting (i.e., psychological control). Again, given the limited research on ADHD youth with good peer functioning (e.g., "liked ADHD"), no specific a priori hypotheses were made with regard to the group differences involving this group of youth.

(5) Because of the mixed findings in the previous studies with regard to the effect of

gender, no specific a priori hypotheses were generated. However, I expect that the negative impact of ADHD symptoms on peer functioning may be greater for girls than for boys according to the gender non-normative hypothesis.

Methods

Participants

The sample of this study consisted of 739 preadolescents (239 fourth graders and 500 fifth graders) from northern Taiwan who participated in a short-term longitudinal study across three time points, six months apart. Of 739 participants, 386 were boys and 353 were girls. The mean age of the sample was 10.06 years ($SD = 0.59$). Four hundred seventy one students (63.73 %) and 514 students (69.55 %) continued their participation at Times 2 and 3, respectively. Participants were recruited from four public elementary schools in Taipei area. In the fall semester of 2008, I sent letters to the principals of the elementary schools in Taipei City and Taipei County to explain the purpose and procedure of this study. Of those schools that agreed to participate, two schools from Taipei City and another two from Taipei County were randomly selected to be included in this study.

Table 1 presents demographics and characteristics of the present sample. The majority of the participants (88.9 %) came from married households. The average ages of the participants' mothers and fathers were 40.05 and 43.22 years, respectively. The median number of children in the families was two, including the participating child. The socioeconomic status of the sample ranged from lower class to upper class based on parents' education levels and the household income. The distributions of paternal and

maternal education levels were 45.4 % and 43.4 % for college and above, 36.9 % and

41.5 % for senior high school and vocational, and 17.7 % and 15.1 % for junior high and

below, respectively. Annual household income ranged from less than $10,258 to over

$41,032, with an average and a median income at the level of $20,516 to $30,774.

Overall, the present sample consisted of students from diverse socioeconomic

backgrounds and was slightly different from the overall population in Taiwan;[1] however,

it was viewed as a representative sample of northern Taiwan.

Participants who dropped out of the study through Time 3 did not differ from

those who remained in the study with respect to ADHD symptoms, key outcome

variables (e.g., peer acceptance, peer rejection, numbers of friends) or most of the

demographic variables including gender, parents' ages, education attainment, household

income, marital status, and numbers of children in the family ($ps = .133$ to $.896$).

However, those who remained in the study were younger than those who dropped out, t

value = -10.22, $p < .001$. Therefore, age was included in the analyses as a covariate to

control for its effect.

Procedures

The data of the present study were collected at three time points, six months apart.

There were four primary sources of the data: parent reports, children's self-reports,

teacher reports, and peer nomination. Each informant completed the same measures at all

three time points. Parents completed a questionnaire regarding their participating child's

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[1] In 2007, the education attainment distributions for overall population in Taiwan were 32.9% for college and above, 32.7% for senior high school and vocational, and 34.4 % for junior high and below. The nation-wide average of household income was $36,782.

ADHD symptoms (i.e., inattention and hyperactivity/impulsivity) and internalizing and externalizing adjustment problems (assessed by the Child Behavior Checklist [CBCL]), their relationships with the child, and their parenting behaviors (i.e., psychological control). Children completed measures that assessed their HABs and the friendship qualities with their best friend. Peers and teachers reported on participating children's prosocial and aggressive behaviors (i.e., physical and relational aggression). Teachers also reported on participating children's academic performance and depressive symptoms, and peers also reported on peer functioning variables (i.e., peer acceptance, peer rejection, popularity, peer victimization, and the number of friendships). A list of measures can be found in Table 2.

Parents completed their versions of the questionnaires at home while children and teachers completed their versions of the questionnaires at schools. Peer nominations were administered in group sessions in the classrooms. More details regarding peer nomination procedures are presented below in the measures section. Children were compensated for their time and participation with a stationary set of a pencil and an eraser (worth about $1). Teachers were given a small gift, a 2G flash drive (worth about $15), for completing questionnaires for participating students in their classrooms. Parents were not provided with any incentives or compensation for their participation.

For those measures without existing Chinese versions (e.g., teacher reports of relational and physical aggression and prosocial behavior), I translated the measures into Chinese. They were then back-translated into English by a native speaker of both English and Chinese to ascertain the validity of the measures.

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The procedure and method of this study were approved by the Institute Review

Board at the University of Minnesota. Of those who were invited, 88.61 % agreed to

participate in the study. For all enrolled participants, written informed consent from the

parents and written assents from the child were obtained after an explanation of the

purpose and procedure of the study, the lack of an obligation to participate in the study,

and a reassurance of confidentiality.

Measures

ADHD symptoms. Children's symptoms of inattention and

hyperactivity/impulsivity were assessed using parent reports of the Chinese version of the

Swanson, Nolan, and Pelham, version IV scale (SNAP-IV). The SNAP-IV is a 26-item

rating instrument with a 4-point Likert scale from 0 (*not at all true*) to 3 (*very much true*;

Gau et al., 2008; Swanson et al., 2001). The SNAP-IV consists of three subscales:

Inattention (9 items), Hyperactivity/Impulsivity (9 items), and Oppositional subscales (8

items) that maps onto the DSM-IV diagnostic criteria for ADHD and oppositional defiant

disorder (Gau et al., 2008; Swanson et al., 2001). Only the subscales of Inattention and

Hyperactivity/ Impulsivity were used in the study. The norm and psychometric

properties of parent reports of the Chinese SNAP-IV have been established in Taiwan

(Gau et al., 2008). For the present sample, Cronbach's alphas (αs) were .89 to .91 for

Inattention and .89 to .90 for Hyperactivity/Impulsivity across three time points,

demonstrating good internal consistency of this measure. Mean score (the average of the

scores on all the items) of each subscale was used in the analyses as a dimensional

measure of ADHD symptoms.

Peer functioning.

Peer acceptance, peer rejection, and popularity. A sociometric procedure was used to generate key peer functioning variables. During the administration of the sociometric instrument in grade school classrooms, participants were provided with a class roster and were asked to nominate up to five classmates who best fit the behavioral descriptions provided for each of the items on the measure. For example, children were asked to name up to five peers in their class who they "like to hang out with the most," "like to hang out with the least," and "see as most popular." The number of nominations that children received from classmates on "like to hang out with the *most*" was standardized within each classroom and was defined as Peer Acceptance; the number of nominations that children received on "like to hang out with the *least*" was standardized and then defined as Peer Rejection; the number of nominations that children received on "see as most popular" was also standardized and then defined as Perceived Popularity. It is noted that children who did not consent to this study were crossed out from the roster and the participants were told not to nominate those who did not participate. Also, the participating children could only nominate children from their classrooms. Details with regard to the use of this peer nomination instrument in Taiwanese child and adolescent population have been described elsewhere (Tseng et al., 2012).

Peer victimization. A six-item peer nomination instrument – Children's Social Experience Questionnaire (CSEQ) – was administered to assess children's physical and relational victimization (Crick & Bigbee, 1998). Items for relational victimization (3 items) asked children to nominate those who "get ignored by other children," "get left out

of the group," or "are the target of rumors or gossip." Items for physical victimization (3 items) asked children to nominate those who "get hit or kicked by peers," "get pushed or shoved," or "get physically threatened." The number of nominations children received from classmates for each of the items on these subscales was standardized within classrooms. The average of the standardized scores for the items on each subscale was used in the analyses. This peer nomination instrument for peer victimization has been used in the past research in Taiwan, and details about the factor structure and psychometric properties of this instrument have been described elsewhere (Tseng, Kawabata, Crick, Gau, & Lee, 2009). In the present sample, Cronbach's αs were .84 – .87 for relational victimization and .91 – .96 for physical victimization across three time points.

Numbers of reciprocated friendships. Peer nomination technique was also used to identify mutual friendships (Grotpeter & Crick, 1996; Parker & Asher, 1993). Participants were asked to nominate up to five best friends from their classroom rosters. Reciprocated friendships were identified as pairs of children who chose each other as a best friend. The number of reciprocated friendships was used in the analysis.

Friendship quality. Children's self-reports of the friendship quality with their best friend were assessed using the Friendship Quality Scale (FQS; Bukowski, Hoza, & Boivin, 1994) and the Friendship Quality Measure (FOM; Grotpeter & Crick, 1996). Children were asked to think about one best friend in the classroom while answering the

questions. Subscales on these measures included: companionship (3 items),[2] closeness (5 items), conflict (5 items), help (7 items), intimacy (5 items), and exclusivity (5 items). Children were asked to identify how true each item was for them within their friendship. The scale ranged from 1 (*never true*) to 5 (*almost always true*). Because psychometric properties of the Chinese version of the FQS and FQM were not available, confirmatory factor analysis (CFA) was conducted in the present study to examine the factor structure of these measures. Findings were described in the results section.

Social behaviors: Relational and physical aggression and prosocial behavior.

Teacher reports. Teacher reports of participants' relational and physical aggression and prosocial behavior were assessed at all three time points using the Children's Social Behavior Scale – Teacher Report (CSBS-T; Crick, 1996). Teachers were asked to rate each child on a 5-point scale from 1 (*not at all true*) to 5 (*always true*). Relational Aggression consisted of 5 items from the original Crick measure (e.g., "Gets other children to stop playing or liking some peers") and 5 new items added for the purpose of the present study to capture subtle and indirect relationally aggressive behavior that might be unique to Taiwanese children (e.g., "Pretends to be close to other kids to make his/her friends upset"). Physical Aggression consisted of 4 items (e.g., "Hits or kicks other peers") and Prosocial Behavior consisted of 5 items (e.g., "Other kids seek out this child for advice or help"). Details with regard to the factor structure and the use of this measure in Taiwanese child and adolescent population have been described elsewhere (Kawabata, Tseng, Murray-Close, & Crick, 2012; Tseng et al., 2012).

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[2] One item from the original FQS ("My friend and I go to each other's house after school and on weekends") was dropped because of low factor loading.

Therefore, factor analysis was not conducted in this study. The three subscales exhibited

acceptable to excellent reliability in the present sample. Cronbach's αs were .92 to .94

for Relational Aggression, .90 to .94 for Physical Aggression, and .81 to .84 for Prosocial

Behavior across three time points. Mean scores on each of the subscales were used in the

analysis.

  Peer nomination. An 11-item peer-nomination instrument was administered to

assess children's Relational Aggression (5 items), Physical Aggression (3 items), and

Prosocial Behavior (3 items; CSBS-P; Crick & Grotpeter, 1995). Participants were asked

to nominate up to five classmates who, for example, "hit, kick, or punch others at school"

(physical aggression) or "who try to make another kid not like a certain person by

spreading rumors about them or talking behind their backs" (relational aggression) or

"who say or do nice things for other classmates" (prosocial behavior). The number of

nominations children received from classmates for each of the items on these subscales

was standardized within class. The average of the standardized scores for the items on

each subscale was used in the analyses. Details with regard to the factor structure and the

use of this measure in Taiwanese child and adolescent population have been described

elsewhere (Tseng et al., 2012). Therefore, factor analysis was not conducted in this

study. Cronbach's αs were .94 to .96 for Relational Aggression, .92 to .95 for Physical

Aggression, and .90 to .92 for Prosocial Behavior across three time points, showing

excellent reliability of these subscales in the present sample.

  HAB. A hypothetical-situation instrument, the Intent Attribution Measure (Crick,

1995; Crick, Grotpeter, & Bigbee, 2002), was used to assess children's HAB toward

relational and physical provocations. A total of six hypothetical stories, three describing

instrumental peer conflicts (e.g., a peer spills a drink all over your back) and three

describing relational peer conflicts (e.g., two classmates look at you, whisper something

to each other and then laugh as they walk by you), were used. Children were asked to

read these six stories in which the intent of the provocateur in the stories is ambiguous

and then answer two questions for each situation to assess their own HAB (i.e., whether

they would infer that the provocateur had acted with hostile or benign intent). In the first

question, children were presented with four possible reasons for the provocation and were

asked to choose the most likely reason. Two of the responses described benign intent

(e.g., "the kids were just having fun") and two described hostile intent (e.g., "the kids

were trying to make me mad"). When children inferred the provocateur's intent as

hostile, they were assigned a score of 1; when they inferred the provocateur's intent as

benign, they were assigned a score of 0. In the second question, children were asked to

indicate whether the aggressor was trying to be mean (coded as 1) or not trying to be

mean (coded as 0). Children's responses to the two questions were summed across

stories within the same type of provocation (e.g., relational or instrumental), resulting in

two total scores – HAB – Ins and HAB – Rel, with possible values ranging from 0 to 6

for each score. Past research conducted in the U.S. samples has demonstrated good

psychometric properties of this measure (Crick, 1995; Crick et al., 2002). However,

because psychometric properties of the Chinese version of this measure were not

available, CFA was conducted in the present study to examine the factor structure of this

measure. Findings were described in the results section.

Internalizing and externalizing problems. Parents completed the CBCL

(Achenbach, 1991) to assess children's internalizing and externalizing adjustment

problems. Eight narrow-band emotional and/or behavioral problems and two broad-band

dimensions, internalizing and externalizing syndromes, can be derived from 118 items of

the CBCL (Achenbach, 1991). The two broad-band subscales of internalizing problems

(i.e., anxious/depressed symptoms, withdrawal, somatic complaints) and externalizing

problems (i.e., aggressive behavior, delinquency) were used in this study. Parents were

asked to rate how true each item was of participants on a 3-point scale from 0 (*not true*)

to 2 (*very true or often true*). The Chinese version of the CBCL has been demonstrated

to be a reliable and valid instrument and has been widely used to measure children's

behavioral syndromes in Taiwanese child populations (Yang, Chen, & Soong, 2001;

Yang, Soong, Chiang, & Chen, 2000). In the present sample, Cronbach's αs were .91 –

.92 for internalizing problems and .90 – .91 for externalizing problems across time points.

Mean scores on the scales were used in the analysis.

Teachers also completed the anxious/depressed subscale in the Teacher Report

Form (TRF) of the CBCL (Achenbach, 1991) to assess children's anxious/depressed

symptoms. Teachers were asked to rate how true each item was of participants on a 3-

point scale from 0 (*not true*) to 2 (*very true or often true*). Composite scores of teacher

and parent reports of the anxious/depressed subscale were created and used in the

analyses as an index of children's depressive symptoms. This was primarily because the

composite scores reflected a broader constellation of children's depressive symptoms,

which may be manifested differently at school and home, compared to symptom scores

assessed by a single informant (i.e., a teacher or a parent). In fact, teacher-reports were

significantly, but modestly, correlated with parent-reports at three time points ($rs = .11 -$

$.19, p < .05$), indicating that teachers and parents viewed somewhat different aspects of

children's depressive symptoms. In the present sample, Cronbach's αs for the subscale of

anxious/depressed symptoms reported by teachers and parents at three time points was

acceptable (> 0.84). The Chinese version of TRF has also been demonstrated to be a

reliable and valid instrument in assessing emotional and behavioral syndromes in

Taiwanese child populations (Yang et al., 2001, 2000). Mean score on the subscale was

used in the analysis.

  Parent-child relationships. Parents completed a 15-item Child-Parent

Relationship Scale (Pianta, 1992) to assess closeness (7 items)[3] and conflict (7 items) in

their relationships with their child. Each item was rated on a 5-point scale from 1

(*definitely does not apply*) to 5 (*definitely applies*). Example items for the closeness and

conflict subscales were "I share an affectionate, warm relationship with this child" and

"This child and I always seem to be struggling with each other," respectively. Mean

scores on each of the subscales were used in the analysis. I conducted CFA to examine

the two-factor structure of this measure and calculated Cronbach's α given that

psychometric properties of this measure in Taiwanese samples were not available in past

studies. Findings were presented in the results section.

  Psychological control. Parents also completed Psychological Control (Hart,

Nelson, Robinson, Olsen, & McNeilly-Choque, 1998) to assess maternal use of love

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[3] One item from the original scale ("My child is uncomfortable with physical affection or touch from me")
was dropped because of low factor loading.

withdrawal (5 items) and guilt induction (5 items) as indices for parenting behaviors.

Psychological control was specifically chosen over other parenting constructs because it

often hinders children's development of social competence by limiting their opportunities

to develop self-regulatory and coping skills in social situations (Nelson et al., 2006). The

two subscales – love withdrawal and guilt induction – were specifically selected because

they were most reflective of Chinese values and beliefs (Nelson et al., 2006; Wu et al.,

2002) and because shaming was found to be commonly practiced by Taiwanese parents

as a socialization tactic (Fung, 1999). Items were rated on a 5-point scale from 1 (*not at

all*) to 5 (*always*). A sample item for love withdrawal subscale was "Avoiding looking at

my child when my child has disappointed me." A sample item for guilt induction was

"Telling my child he/she is not as good as other children." Mean scores on each of the

subscales were used in the analysis. CFA was also conducted to examine the factor

structure of this measure in the present Taiwanese sample. Findings were described in

the results section.

Academic performance. Teachers were asked to rate each student's academic

performance in terms of their ranking relative to other students in the class. Each student

was rated on a 5-point scale from 1 (*top 1/5)* to 5 (*bottom 1/5*) in terms of their academic

performance in the class. Scores were reverse coded so that higher scores indicated

better academic performance.

<div align="center">

Data Analysis Plan

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(1) a. Analyses using linear mixed models in SAS 9.2 were conducted to test the

 hypotheses that inattention and hyperactivity/impulsivity would be *concurrently*

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associated with more peer relationship problems including less peer acceptance, more peer rejection, lower popularity, more peer victimization, fewer reciprocated friendships, poorer quality of friendship (i.e., low companionship, low help, low closeness, low intimacy, high exclusivity, and more conflicts), more relational and physical aggression, and less prosocial behavior. Independent variables were inattention and hyperactivity/impulsivity from Time 1, and dependent variables were the abovementioned peer variables from Time 1. Inattention and hyperactivity were included simultaneously in the models to examine their relative effects on the outcomes. Age and gender were included in the models as covariates. Mixed model analyses were performed by the PROC MIXED procedure with maximum likelihood (ML) estimation. Mixed models were used (instead of traditional regression) because it is a better mechanism for handling data that are missing at random (Raudenbush & Bryk, 2002). Additionally, because data in the present study were structured hierarchically (i.e., observations were not independent since they are nested within classrooms), linear mixed models can account for the dependencies between individuals and classrooms, adjusting the variance that is due to individuals and classrooms. This procedure generates more accurate estimates than the traditional OLS (ordinary least squares) regression approach (Raudenbush & Bryk, 2002).

b. Mixed models were also used to examine the hypotheses that inattention and hyperactivity/impulsivity would be *longitudinally* associated with more peer relationship problems including less peer acceptance, more peer rejection, lower

popularity, more peer victimization, fewer reciprocated friendships, poorer quality

of friendship (i.e., low companionship, low help, low closeness, low intimacy,

high exclusivity, and more conflicts), more relational and physical aggression,

and less prosocial behavior. Independent variables were inattention and

hyperactivity/impulsivity from Time 1, and dependent variables were the

abovementioned peer variables from Time 3. Inattention and hyperactivity were

also included simultaneously in the models to examine their relative effects on the

outcomes. Age and gender were included in the models as covariates, while

outcome variables from Time 1 were included to control for their effects.

