Relations of Inattention and Hyperactivity/Impulsivity to Preadolescent Peer Functioning: The Mediating Roles of Aggressive and Prosocial Behaviors

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Relations of Inattention and Hyperactivity/Impulsivity to Preadolescent Peer Functioning: The Mediating Roles of Aggressive and Prosocial Behaviors

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This study examined the structural relations of preadolescents’ inattention and hyperactivity/impulsivity, aggressive and prosocial behaviors, and peer functioning. There were 739 fourth \( n = 239 \) and fifth \( n = 500 \) graders (52.23% boys) in Taiwan who participated in this study. Preadolescents’ inattention and hyperactivity/impulsivity were assessed using parent reports on the Swanson, Nolan, and Pelham IV Rating Scale. Aggressive behaviors, including physical aggression and relational aggression, and prosocial behaviors were assessed using teacher and peer reports. Peer acceptance and the number of reciprocated friendships were obtained through peer nomination administered 6 months later after initial assessment and were combined to assess children’s peer functioning. Results of structural equation modeling demonstrated that inattention was indirectly linked to impaired peer functioning through low levels of prosocial behavior, regardless of gender. In addition, inattention was directly related to less optimal peer functioning only for girls. Hyperactivity/impulsivity was neither directly nor indirectly related to impaired peer functioning in boys, although it was related to more physical and relational aggression. However, for girls, a positive and direct path existed between hyperactivity and peer functioning. Further, hyperactivity in girls was associated with more physical aggression, which in turn led to poorer peer functioning. These findings suggested that the processes related to each core domain of ADHD and peer functioning may be varied, depending on the mediating factors (e.g., aggression or prosocial behavior) and gender.

Inattention, hyperactivity, and impulsivity are the core symptoms of attention-deficit hyperactivity disorder (ADHD), one of the most prevalent neurodevelopmental disorders in childhood (American Psychiatric Association, 2000). It has been widely documented that children who display ADHD symptoms, whether they are clinically diagnosed or not, are at high risk of pervasive and persistent peer problems, including peer rejection, peer dislike, and few reciprocated friendships (e.g., Diamantopoulou, Henricsson, & Rydell, 2005; Hoza et al., 2005). Early social problems or peer difficulties, in turn, lead to a wide variety of maladaptive outcomes, including anxiety, depression, delinquency, and various adult mental health problems (for a review, see Parker, Rubin, Erath, Wojcieszawicz, & Buskirk, 2006). Although the link between symptoms of ADHD
and impaired peer functioning has been well established, relatively little is known as to the processes involved in this link (Hoza, 2007; Hoza et al., 2005) and the unique, predictive effect of each ADHD domain (i.e., inattention and hyperactivity/impulsivity) on children’s peer functioning.

Another limitation in the literature is that the vast majority of research in this area has primarily focused on Western samples. This is unfortunate given the literature that has indicated some cross-cultural differences in peer socialization between Chinese children and Western children (Chen & French, 2008). For example, in the relationship-oriented Chinese cultures, of which Taiwan is a representative, 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 Chinese children (Bond, 1996). By contrast, in Western societies, individual freedom of choice, self-expression, and independence/autonomy are often preferably valued (Miller, 1994). In light of this difference, it is plausible that in Chinese culture, relative to children without ADHD symptoms, children with ADHD symptoms, whose behavioral profile tend to violate the social expectations of others, may suffer greater dislike by peers. The present study was designed to address these gaps in the literature by investigating the associations between ADHD symptoms and peer functioning (i.e., peer acceptance and the number of friendships) and the mediating effects of aggressive and prosocial behaviors on these associations in a Taiwanese sample.

**ADHD Symptoms and Peer Functioning**

Past literature on ADHD symptoms and social adjustment has demonstrated that children with ADHD are often rejected by their peers (Hoza, 2007; Hoza et al., 2005; Mrug, Hoza, & Gerdes, 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 by peers and had fewer mutual friendships than children without the symptoms (Hoza et al., 2005; Mrug et al., 2009). Nevertheless, the majority of past studies in this area have not explicitly differentiated between inattention and hyperactivity when examining their effects on peer functioning (Hodgens, Cole, & Boldizar, 2000; Wheeler & Carlson, 1994). This is problematic given that inattention and hyperactivity/impulsivity seem to be associated with different kinds of social deficits (Wheeler & Carlson, 1994), which may result in differential effects of these ADHD symptoms on social adjustment with peers.

It has been generally 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 (e.g., Wheeler & Carlson, 1994). However, it appears that children with hyperactivity engage in as much social interaction as their peers (e.g., Pelham & Bender, 1982) and seem to be no less prosocial than normal controls in their responses to hypothetical social situations (Cunningham & Siegel, 1987; Pelham & Bender, 1982; Wheeler & Carlson, 1994). In other words, these children seem to possess appropriate social skills and have many opportunities to learn appropriate social behaviors as other peers do. As such, the social deficit of the hyperactive children may not be attributable to the mere lack of social knowledge or inability to initiate social interactions with peers. Rather, it is possible that children with hyperactivity/impulsivity may not fully demonstrate the ability to perform 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).

