AN ANALYSIS OF THE LINK BETWEEN INATTENTION/IMPULSIVITY AND PEER

DISLIKING THROUGH THE QUADRATIC ASSIGNMENT PROCEDURE

By

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(Under the Direction of A. Michele Lease)

ABSTRACT

The current study aimed to build on past research investigating the link between behaviors associated with Attention-Deficit/Hyperactivity Disorder (ADHD) and poor peer relations. This study utilized the Quadratic Assignment Procedure (QAP) to address limitations of prior work, which has mainly utilized either third-party ratings or aggregated peer data, by examining concordance in peer nominations between inattentive or hyperactive/impulsive behaviors and peer disliking. Participants were 387 fourth and fifth graders from rural classrooms in the southeastern United States. Students were instructed to respond to questionnaires where they chose three classmates they felt best fit each behavioral descriptor and the "like least" item. Results indicated a stronger association between behaviors of interest and dislike within QAP correlations compared to Pearson correlations (i.e., using aggregated data). Regression analyses revealed links between these behaviors and dislike with no one behavior as a consistent predictor across classrooms, indicating the importance of context and classroom norms.

INDEX WORDS: Peer Dislike; Quadratic Assignment Procedure; Attention-

Deficit/Hyperactivity Disorder

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CHAPTER 1

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a highly prevalent disorder among youth. According to the National Survey of Children's Health, from 2003 to 2011, parent-reports of ADHD in children ages 4 to 17 increased by about 2%, indicating that the disorder effects more than 1 in 10 children (11%) in the United States (Visser, Danielson, Bitsko, Holbrook, Kogan, Ghandour, Blumberg, 2014). It is a disorder characterized by persistent inattention and/or hyperactivity-impulsivity, which results in impairment across multiple domains. One such area of impairment is consistently observed in teacher and parent reports of poor peer relations in those diagnosed with ADHD (Hinshaw, Zupan, Simrnel, Nigg, & Melnick, 1997; Hoza, 2007; Mrug, Molina, Hoza, Gerdes, Hinshaw, Hechtman & Arnold, 2012; Pelham & Milich, 1984).

It is well established that those with ADHD have poor peer relations (Hinshaw et al., 1997; Mrug et al., 2012; Stenseng, Belsky, Skalicka, & Wichstrøm, 2015; Tseng, Kawabata, Gau, & Crick, 2014; Zoromski, Owens, Evans, & Brady, 2015). Poor peer status is often indexed in one of two ways – peer rejection or peer neglect – and both are associated with ADHD (Coie & Dodge, 1983). However, individuals with ADHD are more often rejected, or disliked, rather than neglected, or ignored/overlooked, in the peer group, given the overt and often irritating, or aggressive, nature of many behaviors associated with hyperactivity/impulsivity that are part of the presentation of ADHD (Hinshaw et al., 1997; Stenseng et al., 2015). Peer rejection occurs when children in the peer group actively dislike the individual (Coie & Dodge, 1983) and is the most stable social status a child can attain within the peer group (Coie, Terry, Lenox, &

Lochman, 1995; DeRosier, Kupersmidt, & Patterson, 1994). On the other hand, peer neglect tends to be highly unstable year to year and oftentimes is a status ascribed to those who are socially withdrawn, a tendency which is associated with the inattentive behaviors linked with ADHD (Hodgens, Cole, & Boldizar, 2000). However, both hyperactive/impulsive and inattentive behaviors have been shown to predict peer rejection (Bagwell et al., 2001; Hoza, 2007; Stenseng, 2016). This relationship between inattentive/impulsive behaviors and poor peer relations has been shown cross-sectionally as well as over time. (Atkins, Pelham, & Licht, 1989; Hodgens, Cole, & Boldizar, 2000; Mrug et al., 2012; Pope, Bierman, & Mumma, 1989; Tseng et al., 2014).

Peer rejection is just one area of impairment associated with the inattentive and impulsive behaviors of ADHD. Peer rejection is a construct which is related to numerous other negative outcomes for the rejected individual, including increased externalizing behavior problems (e.g., aggression), internalizing problems (i.e., depression and anxiety), drug use, and poor academic achievement (Deater-Deckard, 2001). Those with ADHD are already vulnerable to these same areas of impairment, as well as many others. Therefore, the tendency towards peer rejection in those diagnosed with ADHD leads to a duel-disadvantage in terms of outcomes – impairment related to rejection combined with impairment related to the disorder.

The relationship between the problem behaviors associated with ADHD and poor peer relations is well supported through data collected from third party raters, including teachers and parents (Hinshaw et al., 1997; Mrug et al., 2012; Hoza, 2007; Pelham & Milich, 1984); however, this relationship might be more accurately assessed by asking their peers directly, through peer nomination or other data collection procedures. Peer nomination data is desirable, compared to other third-party data, because peers observe a wider range of behavior on which to form opinions about their peers. Further, peer judgements include the viewpoint of many children,

whereas teacher and parent ratings index a single viewpoint (Herrington & Parke, 1999; Lease, Kennedy, & Axelrod, 2002). Finally, peers offer a useful perspective on the behavior of their fellow peers, as many social interactions take place at times and places not accessible to parents or teachers. In assessing "peer" rejection, data gathered from children about what behaviors they find aversive and which peers they dislike is valuable information. However, one limitation of research designs that make use of peer nomination data is that the data are aggregated across peer nominators. That is, within the peer nominations procedure, children are asked to nominate peers for behavioral descriptors, such as who they like or who is aggressive, and the nominations that each child receives from peers for a particular item are summed. The identity of the nominator is not typically retained during analyses. Thus, it is unclear whether an individual who nominates a peer for one specific behavior (e.g., inattentive) also nominates that same peer for another (e.g., someone they dislike). It is possible for a child to receive a large number of nominations for a behavior, such as "impulsive", and a large number of nominations for another item, such as, "who do you like least?", without a given peer nominating the same child as both someone who is impulsive and someone whom they dislike.

Fortunately, methods exist, such as the Quadratic Assignment Procedure (QAP) available as part of Social Network Analysis (SNA) statistical packages (e.g., UCINET) (Borgatti et al., 2002), that retain the identity of the nominator and nominee so as to examine such nomination patterns. Furthermore, SNA procedures, such as the QAP, account for the fact that interdependencies exist between the nominators and nominees within a specified unit, such as the classroom. Typical statistical procedures assume independence of observations.