(2) Structural Equation Modeling (SEM) analyses by Amos 19.0 were conducted to test

my hypothesized mediation model (Figure 1). One of the primary advantages of

SEM is that multiple measures could be combined to create latent constructs that

minimize measurement error, thereby reducing the possibility of underestimation of

the effect sizes due to unreliability of the measures (Card & Little, 2007). Also,

measures from different sources can be combined to create latent constructs to

minimize the biases associated with one single source or scale. Other advantages of

SEM over traditional analyses of manifest variables (e.g., regression or analysis of

variance) include greater ability to model complex multivariate relations (e.g.,

multiple dependent variables, indirect or mediated processes, interactive processes)

and the ability to obtain fit indices that allow for explicit testing of competing models

and specific hypotheses (Card & Little, 2007; Kline, 1998). Using SEM, my

hypothesized model examined the independent prediction from each domain of

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ADHD (i.e., Time 1 inattention and Time 1 hyperactivity) to the intervening variables
(i.e., Time 1 HAB – Rel and HAB – Ins, Time 2 physical aggression, relational
aggression, and prosocial behavior) and to the outcome variables (i.e., Time 3 peer
rejection, peer acceptance, and the number of friendships), controlling for all other
variables in the hypothesized model. Paths from HAB – Rel to relational aggression
and from HAB – Ins to physical aggression were also tested to examine the mediation
of HABs in the links between two core domains of ADHD symptoms and
relational/physical aggression. Teacher and peer reports were used to create latent
constructs for physical aggression, relational aggression, and prosocial behavior. All
the paths in Figure 1 were tested.

(3) To further examine longitudinal effects of ADHD symptoms (i.e., inattention and
hyperactivity) and the interplay between ADHD symptoms and peer functioning (i.e.,
peer rejection, peer acceptance, and the number of friendships), cross-lagged panel
models were tested (see Figure 2). Three different cross-lagged panel models with
each peer functioning variables were examined. In the cross-lagged panel models,
stabilities of ADHD symptoms, peer rejection, peer acceptance, and the number of
friends across three time points and the covariance among these constructs within
time were estimated as well as the bidirectional effects between inattention and peer
functioning variables (e.g., peer rejection, peer acceptance or the number of
friendships) and between hyperactivity/impulsivity and these peer variables (see
Figure 2). Such cross-lagged panel model allows for testing of the unique and
independent effect of inattention and hyperactivity/impulsivity on peer functioning; it

also allows for examining the continuity of constructs over time and the covariances between constructs within and over time that are over and above what may have already occurred in previous times. Thus, significant cross-lagged associations suggest that constructs in one area (i.e., ADHD symptoms or peer functioning) predicts changes in constructs in another area over time.

(4) To identify potential risk factors for and protective factors against peer difficulties among children with ADHD symptoms, analyses were conducted in four groups of children: "liked ADHD ($n = 28$)," "disliked ADHD ($n = 69$)," "liked controls ($n = 85$)," and "disliked controls ($n = 141$)." Only data from Time 1 were used in testing this set of hypotheses. ADHD total symptoms and peer acceptance scores were used to classify the four groups of children: 1) "liked ADHD" were children who had ADHD symptoms ≥ 1 *SD* above the mean and standardized peer acceptance score ≥ 0;[4] 2) "disliked ADHD" were children who had ADHD symptoms ≥ 1 *SD* above the mean and standardized peer acceptance score < 0; 3) "liked controls" were children who had ADHD symptoms < 1 *SD* below the mean and standardized peer acceptance score ≥ 0; and 4) "disliked controls" were children who had ADHD symptoms < 1 *SD* below the mean and standardized peer acceptance score < 0.

a. A series of general linear models (GLM) that adjust for unbalanced designs were conducted to examine differences among these four groups of children in multiple aspects such as relational and physical aggression, prosocial behaviors, internalizing and externalizing problems, ADHD symptoms, HABs, and academic

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[4] Standardized score of 0 (instead of 1 *SD*) was chosen as the cutoff for peer acceptance to maximize the sample size.

achievement.

b. Similarly, a series of GLMs were conducted to examine differences among these four groups of children in terms of parent-child relationships (i.e., conflict and closeness) and parenting behaviors (i.e., psychological control).

(5) To explore the moderating effect of gender on the association between ADHD symptoms and peer functioning (hypothesis 1), two-way interactions of Gender × Inattention and Gender × Hyperactivity were added in the mixed models. The effect of gender was also examined by testing whether the strength and direction of the paths in the mediation model in Figure 1 (hypothesis 2) and the cross-lagged model in Figure 2 (hypothesis 3) differed between boys and girls. This was done by conducting multi-group SEM analyses in AMOS with gender as the grouping variable. Given the exploratory nature of hypothesis 4 and the limited statistical power due to small sample size in testing hypothesis 4, the effect of gender was not tested with regard to hypothesis 4.

Results

Confirmatory Factor Analyses

   Friendship qualities. I conducted CFA using AMOS 19.0 to examine the factor structure of the Chinese version of the FQS and FQM at the initial assessment. There were six subscales in the measures. Model fit was assessed with multiple criteria: Chi-Square (χ^2), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). In general, nonsignificant Chi-Squares, CFIs greater than .95, and RMSEAs less than .05 suggest a good model fit with the observed data (Hu & Bentler, 1999;

McDonald & Ho, 2002); however, some argue that CFIs > .90, RMSEA < .10 may also

be considered as indicating adequate fit (Kline, 1998; McDonald & Ho, 2002). Because

the Chi-Square statistic is directly related to sample size, it was not used as the primary

indicator of the model fit (Hu & Bentler, 1999). Results of the CFA indicated that a six-

factor model (i.e., companionship, closeness, conflict, help, intimacy, and exclusivity) fit

the Time 1 data fairly well: $\chi^2 = 811.78$, $df = 386$, $p < .001$, CFI = .95, and RMSEA = .04,

[.03, .04]. All factor loadings were significant at $p < .001$ with standardized factor

loadings greater than .40. Table 3 presents the items of each subscale and the factor

loadings. Cronbach's alpha (α) for the internal consistency of these six subscales was

then computed. Cronbach's αs for the six subscales ranged from .74 to .88 (Table 3),

demonstrating adequate to good reliability of these subscales in the present sample.

HAB. The measure for HAB consisted of two subscales: HAB – Rel and HAB –

Ins. CFA was conducted to examine the two-factor structure of this measure. Results

demonstrated that a two-factor model fit the data (Time 1) well, $\chi^2 = 134.85$, $df = 47$, $p <$

.001, CFI = .97, and RMSEA = .05 [.04, .06]. Consistent with previous work, this

measure showed acceptable reliability in the present sample; Cronbach's αs were .77 for

both HAB – Rel and HAB – Ins at the initial assessment.

Child-parent relationships. The Child-Parent Relationship Scale consisted of

two subscales: closeness and conflict. CFA was conducted to examine the two-factor

structure of this measure. Results indicated that a two-factor model fit the data (Time 1)

well, $\chi^2 = 193.68$, $df = 73$, $p < .001$, CFI = .96, and RMSEA = .05 [.04, .06]. All factor

loadings were significant at $p < .001$ with standardized factor loadings greater than .49.

Table 4 presents the items of each subscale and the factor loadings. This measure demonstrated good reliability in this present sample with Cronbach's αs = .85 for closeness subscale and .80 for conflict subscale at the initial assessment.

Psychological control. The measure for psychological control consisted of two subscales: love withdrawal and guilt induction. Results of the CFA indicated that a two-factor model fit the data (Time 1) well, $\chi^2 = 86.71$, $df = 32$, $p < .001$, CFI = .94, and RMSEA = .05 [.04, .06]. All factor loadings were significant at $p < .001$ with standardized factor loadings greater than .40. Table 5 presents the items of each subscale and the factor loadings. Cronbach's αs were .68 for love withdrawal subscale and .72 for guilt induction subscale at the initial assessment, indicating marginally adequate reliability of this measure for the present sample.

Preliminary Analyses

Table 6 presents the means and standard deviations of the study variable across time points. Skewness and kurtosis of the study variables were also examined. The skewness values of all the variables were reasonable except for teacher-reported relational and physical victimization (skewness > 2). Using log-transformed variables of teacher-reported relational and physical victimization did not change the patterns of findings in the main analyses (hypothesis 1). Therefore, for ease of interpretation, untransformed values were used in all subsequent analyses.

Concurrent and Longitudinal Associations between ADHD Symptoms and Peer Functioning

Concurrent associations. Table 7 presents the results of mixed models

examining concurrent associations between ADHD symptoms and peer functioning variables. As shown in Table 7, after the effect of hyperactivity/impulsivity was taken into account, inattention was concurrently associated with lower peer acceptance, lower popularity, more teacher- and peer-reported relational victimization, less teacher- and peer-reported prosocial behavior, and less peer-reported physical aggression. There was a trend that inattention was concurrently related to more peer-reported physical victimization and more conflict with friendships. In contrast, after the effect of inattention was taken into account, hyperactivity was concurrently associated with more peer rejection, more teacher-reported physical victimization, less intimacy and more conflict within friendships, more teacher-reported physical aggression and relational aggression (result was marginally significant for relational aggression), and more peer-reported physical and relational aggression. There was a trend that hyperactivity was concurrently related to more peer-reported relational victimization.

Moreover, the moderating effect of gender was evident in several places. Simple slope analyses (Aiken & West, 1991) were conducted to probe significant gender interactions. Results showed that the association between inattention and peer-reported prosocial behavior was greater for girls than for boys (Table 7). Similarly, the association between hyperactivity and peer rejection was moderated by gender, such that this association was stronger for girls than for boys (Table 7). In addition, gender moderated the association between hyperactivity and intimacy within friendship; that is, this association was significant for girls, but not for boys (Table 7).

Longitudinal associations. Table 8 presents the results of mixed models

examining longitudinal associations between Time 1 ADHD symptoms and Time 3 peer functioning variables, controlling for Time 1 peer functioning variables. As shown in Table 8, after the effect of hyperactivity/impulsivity was controlled for, inattention longitudinally predicted more teacher-reported physical victimization, less help within friendships, and less peer-reported relational aggression. There was a trend that inattention longitudinally predicted more teacher-reported relational victimization and lower companionship within friendships. On the other hand, hyperactivity, after controlling for the effect of inattention, was only marginally significant in predicting more intimacy, more conflict, more teacher-reported relational aggression, and more peer-reported prosocial behavior.

Gender moderation was also evident for several associations. Again, simple slope analyses (Aiken & West, 1991) were conducted to probe significant gender interactions. Results showed that the effect of inattention on teacher-reported physical victimization was significant for girls, but not for boys (Table 8). Likewise, the association between hyperactivity and conflict within friendships was significant for girls, but not for boys (Table 8). Further, gender moderated the association between inattention and teacher-reported prosocial behavior, such that this association was significant for boys, but not for girls (Table 8).

Mediation Model of ADHD Symptoms and Peer Functioning

Before testing the mediation model of ADHD symptoms and peer functioning, correlations among the observed variables in the model were examined. As shown in Table 9, inattention and hyperactivity/impulsivity were highly correlated ($r = .59$), which

was consistent with the literature. In general, Time 1 inattention was positively related to Time 1 HAB – Ins and negatively related to Time 2 teacher- and peer-reported prosocial behavior. Time 1 inattention was also positively related to Time 3 peer rejection and negatively related to Time 3 peer acceptance and the number of friendships (Table 9). Time 1 hyperactivity/impulsivity was positively related to Time 1 HAB – Ins and Time 2 teacher- and peer-reported physical and relational aggression and was negatively related to Time 2 peer-reported prosocial behavior. Time 1 hyperactivity/impulsivity was not significantly related to Time 3 peer functioning variables (Table 9). Moreover, there were moderate to large correlations between teacher and peer reports on physical aggression, relational aggression, and prosocial behavior (rs = .38 – .56). This suggested that teachers and peers provided overlapping yet unique information on children's social behaviors. As such, the combination of teacher reports and peer reports of these constructs likely represented a broader constellation of aggressive and prosocial behaviors. Therefore, the decision of combining teacher and peer reports in creating latent constructs was supported. Further, teacher-reported relational and physical aggression, as well as peer-reported relational and physical aggression, were highly correlated with each other (rs ≥ .68); so were self-reported HAB – Rel and HAB – Ins (r = .47). Moreover, the majority of Time 2 mediators (i.e., relational and physical aggression, and prosocial behavior) were significantly correlated with Time 3 peer rejection, peer acceptance, and the number of friendships.

Figure 1 presents the hypothesized mediation model and all the paths that were tested using SEM. Inattention and hyperactivity/impulsivity were allowed to be

correlated. Given some high correlations between constructs reported earlier, several

covariances were also tested in the analyses but were not shown in Figure 1. Those

included: measurement errors of the observed variables within the same reporter (e.g.,

teacher-reported physical aggression, relational aggression, and prosocial behaviors;

peer-reported physical aggression, relational aggression, and prosocial behaviors); errors

of teacher- and peer-reported physical aggression, errors of teacher- and peer-reported

relational aggression, and errors of HAB – Rel and HAB – Ins. It should be noted that

three separate outcomes (peer rejection, peer acceptance, and the number of friends) were

tested simultaneously in the model. These three outcomes were not combined into one

single latent variable because peer relationship variables at the group level (e.g., peer

rejection, peer acceptance) may be distinct from those at the dyadic level (e.g.,

friendship; Asher et al., 1996; Hoza, Mrug, et al., 2005; Mikami, 2010; Parker et al.,

2006) and also because previous research has suggested that social impairment in

children with ADHD may be more pronounced for negative nominations (e.g., peer

rejection) than for positive nominations (e.g., peer acceptance; Hinshaw, 2002).

This hypothesized mediation model fit the overall data fairly well, $\chi^2 = 86.23$, $df =$

40, $p < .001$, CFI = .97, and RMSEA = .04 [.03, .05]. A series of nested models were

then tested to examine whether gender moderated the paths in the model. This was

conducted using multi-group analysis in AMOS where the model was run as a two-group

model with gender as the grouping variable. First, a fully unconstrained model was run

where all the parameters were allowed to vary by gender. The model fit was good, χ^2

(80) = 139.30, $p < .001$, CFI = .96, RMSEA = .03 [.02, .04]. I then compared this model

to the same two-group model where all the parameters were set to be equal across genders (fully constrained model). The fully constrained model had a worse model fit compared to the unconstrained model, χ^2 (128) = 219.99, p < .001, CFI = .94, RMSEA = .03 [.02, .04]. However, the reduction in fit was not significant, $\Delta\chi^2$ (48) = 80.69, p = .083, suggesting that the parameters and paths in the model did not vary with gender. Therefore, results from the SEM analysis that fitted the hypothesized model with overall sample were reported. The model fit, reported in the beginning of this paragraph, was excellent. For clarity reason, results were presented separately for the three outcomes (i.e., peer rejection, peer acceptance, and the number of friendships) in Figure 3a-3c.

As shown in Figure 3a-3c, inattention at Time 1 predicted less prosocial behavior at Time 2 which, in turn, predicted more peer rejection (Figure 3a), less peer acceptance (Figure 3b), and fewer numbers of friends (Figure 3c) at Time 3. Inattention, however, was neither directly nor indirectly (through HABs) related to relational or physical aggression, although it was related to more HAB – Ins (Figure 3a-3c). There was a trend that inattention directly predicted peer rejection one year later (p = .09; Figure 3a). Hyperactivity, on the other hand, was marginally significant in predicting HAB – Rel (p = .08) which, in turn, predicted more relational aggression six months later (Figure 3a-3c). Hyperactivity at Time 1 was also directly linked to more relational and physical aggression at Time 2 (Figure 3a-3c); both forms of aggression, in turn, predicted more peer rejection (Figure 3a), less peer acceptance (Figure 3b), and fewer numbers of dyadic friendships (Figure 3c) at Time 3. Interestingly, hyperactivity at Time 1 directly predicted *less* peer rejection (Figure 3a), *more* peer acceptance (Figure 3b), and *more*

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dyadic friendships (Figure 3c) at Time 3.

Dynamic Interplay between ADHD Symptoms and Peer Functioning over Time

Figure 2 presents the paths in the cross-lagged panel models that were tested to examine the interplay between ADHD symptoms and peer functioning (i.e., peer rejection, peer acceptance, and the number of friendships). Separate analyses were run for each peer functioning variables.[5]

Peer rejection. The cross-lagged model involving peer rejection was fitted to the overall data first. Results indicated an adequate model fit, $\chi^2 = 96.34$, $df = 15$, $p < .001$, CFI = .96, and RMSEA = .08 [.07, .10]. A series of nested models were then tested to examine whether gender moderated the paths in the model (Table 10). First, a fully unconstrained model (Model 1 in Table 10) was run where all the parameters were allowed to vary by gender. The model fit was good, $\chi^2 (26) = 124.47$, $p < .001$, CFI = .95, RMSEA = .07 [.06, .09]. I then compared this model to a fully constrained model where all the parameters were set to be equal across genders (Model 2 in Table 10). This fully constrained model had a worse model fit compared to the unconstrained model, $\chi^2 (49) = 175.05$, $p < .001$, CFI = .94, RMSEA = .06 [.05, .07]. The reduction in fit was significant, $\Delta\chi^2 (23) = 50.58$, $p < .001$, suggesting that the paths may be different between boys and girls. To locate which paths differed by gender, two additional models that constrained within-time covariances among constructs (Model 3) and all the directional paths (Model 4) were tested and compared to the unconstrained model (Model 1). Tests

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[5] Including all three peer constructs simultaneously in one model resulted in poor model fit presumably because the three constructs were high correlated with each other. Therefore, separate models for each peer constructs were tested.

of Chi-square differences suggested that covariances did not vary between boys and girls; directional paths, however, varied by gender. Therefore, I adopted a new baseline model in which covariances were constrained to be equal across gender (Model 5). I then ran a series of nested model to examine which specific directional paths differed between boys and girls. A model (modified from the new baseline model) that constrained stability paths (Model 6) was significantly different from the new baseline model (Model 5). Follow-up nested model comparisons indicated that two stability paths for inattention (Time 1 to Time 2 and Time 2 to Time 3) and one stability path for hyperactivity (Time 2 to Time 3) differed across gender. A model (modified from the new baseline model) that constrained cross-lagged paths (Model 7) was not significantly different from the new baseline model (Model 5). As a result, a final model (Model 8) was generated that constrained all the paths that did not differ across gender to be equal between boys and girls. Model fit for this final model was good, χ^2 (46) = 151.84, $p < .001$, CFI = .945, RMSEA = .056 [.047, .067]. Figure 4 presents the standardized estimates of the paths from the final model.

As shown in Figure 4, inattention, hyperactivity, and peer rejection were fairly stable over one year period in Taiwanese children. Inattention and hyperactivity were highly correlated with each other within time. Even at Time 2 and Time 3 when the previous relations of the two constructs were controlled for, the residuals of inattention and hyperactivity were still significantly correlated with each other. Also, inattention and hyperactivity were significantly related to peer rejection at the initial time point. Importantly, Time 1 peer rejection predicted increases in Time 2 inattention and Time 2

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hyperactivity. Similarly, Time 2 peer rejection continued to predict increases in Time 3

inattention and Time 3 hyperactivity. With respect to gender moderation, cross-lagged

paths between ADHD symptoms and peer rejection did not vary by gender. In fact, the

only gender moderation was found in the stability paths. That is, inattention was more

stable from Time 1 to Time 2 for girls than for boys, while inattention and hyperactivity

were more stable from Time 2 to Time 3 for boys than for girls.