Children with inattention, on the other hand, tend to display fewer disruptive behaviors than children with hyperactivity, yet experience peer difficulties as their hyperactive counterparts do (e.g., Hinshaw & Melnick, 1995; Wheeler & Carlson, 1994). These children seem to be more timid, shy, and socially withdrawn and tend to participate in fewer social interactions than their peers (Wheeler & Carlson, 1994). Moreover, due to the attention problems, these children may have difficulties attending to social cues and conforming to implicit rules for social interactions, which results in insensitive and strange social behaviors that are as equally aversive to peers as disruptive behaviors are (Bierman, Smoot, & Aumiller, 1993). These findings suggest that the nature of social deficits associated with peer difficulties may be different for children with hyperactivity and children with inattention, and thus, children with specific ADHD symptoms may follow differential pathways to poor peer functioning.

**The Mediating Roles of Aggressive and Prosocial Behaviors**

Several factors, such as lack of social skills and the presence of other negative behaviors (e.g., aggression) may explain the mechanisms by which symptoms of ADHD are related to peer problems. Aggression, for example, has been documented to be associated with ADHD symptoms, especially hyperactivity/impulsivity (e.g., Erhardt & Hinshaw, 1994; Hinshaw & Melnick, 1995; Hodgens et al., 2000; Maedgen & Carlson, 2000). Parents and teachers rate children with ADHD combined type (ADHD-C) as more aggressive than children with ADHD inattentive type (ADHD-I; Hodgens et al.,
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 (Coe, Dodge, & Kupersmidt, 1990). In a summer camp setting, Erhardt and Hinshaw (1994) reported that boys with ADHD were overwhelmingly rejected by their peers within the first day of meeting and that an interactive style marked by aggression most strongly accounted for peer rebuff. In sum, these findings suggest that physically aggressive behavior may be an explanatory factor for the association between ADHD and poor peer relations.

Physically aggressive behavior has been observed among children displaying both hyperactive/impulsive and inattentive behaviors 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 characterized by lower levels of aggression and higher levels of passive and withdrawn behavior (Hinshaw & Melnick, 1995; Hodgens et al., 2000; Maedgen & Carlson, 2000). Similar to aggressive ADHD youngsters, nonaggressive children with ADHD, who are usually the inattentive type, are also at risk of being rejected by peers (Hinshaw & Melnick, 1995). 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. In light of this, it is conceivable that children with ADHD-C and children with ADHD-I may follow different pathways to the same negative social outcome (Hinshaw & Melnick, 1995).

Although past research has successfully demonstrated the associations 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 increased 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.

Subsequent research by Ohan and 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). Hence, it appears that girls with ADHD engage in more rash and direct forms of relational aggression (e.g., overt 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).

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. Research suggests that success in the peer domain depends not only on the absence of aggression but also 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) and lack of prosocial behavior is detrimental because it is predictive of peer rejection and low peer acceptance subsequently (Crick, 1996). Unfortunately, less attention has been paid to prosocial skills in the past research, especially research in non-Western settings. Nonetheless, the existing research indicates that ADHD symptoms are negatively correlated with prosocial behavior and social skills (Diamantopoulou et al., 2005; Murray-Close et al., 2010) and that impaired social skills in turn predict peer rejection (Murray-Close et al., 2010).

**THE ROLE OF GENDER**

It is not yet clear whether boys with ADHD symptoms suffer greater social impairment than girls with ADHD symptoms (Hoza, 2007). The literature on ADHD and associated social deficits has largely been dominated by male samples due to the higher prevalence rate of ADHD in boys (American Psychiatric Association, 2000), as well as behaviors more commonly observed among males (i.e., physical aggression). Relatively little is known about social functioning of girls with ADHD symptoms (Greene et al., 2001; Hinshaw, 2002; Mikami & Lorenzi, 2011). Some evidence suggests that girls with ADHD exhibit lower levels of symptom severity yet suffer a higher risk of social rejection than boys (Diamantopoulou et al., 2005; Gaub & Carlson, 1997). Peers are more willing to tolerate higher levels of hyperactivity in boys, perhaps because this behavior is consistent with gender expectations (Diamantopoulou et al., 2005). However, some other researchers reported greater peer problems in boys than in girls with ADHD symptoms (Thorell & Rydell, 2008). Still others found that ADHD symptoms affect social functioning equivalently for both boys and girls (Cunningham, Siegel, & Offord, 1985; Greene et al.,...
and hyperactivity (2005), suggesting that the direct paths of inattention and hyperactivity/impulsivity to peer functioning may exist for both boys and girls. Nonetheless, the processes by which symptoms of ADHD relate to peer functioning may differ across gender, and thus warrant further exploration.

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 hyperactive/impulsive type (ADHD-II; Gaub & Carlson, 1997). Therefore, girls may be more likely to follow a route to peer rejection characterized 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, given a relatively low base rate of hyperactivity/impulsivity and physical aggression in girls, peers may be less tolerant of girls who display these behaviors and who violate the gender norms. Thus, relative to boys, girls who exhibit hyperactivity/impulsivity and physical aggression may be perceived as more gender nonnormative and suffer greater peer impairment (i.e., lower peer acceptance and fewer same-sex friendships) accordingly. This view is partially supported by a recent work of Mikami and Lorenzi (2011) in which they found that among children with ADHD, conduct problems exerted a greater negative effect on peer relationships for girls than for boys. Another point worthy of mention is that although girls are generally better represented in the ADHD-I subtype than in other ADHD subtypes, they are outnumbered by boys at least 2:1 (Gaub & Carlson, 1997). Therefore, inattention for girls may still be considered as gender nonnormative, and thus place girls at a higher risk for peer problems, as compared to boys.