In the current study, peer nominations of three problem behaviors associated with ADHD (i.e., impulsivity, disorganization, and inattentiveness) and peer problems (i.e., "like least") were

collected. Clearly, these problem behaviors are not exclusive to ADHD and are associated with a number of other disorders and difficulties; however, these problem behaviors have been shown to play a significant role in peer difficulties for those diagnosed with ADHD in particular (Hinshaw et al., 1997; Hoza, 2007; Mrug et al., 2012; Pelham & Milich, 1984). The goal was to examine if the children who nominate a peer as someone they dislike also nominate that same peer as impulsive, disorganized, or inattentive. Using the QAP method for data analysis, the direct link between the nominator and nominee is taken into account. This study will contribute valuable information towards the understanding of how children with behaviors, possibly indicative of ADHD, are perceived by their peers, particularly if perceptions of impulsive, disorganized, and inattentive behaviors are explicitly tied with peer disliking.

CHAPTER 2

LITERATURE REVIEW

ADHD is a neurodevelopmental disorder distinguished by symptoms of inattention

and/or hyperactivity/impulsivity (APA, 2013). Both sets of symptoms are impairing to the

individual in a variety of ways; however, poor peer relations are one area of impairment

associated with both symptom sets. In the school setting or in a novel setting, such as a summer

camp, those diagnosed with ADHD are rejected by their peers at a much higher rate than their

peers who are not diagnosed with the disorder (Hinshaw et al., 1997 Hodgens, Cole, & Boldizar,

2000; Visser et al., 2014). Longitudinal data consistently reveal that high levels of inattentive

and/or impulsive behaviors at a young age predict peer rejection years later (Bagwell et al., 2001;

Hoza, 2007; Stenseng, Belsky, Skalicka, & Wichstrøm, 2014). Generally, this relationship has

been found to be reciprocal in nature, with peer rejection at a young age being associated with

higher levels of inattentive and/or impulsive behaviors years later (Stenseng et al., 2015; Tseng

et al., 2014). Granted, the presence of inattentive or impulsive behaviors does not mean ADHD

or any other disorder is present; however, these problem behaviors have been shown to play a

significant role in peer difficulties for those diagnosed with ADHD (Hinshaw et al., 1997; Hoza,

2007; Mrug et al., 2012; Pelham & Milich, 1984) and for those without any diagnosis who

exhibit these behaviors (Evans, Brady, Harrison, Bunford, Kern, State, & Andrews, 2013;

Gomez & Gomez, 2015; Hodgens et al., 2000; Stenseng et al., 2015; Tseng et al., 2014;

Zoromski et al., 2015). One prominent study which touched on this relationship was the

Multimodal Treatment Study of Children with ADHD (MTA) (MTA Cooperative Group, 1999).

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Approximately 600 children ages 7 to 9 diagnosed with the ADHD combined presentation (ADHD-C; i.e., exhibiting symptoms of both inattention and hyperactivity/impulsivity) participated in the 14-month study, which investigated the effectiveness of various forms of treatment for the disorder. One area of focus within the study was peer difficulties, as indicated by peer rejection and engagement in reciprocated friendships. These data revealed that, at the pre-treatment stage, 52% of the children diagnosed with ADHD-C were rejected by their peers, whereas only 14% of randomly selected classmates were peer rejected. Results also showed that 56% of those diagnosed with ADHD-C did not have a reciprocated friendship, a significantly higher percentage than the 32% rate found in undiagnosed classmates.

A study by Mrug et al., in 2012 followed up on about half ($N = 300$) of the individuals with ADHD who participated in the MTA study over the course of 8 years, confirming their continued struggles with peer difficulties and revealing negative outcomes associated with these difficulties and their diagnosis. It was found that those with ADHD-C who were rejected by peers around the age of 10-years old exhibited more delinquent behavior, anxiety, and general impairment during early adolescence, compared to other children with ADHD-C who were not peer rejected. Thus, even among those with ADHD-C, those rejected by peers had a more negative trajectory than did children with ADHD-C who were not rejected by peers. These findings are in agreement with those of others within the literature, as numerous studies have documented the link between ADHD plus peer rejection and poorer outcomes compared to those who are not peer rejected (Barkley, 2014; Hecht, Inderbitzen, & Bukowski, 1998; Hoza, 2007; Hymel, Rubin, Rowden, & LeMare, 1990; McKee, 2012; Parker & Asher, 1987; Pelham & Milich, 1984; Stenseng et al., 2016; Tseng et al., 2014). A range of areas are negatively impacted in addition to those described above, including poor academic outcomes, increased substance

use, heightened levels of internalizing and externalizing symptoms, and general impairment (Amori & Hinshaw, 2006; Hoza, 2007; Owens, Zalecki, Gillette, & Hinshaw, 2017).

Some research has focused on how outcomes and areas of impairment differ in individuals based on which type of ADHD symptom presentation they are diagnosed with (APA, 2013). Specifically, there are three diagnosable subtypes of ADHD, each with differing symptom presentations. ADHD – Predominately Inattentive Presentation (ADHD-IA) is specified when the individual exhibits many symptoms of inattention (e.g., often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities), without many symptoms of hyperactivity/impulsivity. Similarly, ADHD – Predominately Hyperactive/Impulsive Presentation (ADHD-HI) is specified when the individual exhibits many symptoms of hyperactivity/impulsivity (e.g., often runs about or climbs in situations where it is inappropriate) in the absence of many inattentive symptoms. ADHD – Combined Presentation (ADHD-C) is specified when the individual experiences many symptoms from both types of criteria.

Those diagnosed with ADHD-IA struggle with internalizing symptoms as well as difficulties with academic achievement, social skills and cognitive performance (Barkley, 2014; Bauermeister, Barkley, Bauermeister, Martínez, & McBurnett, 2012; McKee, 2012; Palili et al., 2011). The presence of internalizing symptoms is reflected in the higher rates of comorbid depression and anxiety disorders diagnosed for those with this presentation than those with ADHD-HI; social impairment is also strongly correlated with ADHD-IA (Barkley, 2014; McKee, 2012). Those diagnosed with ADHD-IA also tend to be rated highly on measures of social withdrawal (Hodgens et al., 2000; Marshall, Evans, Eiraldi, Becker, & Power, 2014; Tarver, Daley, & Sayal, 2014). Those diagnosed with ADHD-HI, on the other hand, display

differing areas of impairment from ADHD-IA, likely related to their differing behaviors and symptom profiles. The most robust difference between the two presentations is the strong association between the hyperactive/impulsive behaviors and symptoms associated with ADHD-HI and externalizing problems (Barkley, 2014; Palili et al., 2011). These externalizing problems manifest as aggressive behavior, substance use, and other acting-out behaviors, often associated with behavioral disorders such as Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD), both of which have a high rate of comorbidity with especially ADHD-HI and ADHD-C (APA, 2013; Hofvander, Ståhlberg, Nydén, Wentz, Deglinnocenti, Billstedt, & Anckarsäter, 2011). Difficulties with peers are also common amongst those diagnosed with ADHD-HI and ADHD-C, likely related to their tendency towards externalizing behaviors, such as aggression (Erhardt & Hinshaw, 1994; Hinshaw et al., 1997; Hoza, 2007; Tseng et al., 2014).