Peer acceptance. Similarly, a cross-lagged model involving peer acceptance was

first fitted to the overall data. Model fit was good, $\chi^2 = 53.67$, $df = 15$, $p < .001$, CFI =

.98, and RMSEA = .06 [.04, .08]. A series of nested models were then tested to examine

whether gender moderated the paths in the model (Table 11). First, a fully unconstrained

model (Model 1 in Table 11) was run where all the parameters were allowed to vary by

gender. The model fit was good, $\chi^2 (26) = 93.40$, $p < .001$, CFI = .96, RMSEA = .06 [.05,

.07]. I then compared this model to a fully constrained model where all the parameters

were set to be equal across genders (Model 2). This fully constrained model had a worse

model fit compared to the unconstrained model, $\chi^2 (49) = 150.96$, $p < .001$, CFI = .94,

RMSEA = .05 [.04, .06]. The reduction in fit was significant, $\Delta\chi^2 (23) = 57.56$, $p < .001$,

suggesting that the paths may be different between boys and girls. Again, to locate which

paths differed by gender, two additional models that constrained within-time covariances

among constructs (Model 3) and all the directional paths (Model 4) were tested and

compared to the unconstrained model (Model 1). Tests of Chi-square differences

suggested that both covariances and directional paths varied by gender. Follow-up nested

model comparison showed that covariances between Time 2 peer acceptance and Time 2

hyperactivity and between Time 3 inattention and Time 3 hyperactivity differed across

gender. Therefore, I adopted a new baseline model in which these two covariances were

set to be freely estimated across gender while the rest of the covariances were constrained

to be equal across gender (Model 5). I then ran a series of nested model to examine

which specific directional paths differed between boys and girls. A model (modified

from the new baseline model) that constrained stability paths (Model 6) was significantly

different from the new baseline model (Model 5). Follow-up nested model comparisons

indicated that, again, two stability paths for inattention (Time 1 to Time 2 and Time 2 to

Time 3) and one stability path for hyperactivity (Time 2 to Time 3) differed across

gender. Model 7 (modified from the new baseline model) that constrained cross-lagged

paths was not significantly different from the new baseline model (Model 5). As a result,

a final model (Model 8) was generated that constrained all the paths that did not differ

across gender to be equal between boys and girls. Model fit was good for this final

model, χ^2 (44) = 119.86, $p < .001$, CFI = .956, RMSEA = .048 [.038, .059]. Figure 5

presents the standardized estimates of the paths from the final model.

Figure 5 shows that, again, inattention and hyperactivity were fairly stable over

one year; so was peer acceptance. Inattention and hyperactivity were highly correlated

with each other within time. Even at Time 2 and Time 3 when the previous relations of

the two constructs were controlled for, residuals of inattention and hyperactivity were

still significantly correlated with each other. Also, inattention and hyperactivity were

significantly related to less peer acceptance at the initial time point. Importantly, Time 1

inattention predicted decreases in Time 2 peer acceptance which, in turn, predicted

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increases in Time 3 inattention and hyperactivity (Figure 5). Additionally, low peer

acceptance at Time 1 predicted increases in inattention at Time 2; or, in other words, high

peer acceptance predicted decreases in Time 2 inattention (Figure 5). In terms of gender

moderation, again, inattention was more stable from Time 1 to Time 2 for girls than for

boys, while inattention and hyperactivity were more stable from Time 2 to Time 3 for

boys than for girls (Figure 5). Also, the correlation between Time 2 peer acceptance and

Time 2 hyperactivity was not significant for girls ($r = -.04$, $p = .588$) but was marginally

significant for boys ($r = -.14$, $p = .07$); the correlation between inattention and

hyperactivity at Time 3 was lower in girls than in boys (Figure 5).

Dyadic friendships. Following the same procedures, a cross-lagged model

involving dyadic friendships was first fitted to the overall data. Model fit was excellent,

$\chi^2 = 47.27$, $df = 15$, $p < .001$, CFI = .98, and RMSEA = .05 [.04, .07]. A series of nested

models were then tested to examine whether gender moderated the paths in the model

(Table 12). First, a fully unconstrained model (Model 1 in Table 12) was run where all

the parameters were allowed to vary by gender. The model fit was good, χ^2 (26) = 84.40,

$p < .001$, CFI = .96, RMSEA = .06 [.04, .07]. I then compared this model to a fully

constrained model where all the parameters were set to be equal across genders (Model

2). This fully constrained model had a worse model fit compared to the unconstrained

model, χ^2 (49) = 139.45, $p < .001$, CFI = .93, RMSEA = .05 [.04, .06]. The reduction in

fit was significant, $\Delta\chi^2$ (23) = 55.05, $p < .001$, suggesting that the paths may be different

between boys and girls. Again, to locate which paths differed by gender, two additional

models that constrained within-time covairances among constructs (Model 3) and all the

directional paths (Model 4) were tested and compared to the unconstrained model (Model 1). Tests of Chi-square differences suggested that covariances did not vary between boys and girls; directional paths, however, varied by gender. Therefore, I adopted a new baseline model in which covariances were constrained to be equal across gender (Model 5). I then ran a series of nested model to examine which specific directional paths differed between boys and girls. A model (modified from the new baseline model) that constrained stability paths (Model 6) was significantly different from the new baseline model (Model 5). Follow-up nested model comparisons indicated that, again, two stability paths for inattention (Time 1 to Time 2 and Time 2 to Time 3) and one stability path for hyperactivity (Time 2 to Time 3) differed across gender. Model 7 (modified from the new baseline model) that constrained cross-lagged paths did not significantly differ from the new baseline model (Model 5). As a result, a final model (Model 8) that constrained all the paths that did not differ across gender to be equal between boys and girls was tested. Model fit was good for this final model, $\chi^2(46) = 115.42$, $p < .001$, CFI = .949, RMSEA = .045 [.035, .056]. Figure 6 presents the standardized estimates of the paths from the final model.

As can be seen in Figure 6, inattention and hyperactivity, again, were highly stable over one year; the number of friendships was also stable over time. Inattention and hyperactivity were highly correlated with each other within time. Even at Time 2 and Time 3 when the previous relations of the two constructs were controlled for, the residuals of inattention and hyperactivity were still significantly correlated with each other. In addition, inattention was significantly related to fewer friends at Time 1, while

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hyperactivity was related to fewer friendships at Time 3. Importantly, Time 1 inattention predicted decreases in numbers of friends at Time 2 which, in turn, predicted increases in Time 3 inattention and hyperactivity (Figure 6). Moreover, fewer numbers of friendships at Time 1 predicted increases in inattention at Time 2, which, in turn, predicted fewer friends at Time 3. Interestingly, hyperactivity at Time 2 predicted more friendships at Time 3. In terms of gender moderation, again, no cross-lagged paths differed between boys and girls. Inattention, however, was more stable from Time 1 to Time 2 for girls than for boys, while inattention and hyperactivity were more stable from Time 2 to Time 3 for boys than for girls.

Group Differences among Liked and Disliked Youth with and without ADHD

 Aggression and prosocial behavior. GLMs were conducted to examine the differences among four groups of children – liked ADHD, disliked ADHD, liked controls, and disliked controls – in multiple aspects of functioning. Results showed significant group differences in teacher-reported relational aggression, physical aggression, and prosocial behavior (Table 13). Post hoc Tukey pairwise comparisons indicated that disliked ADHD group showed more teacher-reported relational aggression, physical aggression, and less prosocial behavior than liked and disliked control groups, who did not differ from each other (Figure 7). Disliked ADHD group also showed more teacher-reported physical aggression than liked ADHD group (Figure 7). Similarly, there were significant group differences in peer-reported relational aggression, physical aggression, and prosocial behavior (Figure 8). Post hoc Tukey pairwise comparisons indicated that disliked ADHD group showed more peer-reported relational aggression

and physical aggression than liked controls and liked ADHD group, while the later two

groups did not differ from each other (Figure 8). Moreover, disliked ADHD group had

less prosocial behavior than liked ADHD group who, in turn, had less prosocial behavior

than liked controls (Figure 8).

Internalizing and externalizing problems. Significant group differences were

found in externalizing problems, internalizing problems, and depressive symptoms (Table

13). Post hoc comparisons indicated that the two ADHD groups had more internalizing

and externalizing problems than the two control groups, but the two ADHD groups or

two control groups did not differ from each other (Figure 9). In addition, disliked ADHD

group had more depressive symptoms than the other three groups (although $p = .06$ when

compared to liked ADHD group), while liked ADHD group had more depressive

symptoms than liked controls (Figure 9).

ADHD symptoms. Similar to the findings in externalizing and internalizing

problems described above, significant group differences were found in ADHD symptoms

(Table 13). Post hoc comparisons indicated that the two ADHD groups had higher levels

of ADHD symptoms than the two control groups, but the two ADHD groups (or two

control groups) did not differ from each other (Figure 10).

HAB. Significant group differences were found in HAB – Ins, but not in HAB – Rel

(Table 13). Post hoc comparisons revealed that liked ADHD group was more likely to

exhibit HAB – Ins than liked controls ($p = .04$) and disliked controls (although $p = .09$;

Figure 11).

Academic performance. The four groups also differed in academic performance

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(Table 13). Post hoc comparisons showed that liked ADHD group had poorer academic performance than liked controls, whereas disliked ADHD group had poorer academic performance than both control groups (Figure 12).

Parent-child relationships and parenting. Significant group differences also existed in parent-child relationships and psychological control parenting behaviors (Table 13). Post hoc comparisons indicated that the two ADHD groups had lower levels of closeness and higher levels of conflict in their relationships with parents when compared to the two control groups, but the two ADHD groups or the two control groups did not differ from each other (Figure 13). Similar patterns were found in parents' use of love withdrawal and guilt induction (Figure 14).

Discussion

The goals of the present study were to (1) systematically examine aspects of peer functioning that are *concurrently* and *longitudinally* associated with ADHD symptoms; (2) investigate differential and independent effects of inattention and hyperactivity/ impulsivity on peer functioning; (3) examine potential mechanisms and processes involved; (4) study longitudinal effects of ADHD symptoms as well as the dynamic interplay between ADHD symptoms and their associated peer impairment over time; (5) explore potential risk and protective factors underlying the link between ADHD symptoms and peer problems; (6) explore the effect of gender; and (7) expand the current literature in this area of research to a non-Western culture (i.e., Taiwan). I attempted to achieve these goals by adopting a study design, methods, and an approach that were grounded in the developmental psychopathology perspective. Overall, findings from the

present study suggest that inattention and hyperactivity/impulsivity each made

contributions (both concurrently and longitudinally) to a variety of peer relationship

problems. Moreover, each core domain of ADHD was associated with different patterns

of social behaviors, conferring differential pathways and mechanisms underlying peer

impairment. Findings also support a vicious cycle in which ADHD symptoms predict

later peer impairment, which in turn leads to increases in ADHD symptoms, offering a

good example of an important tenet of the developmental psychopathology perspective;

that is, maladaptation is a result of reciprocal transactions between individuals and their

socio-ecological context (Cicchetti & Rogosch, 2002; Sameroff, 1995). This study

further reveals some potential protective factors (e.g., high levels of prosocial behavior

and low levels of physical aggression, relational aggression, and depressive symptoms)

that may buffer against peer dislike in youth with ADHD symptoms. Further, ADHD

symptoms may affect girls' peer functioning to a greater extent than boys'. In general,

the present findings from a Taiwanese sample, in comparison to the Western literature,

demonstrated both similarities and differences in the associations between children's

ADHD symptoms and their peer functioning as well as the mechanisms and the effect of

gender involved. I discuss each of these findings in turn.

Peer Relationship Problems Associated with ADHD Symptoms

Consistent with the literature, inattention was concurrently associated with

multiple peer relationships problems including low peer acceptance (e.g., Bellanti et al.,

2000; Hoza, Mrug, et al., 2005; Mikami & Lorenzi, 2011), low popularity (Elkins et al.,

2011; Hinshaw & Melnick, 1995; Hoza, Mrug, et al., 2005), more relational victimization

(Cardoos & Hinshaw, 2011; Sciberras et al., 2012), less prosocial behavior (Diamantopoulou et al., 2005; Gau et al., 2010; Murray-Close et al., 2010; Ohan & Johnston, 2007), and less peer-reported physical aggression. Moreover, inattention predicted increases in teacher-reported physical victimization, decreases in help within friendships, and decreases in peer-reported relational aggression one year later, after controlling for prior levels of these outcomes. These findings suggest that children with inattention, despite showing less disruptive and negative behaviors (i.e., physical aggression), have problems in getting along with peers. This is in line with a past study reporting that inattentive behaviors such as difficulties following activity rules, paying attention, and following directions were related to negative peer status in children with ADHD (Mrug et al., 2007). Moreover, due to attention problems, these children may have difficulties attending to social cues and conforming to implicit rules for social interactions, thereby making them more likely to show socially insensitive, inappropriate, and even situationally strange behaviors that are as aversive to peers as disruptive behaviors (Bierman, Smoot, & Aumiller, 1993). In addition, children with inattention are often described as "dreamy," passive, timid, shy, and socially withdrawn (Maedgen & Carlson, 2000; Wheeler & Carlson, 1994), all of which may place these children at increased risk of being less liked by peers, unpopular among peers, and relationally victimized by peers (e.g., being left out or ignored).

On the other hand, hyperactivity, consistent with previous findings, was concurrently associated with multiple peer relationship problems such as more peer rejection (e.g., Erhardt & Hinshaw, 1994; Hinshaw et al., 1997; Hoza, Mrug, et al., 2005;

Mrug et al., 2009; Pelham & Bender, 1982), more teacher-reported physical victimization (Cardoos & Hinshaw, 2011; Sciberras et al., 2012), less intimacy and more conflict within friendships (e.g., Blachman & Hinshaw, 2002; Normand et al., 2011), and more physical and relational aggression (e.g., Abikoff et al., 2002; Erhardt & Hinshaw, 1994; Hinshaw & Melnick, 1995; Hodgens et al., 2000; Maedgen & Carlson, 2000; Ohan & Johnston, 2007; Pelham & Bender, 1982; Zalecki & Hinshaw, 2004). These findings fit the behavioral profile that is often used to describe youth with ADHD (either combined type or hyperactive-impulsive type). For example, it has been documented that children with hyperactivity tend to be disagreeable, show disruptive behaviors that are annoying to peers, and engage in negative social interactions in play groups (Whalen & Henker, 1985; Wheeler & Carlson, 1994). Additionally, during group activities, children with ADHD are more likely to show negative behaviors, such as complaining, whining, teasing, not following activity rules, and interrupting or disrupting ongoing activities, all of which are related to negative peer status (Mrug et al., 2007). The disruptive and negative nature of hyperactive children's behaviors may have a direct impact on children's peer functioning, including peer dislike, physical victimization by peers, and poor quality of friendships (i.e., less intimacy and more conflict).

Furthermore, I found that the longitudinal effect of hyperactivity was less evident, relative to the effect of inattention. Specifically, results showed that hyperactivity was only marginally significant in predicting more intimacy, more conflict, more teacher-reported relational aggression, and more peer-reported prosocial behavior one year later (after controlling for the effect of inattention). Together, this finding seems to suggest

that attention problems may have longer-lasting effects on children's peer functioning than hyperactive or impulsive behaviors, at least in late middle childhood and early adolescence. This may be partly explained by the clinical observation that, with age, overall ADHD symptoms tend to remit; however, symptoms of hyperactivity/impulsivity often decline at a higher rate than symptoms of inattention (e.g., Biederman, Mick, & Faraone, 2000). This finding has important implications because it suggests that as children with ADHD symptoms grow up, the severity and levels of their ADHD symptoms may decline; however, they may still suffer impaired peer functioning due to their attention problems (and possibly hyperactivity and impulsivity).

Results also illustrate differential and unique effects of each core domain of ADHD on specific facets of peer functioning. For example, inattention was more strongly related to low peer acceptance and low popularity, whereas hyperactivity was more strongly related to active peer rejection. This is congruent with a past study where Hinshaw (2002) found that girls with ADHD-I were more socially isolated but less rejected by peers, whereas girls with ADHD-C were actively rejected by peers (Hinshaw, 2002). In addition, only symptoms of inattention, but not hyperactivity/impulsivity, were related to less prosocial behavior. This finding parallels previous findings reporting that children with hyperactivity engaged in as much social interaction as their peers (e.g., Pelham & Bender, 1982) and seemed to be no less prosocial in their responses to hypothetical social situations (Pelham & Bender, 1982; Wheeler & Carlson, 1994) and showed no differences in positive social interactions (Cunningham & Siegel, 1987), compared to those without hyperactivity. Moreover, inattention was found to be related

to less physical aggression and decreases in relational aggression one year later, while hyperactivity was related to more physical and relational aggression. This is consistent with the well-documented, unique patterns of social behaviors observed in children with ADHD-I and ADHD-C. That is, children with ADHD-I tend to be passive, withdrawn, and nonaggressive, whereas children with ADHD-C tend to be physically and/or relationally aggressive (e.g., Erhardt & Hinshaw, 1994; Hinshaw, 2002; Hinshaw & Melnick, 1995; Hodgens et al., 2000; Maedgen & Carlson, 2000; Wheeler & Carlson, 1994; Zalecki & Hinshaw, 2004). Taken together, these findings underscore the importance of differentiating the two core domains of ADHD symptomatology (i.e., inattention versus hyperactivity/impulsivity) as each domain of ADHD symptoms may be associated with specific and unique social behaviors or social deficits that may have differential effects on children's peer functioning. These findings also expand the existing literature to a non-Western culture (i.e., Chinese culture) by showing that, similar to children from the Western cultures, Taiwanese children with inattention and/or hyperactivity/impulsivity may be at risk of peer relationship problems.

Unexpectedly, neither inattention nor hyperactivity/impulsivity was associated with numbers of dyadic friendships. This finding is inconsistent with previous studies showing that children with ADHD symptoms tended to have fewer numbers of reciprocated friendships or even no friends compared to those without ADHD symptoms (Blachman & Hinshaw, 2002; Cardoos & Hinshaw, 2011; Erhardt & Hinshaw, 1994; Gresham et al., 1998; Hoza, Mrug, et al., 2005; Rielly et al., 2006). This null findings is less likely to be due to the use of limited numbers of nomination for friendships in this

study (i.e., children could only nominate up to five peers as their friends) because the

majority of the previous research using peer nomination procedure to assess friendships

employed limited numbers of nominations (up to three peers in most cases; Blachman &

Hinshaw, 2002; Cardoos & Hinshaw, 2011; Hoza, Mrug, et al., 2005). Instead, this

discrepancy may be due to differences in samples or approaches between the present

study and the previous ones. That is, the present sample is a school-based sample, and I

used dimensional, continuous measures of ADHD symptoms as opposed to categorical

variable of ADHD status. On the other hand, all of the above studies either employed

clinical samples of ADHD (Blachman & Hinshaw, 2002; Cardoos & Hinshaw, 2011;

Erhardt & Hinshaw, 1994; Hoza, Mrug, et al., 2005) or selected extreme groups of

children with heightened levels of ADHD symptoms from community-based samples

(Gresham et al., 1998; Rielly et al., 2006). It is possible that only children with elevated

ADHD symptoms are more likely to have difficulties making friends, whereas those with

moderate ADHD symptoms may still manage to have some close friends. Nonetheless,

this is an unexpected finding that needs to be validated in the future research.

Mechanisms underlying ADHD Symptoms and Peer Functioning

Mounting evidence has suggested that in regards to social functioning, ADHD

cannot be viewed as a homogenous disorder (Hodgens et al., 2000; Maedgen & Carlson,

2000; McQuade & Hoza, 2008; Mikami et al., 2007; Wheeler & Carlson, 1994). It is

important to make a distinction between ADHD subtypes or core ADHD symptoms when

studying peer functioning and social problems in youth with ADHD (Nijmeijer et al.,

2008) in order to understand the independent effects of inattention and hyperactivity.

Equally important is the investigation of differential processes that link each core domain of ADHD to peer functioning as the nature of social deficits associated with peer difficulties may be different for children with hyperactivity/impulsivity and for children with inattention problems. Thus, children with specific ADHD symptoms may follow differential pathways to poor peer functioning. I attempted to test this premise in the present study using SEM. Overall, as expected, findings from the SEM provide evidence to support the link between ADHD symptoms and subsequent peer relationship problems (i.e., peer rejection, low peer acceptance, few numbers of friendships) and the mediating effects of prosocial behavior and aggression on this link. Importantly, there were independent, distinct pathways through which each ADHD domain (i.e., inattention and hyperactivity/ impulsivity) related to peer functioning. Findings, in general, illustrate some important principles from the developmental psychopathology perspective. That is, there are likely to be different pathways by which children come to experience peer difficulties, and multiple mechanisms and processes may be involved in determining a particular maladaptive outcome (e.g., Parker et al., 2006).