THE CONTEXT OF CHINESE CULTURE

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. It has been documented that peer socialization, including peer acceptance, peer rejection, and the formation of friendships may reflect cultural beliefs and values that are emphasized in the respective cultures (Chen & French, 2008). 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. For example, Chinese culture, in contrast to the relatively individualistic Western cultures, places higher emphasis on interdependence, sensitivity to others, and the avoidance of conflict (Bond, 1996). The primary goals in the socialization of Chinese children aims at helping children learn self-control, develop an interdependent sense of self, and foster cooperative and prosocial behavior (Bond, 1996). Accordingly, disruptive behaviors including hyperactivity/impulsivity and aggression that seem to violate these cultural norms may place children at an increased risk for peer rejection. Indeed, aggression in Chinese culture has been reported as a robust predictor of peer rejection (Chang, 2004; Xu, Farver, Schwartz, & Chang, 2003) and hyperactive/impulsive behaviors have been shown to be predictive of peer victimization in Chinese children (Xu et al., 2003). Such negative impact of disruptive behaviors on peer relationships may be greater for girls in Chinese culture because they often receive social pressure to behave more compliantly and submissively than boys (Xu et al., 2003), and peers may view girls’ disruptive behaviors more harshly because these behaviors are gender nonnormative (Crick, 1997; Mikami & Lorenzi, 2011).

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. By contrast, Chinese children who behave in a nonprosocial manner may be especially prone to peer problems for behaviors that favor self-interests over group interests are generally discouraged in Chinese cultures where interdependence and relationships are highly valued (Bond, 1996). These views are in line with a previous finding that lack of prosocial behavior was related to negative peer outcomes such as peer victimization in a Chinese culture (e.g., Schwartz, Chang, & Farver, 2001).

THE PRESENT STUDY

To summarize, the main goal of this study was to examine the predictive and unique effect of each domain of ADHD (i.e., inattention and hyperactivity/impulsivity) on children’s peer functioning, as well as the mediating roles of aggressive and prosocial behaviors in the link between ADHD symptoms and peer functioning. The present study was conducted in a sample of 739 fourth and fifth graders given that the significance of peer relationships and social support from peers increases during middle childhood (for a review, see Rubin, Bukowski, & Parker, 1998). A multi-informant and multifaceted approach was adopted in the present study where data were collected from multiple informants (i.e., parents, teachers, and peers) and more than one aspect of peer
functioning, including dyadic friendships and peer acceptance, was examined. Reports from teachers and peers were combined to create latent variables to increase the validity of constructs assessing children’s aggression and prosocial behavior. This multi-informant approach seems to be necessary given that lack of agreement among informants is most pronounced in the assessment of peer constructs and that reports by adults are limited in scope when children’s peer problems are assessed (Hoza, 2007).

Another goal of this study was to examine the association between ADHD and peer functioning with a Chinese sample and explore whether this association is different from what has been reported in the prior studies in Western cultures. Based on our literature review, we expected that inattention and hyperactivity/impulsivity would be associated with poor peer functioning and that physical and relational aggression, and prosocial behavior would mediate these associations. Given the mixed findings of the previous studies, we did not generate a priori hypotheses regarding gender differences in the processes involving ADHD, peer functioning, and aggressive and prosocial behavior. However, based on the gender nonnormative hypotheses, we expected that girls would be more likely than boys to show impaired peer functioning as a result of hyperactivity and physical aggression, whereas both boys and girls would follow a path to poor peer functioning characterized by inattention and low prosocial behavior.

**METHOD**

**Participants**

Participants were assessed at two time points (i.e., fall and spring semesters) during one academic year. The initial assessments involved 739 fourth (n = 239) and fifth (n = 500) graders (52.23% boys) from northern Taiwan. The mean age of the sample was 10.06 years (SD = 0.59). At Time 2, 471 (63.73%) remained in the study. Participants were recruited from four public elementary schools in Taipei area. In the fall semester of 2008, we 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.

The socioeconomic status of the sample ranged from lower class to upper class based on parents’ education level and the household income. The distributions of paternal and maternal education levels were 45.6% and 43.5% for college and above, 36.8% and 41.4% for senior high school and vocational, and 17.6% and 15.1% for junior high and below, respectively. Annual household income ranged from less than $10,258 to more than $41,032, with the average income at the level of $20,516 to $30,774. Overall, the current sample consisted of students from diverse socioeconomic backgrounds and was slightly different from the overall population in Taiwan; however, it was viewed as a representative sample of northern Taiwan.

The procedure and method of this study were approved by the Institute Review Board at the authors’ university. Of those who were invited, 88.61% agreed to participate in the study. For all enrolled participants, written informed consent was 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.