Despite the differing presentation of symptoms within the subtypes of ADHD-IA and ADHD-HI/C, both subtypes and symptom profiles (i.e., inattention and hyperactivity/impulsivity) are associated with peer difficulties. These associations are particularly relevant for individuals experiencing these inattentive and hyperactive/impulsive symptoms, as peer difficulties not only exacerbate these existing symptoms, (Stenseng et al., 2016; Tseng et al., 2014) but also create risk for additional poor outcomes already associated with ADHD. A meta-analysis conducted by Asher and Parker in 1987 highlighted the link between peer difficulties and risk for later adjustment problems. Specifically, they found that a lack of acceptance by one's peers during school-aged years predicted school dropout at twice the rate compared to those without peer difficulties. Similar rates for outcomes including juvenile and adult crime and adult psychopathology were also found. Subsequent research generally supports this link between poor peer relations and later negative outcomes, displaying evident

associations between relational difficulties and constructs including internalizing problems, externalizing problems, mental health difficulties, academic difficulties, delinquent behavior, and substance abuse (Hecht et al, 1998; Hymel et al., 1990, Ladd & Troop-Gordon, 2003; Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006). These outcomes are associated with both ADHD and peer difficulties; however, they are associated with each construct independent of the other. Therefore, those diagnosed with ADHD and who experience peer difficulties (a likely combination) can be thought of as at dual-risk for these negative outcomes. Their behavior associated with their diagnosis leads to these outcomes and peer difficulties. Their peer difficulties then exacerbate the existing trajectory, making the occurrence of the negative outcomes mentioned more likely.

In the case of ADHD-HI and ADHD-C, aggressive and delinquent behaviors, associated with symptoms of hyperactivity/impulsivity, are strongly associated with peer disliking (Coie et al., 2009; Coie & Dodge, 1983). Aggression is the most commonly correlated behavior with peer rejection, a phenomenon seen across informants (e.g., peer, parent, and teacher), and consistent between the differing types of aggression (i.e., physical, relational, verbal, and nonverbal) (Rubin, Bukowski, & Bowker, 2015). In studies regarding peer acceptance, aggression is seen not only as the most salient cause for peer difficulties but also as the most salient risk factor for negative outcomes (Rubin et al., 2015; Parker & Asher, 1987). For example, in the meta-analysis conducted by Parker and Asher in 1987, rejected aggressive individuals displayed the highest rates of school dropout and criminality later in life. Furthermore, the hyperactive/impulsive symptoms associated with ADHD-HI and ADHD-C are implicated as the driving factor behind why those diagnosed with disorder are seen as intrusive, loud, annoying, and aversive to their peers (Landau & Moore, 1991). This tendency is supported by findings that hyperactive children

display significant difficulties regarding peer relations, a trend that is worsened if the individual is both hyperactive and aggressive (Pelham & Millich, 1984).

In the case of ADHD-IA, inattentive symptoms and associated behaviors negatively impact social functioning leading to peer problems. These problems include difficulties socializing and withdrawal from the peer group (Barkley, 2014; McKee, 2012; Palili et al., 2011). In general, difficulty socializing with peers is strongly associated with peer rejection. For inattentive individuals, these social difficulties relate to key interaction components such as turn-taking and conversational conventions. Deficits in such areas tend to frustrate peers and lead to increased risk for rejection within the peer group. A second issue related to inattention is social withdrawal, which is more strongly associated with peer neglect, or the tendency for an individual to be overlooked or ignored within the peer group (Coie & Dodge, 1983; Bierman, 1987). However, it has also be found that highly withdrawn children comprise 10% - 20% of the rejected group within a peer network (Rubin, Bukowski, & Parker, 2006). This finding is supported by work which has found that withdrawn individuals are vulnerable to the same risk associated with low peer acceptance (Hecht et al., 1998; Hymel at al., 1990; Parker & Asher, 1987). Therefore, individuals exhibiting inattentive symptoms are at risk for peer difficulties due to both struggles with social interactions or withdrawal from the peer group.

In sum, the hyperactive/impulsive behaviors seen in individuals diagnosed with ADHD-HI and ADHD-C create a strong propensity towards peer disliking, perhaps due to associated aggression and actions that peers find generally aversive or disruptive. On the other hand, the inattentive symptoms associated with ADHD-IA create risk for peer disliking due to difficulties socializing and withdrawal from the peer group, even though these symptoms are also associated with peer neglect. These behaviors are not exclusive to those diagnosed with ADHD and do not

necessarily indicate the presence of any disorder, however, these behaviors have been shown to be significantly related to peer difficulties in those with and without a diagnosis of ADHD (Evans et al., 2013; Gomez & Gomez, 2015; Hinshaw et al., 1997; Hodgens et al., 2000; Hoza, 2007; Mrug et al., 2012; Pelham & Milich, 1984; Stenseng et al., 2015; Tseng et al., 2014; Zoromski et al., 2015).

Peer Nominations Data and Analyses

ADHD is often shown to be associated with peer difficulties, yet many of the studies displaying this finding utilize parent and teacher report (Hinshaw et al., 1997; Hoza, 2007; Mrug et al., 2012; Pelham & Milich, 1984); a more useful approach might utilize peer report. Peer nominated data yield results that have been shown to be highly reliable and valid, and are often in agreement with parent, teacher, and self-report measures (Gomez & Gomez, 2015; Gest, 2006). For instance, teacher and peer reports have been shown in various studies to be moderately correlated for constructs as far ranging as obesity, victimization and bullying, and callous-unemotional traits (Graziano et al., 2016; Jansen et al., 2014; Verlinden et al., 2014). In the school setting, peer nominations have been shown to correlate moderately to highly with teacher ratings of varying constructs (Evans et al., 2013; Hymel et al., 1990; Zoromski et al., 2015). Agreement tends to be highest for overt behaviors, as these actions are readily identified by individuals in the peer group and by observers (e.g., teachers; Rubin et al., 2015). Research regarding aggression and bullying highlights this tendency, as teacher and peer reports have high degrees of concordance when identifying aggressive individuals or those who bully their peers (Monks, Smith, & Swettenham, 2003; Wang et al., 2011). Agreement is moderate when assessing more subtle interactions or characteristics that are more difficult to observe such as social withdrawal, victimization, and internalizing problems (Shoemaker, Erickson, & Finch,