Specifically, results demonstrated that children with inattention exhibited less prosocial behavior six months later. Less prosocial behavior, in turn, predicted more peer rejection, less peer acceptance, and fewer numbers of friendships six months later. These findings mirror those from the prior studies indicating that relative to peers, children with inattention were more rejected and less liked by their peers (Bellanti et al., 2000; Hoza, Mrug, et al., 2005) and had difficulties making or maintaining friendships (Blachman & Hinshaw, 2002). These peer difficulties may be due to their lack of social knowledge and

limited behavior repertoires for engaging in prosocial acts (Bellanti et al., 2000; Murray-Close et al., 2010). One possible explanation for this finding is that attention problems may make it difficult for children with ADHD to pick up on social cues that are crucial for positive social interaction and prosocial behavior (Landau & Milich, 1988). It is also likely that, as the literature suggests, children with inattention tend to be more socially isolated and participate in fewer social interactions with peers than children with hyperactivity or normal controls do (Hinshaw, 2002; Wheeler & Carlson, 1994). Given that peer interaction is crucial for children to learn social norms, practice social skills, and develop the capacity for perspective-taking (Hartup, 1983), the limited social interactions for children with inattention may be problematic. For instance, these children may not have enough opportunity to fully develop social competence (e.g., role-taking, empathy) and to learn to be helpful, supportive, and prosocial through observational learning (Cunningham et al., 1985). These social deficits and limited peer interactions that are associated with inattention may explain why inattention was indirectly linked to impaired peer functioning such as being rejected by peers, being least liked as preferred playmates, and having difficulties making or maintaining friendships.

In contrast, hyperactivity/impulsivity was associated with elevated relational and physical aggression. This finding is largely consistent with the literature suggesting that children with ADHD, especially those who show hyperactivity and impulsivity, tend to be more physically aggressive (Hodgens et al., 2000; Maedgen & Carlson, 2000) and more relationally aggressive (Zalecki & Hinshaw, 2004) than typically developing control children. Given that hyperactive children seem to possess appropriate social

knowledge and social skills as other peers do (e.g., Wheeler & Carlson, 1994), it is conceivable that social deficits of hyperactive children may not be attributable to the mere lack of social knowledge or inability to initiate social interactions with peers. Rather, it appears that children with hyperactivity/impulsivity may have difficulties performing behaviors that are appropriate to specific social contexts (i.e., peer interactions), perhaps due to the impulsive nature of their behaviors and lack of self-control (Mrug et al., 2001; Wheeler & Carlson, 1994). Aggressive behaviors may be one of those situationally-inappropriate behaviors that result from lack of self-control or impulsivity.

Relational and physical aggression further mediated the link between hyperactivity/impulsivity and peer relationship problems (e.g., peer rejection, low peer acceptance, and few numbers of friendships). That is, hyperactive/impulsive children in Taiwan showed more physical and relational aggression, were more likely to be actively rejected and less-accepted by peers, and had fewer close friendships as a result of their aggressive behaviors. As previous literature suggests, aggression is one of the most consistent predictors of peer dislike and rejection in normative samples from both Western (Coie et al., 1990) and Chinese cultures (Xu et al., 2003). In the present study, aggression in hyperactive children also appears to be a consistent predictor of a variety of peer outcomes. This finding extends beyond previous findings by demonstrating that peer difficulties in children with hyperactivity and impulsivity may be largely explained by their aggressive behaviors.

Surprisingly, more hyperactivity/impulsivity was directly linked to better peer

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functioning including less peer rejection, more peer acceptance, and more numbers of dyadic friendships in Taiwanese children. Although unexpected, this finding is similar to that reported in a previous community-based study where Diamantoupoulou et al. (2005) found that ADHD symptoms were positively associated with peer liking in boys. I speculate that there might be subgroups of hyperactive children in Taiwan. Hyperactive-aggressive children may be less liked and more rejected by peers, but hyperactive-nonaggressive children may be somewhat liked and accepted by peers. It is plausible that in Chinese culture, hyperactive-nonaggressive children may be relatively active, outgoing, and socially initiating, and thus are viewed by peers as "fun" to hang out with, provided that their hyperactive and impulsive behaviors are not excessive. This premise is partially supported by the literature suggesting that similar to their inattentive counterparts or control children, children with hyperactivity are high in initiative and sociability (Wheeler & Carlson, 1994). Social initiative, in turn, is related to high social status in the peer group (i.e., peer acceptance and popularity; Rydell, Hagekull, & Bohlin, 1997). Nevertheless, it should be noted that these views are speculative; thus, this unexpected finding requires replication.

Dynamic Interplay between ADHD Symptoms and Peer Functioning over Time

As hypothesized, inattention and hyperactivity/impulsivity in Taiwanese children were fairly stable over one year; so were peer rejection and peer acceptance. Numbers of dyadic friendships were also stable over time, although to a lesser extent. Most importantly, evidence was found to support bidirectional and reciprocal effects between ADHD symptoms (especially inattention) and peer problems. Specifically, Time 1

inattention predicted decreases in Time 2 peer acceptance and numbers of friends, which in turn predicted increases in Time 3 inattention and hyperactivity. In addition, low peer acceptance and fewer numbers of friendships at Time 1 predicted increases in inattention at Time 2, which in turn predicted fewer friends at Time 3. Moreover, peer rejection at Time 1 predicted increases in inattention and hyperactivity at Time 2; further, peer rejection at Time 2 continued to predict increases in inattention and hyperactivity at Time 3. Interestingly, hyperactivity at Time 2 predicted more friendships at Time 3.

As described previously, children with attention problems may have trouble attending to social cues that are important for successful social interactions or adjusting their behaviors in response to a rapidly-changing social world (Landau & Milich, 1988). Alternatively, inattentive children may have difficulties acquiring social skills through observational learning (Cunningham et al., 1985). All of these difficulties may place children with inattention at increased risk of being less liked by peers. Attention problems may likewise negatively impact friendships (Mikami, 2010). It is conceivable that attention problems may impede children's ability to engage in reciprocated behaviors such as listening, give-and-take, caring, and sharing, all of which are key elements in friendships (Buhrmester, 1990). Being friendless, less-liked, or rejected by peers, in turn, further deprives these children of important developmental opportunities to interact with peers and friends, thereby resulting in fewer chances to learn social knowledge and to practice social skills through these interactions. This may explain the existence of strong continuity in peer relationship problems such as peer rejection, low peer acceptance, and friendlessness.

Most importantly, results showed that all of the above peer difficulties such as rejection, low acceptance, and friendlessness may aggravate the severity and levels of ADHD symptoms, lending support for the significance of friendships and peer relationships on children's adjustment and adaptive functioning (Parker & Asher, 1987; Parker et al., 2006). It seems plausible that inattention, hyperactive, and impulsive behaviors may develop, in part, as a result of reciprocal transactions between the child's behavior and the social context (e.g., peer appraisal, friendships). This notion is supported by the only relevant past research showing that boys with ADHD who had social disability showed more attention problems four years later (Greene et al., 1997). One explanation is that negative peer experiences, such as peer rejection and being friendless, may lead a child to view him- or herself or others negatively, which in turn influences him or her to behave in further maladaptive ways toward peers or during peer interactions (Parker et al., 2006).

From a positive side, these findings can be interpreted as suggesting that positive functioning in peer relationship and friendship domains (i.e., high peer acceptance, low peer rejection, having reciprocated friendships) may improve children's ADHD symptoms. Through positive peer interactions, children with inattention and/or hyperactivity may gain emotional support and positive reinforcement from peers, which may help boost their self-esteem and motivation to improve. This is an exciting and promising avenue for future research, given that this is only the second study that specifically examined the effect of peer functioning on children's ADHD symptoms.

In all, these findings provide an excellent example to illustrate the dynamic and

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transactional views of development; that is, development is better conceptualized as a

dynamic process where characteristics of the child and his/her environment undergo

continual changes through processes of mutual influence over time (e.g., Sameroff, 1995;

Parker et al., 2006). Specifically, these findings suggest that while ADHD symptoms,

especially inattention, may fuel peer relationship problems, the reverse is equally

plausible; peer relationships problems may contribute to increases in hyperactive and

inattentive behaviors, thereby creating a vicious cycle that likely explains why peer

relationships problems are so prevailing and persistent in children with ADHD

symptoms.

Potential Risk and Protective Factors

One of the goals of this work is to identify a subgroup of children with ADHD

symptoms who are able to navigate successfully in the social world. By comparing this

group to the group of youth with ADHD who showed peer problems, I hoped to identify

some risk factors for and protective factors against peer relationship problems often faced

by youth with ADHD. According to the results, several factors emerged that differentiate

between youth with ADHD who were liked by peers and those with ADHD who were *not*

liked by peers. These factors include teacher- and peer-reported physical aggression,

peer-reported relational aggression, and peer-reported prosocial behavior. There is a

possibility that depressive symptoms also distinguished between these two ADHD

groups. Other factors, such as severity of ADHD symptoms, HAB, academic

performance, parenting (i.e., love withdrawal, guilt induction), or dimensions of parent-

child relationships (i.e., closeness, conflict) *did not* distinguish between the two ADHD

groups. These findings mirror those reported by Greene and colleagues (1996). Green et al. (1996) found that a subgroup of boys with ADHD and social disability, relative to those with ADHD without social disability, showed higher rates of depression, CD, externalizing problems, and internalizing problems. The two ADHD groups, however, did not differ in age, SES, IQ, or family functioning (i.e., cohesion, expression, and conflict; Greene et al., 1996).

These findings suggest that the presence of aggressive behaviors may be an important risk factor for experiencing peer relationship problems in youth with ADHD. On the flip side, the absence of aggressive behavior may protect children with ADHD against peer problems such as peer rejection and peer dislike. Coupled with the finding reported earlier that it was through physical and relational aggression that symptoms of hyperactivity/impulsivity were linked to peer relationship problems, these findings highlight the importance of aggression as a contributing factor to peer difficulties often faced by youth with ADHD symptoms. Intervention programs aiming at reducing aggressive behavior or coaching alternative social strategies and appropriate social skills to solve peer conflicts may be effective in improving peer functioning in children with ADHD, especially those with hyperactivity/impulsivity.

In addition, results showed that although youth with ADHD who were liked and accepted by peers had lower levels of prosocial behavior (indexed by peer reports) compared to well-liked normal controls, they had higher levels of prosocial behaviors than youth with ADHD who were disliked by peers. This provides evidence to support the presence of prosocial behavior as a potential protective factor or the lack of prosocial

behavior as a potential risk factor for peer relationship problems in children with ADHD

symptoms. As developmental literature indicates, prosocial behavior such as helping,

cooperating, sharing, and caring, is significant for the development of successful social

interactions and relationships in both Western cultures (e.g., Eisenberg & Fabes, 1998;

Eisenberg & Mussen, 1989) and Chinese cultures (e.g., Chen et al., 2000). Thus, it is not

surprising that youth with ADHD who are able to be prosocial and helpful to peers may

be more likely to be accepted and liked by peers than youth with ADHD who evidence

few prosocial behaviors. This may be particularly the case in Chinese culture in which

behaviors and attitudes that favor group interests over self interests are highly valued and

encouraged (e.g., Bond et al., 1996; Chen et al., 2000). Children who are sensitive to

others' distress and needs and who are capable of displaying helping behavior and caring

and concern for others may receive recognition, respect, and reciprocal assistance from

peers, which in turn, may lead to higher peer status and may contribute to positive social

development (Chen et al., 2000; Eisenberg & Fabes, 1998). On the hand, children who

are inept at sharing, helping, and caring, may be at risk of being disliked and rejected by

peers.

There is a possibility that the presence of depressive symptoms may likewise be a

risk factor for peer relationship problems in youth with ADHD. This is in line with a

previous finding showing that children with ADHD symptoms comorbid with depression

were more likely to have impaired social competence than their non-depressed ADHD

counterparts or comparison controls (Blackman et al., 2005). Developmental research in

normative samples has also demonstrated that depressive symptoms may interfere with

children's development of adaptive social skills and lead to peer relationship difficulties (e.g., Kochel, Ladd, & Rudolph, 2012; Rudolph, 2009). From a positive perspective, the absence of depressive symptoms may protect children with ADHD from undesirable peer outcomes such as peer rejection and peer dislike. If this is indeed the case, interventions that target reducing depressive symptoms can then be designed to help promote peer functioning in children with both ADHD and depressive symptoms. Unfortunately, not enough studies have been done to examine the role that depressive symptoms play in contributing to peer functioning in children with ADHD symptoms. More research attention and efforts in this area of inquiry are imperative.

The Effect of Gender

It has been proposed that ADHD symptoms may have a greater negative impact on girls' peer functioning than on boys' because peers may be more tolerant of ADHD-like behaviors when displayed in boys than in girls, given that these behaviors are consistent with gender expectations (Diamantopoulou et al., 2005; Mikami & Lorenzi, 2011). The present study found some evidence to support this notion. For example, inattention was more strongly related to increases in physical victimization for girls than for boys. In addition, hyperactivity was more strongly related to peer rejection for girls than for boys and was related to less intimacy and increases in conflict within friendships only for girls. The only finding in which boys were shown to be more affected than girls is that inattention was related to decreases in teacher-reported prosocial behaviors for boys, but not for girls. Together, these findings provide support for the view that girls

who show inattention and/or hyperactivity/impulsivity may be, in fact, more affected in their peer functioning than their male counterparts (Mikami, 2010; Elkins et al., 2011).

Results are consistent with a recent study where Elkins et al. (2011) found that relative to boys with ADHD, girls with ADHD (especially the inattentive subtype) were more negatively affected in peer relationships. Specifically, inattentive girls were less popular and more likely to be bullied than girls without ADHD, whereas inattentive boys were not (Elkins et al., 2011). This may be because girls are expected to be aware of and responsive to social cues to a greater degree than boys; this may put girls who are inattentive at a higher risk for peer relationship problems (Elkins et al., 2011). Alternatively, girls' friendships and peer networks are characterized by higher intimacy and closeness, more self-disclosure and social conversation, and smaller sizes, as compared to boys' friendships and peer network (Maccoby, 1998; Rose & Rudolph, 2006). In light of this, hyperactive girls, who have trouble with appropriate give-and-take and reciprocity and are likely to interrupt or burst out insensitive comments during ongoing conversations with friends, may be more likely to have more conflictual and less intimate friendships, relative to non-hyperactive girls (and relative to hyperactive boys). Likewise, hyperactive girls who are more likely to interrupt and show disruptive behaviors during peer group activities may be more likely to be rejected by their female peers. These may be particularly true in Chinese culture where girls often experience social pressure and expectations to behave more cooperatively, compliantly, and sometimes submissively than boys do (Xu et al., 2003).

Interestingly, the mechanisms and processes as to how ADHD symptoms relate to peer functioning did not seem to differ across gender. In other words, girls and boys who show ADHD symptoms may travel similar pathways to the same peer outcomes, although girls' peer relationships may be impaired to a greater extent than boys as described above. Likewise, the reciprocal associations between ADHD symptoms and peer functioning did not vary by gender. Given the limited literature on the mechanisms underlying and dynamic interplay between ADHD symptoms and peer relationships and the role of gender involved, more research is clearly needed to validate these findings.

Limitations and Future Directions

Limitations. Despite some interesting findings from the present study, several limitations need to be noted. First, ADHD symptoms were assessed through parent reports only. Teacher reports may have enhanced the validity of ADHD symptoms given that the diagnostic criteria of ADHD require symptoms and impairment to be apparent in more than two settings or contexts (APA, 2000). In the present study, teachers were not asked to report on children's ADHD symptoms to lessen their burden of having to fill out lengthy questionnaires. Second, the sample size for the "liked ADHD" group was small ($n = 28$) in testing of hypothesis 4, which may have limited the statistical power to detect significant effects. Future studies that aim at identifying and recruiting youth with ADHD symptoms who are well-liked by peers are warranted. Investigation on children and adolescents with ADHD symptoms who do not evidence peer relationship problems is important as it may shed light on crucial protective factors that buffer youth with ADHD symptoms against peer problems. Third, although the present study incorporated

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a longitudinal design where data were collected at three points in time, it is still correlational in nature. Thus, it does not allow us to draw definite conclusions regarding the causal relationships between ADHD symptoms and peer relationship problems. Future studies with an experimental design or intervention programs may better elucidate the causal effects of ADHD symptoms and peer functioning. Fourth, because of the high attrition rate (69.55 % of the sample remained at Time 3), results and conclusions of this study should be interpreted with cautions. The high attrition rate was mainly due to the fact that one school decided not to continue participating in the study. Fifth, it is important not to equate this sample to a clinical population of children with ADHD when interpreting the results, given that the present study used a community sample for which ADHD symptoms were assessed dimensionally. Replication of the findings from the present study with a clinically diverse sample is needed. Finally, findings of this study are pertinent to Taiwanese children and may not be generalized to other Chinese societies such as Hong Kong or China.

Future directions. Findings from the present study, along with those from the previous studies, suggest that qualitatively dissimilar processes or social deficits may differentially link each core domain of ADHD (i.e., inattention and hyperactivity/ impulsivity) to peer difficulties. Therefore, rather than examining ADHD symptomatology as a whole, future research should distinguish between the two core domains of ADHD (or between different ADHD subtypes) to investigate the unique and independent effects of inattention and hyperactivity/impulsivity on children's peer relationships.

Further, as pointed out previously in the introduction, the vast majority of research in this area has primarily focused on Western samples. Developmental literature has stressed the importance of culture in shaping children's development (Bronfenbrenner, 1979; Bronfenbrenner & Morris, 1998) and the significance of incorporating culture as a contextual factor into research and conceptualization in the unfolding of psychopathology and maladjustment (García Coll et al., 2000; Sameroff, 2000). Therefore, more research from non-Western cultures in this area is needed. Also, no studies to date have directly compared and investigated cross-cultural similarities and differences in peer functioning associated with ADHD. Cross-cultural research would greatly benefit the field by allowing us to further identify potential factors shared or varied across cultures that are responsible for the link between ADHD symptoms and peer relationship problems.

Another direction for future work is to initiate longitudinal studies. Thus far, only a few existing studies have employed a longitudinal, prospective design (Lee & Hinshaw, 2006; Lee et al., 2008; Murray-Close et al., 2010; Owens et al., 2009). We know relatively little about the long-term peer impairment associated with ADHD symptoms (Bagwell et al., 2001; Klein & Mannuzza, 1991) and the role of developmental age in this association. Given that hyperactive and impulsive behaviors tend to decline and may become more non-normative with age (Biederman et al., 2000; Nagin & Tremblay, 1999), these behaviors may be viewed as more aversive by peers as children grow older. As such, the negative impact of ADHD symptoms on children's social functioning may become greater with age (Booster, Dupaul, Eiraldi, & Power, 2012). Moreover, because

the significance of peer acceptance increases and the perception of social support shift toward peers during middle childhood and adolescence (Rubin et al., 1998), future research focusing on this developmental period would be of particular import.

In addition, another promising avenue for future research is to examine the dynamic, bidirectional, and reciprocal effects of ADHD symptoms and peer functioning over time. The present study is the first one to do so, and I found evidence to support the reciprocal influences between ADHD symptoms and peer difficulties (i.e., peer rejection, low peer acceptance, few numbers of friends). Future research needs to recognize the dynamic and transactional nature of human behaviors over time and to reflect the complexity of development in the study design and data analytic approach.