**Procedure**

The data of the present study were collected at two time points, 6 months apart (i.e., the fall and spring semesters), during one academic year. There were three primary sources of the data: parent reports, peer nomination, and teacher reports. At Time 1, parents completed a questionnaire about their participating children’s ADHD symptoms (i.e., inattention and hyperactivity/impulsivity) and peers and teachers reported on participating children’s prosocial and aggressive behaviors (i.e., physical and relational aggression). At Time 2, peers were asked to report on children’s peer functioning (i.e., peer acceptance and the number of friendships). Students who participated at both time points (n = 471) were compared with those who were lost because of attrition (n = 268) on the demographic and study variables at Time 1. Results indicated that the participants who continued with Time 2 assessment did not differ from those who dropped out with regard to gender, household income, parental education, and most of the study variables at Time 1 (χ² = 0.0004–10.53, p > .06; F = 0.11–0.63, p > .43). However, children who remained in the study were younger (M = 9.91 years) than those who dropped out (M = 10.23 years), F(1, 674) = 54.95, p < .001. As a result, age was treated as a covariate in the models to control for its effect. Also, children who continued in the study showed more teacher-reported relational aggression and prosocial behavior (M = 1.67 and 2.15) than those who dropped from the study (M = 1.48 and 1.94), F(1, 659) = 14.12, p < .001, and F(1, 659) = 9.57, p = .002, respectively.

Parents and teachers completed their versions of the questionnaire at homes and at schools, respectively. Peer

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1In 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 nationwide average of household income was $36,782.
nominated was administered in group sessions in the classrooms. 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 each participating student in their classrooms. Parents were not provided with any incentives or compensation for their participation.

For those measures without existing Chinese versions, such as teacher reports of relational and physical aggression and prosocial behavior, the measures were translated into Chinese by the first author who is a native speaker of Chinese. It was then back-translated into English by a native speaker of both English and Chinese to ascertain the validity of the measures.

Measures

**ADHD Symptoms**

Children's inattention and hyperactivity/impulsivity were assessed at Time 1 using parent report of the Chinese version of the Swanson, Nolan, and Pelham, version IV scale (SNAP–IV–C). 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 (nine items), Hyperactivity/Impulsivity (nine items), and Oppositional subscales (eight items) that mapped 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 report of the SNAP–IV–C have been established in Taiwan (Gau et al., 2008). For the current sample, Cronbach's alphas for both Inattention and Hyperactivity/Impulsivity were .89. Mean scores (the average of the scores on all the items) on each of the subscales were used in the analysis.

**Relational and Physical Aggression and Prosocial Behavior**

**Teacher reports.** Teacher reports of participants’ relational and physical aggression and prosocial behavior were assessed at Time 1 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 five items from the original Crick measure (e.g., “Gets other children to stop playing or liking some peers”) and five new items added for the purpose of the present study to capture the more 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 four items (e.g., “Hits or kicks other peers”) and Prosocial Behavior consisted of five items (e.g., “Other kids seek out this child for advice or help”). All three subscales exhibited acceptable reliability in the present sample. Cronbach’s alphas for Relational Aggression, Physical Aggression, and Prosocial Behavior were .92, .91, and .84, respectively. 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 (five items), Physical Aggression (three items), and Prosocial Behavior (three items; CSBS–P; Crick & Grotpter, 1995). During the administration of the peer-nomination 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 “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). 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 in the study. Also, the participating children could only nominate children from their classrooms. 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. Cronbach’s alphas for Relational Aggression, Physical Aggression, and Prosocial Behavior were .94, .94, and .91, respectively.

**Peer Functioning**

**Peer acceptance.** Participants were asked to nominate up to five peers that they “like to hang out with the most.” The number of nominations that children received from classmates was standardized within each classroom and was defined as peer acceptance.

**Number of reciprocated friendships.** Peer nomination technique was also used to identify mutual friendships (Grotpter & 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.
RESULTS

Confirmatory Factor Analysis

Confirmatory factor analyses were conducted by using LISREL 8.72 to evaluate the validity of the CSBS–T and peer nomination instrument (CSBS–P) used to assess relational aggression, physical aggression, and prosocial behavior in Taiwan. Model fit was assessed with chi-square, comparative fit index (CFI), and root mean square error of approximation (RMSEA). In general, nonsignificant chi-squares, CFIs greater than .90, and RMSEAs less than .08 (RMSEA < .10 indicates adequate fit; Kline, 1998) suggest a good model fit with the observed data (Hu & Bentler, 1999). Because the chi-square statistics is considerably affected by sample size, it was not used as the primary indicator of the model fit (Hu & Bentler, 1999; Kline, 1998). Results for the CSBS–T indicated that the model fit the data adequately, $\chi^2(1, 149) = 1035.67, p < .05$, RMSEA = .04, and CFI = .97. Results for the CSBS–P showed a good model fit, $\chi^2(1, 41) = 51.66, p = .12$, RMSEA = .04, .04, and CFI = .99. All the items in both measures were included because the standardized factor loadings were larger than .40. In sum, these findings corroborated the validity of the measures, suggesting that in both measures, relational aggression, physical aggression, and prosocial behavior were conceptually distinct from one another in this Taiwanese sample.