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1986; Younger, Schneider, Wadeson, Guirguis, & Bergeron, 2000; Wang et al., 2011). Parent reports display similar trends in agreement with peer nominations, as readily observable actions such as aggression and prosocial behaviors garner high correlations between reporters (Kuppens, Grietens, Onghena, & Michiels, 2009), whereas agreement between reports on more intimate or personal constructs, such as friendship patterns or depressive symptoms, is lower by comparison (Cole et al., 2017; Yugar & Shapiro, 2001). The concordance shown within these studies between peer nominations and third-party ratings from both parents and teachers indicates that peer nominations produce valid measures of an individual's traits, social standing/competence and other behaviors given this concurrent validity.

Much of the research studying the relationship between peer problems and inattention and/or hyperactivity/impulsivity utilizes parents and teachers as raters. Within these third-party ratings, inattention, impulsivity, and hyperactivity are strongly associated with poor peer relations (Bagwell et al., 2001; Hoza, 2007; Mrug et al., 2012; Stenseng, 2016). However, this association may also be assessed through peer nominations data and related analyses. Peer nominations data are desirable because peers observe a wider range of social experiences involving their peers. Peer judgements also include the viewpoint of many children and are not determined by a single opinion (Herrington & Parke, 1999; Lease, 2002). Further, peers offer a more comprehensive viewpoint on the behavior of their fellow peers, as many social interactions take place at times or in places which parents or teachers are not privy to, such as in the lunchroom, hallway, and bathroom. Peers within a school setting share their environment more closely with each other than with anyone else. This concept of a shared peer environment creates a host of knowledgeable and valid reporters (Achenbach, McConaughy, & Howell, 1987). In fact, it has been shown that peers displayed superior discriminant and convergent validity

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compared to teacher and parent reports when reporting on the social status and social interactions of their peers (Spangler & Gazelle, 2009). Finally, when studying impairment regarding peer relations, asking peers their perspective "on" or "about" who they like or dislike to play with is particularly relevant.

Despite the desirable aspects of peer ratings there are limitations. A notable limitation is that peer reported data is aggregated across nominators, meaning that children's nominations of a peer for a given behavior are not specifically linked to other nominations they make for that same peer. It is therefore possible for an individual to receive a high number of (aggregated) nominations for two behaviors, which would lead to a strong correlation, without any given peer nominating that individual for both behaviors. Regarding the relationship between peer dislike and inattention/impulsivity, past studies have shown the strength of this link, but the studies involve aggregated data (Bagwell et al., 2001; Hinshaw et al., 1997; Hodgens et al., 2000; Mrug et al., 2012; Pope et al., 1989; Stenseng et al., 2016; Tseng et al., 2014).

Recognizing this limitation of prior work, the method utilized within this study recognizes the non-independence of peer ratings while still accomplishing the primary goal of examining specific ties. Data regarding specific ties are non-independent by definition, meaning that the characteristics of the child influence the ratings or "ties" they receive from their peers (Borgatti, Everett, & Johnson, 2013). These ties are examined using the Quadratic Assignment Procedure (QAP) available in social network analysis software (e.g., UCINET). In QAP, the data is contained in a 2x2 matrix, with the "tie" or "adjacency" between every pair of actors contained in the cells of the matrix. In the current research, all nominators comprised the rows and all possible nominees comprised the columns of the matrix. Through QAP, the tie between who children nominate for impulsivity, disorganization, or inattentiveness and disliking is observed

(Borgatti et al., 2002). With QAP, two matrices can be correlated, specifically examining if a tie between actors in one matrix is correlated with ties between those same actors in another matrix. In this way, one can discern whether nominators who choose to nominate a peer as disliked also choose to nominate that same peer as inattentive or impulsive. The retention of nominator and nominee identities has the added benefit of also retaining the gender of the nominators and nominees. This allows one to account for the potential moderating effect of gender in the nominations for disliking and the measures behavioral attributes through the inclusion of a gender homophily matrix within analyses. The inclusion of such a matrix reveals the extent to gender homophily impacts the tie between two children in terms of concordance between nominations for dislike and problem behaviors (Hirsch, Prange, Hauver, & Gehrt, 2013). This is a strong benefit, as peer nominations have been shown to be related to gender (i.e., nominations tend to be same-sex rather than cross-sex for both positive and negative attributes; Card, Hodges, Little, & Hawley, 2005).

The Current Study

The current study attempts to examine if the link between inattention and impulsivity and peer disliking, shown in past studies, is significant when using the QAP analysis strategy. Through the use of the QAP methodology, the current study addresses limitations of prior work, which has mainly relied on either third-party ratings or aggregated peer data, by examining concordance in peer nominations between inattentive or hyperactive/impulsive behaviors and peer disliking. In this study, peer nomination data was collected for three behaviors related to ADHD (i.e., inattentiveness, disorganization, and impulsivity) and peer rejection (i.e., "like to play with least;" Coie et al., 2009; Coie & Dodge, 1983). Using methods from social network analysis (QAP), the specific ties between nominators and nominees form the basis analyses.

CHAPTER 3

METHOD

Participants

The participants in the current study were 387 elementary school students drawn from 21

fourth and fifth grade classrooms located in a rural school system in the southeastern United

States; five schools throughout the district were sampled. Overall the sample was 55.8% White,

41.1% Black, and 3.1% some other ethnicity; 53% were girls. Parental consent forms were sent

home with students. Both parental consent and child assent were required for inclusion in the

study; parental consent was obtained for 88% for all participants; no child declined assent if

parental consent had been granted.

Procedure

Measures used in this study were peer reported. Questionnaires were group administered

to each classroom; instructions were read aloud to the participants by one researcher, while a

second researcher aided students with individual questions. Students were asked to choose the

three classmates they felt best fit each behavioral descriptor given in the questionnaire. Students

nominated three peers for each of three specific behaviors and for the "like least" item. For ease

of data collection and to protect the identity of the nominees, participants used a classroom roster

on which student names were given a corresponding number. Due to the university's Institutional

Review Board (IRB) guidelines, only students whose parents consented to participation were

included on the roster; therefore, students could not nominate nonparticipants. All children in the classroom, regardless of participation, were given a small gift as thanks for the use of class time.