Finally, this area of research will benefit from future studies that aim to uncover neurobiological factors and brain mechanisms underlying social cognition and emotion regulation in children with ADHD symptoms (McQuade & Hoza, 2008). This is a relatively understudied area. Understanding potential deficits in social cognition and emotion regulation may help us identify additional contributors to the peer difficulties often observed in children with ADHD symptoms. In particular, research is needed that incorporates the neurobiological level of analysis along with behavioral, environmental, and experiential levels of analysis. Such multi-level approaches have promise for offering a more complete understanding of social functioning in children with ADHD symptoms, which in turn, may yield important knowledge to better inform efforts in designing more effective evidence-based and tailored intervention programs for those with peer difficulties.

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Appendix B: Tables

Table 1

Sample Characteristics at Initial Assessment

	Overall Sample (*N* = 739)
Age, Mean ± *SD*	10.06 ± 0.59
Boys (%)	52.2
Household Income (Median)	$ 20,516 to $ 30,774
Parents' Marital Status (%)	
Married	88.9
Divorced/Separated	8.4
Widow	0.8
Unmarried	1.1
Others	0.8
Maternal Education	
College and above	43.4
High school and vocational	41.5
Junior high and below	15.1
Paternal Education	
College and above	45.4
High school and vocational	36.9
Junior high and below	17.7
# of children in the family (Median)	2
Maternal Age, Mean ± *SD*	40.05 ± 4.89
Paternal Age, Mean ± *SD*	43.22 ± 5.45

Note. SD = Standard Deviation.

Table 2

List of Measures at Each Assessment Wave

Constructs	Measures	Sources
ADHD Symptoms	SNAP-IV	Parents
Peer Functioning		
Peer Group Level		
• Acceptance, Rejection	Peer nomination	Peers
• Popularity	Peer nomination	Peers
• Peer Victimization	CSEQ (peer nomination)	Peers, teachers
Friendship Level		
• Number of Friendships	Peer nomination	Peers
• Friendship Qualities	FQS, FQM	Children
Social Behaviors		
• Aggression	CSBS-T, CSBS-P	Peers, teachers
• Prosocial Behavior	CSBS-T, CSBS-P	Peers, teachers
Internalizing & Externalizing Problems	CBCL	Parents, teachers
Nonbehavioral Factors		
• Hostile Attribution Bias	Intent attribution measure	Children
• Academic Performance	Teacher report	teachers
Familial Factors		
• Parenting	Psychological Control	Parents, children
• Parent-child relationships	Child-Parent Relationship Scale	Parents

Note. SNAP-IV = Swanson, Nolan, and Pelham, version IV scale; CSEQ = Children's Social Experience Questionnaire; FQS = Friendship Quality Scale; FQM = Friendship Quality Measure; CSBS-T = Children's Social Behavior Scale – Teacher Report; CSBS-P = Children's Social Behavior Scale – Peer Report; CBCL = Child Behavior Checklist.

Table 3

Items and Standard Loadings of the Friendship Quality Measure

Companionship (α = .74)	
My friend and I spend all our free time together [a]	.67
My friend thinks of fun things for us to do together	.81
Sometimes my friend and I just sit around and talk about things like school, sports, and things we like	.65
Conflict (α = .75)	
I can get into fights with my friend	.52
My friend can bug me or annoy me even though I ask him/her not to	.66
My friend and I can argue a lot	.82
My friend and I disagree about many things	.52
If I said I was sorry after I had a fight with my friend, he/she would still stay mad at me	.60
Help (α = .84)	
If I forgot my lunch or needed a little money, my friend would loan it to me	.40
My friend helps me when I am having trouble with something [a]	.75
My friend would help me if I needed it [a]	.76
If other kids were bothering me, my friend would help me [b]	.71
My friend would stick up for me if another kid was causing me trouble [b]	.65
If my friend or I do something that bothers the other one of us, we can make up easily [c]	.59
If my friend and I have a fight or argument, we can say 'I'm sorry' and everything will be alright [c]	.60
Closeness (α = .85)	
If my friend had to move away, I would miss him/her [d]	.68
I feel happy when I am with my friend	.72
I think about my friend even when my friend is not around [d]	.68
When I do a good job at something, my friend is happy for me	.77
Sometimes my friend does things for me, or makes me feel special	.75
Exclusivity (α = .88)	
I feel jealous if I see my friend hanging out with another kid	.77
It bothers me if my friend hangs out with other kids even when I am busy	.79
I would rather hang out with my friend alone, and not other kids too	.64
I feel sad and upset when my friend wants to be good friend with others	.81
When I see my friend hangs out with others, I feel mad and upset	.84
Intimacy (α = .86)	
If I have a problem at school or at home, I can talk to my friend about it	.72
If there is something bothering me, I can tell my friend about it even if it is something I cannot tell other people	.76
I can tell my friend my problems	.81
I can tell my friend my secrets	.71
I can talk with my friend about the things that make me sad	.69

Note. α = Cronbach's alpha.

[a, b, c, d] Error variances of the two items were allowed to correlate with each other in the model, according to the modification indices.

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Table 4

Items and Standard Loadings of the Child-Parent Relationship Scale

Closeness (α = .85)	
I share an affectionate, warm relationship with my child	.73
If upset, my child will seek comfort from me	.73
My child values his/her relationship with me [a]	.69
When I praise my child, he/she beams with pride [a][b]	.49
My child spontaneously shares information about him/herself [b]	.74
It is easy to be in tune with what my child is feeling	.66
My child openly shares his/her feelings and experiences with me	.63
Conflict (α = .80)	
My child and I always seem to be struggling with each other	.63
My child easily becomes angry at me	.58
My child remains angry or is resistant after being disciplined	.63
Dealing with my child drains my energy	.62
When my child is in a bad mood, I know we're in for a long and difficult day	.69
My child's feelings toward me can be unpredictable or can change suddenly [c]	.67
My child is sneaky or manipulative with me [c]	.51

Note. α = Cronbach's alpha.

[a, b, c] Error variances of the two items were allowed to correlate with each other in the model on the basis of modification indices.

Table 5

Items and Standard Loadings of the Measure for Psychological Control

Love Withdrawal (α = .68)	
Avoid looking at my child when my child has disappointed me [a]	.52
Ignoring my child when he/she tries to get attention	.58
If my child has hurt my feelings, ceasing to talking to him/her until s/he pleases me again	.54
Being less friendly with my child if my child does not see things my way	.56
Not paying attention when my child is talking to me	.64
Guilt Induction (α = .72)	
Making my child aware of how much I sacrifice or do for him/her [b]	.40
Telling my child that he/she should be ashamed when he/she misbehaves [a b]	.51
Telling my child that I get embarrassed when he/she does not meet my expectations	.74
Making my child feel guilty when he/she does not meet my expectations	.77
Telling my child he/she is not as good as other children	.64

Note. α = Cronbach's alpha.

[a, b] Error variances of the two items were allowed to correlate with each other in the model, according to the modification indices.

Table 6

Means and Standard Deviations of Study Variables

Variables	Sources	Scale	Mean (*SD*)		
			Time 1	Time 2	Time 3
ADHD Symptoms					
Inattention	parent	0 – 3	0.88 (0.55)	0.81 (0.54)	0.80 (0.57)
Hyperactivity	parent	0 – 3	0.55 (0.50)	0.48 (0.48)	0.45 (0.46)
Total Symptoms	parent	0 – 3	0.71 (0.47)	0.65 (0.46)	0.62 (0.47)
Peer Functioning					
Peer acceptance	peer	z scores	0.09 (0.99)	0.04 (0.98)	0.04 (1.00)
Peer rejection	peer	z scores	0.03 (0.99)	0.00 (0.97)	0.00 (0.98)
Popularity	peer	z scores	0.06 (1.02)	0.02 (1.01)	0.03 (1.00)
Peer Victimization					
Relational victimization	teacher	1 – 5	1.32 (0.64)	1.38 (0.70)	1.54 (0.87)
Physical victimization	teacher	1 – 5	1.27 (0.57)	1.23 (0.46)	1.42 (0.76)
Relational victimization	peer	z scores	0.02 (0.88)	0.00 (0.85)	0.01 (0.87)
Physical victimization	peer	z scores	0.04 (0.93)	0.00 (0.92)	0.01 (0.97)
Number of Friendships	peer, child	0 – 5	2.40 (1.25)	1.92 (1.50)	2.20 (1.54)
Friendship Quality					
Companionship	child	1 – 5	3.78 (0.98)	3.85 (0.99)	3.85 (0.96)
Help	child	1 – 5	3.66 (0.95)	3.75 (1.01)	3.79 (0.93)
Closeness	child	1 – 5	3.99 (0.99)	3.99 (1.03)	3.96 (0.98)
Intimacy	child	1 – 5	3.32 (1.17)	3.40 (1.23)	3.38 (1.16)
Exclusivity	child	1 – 5	1.80 (1.01)	1.76 (1.00)	1.62 (0.83)
Conflict	child	1 – 5	1.92 (0.78)	1.92 (0.79)	1.84 (0.67)
Social Behavior					
Relational aggression	teacher	1 – 5	1.57 (0.67)	1.60 (0.66)	1.71 (0.85)
Physical aggression	teacher	1 – 5	1.39 (0.69)	1.40 (0.69)	1.58 (0.87)
Prosocial behavior	teacher	1 – 5	2.04 (0.85)	2.20 (0.87)	2.21 (0.85)

Table 6 (Cont')

Means and Standard Deviations of Study Variables

Variables	Sources	Scale	Mean (*SD*)		
			Time 1	Time 2	Time 3
Relational aggression	peer	z scores	0.04 (0.90)	0.01 (0.89)	0.01 (0.93)
Physical aggression	peer	z scores	0.02 (0.92)	0.01 (0.94)	0.02 (0.94)
Prosocial behavior	peer	z scores	0.06 (0.94)	0.03 (0.91)	0.05 (0.92)
Internalizing Problems	parent	0 – 2	0.19 (0.21)	0.18 (0.20)	0.18 (0.21)
Externalizing Problems	parent	0 – 2	0.17 (0.18)	0.15 (0.18)	0.15 (0.17)
Anxious/depressed symptoms	parent + teacher	0 – 2	0.21 (0.22)	0.18 (0.18)	0.23 (0.22)
Nonbehavioral Factors					
HAB to relational provocation	child	0 – 6	2.48 (1.84)	2.12 (1.92)	1.99 (1.90)
HAB to instrumental provocation	child	0 – 6	1.43 (1.73)	1.29 (1.71)	1.10 (1.54)
Academic performance	teacher	1 – 5	3.12 (1.39)	3.12 (1.39)	3.16 (1.39)
Familial Factors					
Psychological control					
Love withdrawal	parent	1 – 5	1.62 (0.64)	1.64 (0.75)	1.74 (0.94)
Guilt induction	parent	1 – 5	2.23 (0.76)	2.18 (0.73)	2.21 (0.89)
Parent-child relationships					
Closeness	parent	1 – 5	4.22 (0.67)	4.14 (0.77)	4.12 (0.81)
Conflict	parent	1 – 5	1.74 (0.70)	1.76 (0.71)	1.77 (0.73)

Note. ADHD = Attention-Deficit/Hyperactivity Disorder; HAB = Hostile Attribution Bias.

Table 7

Independent Effects of Inattention and Hyperactivity/Impulsivity on Peer Functioning

Dependent Variables	Inattention			Hyperactivity		
	B	*SE*	*t*	B	*SE*	*t*
Peer acceptance	-.49	.14	- 3.58***	-.02	.17	- 0.09
Peer rejection	.21	.13	1.58	.66	.17	3.96*** [a]
Popularity	-.70	.14	- 4.87***	.25	.18	1.37
Peer Vict						
Relational vict – T	.20	.08	2.54*	.13	.10	1.29
Physical vict – T	.03	.07	0.41	.20	.09	2.26*
Relational vict – P	.38	.12	3.13**	.26	.16	1.70[†]
Physical vict – P	.22	.12	1.83[†]	.16	.15	1.04
Number of Friendships	-.29	.19	- 1.47	.34	.26	1.32
Friendship Quality						
Companionship	-.01	.14	- 0.05	-.17	.18	- 0.97
Help	-.15	.13	- 1.13	-.17	.17	- 1.01
Closeness	.13	.14	0.93	-.27	.18	- 1.51
Intimacy	.09	.16	0.56	-.40	.20	- 1.99* [b]
Exclusivity	.12	.14	0.87	.06	.18	0.32
Conflict	.18	.10	1.67[†]	.34	.13	2.54*
Social Behavior						
Relational agg – T	.05	.08	0.63	.19	.10	1.86[†]
Physical agg – T	-.01	.08	- 0.15	.27	.10	2.75**
Prosocial behavior – T	-.47	.11	- 4.33***	-.06	.14	- 0.45
Relational agg – P	-.02	.13	- 0.19	.47	.16	2.93**
Physical agg – P	-.25	.12	- 2.09*	.54	.15	3.61***
Prosocial behavior – P	-.68	.12	- 5.48*** [c]	.12	.16	0.74

Note. Vict = Victimization; Agg = Aggression; T = Teacher report; P = Peer report.

† *p* < .10, * *p* < .05, ** *p* < .01, *** *p* < .001.

Age and gender were treated as covariates in the model.

[a] Gender × hyperactivity was significant in predicting peer rejection (*p* = .05). Post-hoc analysis indicated that the effect of hyperactivity on peer rejection was greater for girls (*B* = .82, *p* < .001) than for boys (*B* = .40, *p* < .001).

[b] Gender × hyperactivity was significant in predicting self-reported intimacy in best friendship (*p* = .04). Post-hoc analysis indicated that the effect of hyperactivity on intimacy was significant for girls (*B* = -.35, *p* = .029), but not for boys (*B* = -.02, *p* = .845).

[c] Gender × inattention was significant in predicting peer-reported prosocial behavior (*p* = .02). Post-hoc analysis indicated that the effect of inattention on prosocial behavior was greater for girls (*B* = -.63, *p* < .001) than for boys (*B* = -.37, *p* < .001).

Table 8

Independent Effects of Time 1 Inattention and Hyperactivity/Impulsivity on Time 3 Peer Functioning

| Dependent Variables | Time 1 | | | | | |
| | Inattention | | | Hyperactivity | | |
(Time 3 outcomes)	B	*SE*	*t*	B	*SE*	*t*
Peer acceptance	-.20	.20	-1.00	.16	.28	0.58
Peer rejection	.06	.14	0.39	-.05	.20	-0.23
Popularity	-.22	.18	-1.24	.20	.25	0.79
Peer Vict						
Relational vict – T	.21	.11	1.80†	.16	.14	1.14
Physical vict – T	.28	.11	2.41*^{a}	-.02	.15	-0.13
Relational vict – P	.10	.15	0.68	.06	.21	0.27
Physical vict – P	.26	.22	1.17	-.28	.31	-0.90
Number of Friendships	-.60	.40	-1.50	.39	.56	0.70
Friendship Quality						
Companionship	-.27	.15	-1.81†	.15	.19	0.81
Help	-.28	.14	-2.05*	.00	.17	0.01
Closeness	-.13	.15	-0.85	-.06	.19	-0.30
Intimacy	-.28	.17	-1.62	.37	.22	1.67†
Exclusivity	-.04	.14	-0.29	-.07	.17	-0.42
Conflict	-.15	.10	-1.44	.24	.13	1.80$^{† b}$
Social Behavior						
Relational agg – T	-.15	.10	-1.55	.22	.13	1.75†
Physical agg – T	-.01	.11	-0.11	-.04	.14	-0.25
Prosocial behavior – T	.02	.13	0.16^{c}	-.08	.16	-0.49
Relational agg – P	-.37	.18	-2.11*	.28	.25	1.10
Physical agg – P	.02	.16	0.11	-.01	.23	-0.01
Prosocial behavior – P	-.08	.15	-0.54	.35	.21	1.68†

Note. Vict = Victimization; Agg = Aggression; T = Teacher report; P = Peer report.

† $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Effects of age, gender, and outcome variables at Time 1 were controlled for in the models.

[a] Gender × inattention was significant in predicting physical victimization ($p = .05$). Post-hoc analysis indicated that the effect of inattention on physical victimization was significant for girls ($B = .32$, $p = .004$), but not for boys ($B = .08$, $p = .456$).

[b] Gender × hyperactivity was significant in predicting conflict in best friendship ($p = .02$). Post-hoc analysis indicated that the effect of hyperactivity on conflict was significant for girls ($B = .27$, $p = .014$), but not for boys ($B = -.10$, $p = .280$).

[c] Gender × inattention was significant in predicting teacher-reported prosocial behavior ($p = .04$). Post-hoc analysis indicated that the effect of inattention on prosocial behavior was significant for boys ($B = -.33$, $p = .005$), but not for girls ($B = -.18$, $p = .141$).

Table 9

Correlations among Study Variables in the Mediation Model

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Inatt1	—												
2	Hyp1	.59***	—											
3	HAB-RA1	.02	.07	—										
4	HAB-Ins1	.19***	.21***	.47***	—									
5	Tprosoc2	-.23***	-.08	-.13*	-.19***	—								
6	TRA2	.09	.14**	.19**	.14**	-.01	—							
7	TPA2	.11	.24***	.14*	.12*	-.05	.68***	—						
8	Pprosoc2	-.32***	-.19***	-.05	-.18**	.56***	-.11*	-.20***	—					
9	PRA2	.03	.11*	.14*	.10	-.04	.38***	.39***	-.20***	—				
10	PPA2	.10	.27***	.08	.13*	-.09	.33***	.54***	-.24***	.69***	—			
11	Reject3	.23**	.11	.03	.19**	-.30***	.13	.24**	-.34***	.42***	.43***	—		
12	Accept3	-.18*	-.06	.03	-.15*	.40***	-.17*	-.20*	.61***	-.24**	-.25***	-.53***	—	
13	Friends3	-.18*	-.04	-.02	.14	.30***	-.21*	-.28***	.46***	-.11	-.20**	-.45***	.72***	—

Note. Inatt1 = Inattention at Time 1, Hyp1 = Hyperactivity/impulsivity at Time 1, HAB-RA1 = Hostile Attribution Bias – Relational Provocation at Time 1, HAB-Ins1 = Hostile Attribution Bias – Instrumental Provocation at Time 1, Tprosoc2 = Teacher-reported Prosocial Behavior at Time 2, TRA2 = Teacher-reported Relational Aggression at Time 2, TPA2 = Teacher-reported Physical Aggression at Time 2, Pprosoc2 = Peer-reported Prosocial Behavior at Time 2, PRA2 = Peer-reported Relational Aggression at Time 2, PPA2 = Peer-reported Physical Aggression at Time 2, Reject3 = Peer Rejection at Time 3, Accept3 = Peer Acceptance at Time 3, Friends3 = Number of Friendships at Time 3.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 10

Fit Statistics and Model Comparisons for Hypothesized Nested Models Involving ADHD Symptoms and Peer Rejection

Model	χ^2	df	CFI	RMSEA	Model Comparison	$\Delta\chi^2$	Δdf	p
1 Unconstrained	124.47	26	.950	.072	----	----	----	----
2 Fully constrained	175.05	49	.937	.059	2 vs. 1	50.58	23	< .001
3 Covariances constrained	134.74	35	.950	.062	3 vs. 1	10.27	9	.329
4 Structural (directional) paths constrained	161.51	40	.939	.064	4 vs. 1	37.04	14	.001
5 New baseline (covariances constrained)	134.74	35	.950	.062	----	----	----	----
6 Stabilities constrained	155.11	41	.943	.061	6 vs. 5	20.37	6	.002
7 Cross-lagged paths constrained	149.68	43	.946	.058	7 vs. 5	14.94	8	.060
8 Final model (free T1 to T2 inatt, T2 to T3 inatt, T2 to T3 hyp)	151.84	46	.947	.056	----	----	----	----

Note. T = Time; inatt = inattention; hyp = hyperactivity. CFI = Comparative fit index; RMSEA = Root mean square error of approximation.