Preliminary Analyses

Means, standard deviations, and bivariate correlations of the study variables by gender are presented in Table 1. Boys showed higher levels of inattention, hyperactivity/impulsivity, and teacher- and peer-reported physical aggression than girls. Girls showed more prosocial behavior than boys. There were no gender differences in relational aggression, peer acceptance, and the number of dyadic friendships (see Table 1). As suggested in the past literature, inattention and hyperactivity/impulsivity was highly correlated ($r = .55$ for boys and $r = .61$ for girls).

In general, inattention at Time 1 was positively related to boys’ physical aggression and girls’ relational aggression at Time 1 and was negatively related to Time 1 prosocial behavior and Time 2 peer acceptance and Time 2 friendships. Hyperactivity/impulsivity at Time 1 was positively related to physical and relational aggression at Time 1 and was negatively related to Time 1 prosocial behavior and boys’ peer acceptance at Time 2. Moreover, there were moderate correlations between teacher and peer reports on physical aggression, relational aggression, and prosocial behavior for both boys and girls ($rs = .32-.50$). This suggested that each of the constructs provided overlapping along with unique information on children’s behaviors assessed by teachers and peers. Thus, the combination of teacher reports and peer reports of these constructs was considered to represent a broader constellation of aggressive and prosocial

### TABLE 1

Correlations, Means, and Standard Deviations of Study Variables for Boys (Above Diagonal) and Girls (Below Diagonal)

<table>
<thead>
<tr>
<th>Inatt</th>
<th>Hyp</th>
<th>TPA</th>
<th>PPA</th>
<th>TRA</th>
<th>PRA</th>
<th>Tprosoc</th>
<th>Pprosoc</th>
<th>Accept2</th>
<th>Friends2</th>
<th>Boys M (SD)</th>
<th>Girls M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inatt</td>
<td>—</td>
<td>-.55***</td>
<td>.15*</td>
<td>.14*</td>
<td>.06</td>
<td>.05</td>
<td>-.23***</td>
<td>-.27***</td>
<td>-.28***</td>
<td>-.16*</td>
<td>0.96 (0.54)</td>
</tr>
<tr>
<td>Hyp</td>
<td>-.61***</td>
<td>—</td>
<td>-.26***</td>
<td>-.28***</td>
<td>.19***</td>
<td>-.23***</td>
<td>-.11</td>
<td>-.20***</td>
<td>-.18***</td>
<td>.15</td>
<td>0.65 (0.53)</td>
</tr>
<tr>
<td>TPA</td>
<td>-.13*</td>
<td>-.29***</td>
<td>—</td>
<td>.48***</td>
<td>.70***</td>
<td>.43***</td>
<td>-.04</td>
<td>-.25***</td>
<td>-.32***</td>
<td>-.26***</td>
<td>1.58 (0.79)</td>
</tr>
<tr>
<td>PPA</td>
<td>.01</td>
<td>.22***</td>
<td>.32***</td>
<td>—</td>
<td>.38***</td>
<td>.80***</td>
<td>.02</td>
<td>-.23***</td>
<td>-.30***</td>
<td>-.28***</td>
<td>0.27 (1.03)</td>
</tr>
<tr>
<td>TRA</td>
<td>.14*</td>
<td>.20***</td>
<td>.37***</td>
<td>.24***</td>
<td>—</td>
<td>.44***</td>
<td>.07</td>
<td>-.24***</td>
<td>-.25***</td>
<td>-.22***</td>
<td>1.61 (0.66)</td>
</tr>
<tr>
<td>PRA</td>
<td>.13*</td>
<td>-.22***</td>
<td>-.20***</td>
<td>.69***</td>
<td>.37***</td>
<td>—</td>
<td>.09</td>
<td>-.24***</td>
<td>-.27***</td>
<td>-.24***</td>
<td>0.06 (0.94)</td>
</tr>
<tr>
<td>Tprosoc</td>
<td>-.29***</td>
<td>-.18***</td>
<td>-.05</td>
<td>-.01</td>
<td>.04</td>
<td>-.07</td>
<td>—</td>
<td>.40***</td>
<td>.40***</td>
<td>.37***</td>
<td>1.98 (0.83)</td>
</tr>
<tr>
<td>Pprosoc</td>
<td>-.33***</td>
<td>-.17***</td>
<td>-.09</td>
<td>-.01</td>
<td>-.10</td>
<td>-.13*</td>
<td>.50***</td>
<td>—</td>
<td>.66***</td>
<td>.47***</td>
<td>-.18 (0.74)</td>
</tr>
<tr>
<td>Accept2</td>
<td>-.32***</td>
<td>-.07</td>
<td>-.10</td>
<td>-.17*</td>
<td>-.04</td>
<td>-.29***</td>
<td>.31***</td>
<td>.75***</td>
<td>—</td>
<td>.74***</td>
<td>0.03 (1.05)</td>
</tr>
<tr>
<td>Friends2</td>
<td>-.22***</td>
<td>-.02</td>
<td>.002</td>
<td>-.10</td>
<td>.02</td>
<td>-.17*</td>
<td>.19*</td>
<td>.50***</td>
<td>.65***</td>
<td>—</td>
<td>1.87 (1.52)</td>
</tr>
</tbody>
</table>

Note: Correlations for boys are presented above the diagonal and correlations for girls are presented below the diagonal. Inatt = Inattention; Hyp = Hyperactivity; TPA = teacher report physical aggression; PPA = peer report physical aggression; TRA = teacher report relational aggression; PRA = peer report relational aggression; Tprosoc = teacher report prosocial behavior; Pprosoc = peer report prosocial behavior; Accept2 = Peer Acceptance at Time 2; Friends2 = Number of Friendships at Time 2.