Measures

Behavioral Nominations. Rather than utilize a diagnosed sample of youth with ADHD, participants nominated peers for specific behaviors (see Table 1) typical of two subtypes of the disorder (i.e., ADHD-IA and ADHD-HI). A third item was used that falls under the inattentive list of symptoms in DSM-5 and which children might have an easier time recognizing than inattention. Furthermore, disorganization might be an indicator of inattention that is more impairing in the context of dyadic social interactions. The inattentive and disorganization behaviors are more typical of an individual diagnosed with ADHD-IA, whereas the impulsivity behavior relates to individuals diagnosed with ADHD-HI. The instructions for the nomination of peers for these behaviors stated that students could nominate three peers for each item and students could nominate the same peer for multiple items.

Table 1

Problem behavior peer nominated items

Behavior Type	Item
Impulsive	Somebody who gets out of his/her seat a lot, has trouble waiting his/her turn, and is more active than others.
Disorganized	This person is not organized – he/she seems to lose things all the time and has a messy desk.
Inattentive	This person seems to have a hard time paying attention in class, especially if kids are talking in the hallway or something is happening out the window.

Peer Disliking. Participants were allowed to nominate 3 peers for the item "which children do you like to play with the least" (Coie et al., 2009; Coie & Dodge, 1983). Like the behavioral nominations items, students were told they could nominate three peers for this item.

QAP Correlation and QAP Logistic Regression. The dyadic nominations within each classroom for each nominated item were coded in its own matrix, with nominators along the rows and nominees as the columns. Thus, given three behavioral and one disliking items, there were four matrices in all for each classroom. A "1" in the cell indicated that the child (nominator) nominated the peer (nominee) for the specific behavior, whereas a "0" in the cell indicated a lack of a nomination for that peer for the given behavior. These data were directed, so the resulting matrix was asymmetrical. These matrices were analyzed in UCINET 6 using QAP correlation and QAP logistic regression procedures (Borgatti et al., 2002). The QAP correlation procedure computes the correlation between two of these matrices in two steps. First, the Pearson correlation coefficient is calculated between corresponding cells in the two matrices. Second, to create a probability distribution, the labels for the cells of one matrix are randomly permuted, while the second matrix is left constant, and the correlations between cells are again calculated. The result is purely random, however the structure of the two networks remains unchanged. This process is repeated thousands of times creating a random distribution of correlational values regarding the two network structures. If the original correlation between the two matrices is larger than 95% of the random distribution, there is evidence that the correlation is significantly different than chance values, which suggests a meaningful association between the ties. These correlations were completed for the problem behavior matrices in all 21 classrooms. In the next step, QAP logistic regression (LRQAP) analyses examined how well nominations for each behavior alone and nominations for all behaviors together predicted nominations for dislike. The

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LRQAP is an extension of the QAP correlation; multiple matrices are regressed to create a model of a social relation by regressing a dependent matrix on one or more independent matrices. The two-step process that creates these models is analogous to that of QAP correlation. A logistic regression is performed for each of the corresponding cells and the regression coefficient is compared to those of random permutations (Borgatti et al., 2002; Borgatti, Everett, & Johnson, 2013). For the LRQAP analyses, it was desirable to include "gender homophily" matrices, given the tendency for individuals to interact with peers who are similar to themselves (i.e., homophily; McPherson, Smith-Lovin, & Cook, 2001). These gender homophily matrices were created for each classroom and included in all LRQAP analyses to account for the variance of the potential moderating effect that gender has on nominations for dislike. LRQAP models were completed within each of the 21 classrooms for each behavior individually and for one omnibus LRQAP (i.e., all behaviors in one model). The gender homophily matrix was included within all of the LRQAP analyses. For these gender homophily matrices, dyads of similar gender were coded as 1's while dyads of dissimilar gender were coded as 0's. Inclusion of these matrices as covariates accounts for the potential confounding effect gender homophily may have on these nominations. The resulting models show the overall fit (R-squared) for each classroom, displaying the significance and odds ratio of each behavior's predictive power in regard to nominations for peer dislike. QAP procedures are ideal within this study as they allow for the examination of a tie between inattentive/impulsive behaviors and dislike through the analysis of the concordance in nominations for each social relation, thus revealing how well perceptions of these inattentive/impulsive behaviors predict disliking from a given peer.

CHAPTER 4

RESULTS

First, using standard procedures (i.e., Pearson correlations), the peer nominated data

between each of the three behavioral nominations and the nominations for disliking were treated

as aggregated data, as in past studies (see Table 2). These analyses were performed to make

certain that these data corresponded with prior research before addressing the questions in the

current study. These correlations were calculated for all students together and again for all

students separated by gender to account for any differences in nomination by gender.

Correlations in all cases were significant at the $p < .01$ level, commensurate with previous

research (Cantrell & Prinz, 1985; Diamantopoulou, Rydell, Thorell & Bohlin, 2007; Hodgens et

al., 2010; Hoza, 2007; Mrug, Hoza, Pelham, Gnagy, & Greiner, 2007), indicating that an

investigation through further QAP analyses regarding the predictive quality of these three

behaviors for nominations of dislike were appropriate.

Table 2

Pearson Correlations Between Peer Nominated Dislike and Problem Behaviors

Disliking	Impulsive	Disorganized	Inattentive
All Students ($N = 387$)	.39**	.30**	.36**
Males ($N = 182$)	.44**	.42**	.38**
Females ($N = 205$)	.35**	.19**	.35**

$** p < .01$

Next, QAP correlations were performed for each of the behaviors within each of the 21 classrooms. In total, 86% of classrooms ($N = 18$) demonstrated that one or more of the behavioral nominations matrices were significantly correlated with the matrices containing nominations for dislike. Nominations for inattentiveness were correlated with nominations for dislike in the highest number of classrooms (i.e., 12), followed closely by nominations for impulsivity (11 classrooms), and finally nominations for disorganization (10 classrooms). Pearson correlations are reported alongside QAP correlations in Table 3. Interestingly, fewer classrooms (62%) displayed a significant Pearson correlation between one of the problem behaviors and disliking. As can be seen in Figure 1, QAP correlations revealed a higher rate of significant correlations for each behavior across classrooms, with inattentiveness displayed in 8, impulsivity in 7, and disorganization in 6.

Figure 1.