Table 11

Fit Statistics and Model Comparisons for Hypothesized Nested Models Involving ADHD Symptoms and Peer Acceptance

Model		χ^2	*df*	CFI	RMSEA	Model Comparison	$\Delta\chi^2$	Δdf	*p*
1	Unconstrained	93.40	26	.961	.059	----	----	----	----
2	Fully constrained	150.96	49	.941	.053	2 vs. 1	57.56	23	< .001
3	Covariances constrained	111.04	35	.956	.054	3 vs. 1	17.64	9	.040
4	Structural (directional) paths constrained	127.56	40	.949	.054	4 vs. 1	34.16	14	.002
5	New baseline (all covariances constrained except for two) [a]	102.19	33	.960	.053	----	----	----	----
6	Stabilities constrained	121.46	39	.952	.054	6 vs. 5	19.27	6	.004
7	Cross-lagged paths constrained	117.34	41	.956	.050	7 vs. 5	15.15	8	.056
8	Final model (free T1 to T2 inatt, T2 to T3 inatt, T2 to T3 hyp, and two covariances)	119.86	44	.956	.048	----	----	----	----

Note. [a] Covariances between Time 2 acceptance and hyperactivity and between Time 3 inattention and hyperactivity were not constrained.
T = Time; inatt = inattention; hyp = hyperactivity. CFI = Comparative fit index; RMSEA = Root mean square error of approximation.

Table 12

Fit Statistics and Model Comparisons for Hypothesized Nested Models Involving ADHD Symptoms and Dyadic Friendships

Model	χ^2	df	CFI	RMSEA	Model Comparison	$\Delta\chi^2$	Δdf	p
1 Unconstrained	84.40	26	.957	.055	----	----	----	----
2 Fully constrained	139.45	49	.934	.050	2 vs. 1	55.05	23	< .001
3 Covariances constrained	99.96	35	.952	.050	3 vs. 1	15.56	9	.077
4 Structural (directional) paths constrained	116.63	40	.944	.051	4 vs. 1	32.23	14	.004
5 New baseline (covariances constrained)	99.96	35	.952	.050	----	----	----	----
6 Stabilities constrained	122.17	41	.941	.052	6 vs. 5	22.21	6	.001
7 Cross-lagged paths constrained	113.98	43	.948	.047	7 vs. 5	14.02	8	.081
8 Final model (free T1 to T2 inatt, T2 to T3 inatt, T2 to T3 hyp)	115.42	46	.949	.045	----	----	----	----

Note. T = Time; inatt = inattention; hyp = hyperactivity. CFI = Comparative fit index; RMSEA = Root mean square error of approximation.

Table 13
Group Differences among Liked and Disliked Youth with and without ADHD

Mean (*SD*)	Liked Controls (*n* = 85)	Disliked Controls (*n* = 141)	Liked ADHD (*n* = 28)	Disliked ADHD (*n* = 69)	Group Effect
Teacher-reported					
Relational aggression	1.47 (0.63)	1.45 (0.60)	1.55 (0.49)	1.81 (0.70)	F (3, 224) = 3.86**
Physical aggression	1.24 (0.54)	1.28 (0.69)	1.35 (0.56)	1.78 (0.91)	F (3, 224) = 7.02***
Prosocial behavior	2.25 (0.86)	2.06 (0.96)	1.85 (0.68)	1.69 (0.65)	F (3, 224) = 6.61***
Peer-reported					
Relational aggression	-0.18 (0.82)	0.10 (0.94)	-0.06 (0.72)	0.48 (1.15)	F (3, 225) = 5.78***
Physical aggression	-0.11 (0.82)	-0.01 (1.07)	-0.03 (0.59)	0.52 (1.35)	F (3, 225) = 4.52**
Prosocial behavior	0.75 (1.04)	-0.27 (0.70)	-0.04 (0.66)	-0.62 (0.38)	F (3, 225) = 41.88***
Externalizing problems	0.05 (0.09)	0.03 (0.04)	0.37 (0.24)	0.39 (0.24)	F (3, 194) = 64.86***
Internalizing problems	0.07 (0.11)	0.08 (0.10)	0.32 (0.23)	0.35 (0.27)	F (3, 194) = 33.13***
Depressive symptoms	0.09 (0.10)	0.18 (0.20)	0.25 (0.22)	0.38 (0.28)	F (3, 168) = 17.97***
Inattention	0.19 (0.12)	0.21 (0.15)	1.75 (0.40)	1.68 (0.43)	F (3, 194) = 333.02***
Hyperactivity	0.07 (0.10)	0.07 (0.10)	1.29 (0.53)	1.34 (0.53)	F (3, 194) = 177.56***
Overall ADHD symptoms	0.13 (0.07)	0.14 (0.09)	1.52 (0.27)	1.51 (0.31)	F (3, 194) = 564.19***
HAB – Rel	2.63 (1.91)	2.46 (1.79)	3.18 (1.89)	2.62 (1.85)	F (3, 239) = 1.02
HAB – Ins	1.43 (1.57)	1.51 (2.05)	2.54 (2.40)	2.05 (1.82)	F (3, 238) = 2.96*
Academic performance	3.69 (1.33)	3.24 (1.46)	2.73 (1.51)	2.20 (1.24)	F (3, 221) = 12.40***
Parent-child relationships					
Closeness	4.43 (0.57)	4.52 (0.70)	3.93 (0.62)	3.83 (0.75)	F (3, 191) = 13.11***
Conflict	1.60 (0.69)	1.38 (0.61)	2.25 (0.71)	2.12 (0.71)	F (3, 192) = 14.86***
Psychological Control					
Love withdrawal	1.47 (0.48)	1.54 (0.93)	1.97 (0.57)	1.96 (0.74)	F (3, 138) = 5.05**
Guilt Induction	2.11 (0.88)	1.83 (0.77)	2.66 (0.56)	2.69 (0.81)	F (3, 132) = 8.04***

Note. ADHD = Attention-deficit/hyperactivity disorder; HAB – Rel = Hostile Attribution Bias – Relational Provocation; HAB – Ins = Hostile Attribution Bias – Instrumental Provocation. *p < .05, **p < .01, ***p < .001.

Appendix A: Figures

Figure 1

*Hypothesized Mediation Model of ADHD and Peer Functioning*
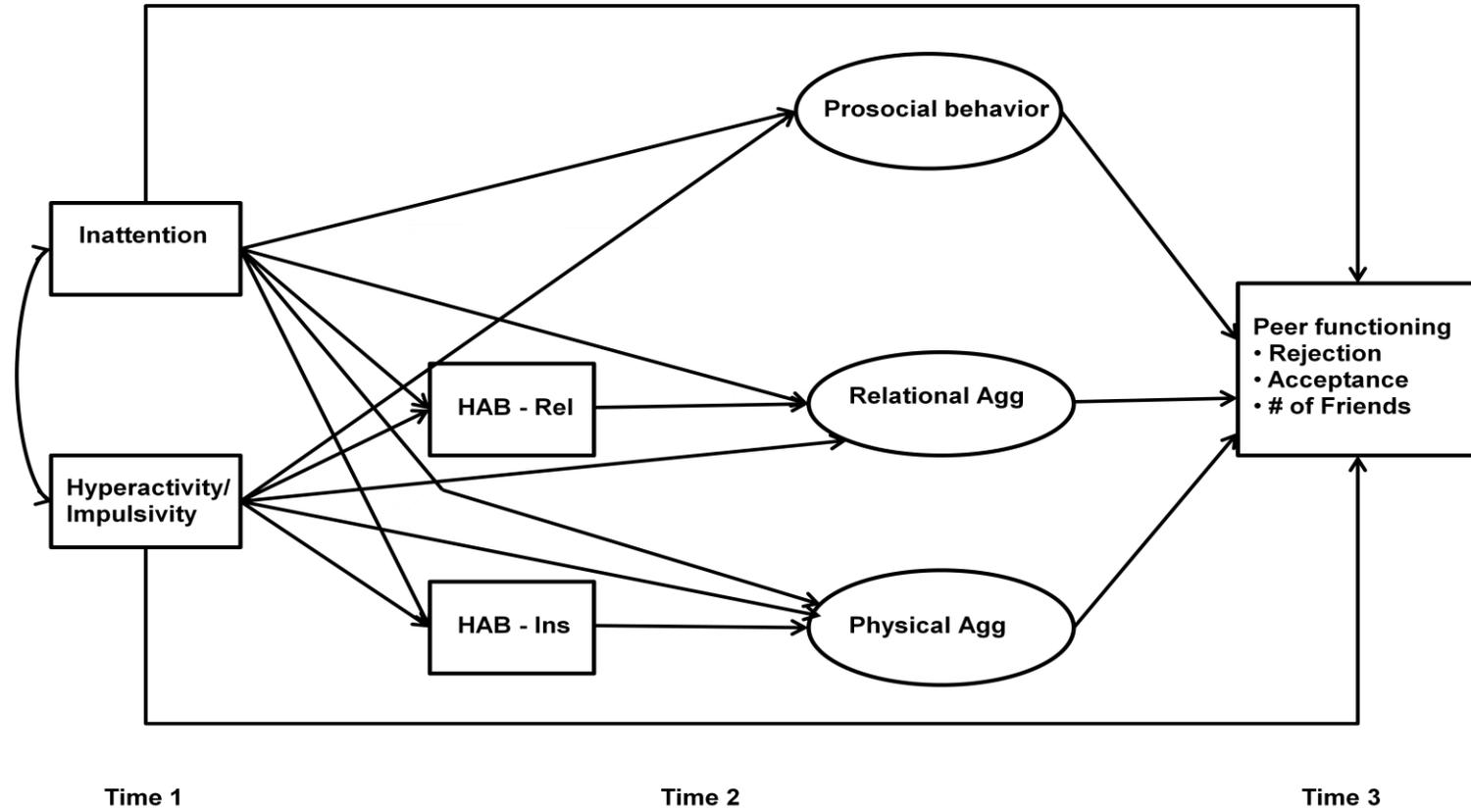
Note. HAB – Rel = Hostile Attribution Bias – Relational Provocation; HAB – Ins = Hostile Attribution Bias – Instrumental Provocation; Agg = Aggression.

Figure 2

Cross-lagged Panel Model of ADHD Symptoms and Peer Functioning
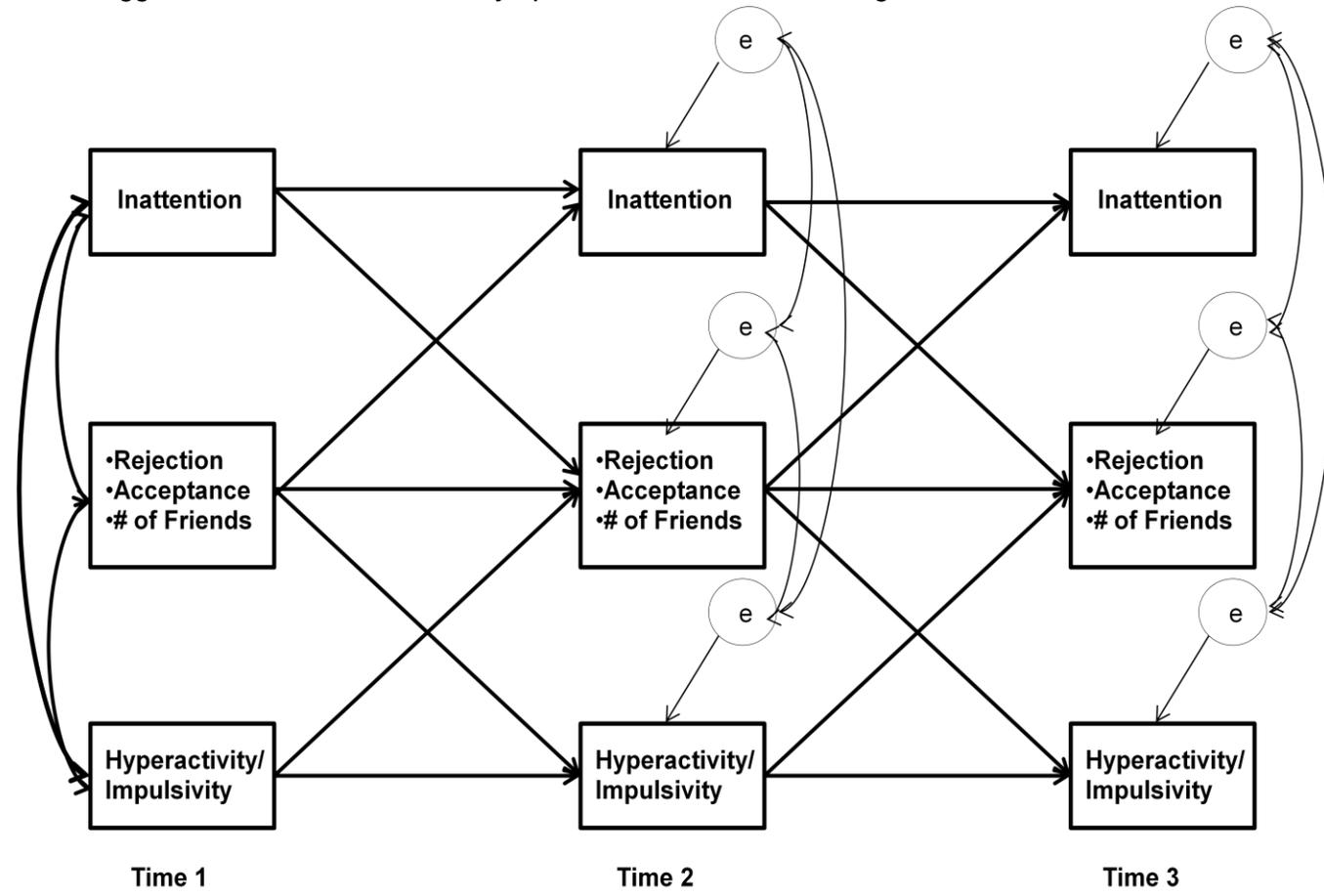
*Note.* ADHD = Attention-deficit/hyperactivity disorder.

Figure 3a
Mediation Model of ADHD Symptoms and Peer Rejection
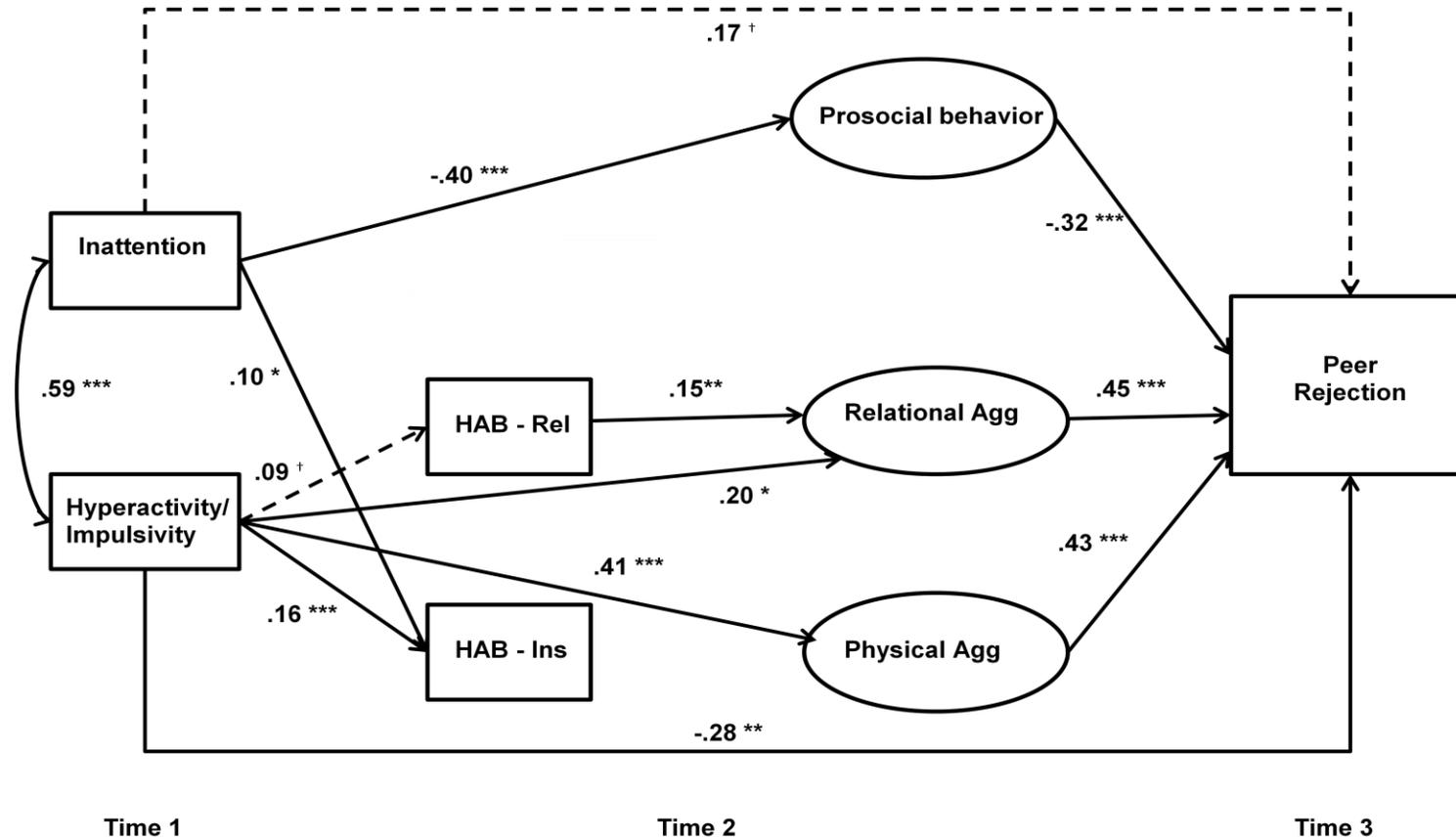
Time 1   **Time 2**   **Time 3**

Note. ADHD = Attention-deficit/hyperactivity disorder; HAB – Rel = Hostile Attribution Bias – Relational Provocation; HAB – Ins = Hostile Attribution Bias – Instrumental Provocation; Agg = Aggression. † $p \leq .09$, * $p < .05$, ** $p < .01$, *** $p < .001$. Only significant paths (with standardized estimates) are shown.