Testing of gender differences in the study variables:

* $F(1, 614) = 17.10, p < .001$.
* $F(1, 614) = 27.17, p < .001$.
* $F(1, 659) = 62.70, p < .001$.
* $F(1, 587) = 47.99, p < .001$.
* $F(1, 587) = 4.50, p < .05$.
* $F(1, 587) = 45.04, p < .001$.
* $p < .05$. ** $p < .01$. *** $p < .001$. 
behaviors. Therefore, our decision to combine teacher and peer reports in creating latent constructs was supported. Further, predictors at Time 1 (i.e., ADHD symptoms, relational and physical aggression, and prosocial behavior) were significantly correlated with peer acceptance and the number of friendships at Time 2 for boys but not for girls.

**Model of ADHD Symptoms Predicting Peer Functioning**

Structural equation modeling (SEM) analyses by Amos 18.0 were conducted to examine the independent prediction of each domain of ADHD (i.e., inattention and hyperactivity) on the intervening variables (i.e., Time 1 physical aggression, relational aggression, and prosocial behavior) and outcome variables (i.e., Time 2 peer functioning), controlling for all other variables in the hypothesized model. One of the primary advantages of SEM, a latent variable technique, is that constructs represented by using SEM analysis could be free from measurement errors, thereby reducing the possibility of underestimation of the effect sizes due to unreliability of the measures (Card & Little, 2007). Thus, multiple measures could be combined to create latent constructs to minimize the biases associated with one single source or scale. In the present study, teacher and peer reports were combined to generate latent constructs for physical and relational aggression and prosocial behavior. Peer acceptance and the number of friendships from peer reports were combined to create a latent construct for peer functioning. 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).

In our hypothesized model, there were paths from inattention to physical aggression, relational aggression, and prosocial behavior and then from each of the three behaviors to peer functioning. There was also a direct path from inattention to peer functioning. Likewise, there were paths from hyperactivity/impulsivity to physical aggression, relational aggression, and prosocial behavior and then from each of the three behaviors to peer functioning, and also a direct path from hyperactivity/impulsivity to peer functioning. In the model, inattention and hyperactivity/impulsivity were allowed to be correlated and so were physical and relational aggression. Errors of indicators for physical aggression and relational aggression from the same reporter were also set to be correlated. Age was added as an exogenous variable to control for its effect on each of the latent constructs in the structural model.

First, a model for an overall sample was tested. The result demonstrated a good model fit, \( \chi^2 (26) = 82.77, p < .001, \text{CFI} = .97, \text{RMSEA} = .05, 90\% \text{CI [.04, .07]} \). To explore the possibility that gender serves as a moderator (i.e., that the paths in the model differ between boys and girls), this model was run as a two-group model with gender as the grouping variable. A fully unconstrained model was run first where all the parameters were allowed to vary by gender. The model fit was good, \( \chi^2 (52) = 133.99, p < .001, \text{CFI} = .96, \text{RMSEA} = .05, 90\% \text{CI [.04, .06]} \). We 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 results showed that the fully constrained model fitted the data poorly, \( \chi^2 (103) = 612.72, p < .001, \text{CFI} = .75, \text{RMSEA} = .08, 90\% \text{CI [.08, .09]} \). The reduction in fit was significant, \( \Delta \chi^2 (53) = 478.73, p < .001 \), suggesting that the strength of the paths may be different between boys and girls. To determine the sources of the gender moderation, we first fitted a model with measurement weights constrained to equal across genders. The fit of this model was good, \( \chi^2 (56) = 141.62, p < .001, \text{CFI} = .96, \text{RMSEA} = .05, 90\% \text{CI [.04, .06]} \), indicating that there was measurement equivalence between boys and girls. Compared to the unconstrained model, this model did not worsen the model fit, \( \Delta \chi^2 (4) = 7.64, p = .106 \). We then fitted a model in which structural weights, in addition to the measurement weights, were constrained to equal across genders. The results indicated a poor model fit, \( \chi^2 (81) = 387.38, p < .001, \text{CFI} = .85, \text{RMSEA} = .07, 90\% \text{CI [.06, .08]} \). This model, compared to the unconstrained model, significantly worsened the model fit, \( \Delta \chi^2 (31) = 253.39, p < .001 \). Therefore, separate SEM analyses that fitted the single theoretical model with data for boys and girls were conducted.