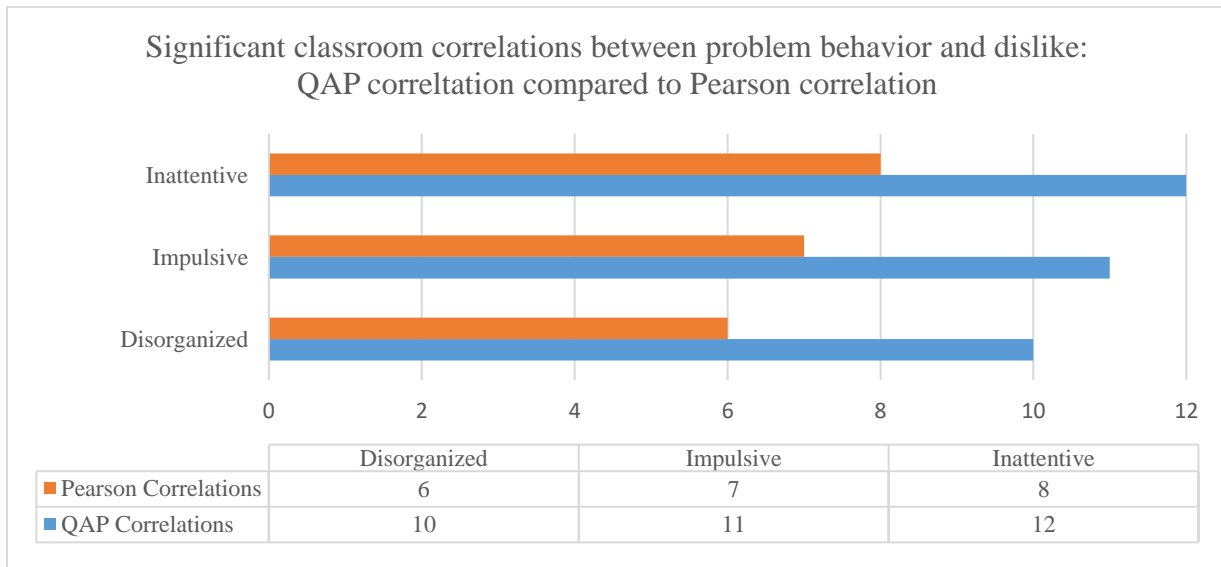Significant classroom correlations between problem behavior and dislike: QAP correltation compared to Pearson correlation

	Disorganized	Impulsive	Inattentive
Pearson Correlations	6	7	8
QAP Correlations	10	11	12

Table 3.
Pearson and QAP correlation results

	Impulsive		Inattentive		Disorganized	
	Pearson Correlation Impulsive	QAP Correlation Impulsive	Pearson Correlation Disorganized	QAP Correlation Disorganized	Pearson Correlation Inattentive	QAP Correlation Inattentive
Classrooms						
1	.313	.144*	.643**	.196**	.216	.076
2	.737**	.382**	.508	.087	.720**	.467**
3	-.015	-.038	.328	.161*	.230	.183*
4	.111	.038	-.009	.115	-.355	-.069
5	-.228	.078	.183	.015	.016	-.002
6	.613*	.229*	.649**	.197*	.539*	.178*
7	.355	.071	.303	.102*	.429*	.162**
8	.623**	.166*	.373	.102	.443*	.171**
9	.757***	.198**	.615**	.236*	.514*	.105
10	.332	.123*	.695***	.176**	.361	.139*
11	.631*	-.052	-.248	.006	.095	.144*
12	.428	.064	.055	.228**	.632**	.172*
13	.311	.247**	-.198	.026	.071	.213**
14	.675***	.226**	.341	.011	.694***	.259**
15	.317	.095*	-.169	.039	.327	.161**
16	.541*	.172**	.428	.027	.347	.211***
17	.211	.005	-.027	.008	.245	.059
18	.237	-.049	.730***	.234**	.268	.071
19	.130	.055	.190	.071	.319	.066
20	.377	.124*	.303	.084*	.533**	.105*
21	.305	.118	.673**	.271**	.370	.061

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

Logistic Regressions

Given that problem behaviors were correlated with nominations for dislike at a similar rate, analyses through LRQAP became necessary as this procedure revealed the independent contribution of each behavior in terms of nominations for dislike, while also indicating which combination of behaviors were more likely to predict nominations for dislike in most classrooms. LRQAP analyses were completed in two steps. In the first step, three separate models were regressed against the disliking matrices in each classroom. These models consisted of one behavioral nominations matrix and the gender homophily matrix, totaling three separate models for each classroom. Results of these analyses can be seen in Table 4. Of the three behaviors of interest, nominations for inattention (i.e., This person seems to have a hard time paying attention in class, especially if kids are talking in the hallway or something is happening out the window) significantly predicated nominations for dislike in the most classrooms (total classrooms = 14) after controlling for gender homophily among nominators and nominees. Individuals nominated by a given peer for this inattentive behavior were a little over three times as likely to be nominated by that same peer as someone who is disliked. Results for the nominations of impulsivity (i.e., Somebody who gets out of his/her seat a lot, has trouble waiting his/her turn, and is more active than others) and disorganized (i.e., This person is not organized – he/she seems to lose things all the time and has a messy desk) were nearly identical, with both behaviors significantly related to nominations of dislike in 11 total classrooms; individuals who were nominated by a given peer for either behavior were about 2.5 times as likely to be nominated by that peer as disliked. Across all three models, nomination patterns based on gender homophily played a minor role, with gender homophily predicting dislike at 1.3 times the rate of cross-gender nominations.

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In the final step of analyses (see Table 5), all three problem behaviors and the gender homophily matrix were included in an omnibus model for each classroom. Such an approach provides a holistic view of which behavior contributes most to nominations for dislike, while also investigating the unique variance each variable accounts for in the model. As can be seen in Table 4, results were similar to the first wave analyses, though slightly less pronounced as each behavior shares some variance with other behaviors within the model. Nevertheless, nominations for inattention were once again the strongest predictor for nominations of dislike, reaching statistical significance in 10 of the 21 models. Across all models, nominations by a given peer for this inattentive behavior predicated nominations by that peer for dislike at about 2.5 times the rate of those who did not receive the inattentive nomination. Within these combined models, nominations for impulsivity and disorganized behavior were again about equal in terms of predicting nominations for dislike. Individuals nominated by a given peer for either behavior were about twice as likely to be nominated by that same peer as disliked. Nominations patterns based on gender did appear to play a minor role within these models as well, as same gendered peers nominated each other for dislike at 1.3 times the rate compared to those of the opposite gender.