Figure 3b

Mediation Model of ADHD Symptoms and Peer Acceptance
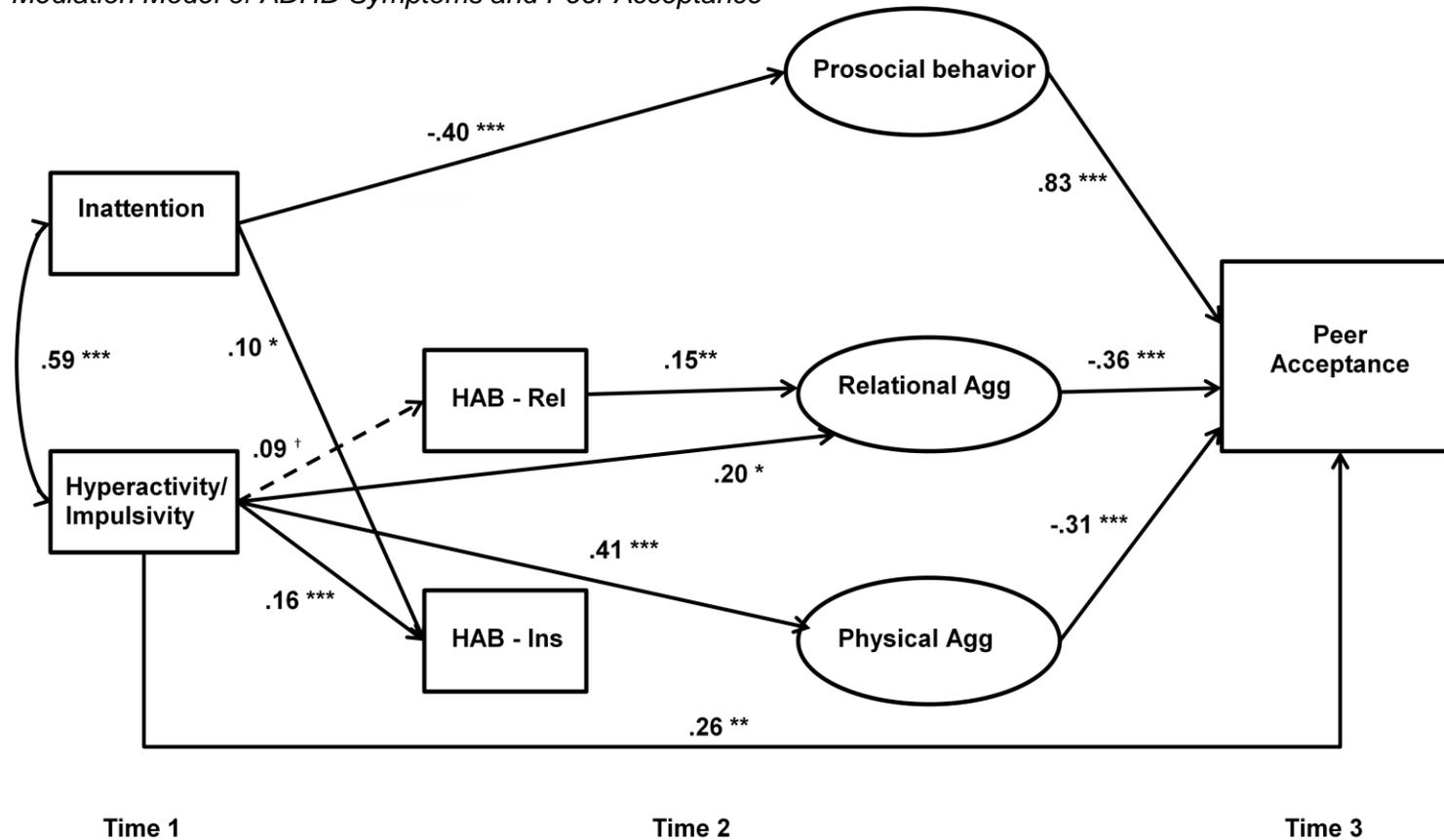
Note. ADHD = Attention-deficit/hyperactivity disorder; HAB – Rel = Hostile Attribution Bias – Relational Provocation; HAB – Ins = Hostile Attribution Bias – Instrumental Provocation; Agg = Aggression. † $p \leq .09$, * $p < .05$, ** $p < .01$, *** $p < .001$. Only significant paths (with standardized estimates) are shown.

Figure 3c

Mediation Model of ADHD Symptoms and the Number of Friendships
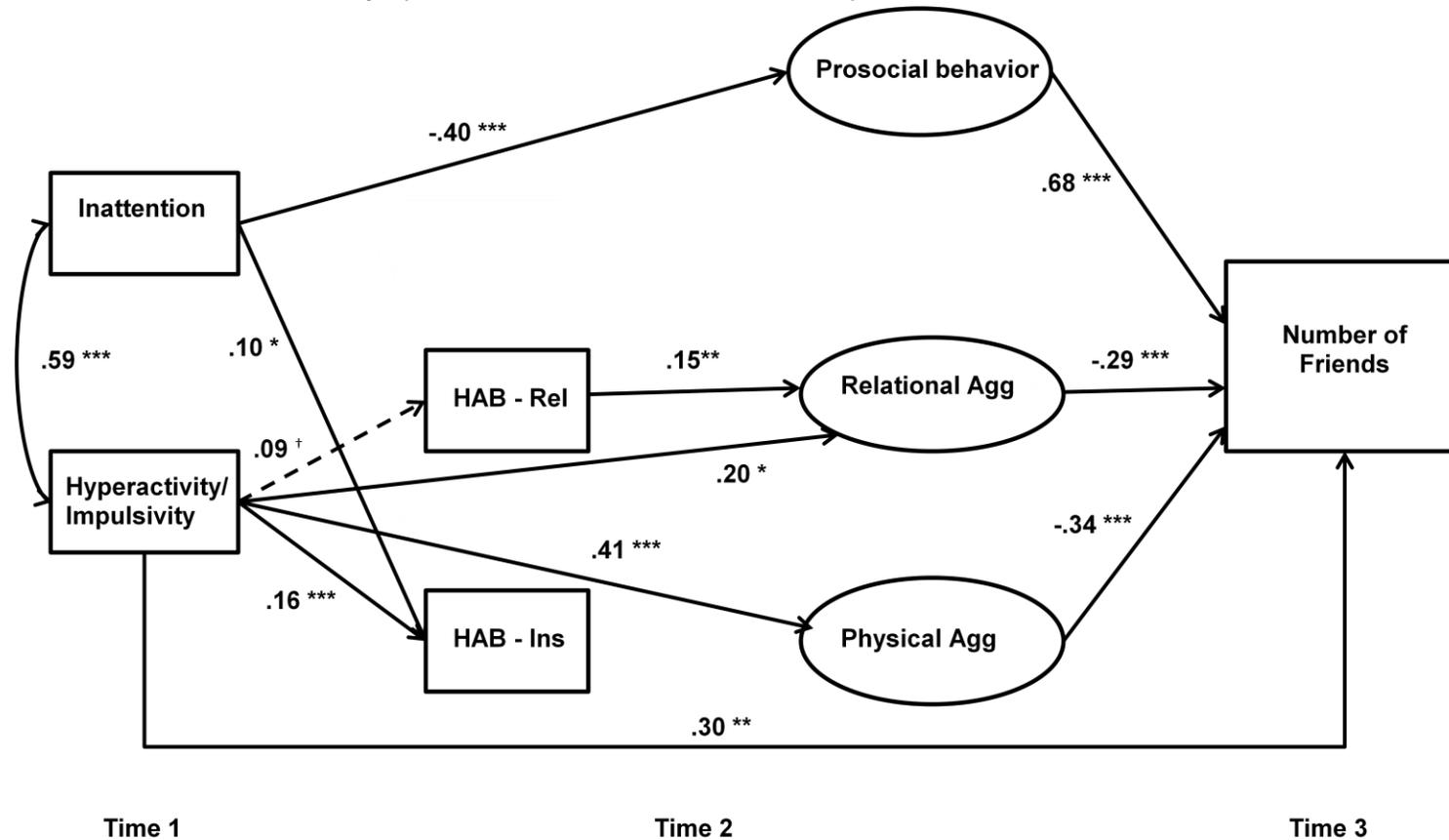
Figure 4

Interplay among Inattention, Hyperactivity, and Peer Rejection over Time
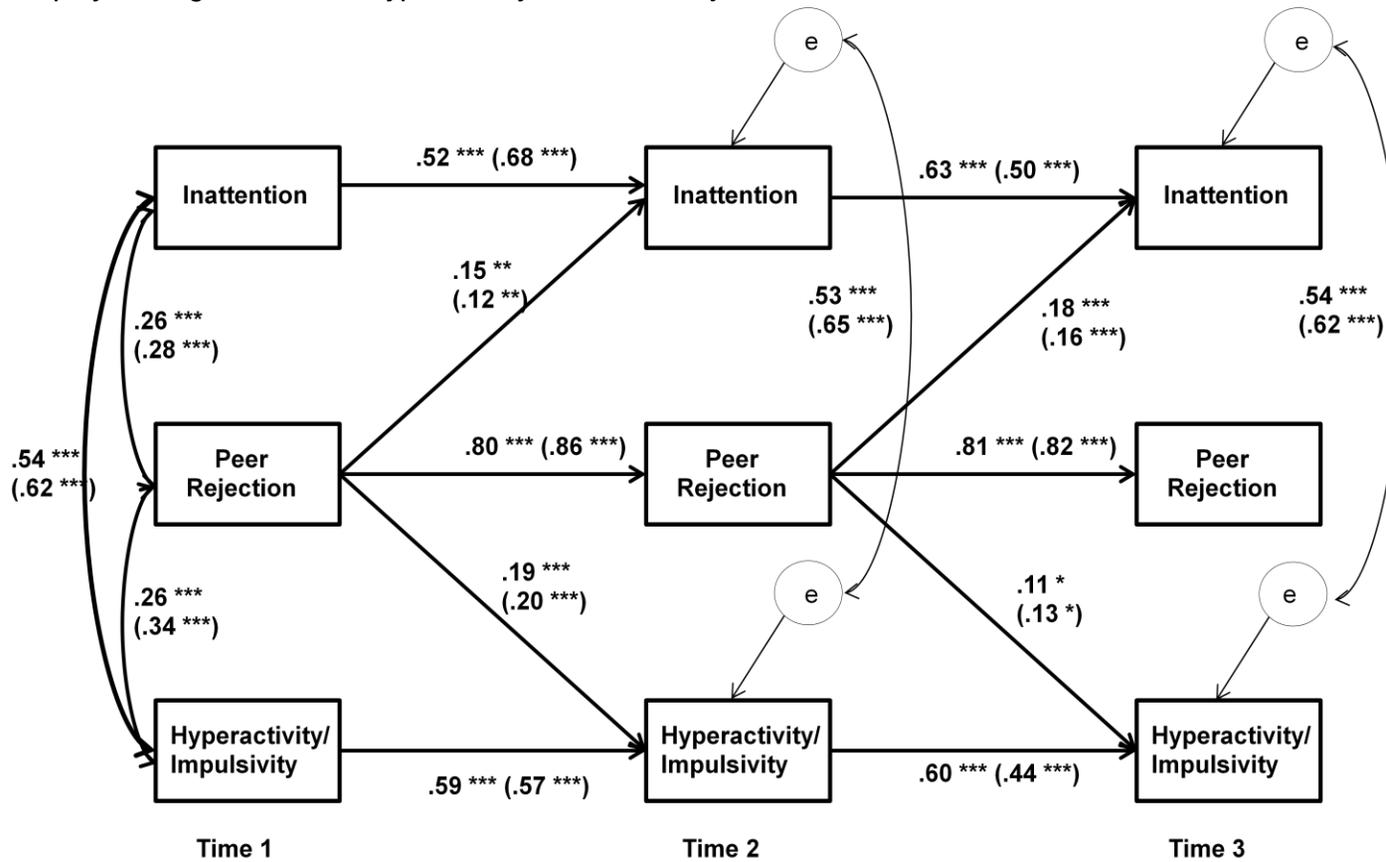
Note. Only significant paths (with standardized estimates) are shown. Estimates for boys are presented outside the parentheses, and estimates for girls are inside the parentheses. * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 5

Interplay among Inattention, Hyperactivity, and Peer Acceptance over Time
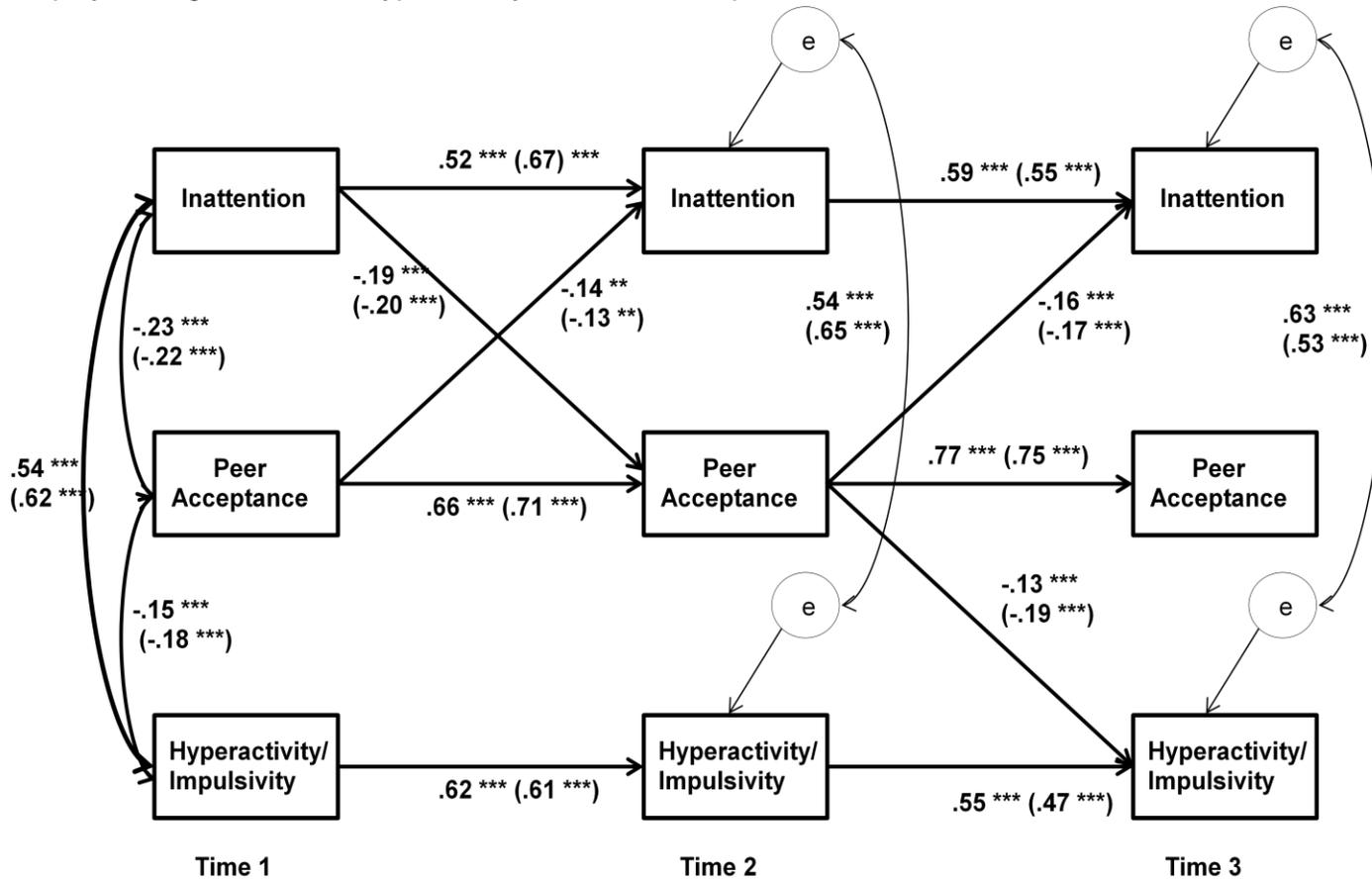
Note. Only significant paths (with standardized estimates) are shown. Estimates for boys are presented outside the parentheses, and estimates for girls are inside the parentheses. * $p < .05$, ** $p < .01$, *** $p < .001$.

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Figure 6

Interplay among Inattention, Hyperactivity, and the Number of Friendships over Time
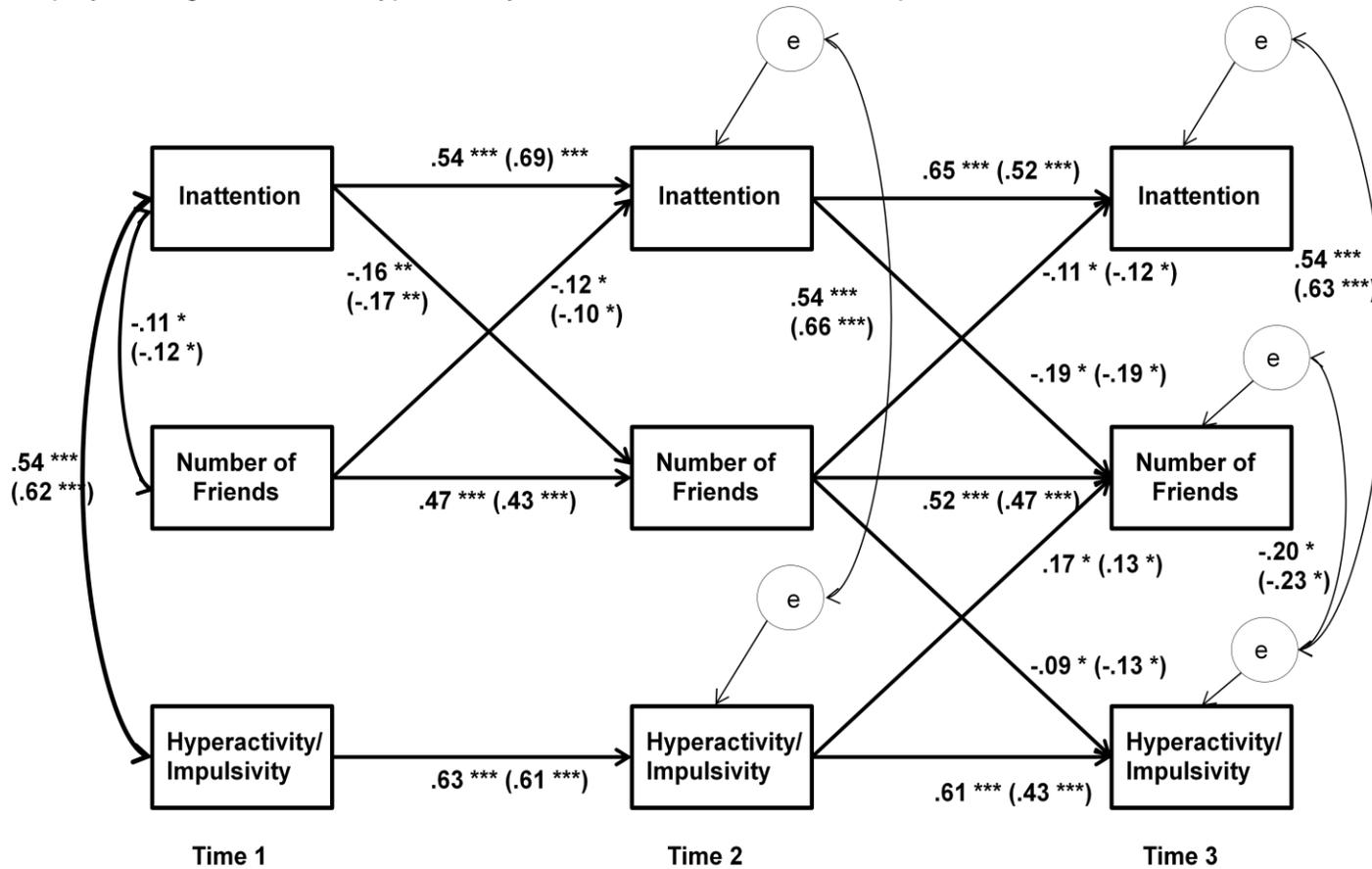
Note. Only significant paths (with standardized estimates) are shown. Estimates for boys are presented outside the parentheses, and estimates for girls are inside the parentheses. * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 7

Group Differences in Teacher-Reported Relational Aggression, Physical Aggression, and Prosocial Behaviors
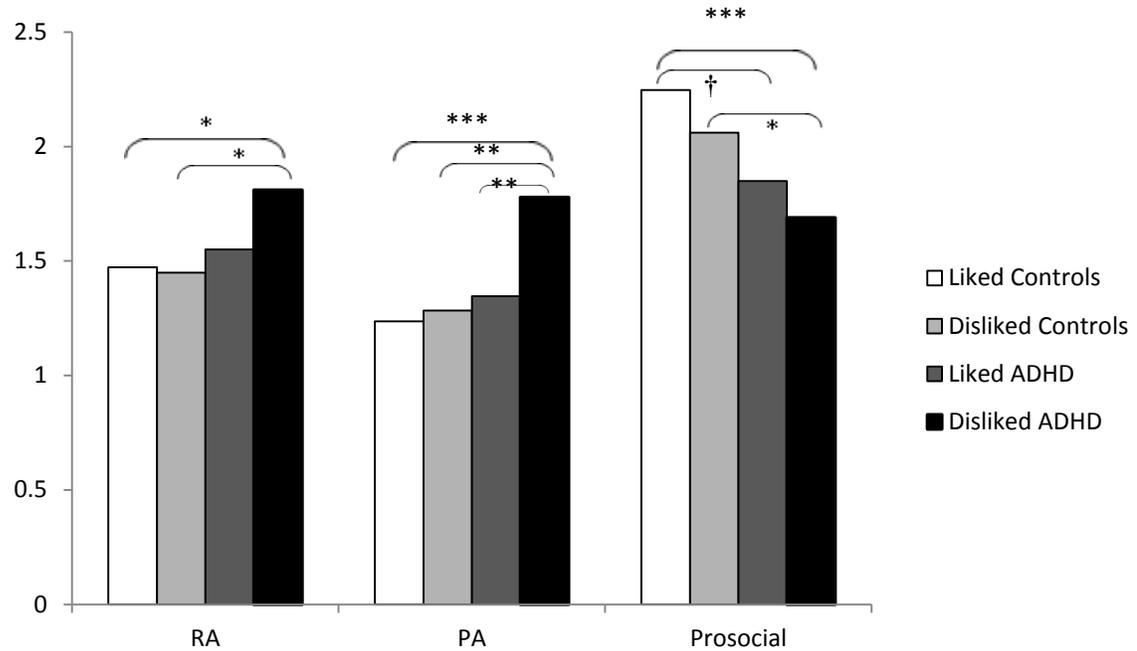

Note. ADHD = Attention-deficit/hyperactivity disorder; RA = Relational Aggression; PA = Physical Aggression. Results controlled for the effects of age and gender.