Results from SEM indicated a good model fit for data with boys and girls (see Figure 1). As the results showed in Figure 1, there were distinct paths as to how each ADHD domain (i.e., inattention and hyperactivity/impulsivity) relates to peer functioning; and these paths differed across gender. For both boys and girls, inattention was related to lower levels of prosocial behavior, which in turn predicted impaired peer functioning 6 months later. A direct link from inattention to peer functioning 6 months later was only noted for girls. Hyperactivity/impulsivity, on the other hand, was neither directly nor indirectly related to impaired peer functioning in boys, although it was associated with more physical and relational aggression. For girls, hyperactivity/impulsivity was related to more physical aggression, which in turn predicted impaired peer functioning in 6 months. Of interest,
hyperactivity/impulsivity in girls directly predicted better peer functioning 6 months later.2

DISCUSSION

The associations between ADHD symptoms and children’s peer functioning have been well documented in predominantly Western cultures; yet little is known as to the underlying mechanisms and the unique effect of each core domain of ADHD on peer functioning, particularly in non-Western cultures such as Taiwan. Overall, as expected, the findings of the present study provide evidence for the link between inattention and subsequent impaired peer functioning and the mediating effect of prosocial behavior on this link. Further, for girls, hyperactivity/impulsivity had direct and indirect effects (i.e., via physical aggression) on their peer functioning 6 months later. However, unexpectedly, hyperactivity/impulsivity in boys was neither directly nor indirectly related to impaired peer functioning, although it was related to more physical and relational aggression. These findings suggest that there were independent, distinct pathways through which each ADHD domain (i.e., inattention and hyperactivity/impulsivity) relates to peer functioning and that these paths were contingent upon the gender of the child, at least in Taiwan.

Our findings demonstrated that children with inattention exhibited a lower level of prosocial behavior concurrently and that they were less liked by their peers and had fewer dyadic friendships 6 months later. These findings mirror prior findings indicating that relative to peers, children with inattention were less accepted by their peers (Bellanti, Bierman, & the Conduct Problems Prevention Research Group, 2000; Hoza et al., 2005) and were less likely to maintain friendships (Blachman & Hinshaw, 2002). These findings mirror prior findings indicating that relative to peers, children with inattention were less accepted by their peers (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 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 (Hinshaw, 2002; Wheeler & Carlson, 1994). Given that peer interaction is crucial for children

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2We conducted additional two sets of SEM analyses using peer acceptance and the number of friendships separately as the outcomes. The results indicated that the patterns of the significant paths were similar to the results reported using the latent construct with one exception; that is, for girls, the paths between inattention and the number of friendships and between physical aggression and the number of friendships were nonsignificant.
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, including role taking, empathy, and prosocial behavior through observational learning (Cunningham et al., 1985). These social deficits and limited peer interaction that are associated with inattention may explain the association between inattention and impaired peer functioning (i.e., less peer acceptance and fewer friendships).

In addition, the present study showed that inattention was directly associated with less optimal peer functioning only for girls, even after the mediating effect of prosocial behavior was considered. That is, prosocial behavior attenuated but did not override the effect of inattention on peer functioning. One possible explanation is that prosocial behavior may largely account for the influence of inattention on poor peer functioning for boys; however, other factors may contribute to its effect for girls. For instance, the literature has demonstrated that relative to boys, girls show higher levels of internalizing problems (for a review, see Crick & Zahn-Waxler, 2003), which in turn are related to interpersonal problems such as peer rejection and peer dislike in children with ADHD (Diamantopoulou et al., 2005). Future research is warranted to examine the mechanisms involving ADHD symptoms, peer functioning, and other potential mediating factors that seem to be more salient for girls such as internalizing problems.

In general, hyperactivity/impulsivity was strongly associated with elevated aggressive behaviors regardless of gender; however, it was not significantly related to relational aggression in girls. 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. However, this finding appears to contradict previous studies reporting that girls with ADHD showed a higher level of relational aggression than normal controls (Ohan & Johnston, 2007; Zalecki & Hinshaw, 2004). It may be that girls with hyperactivity/impulsivity in Taiwan are engaged in more overt and direct forms of aggression (i.e., physical aggression) than more covert, subtle, and planned forms of aggression (i.e., relational aggression). This is in line with a previous study suggesting that when using relational aggression, girls with ADHD tend to use more rash and direct forms of relational aggression, as opposed to more covert and planned forms (Ohan & Johnston, 2007).

We find it interesting that neither form of aggression was associated with peer functioning in boys. This is contradictory to the past studies demonstrating that aggression seems to be one of the most consistent predictors of peer dislike and rejection in Western (Coie et al., 1990) and Chinese culture (Xu et al., 2003). One possible explanation is that aggression displayed by boys is more acceptable among peers because of the gender norm for aggressive behavior stating that boys are generally more aggressive than girls (Chang, 2004). In addition, given that group norms are developmentally crucial for children in the Chinese culture (Chang, 2004), it is possible that group-level or norm-referenced physical aggression may be more predictive of negative peer experiences in such culture than individual-level physical aggression.

Moreover, there was no direct link between more hyperactivity/impulsivity and less optimal peer functioning in boys. This finding is inconsistent with the findings of previous studies in clinical samples indicating that hyperactive boys are not well accepted by peers (e.g., Pelham & Bender, 1982). Such discrepancy may be due to the difference in the sources of samples (i.e., a community sample in the present study and clinical samples in the previous studies). In fact, in one of the community-based study (Diamantopoulou et al., 2005), a null finding was reported between ADHD symptoms and peer liking for girls while a positive association was found for boys. By contrast, the failure to find an association between hyperactivity and low levels of prosocial behavior coincides with the literature suggesting that the majority of hyperactive children were no less prosocial than their peers without hyperactivity (for a review, see Wheeler & Carlson, 1994). In sum, it is conceivable that relative to peers, hyperactive boys in Taiwan may not be less prosocial nor less accepted by peers and may not have fewer friendships despite their higher levels of aggression. Perhaps socio-cognitive factors, not behavioral factors, such as hostile attribution bias that are salient for boys (Lansford et al., 2006) may elucidate the pathways to poor peer functioning among hyperactive boys in Taiwan.