Overall, these results indicated that nominations for three behaviors associated with ADHD were significantly correlated with nominations for dislike within the majority of classrooms analyzed. These results are consistent with past research which has correlated both diagnoses of ADHD (Hinshaw et al., 1997; Hoza, 2007; Mrug et al., 2012; Pelham & Milich, 1984) and behaviors (Evans et al., 2013; Gomez & Gomez, 2015; Hodgens et al., 2000; Stenseng et al., 2015; Tseng et al., 2014; Zoromski et al., 2015) similar to those analyzed within this study to peer rejection. However, the results of these LRQAP analyses go one step further, revealing

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Table 4.
LRQAP results for individual behavior models

	Impulsive		Disorganized		Inattentive	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Classrooms						
1	0.918*	2.5	1.22**	3.4	0.547	1.7
2	1.932***	6.9	0.364	1.4	2.406***	11.1
3	-0.161	0.9	0.989*	2.7	1.04*	2.83
4	0.225	1.3	0.85*	2.3	-0.641	0.5
5	0.566	1.8	0.245	1.3	0.094	1.1
6	1.243*	3.5	1.062*	2.9	1.03*	2.8
7	0.534	1.7	0.619	1.9	0.986**	2.7
8	1.303**	3.7	0.9*	2.5	1.239**	3.5
9	1.311**	3.7	1.574*	4.8	0.855*	2.4
10	0.912*	2.5	1.388**	4.0	1.188**	3.3
11	-0.488	0.6	0.096	1.1	0.768*	2.2
12	0.448	1.6	1.36***	3.9	1.023**	2.8
13	1.398**	4.0	0.242	1.3	1.198**	3.3
14	1.605***	5.0	0.424	1.1	1.709***	5.5
15	0.69*	2.0	0.271	0.7	1.112***	3.0
16	1.222**	3.4	0.343	1.4	1.638***	5.1
17	0.308	1.4	0.227	1.3	0.701	2.0
18	-0.217	0.8	1.534**	4.6	0.511	1.7
19	0.509	1.7	0.686	2.0	0.685	2.0
20	1.258***	3.5	0.803*	2.2	0.987**	2.7
21	0.593	0.6	1.713***	5.5	0.402	1.5

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

Table 5.

LRQAP regressions predicting dislike from inattention, impulsivity, and disorganization, while controlling for gender homophily

	Impulsive		Disorganized		Inattentive		Gender		Overall Model
	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	Coefficient	Odds Ratio	R-Squared
Classrooms									
1	0.606	1.8	1.035*	2.0	-0.126	0.9	0.181	1.2	0.049
2	1.804**	6.1	-0.21	0.8	.2.342***	10.4	0.307	1.4	0.305***
3	-0.794	0.4	0.489	1.6	1.095**	3.0	0.034	1.0	0.058*
4	0.06	1.1	1.147*	3.1	-1.026	0.4	0.383*	1.5	0.040
5	0.559	1.7	0.183	1.2	-0.086	0.9	0.409*	1.5	0.027
6	0.97*	2.6	0.741	2.1	0.42	1.5	-0.191	0.8	0.084*
7	0.332	1.2	0.305	1.4	0.838*	2.3	0.581***	1.8	0.054***
8	0.842	2.3	0.565	1.8	0.759	2.1	0.358*	1.4	0.054**
9	1.195*	3.3	1.45*	4.3	0.622	1.9	0.071	1.1	0.099**
10	0.354	1.4	1.07*	2.9	0.687	2.0	0.573**	1.8	.054***
11	-0.701	0.5	-0.063	0.9	0.907*	2.5	0.354*	1.7	0.043
12	0.124	1.1	1.288**	3.6	0.892*	2.4	0.310	1.4	0.076**
13	1.321**	3.7	-0.05	1.0	1.11**	3.0	-0.196	0.8	0.102**
14	1.291**	3.6	-0.894*	0.4	1.549***	4.7	0.217	1.2	0.113***
15	0.662*	1.9	0.087	1.1	1.088***	3.0	0.225	1.5	0.040*
16	0.777	2.2	-0.036	1.0	1.413*	4.1	0.389*	1.5	0.066***
17	-0.07	0.9	-0.044	0.9	0.75	2.1	0.410**	1.5	0.022
18	-0.576	0.6	1.462**	4.3	0.413	1.5	-0.029	1.0	0.062*
19	0.254	1.3	0.517	1.7	0.482	1.6	0.114	1.1	0.011
20	0.969**	2.6	0.42	1.5	0.656*	1.9	0.477***	1.6	0.042***
21	0.578	1.8	1.69***	5.4	0.081	1.1	0.799*	2.2	0.131**

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that children who nominate a peer as inattentive, impulsive, or disorganized are more likely to nominate the peer for dislike than if the specific child did not nominate the peer for one of those problem behaviors. In other words, the significance of the direct link between the ties of problem behavior nominations to disliking nominations is observed. Analyzed individually, a nomination for inattention was the best predictor for a nomination of dislike, increasing the likelihood that an individual giving such a nomination would dislike a child three times as often as someone who they did not nominate as inattentive. Within a single model, inattention remained the strongest predictor of dislike at an increased rate of 2.5. Across all regression models, gender held relatively constant predictability, with same gendered individuals nominating each other for dislike 1.3 times more often than those of a differing gender. Thus, in terms of predicting who a child would nominate as disliked, inattention was the most salient variable.

CHAPTER 5

DISCUSSION

The goal of the current study was to examine the extent to which behaviors commonly associated with ADHD (i.e., impulsivity, disorganization, and inattention) were related to peer disliking. These relationships were investigated through QAP correlation and QAP regression analyses of peer nominations. Such an approach allowed for the examination of the direct link between nominators and nominees regarding nominations for dislike and problem behaviors. Examining these variables from the perspective of peers in this way uncovers the specific link between perceiving a peer as inattentive, impulsive, or disorganized and disliking that peer, thus building on a larger body of research examining this relationship through third party ratings and aggregated peer reports.