† p = .08, * p < .05, ** p < .01, *** p < .001.

Figure 8

Group Differences in Peer-Reported Relational Aggression, Physical Aggression, and Prosocial Behaviors
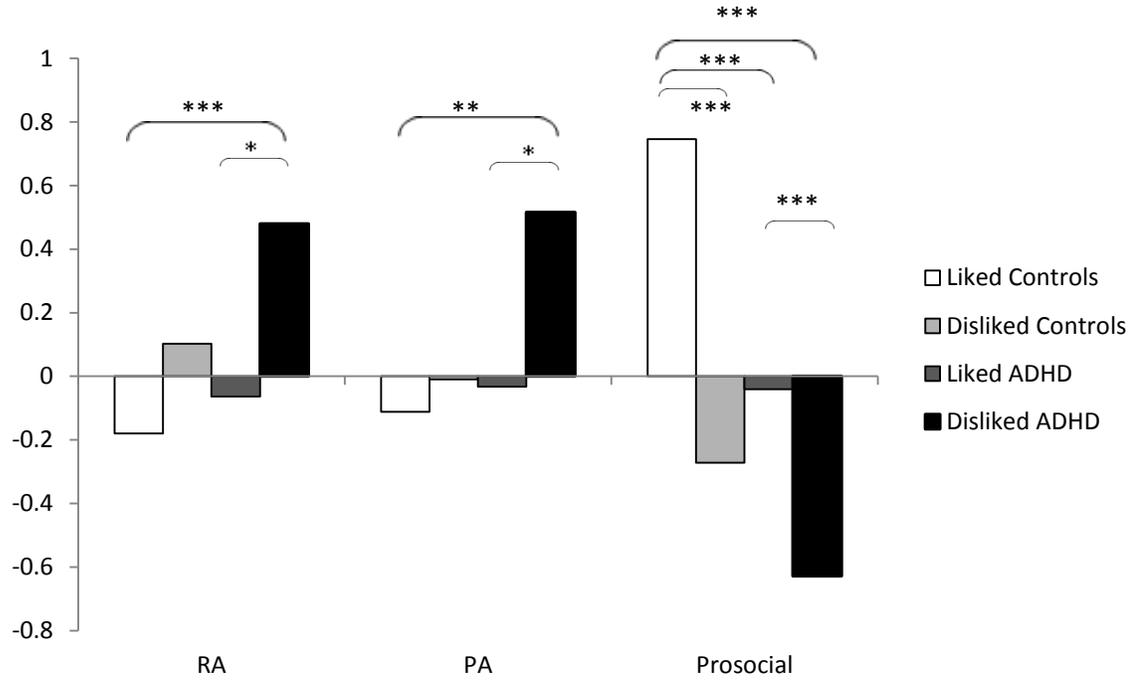
Note. ADHD = Attention-deficit/hyperactivity disorder; RA = Relational Aggression; PA = Physical Aggression. Results controlled for the effects of age and gender.

† p = .07, * p < .05, ** p < .01, *** p < .001.

Figure 9

Group Differences in Parent-Reported Externalizing and Internalizing Problems, and Parent- and Teacher-Reported Depressive Symptoms
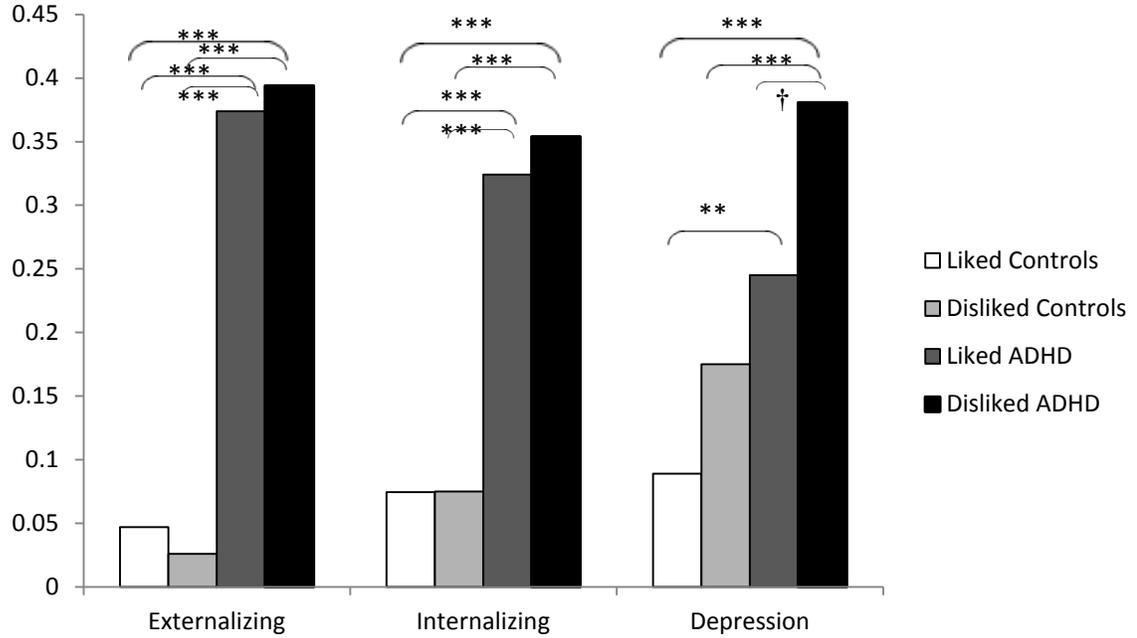

Note. ADHD = Attention-deficit/hyperactivity disorder. Results controlled for the effects of age and gender.

† $p = .06$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 10

*Group Differences in Parent-Reported ADHD Symptoms*
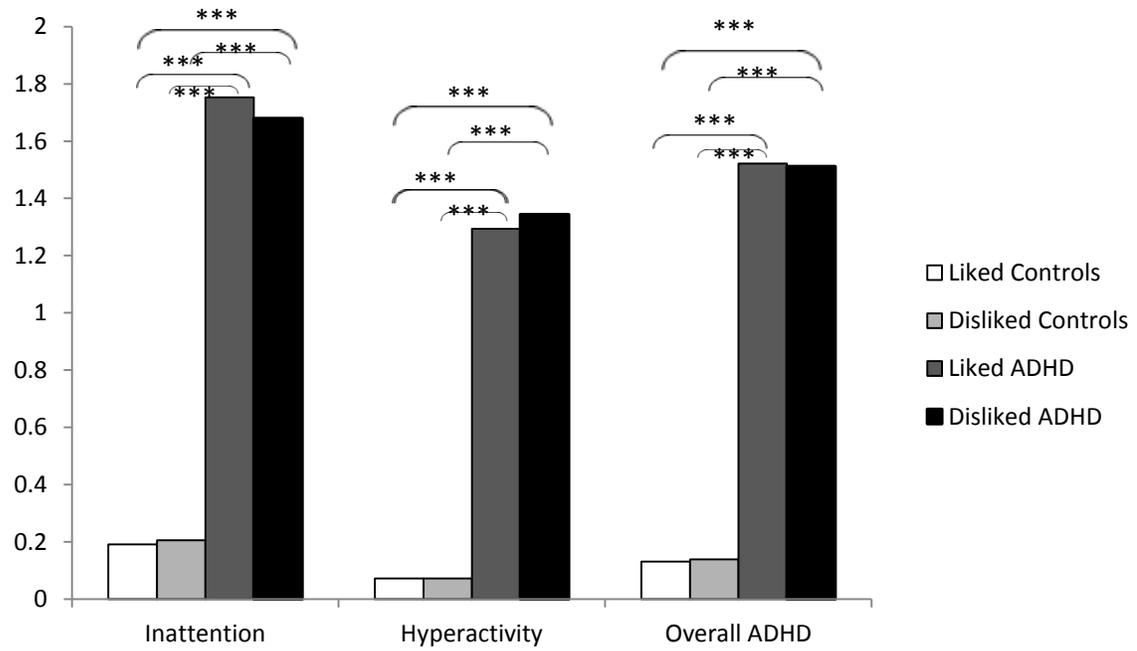
Note. ADHD = Attention-deficit/hyperactivity disorder. Results controlled for the effects of age and gender.

* *p* < .05, ** *p* < .01, *** *p* < .001.

Figure 11

*Group Differences in Hostile Attribution Biases*
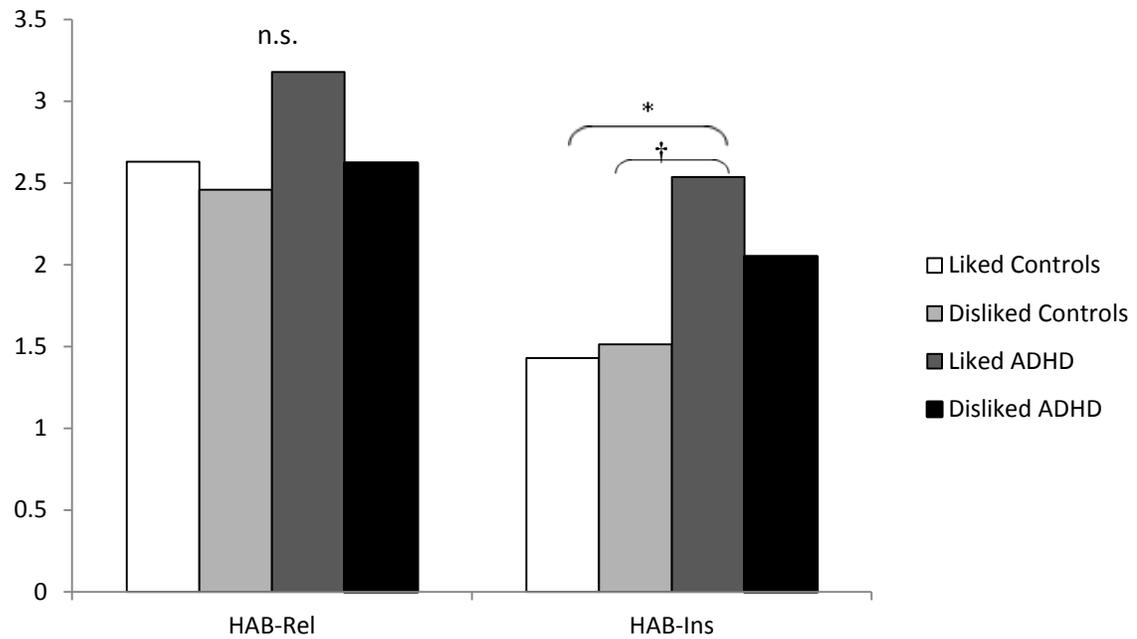
Note. ADHD = Attention-deficit/hyperactivity disorder; HAB – Rel = Hostile Attribution Bias – Relational Provocation; HAB – Ins = Hostile Attribution Bias – Instrumental Provocation. Results controlled for the effects of age and gender.

[†] *p* = .09, * *p* < .05, ** *p* < .01, *** *p* < .001.

Figure 12

*Group Differences in Academic Performance*
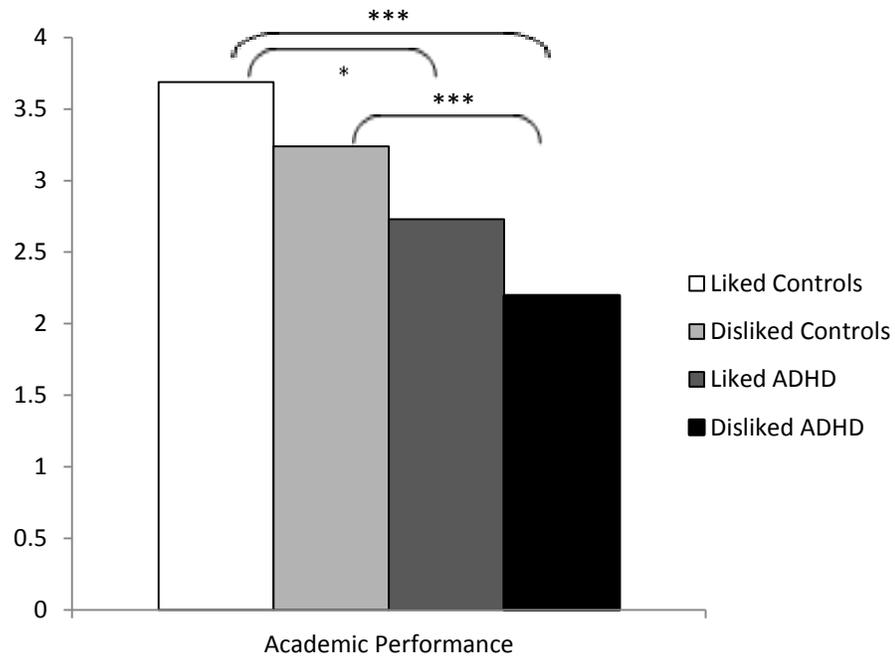
Note. ADHD = Attention-deficit/hyperactivity disorder. Results controlled for the effects of age and gender.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 13

Group Differences in Parent-Child Relationships
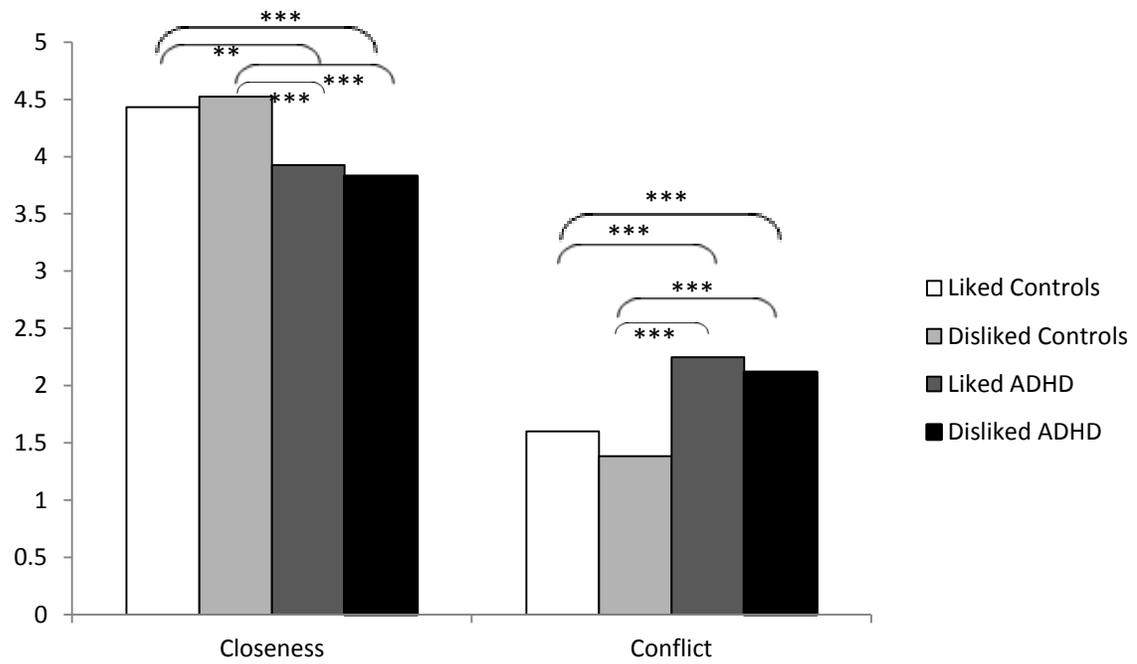
Note. ADHD = Attention-deficit/hyperactivity disorder. Results controlled for the effects of age and gender.

* *p* < .05, ** *p* < .01, *** *p* < .001.

Figure 14

Group Differences in Psychological Control
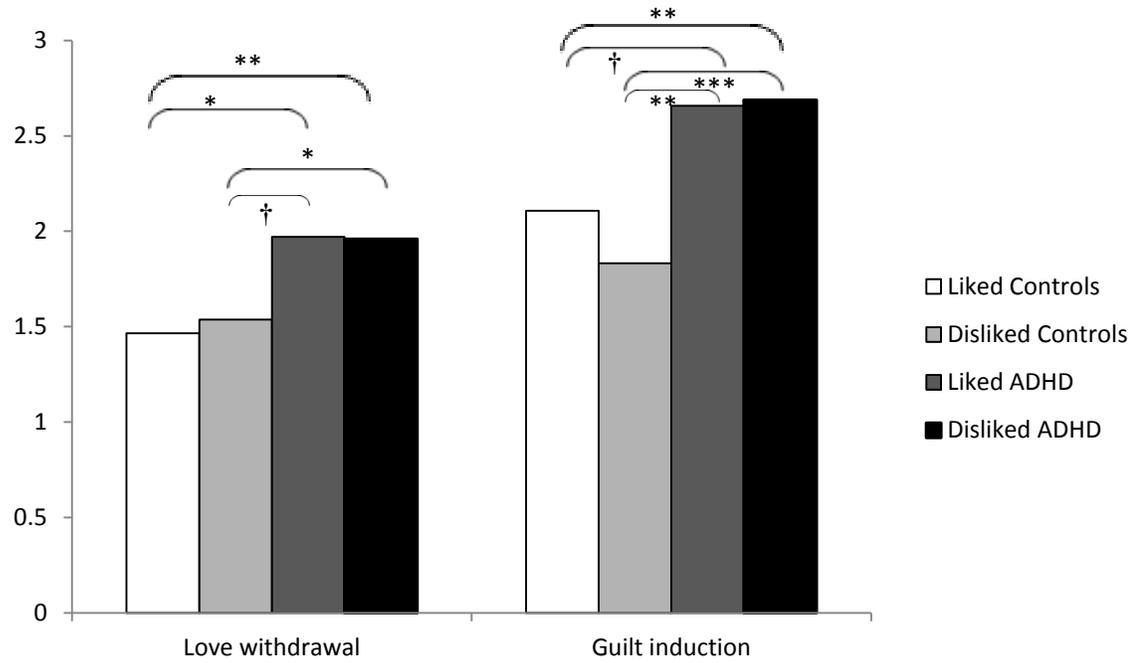
Note. ADHD = Attention-deficit/hyperactivity disorder. Results controlled for the effects of age and gender.

† *p* < .10, * *p* < .05, ** *p* < .01, *** *p* < .001.