In contrast, for girls, there was an indirect path of hyperactivity to poor peer functioning via physical aggression. That is, hyperactive girls in Taiwan showed more physical aggression, which resulted in fewer dyadic friendships and less peer acceptance 6 months later. This is supported by the literature indicating that girls with ADHD were less prosocial, more overtly aggressive, and more rejected by peers (Hinshaw, 2002; Ohan & Johnston, 2007) and a recent study documenting that girls with ADHD comorbid with conduct problems exhibited greater social impairment than boys with similar problems (Mikami & Lorenzi, 2011). These findings, along with the finding of the present study, provide evidence to support the gender nonnormative hypothesis stating that given a relatively low base rate of physical aggression for girls, girls who exhibit a high level of
physical aggression are more censured by peers (Crick, 1997). Due to the closer, more intimate, smaller-sized peer group for girls, as compared to boys’ peer group (Maccoby, 1998), girls who display non-normative, negative behavior (i.e., physical aggression), may be particularly at risk and thus be more rejected by same-sex peers and isolated from the peer group (Crick, 1997). This view may be particularly true in Chinese culture in which girls are expected to behave in a compliant and passive manner, and often receive social pressure to behave more submissively than boys (Xu et al., 2003).

We also find it interesting that more hyperactivity/impulsivity was directly linked to better peer functioning for girls. When physical aggression was considered, girls with hyperactivity seemed to be better accepted by peers and have more mutual friendships than those without hyperactivity. Physical aggression in girls herein serves as a suppressor (i.e., a variable that has no strong relations to the criterion variable but is related to the predictor and may change the prediction of the peer outcomes variable). Given the unique effect of physical aggression for girls with hyperactivity, we speculate that there might be subgroups for hyperactive-aggressive girls in Taiwan. Hyperactive-aggressive girls may be less liked by peers, but hyperactive-nonaggressive girls may be somewhat more liked by peers. It is possible that in Chinese culture, hyperactive-nonaggressive girls may be relatively active, outgoing, and socially initiative, and thus may be viewed by peers as “fun” to hang out with, if their hyperactivity is not excessive. This view 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). In turn, social initiative is related to high social status of peer group (i.e., peer acceptance and popularity; Rydell, Hagekull, & Bohlin, 1997). Nonetheless, it should be noted that these views are speculative; thus, this unexpected finding requires replication.

As other studies, several limitations need to be addressed. First, the findings of this study are pertinent to Taiwanese children and may not be generalized to other Chinese societies such as Hong Kong or China. Second, ADHD symptoms were obtained through parent reports only. Teacher reports may highly enhance the validity of ADHD symptoms given that the diagnostic criteria of ADHD require symptoms and impairment to be apparent in more than two settingscontexts (American Psychiatric Association, 2000). Third, the outcome in this study was obtained through peer reports. Information from other informants (e.g., teachers) would increase the validity of the construct. Fourth, ADHD symptoms and the mediators (i.e., aggressive and prosocial behaviors) were measured concurrently. Whereas ADHD symptoms were conceptualized as the antecedents of aggression and prosocial behavior, the directionality of the association between ADHD symptoms and these behaviors remains unclear. Fifth, because of the relatively high attrition rate (63.73% of the sample remained at Time 2), results and conclusions of this study should be interpreted with cautions. Sixth, 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 current study with a clinically diverse sample is needed. Finally, the present study only included positive nominations. Future research should include both positive and negative liking nominations to examine if the patterns of associations between ADHD symptoms and liking or disliking nominations are the same, considering some studies have suggested that the social impairment in children with ADHD may be more pronounced for negative nominations than for positive nominations (Hinshaw, 2002).

Implications for Research, Policy, and Practice

In all, the present study demonstrated (a) the unique, independent effects of inattentiveness and hyperactivity/impulsivity on children’s peer functioning, (b) distinct pathways from ADHD symptoms to peer functioning, and (c) gender differences in these processes. Differences between these findings and the findings in the prior Western studies highlight the importance of considering cultural context in the studies of psychopathology. Further, as stated earlier, other potential explanatory factors that may be related to ADHD and peer functioning are worth further investigation (e.g., internalizing problems or positive illusory bias). For example, positive illusory bias has been proposed to explain elevated aggression and poor social skills in children with ADHD (Murray-Close et al., 2010), which are related to peer rejection in this group.

Findings of the present study may shed light on interventions that target on improving peer relationships among children with symptoms of ADHD. For example, this study demonstrated that prosocial behavior played a crucial role in explaining peer difficulties in children with inattention. As such, intervention programs aiming at promoting prosocial behavior or coaching of social skills may be effective in improving peer functioning in children with ADHD, especially those with inattention. Moreover, based on the findings of the present study, girls with hyperactivity/impulsivity who are physically aggressive may be at risk for peer dislike and for having fewer friends than their nonaggressive peers. Therefore, interventions that focus on peer competence are particularly urgent for hyperactive and physically aggressive girls.
REFERENCES