Indeed, past research involving aggregated data has shown that both inattentive and impulsive behaviors are related to peer disliking (Cantrell & Prinz, 1985; Diamantopoulou, Rydell, Thorell & Bohlin, 2007; Evans et al., 2013; Gomez & Gomez, 2015; Hodgens et al., 2010; Hoza, 2007; Mrug et al., 2007; Stenseng et al., 2015; Tseng et al., 2014). Results of the current study were no different, with Pearson correlations calculated with aggregated data from the current study revealing a significant relationship between the three behaviors of interest and peer disliking; this relationship held when nominations were separated by gender. Thus, the relationship between inattentive/impulsive behaviors and peer disliking was supported, as in past studies

However, the primary aim of the current study was to examine whether the relationship between these problem behaviors and disliking is maintained when the direct tie between these nominations is scrutinized through QAP analyses. QAP correlations between matrices for each behavior and disliking were performed within all classrooms. For most of the classrooms (i.e., 86%), one or more of the problem behaviors were significantly correlated with disliking. Each behavior was correlated with dislike at a similar rate. Compared to Pearson correlations, with aggregated data, performed at the classroom level, 62% of classrooms displayed a significant correlation between at least one problem behavior and disliking. Thus, a lower rate of significant Pearson correlations between individual problem behaviors and disliking were found in classrooms compared to the rate found using the QAP.

A comparison between Pearson correlations with aggregated data and QAP correlations at the classroom level displays two findings. The first is that the QAP revealed a stronger relationship between the direct tie of nominations for a problem behavior and nominations for dislike compared to the relationship revealed through aggregated correlations of these nominations. This displays the importance of examining the concordance between these peer ratings. Children who noticed these problem behaviors in their peers also disliked those same peers at a significant rate in most classrooms, showing the strong effect these behaviors can have on socialization. However, aggregated data analyses did not show this relationship as strongly at the individual classroom level, suggesting variability due to classroom context or other features of the peer group.

The second finding gleaned from these correlational results was that, in some classrooms, presence of these problem behaviors played little to no role in nominations for dislike. This schism between classrooms where inattentive, impulsive, and disorganized behaviors are

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strongly related to dislike and classrooms where they are not highlights the importance of

classroom-based norms and contextual factors when looking at constructs such as disliking

within such an environment (Epstein et al., 2005; Wright, Giammarino, & Parad, 1986;

Meisinger, Blake, Lease, Palardy, & Olejnik, 2007). Past research has shown factors like person-

group similarity and global classroom norms to be very important in predicting social status or

popularity, as well perceptions of behavior within classrooms (Epstein et al., 2005; Wright et al.,

1986; Meisinger, et al., 2007). For example, a study conducted by Epstein and colleagues in

2005 on children diagnosed with ADHD from the MTA sample revealed that teacher ratings and

classroom observations of ADHD-related behavior varied by the ethnicity of the child. African

American children were perceived as exhibiting more ADHD-related behavior compared to

Caucasian children. However, this difference was found to be nonsignificant when the behavior

of an average child within the classroom was taken into account. Therefore, when the ADHD-

related behaviors of children were similar to the normative behavior within their classroom, the

behaviors were found to be less severe. Within the current study, it is possible that within

classrooms where these problem behaviors were not related to dislike, these behaviors were the

norm within that classroom or the individuals exhibiting these behaviors were otherwise very

similar to the rest of the group. Factors such as these might explain why nominations for problem

behaviors were strongly related to dislike in some but not all of the classrooms.

LRQAP analyses were also performed within each classroom to examine the likelihood

of a behavioral nomination leading to a nomination for dislike. In the first step of LRQAP

analyses, each behavior was regressed against dislike, separate from the other behaviors. The

only other variable included in these models was gender homophily, which was included as a

control due to the tendency for individuals to favor others who are like themselves in their

nominations (McPherson, Smith-Lovin, & Cook, 2001). Similar to the QAP correlation analyses, all behaviors were similarly associated with nominations for dislike, with inattention displaying a slightly higher odds ratio of 3.0 compared to impulsivity and disorganization, both at an odds ratio of 2.5.

To investigate which behavior was contributing the most to these nominations for dislike, all of the behaviors were included together in one omnibus model, again with gender homophily also included as a control. Results were similar to the first step of LRQAP analyses, though they were slightly less strong as each behavior included in the model likely shares some portion of variance with the other behaviors. Therefore, inattention was the strongest predictor for nominations of dislike, followed by impulsivity and disorganization which predicted nominations for dislike at the same rate and gender homophily had a modest effect.

In sum, the results of the current study suggest that children exhibiting any of these three problem behaviors commonly associated with ADHD (i.e., impulsivity, disorganization, or inattention) are more likely to be rejected by peers who observe these behaviors. This relationship held within QAP analyses, with QAP correlations within classrooms displaying a stronger relationship between these nominations than that revealed through Pearson correlations. Thus, this study addresses limitations of prior work, which has often utilized either third-party ratings or aggregated peer data, by examining concordance in nominations for these problem behaviors and nominations for peer disliking. This study suggests that a range of behaviors (i.e., impulsivity, disorganization, and inattentiveness) which are all associated with ADHD, all create risk for peer difficulties, rather than any one behavior in particular. However, there are classroom environments or specific individuals within classrooms for which these behaviors will not be related to dislike. The context of the classroom and the global norms therein, in addition to the

behaviors of the individual, will more comprehensively predict factors such as dislike more effectively than examining just individual behavior alone in the classroom context.

Limitations and Future Directions

Whereas the current study offers useful information regarding the effect certain behaviors associated with ADHD have on peer disliking, it is not without its limitations. Of interest were behaviors associated with ADHD, however these data were collected from a sample of elementary school students of whom diagnostic status was not known, meaning that the behaviors of interest were present amongst the participants but a diagnosis of the disorder with which the behaviors were associated with was unknown. Also, in creating a predictive model for nominations of dislike, the only behavioral nominations included were the behaviors of interest (i.e., impulsivity, disorganization, and inattentiveness). Many other nominations or variables would likely contribute to predicting nominations for dislike, however the scope of the current study was limited to only those three behaviors. Further, this study examined nominations for "like least," whereas most studies of peer rejection utilize social preference (i.e., "like most – "like least") scores (Coie et al., 2009; Coie & Dodge, 1983; Hinshaw et al., 1997; Hodgens et al., 2000). Given the matrix coding of nominations required within the QAP, only the "like least" nomination could be included in analyses as matrices are only capable of displaying nominations for a single variable. By only examining the "like least" nomination, this study is discrepant from other studies that use social preference to index peer rejection. Finally, the number of students within the classrooms analyzed ranged from 12 to 27 students. While these sample sizes are adequate for analysis through Pearson correlations (Kirk, 2007), the reliability associated with these smaller sample sizes is a limitation.

Despite these limitations, future endeavors could build upon the findings of the current study through the investigation of other behaviors associated with ADHD and/or peer disliking. Follow up studies will focus on the inclusion of such variables in new models for nominations of dislike in the interest of parsing out which behaviors are most salient to peers. Uncovering which behaviors most often lead to peer disliking will allow for more effective interventions.

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