

# the **ADHD**

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## **Understanding the Friendships of Individuals with ADHD from an Executive Function Perspective**

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Attention deficit hyperactivity disorder (ADHD) is both a persistent and a pervasive neurobiological disorder. It affects approximately 5% of children (Polanczyk, de Lima, Horta, Biederman, & Rohde, 2007) and has genetic connections with heritability approximations between 70 and 90% (Burt, 2009; Faraone & Mick, 2010; Kotte, Faraone, & Biederman, 2013; Larsson, Chang, D'Onofrio, & Lichtenstein, 2014; Thapar, Cooper, Eyre & Langley, 2013). The symptomatology manifests itself as age-inappropriate levels of inattention and/or hyperactivity/impulsivity, and frequently coexists with executive dysfunctions (Chudasama & Robbins, 2006; Clark et al., 2007; Cools, 2008; Depue et al., 2010; Naglieri & Goldstein, 2006).

Even though various definitions of executive functions (EFs) exist, Lezak (1995) provides a useful definition: EFs are “a collection of interrelated cognitive and behavioral skills that are responsible for purposeful, goal-directed activity and include the highest level of human functioning such as intellect,

thought, self-control, and social interaction” (p. 42). As a result, amongst the most deep-seated and documented domains of impairments in those with ADHD is their difficulty bonding with their typically developing peers (TDP) (Hoza, 2007). Nevertheless, individuals with ADHD do not typically lack knowledge in social skills but instead have difficulty applying their knowledge (Wheeler & Carlson, 1994). The overarching goal of this article is to highlight how executive dysfunctions, including but not limited to cognitive inflexibility, organization/planning deficits, disinhibition, working memory, and low levels of self-monitoring may interfere with the development

and maintenance of healthy friendships among individuals with ADHD.

It is necessary to understand the executive dysfunctions that may underpin unhealthy friendships among individuals with ADHD to inform intervention efforts and better the lives of people who have the disorder. Thus, the literature on the characteristics of friendships among individuals with ADHD will be reviewed first. Second, EFs will be defined. Third, research linking the friendship characteristics to executive dysfunctions among individuals with ADHD will be outlined. Finally, interventions to support the development and maintenance of healthy friendships among individuals with

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ADHD will be discussed, followed by concluding remarks.

#### Characteristics of Friendships Among Individuals with ADHD

Quality of life (QoL), a multifaceted concept (Coghill, Danckaerts, Sonuga-Barke, & Sergeant, 2009), is understood as perceived well-being and satisfaction across diverse life domains, including family, friends, school, or occupation as well as good physical and mental health (Schei, Nøvik, Thomsen, Indredavik, & Jozefiak, 2015). Importantly, the results of Schei and colleagues' (2015) research suggest that those with ADHD who have social resources may be protected against the emergence of externalizing and internalizing disorders, and have improved QoL. Further, close friendships have long-term implications, including improving self-esteem, diminishing depressive symptomatology, encouraging healthy family relationships, improving peer acceptance, altruism, sociability, enjoyment in school, and better adjustment (Bagwell & Schmidt, 2011; Bagwell, Schmidt, Newcomb, & Bukowski, 2001; Rubin, Bukowski, & Parker, 2006). One example of improved adjustment comes through the longitudinal studies demonstrating that children with stable high-quality friendships can adjust better to school transitions compared to those without high-quality friendships (e.g., Ladd, Kochenderfer, & Coleman, 1996).

On the other hand, peer problems can lead to multiple negative outcomes, including dropping out of school, academic underachievement, delinquency, truancy, and maladjustment (Parker & Asher, 1987; Rubin, Bukowski, & Parker, 1998). The existing research, unfortunately, suggests that individuals with ADHD are more likely to have fewer friendships considered to be high quality (Heiman, 2005; Nijmeijer et al., 2008). In addition, individuals with ADHD are less content with their friendships and are less likely to be able to maintain their friendships (Blachman & Hinshaw, 2002; Normand et al., 2011; Soucisse, Maisonneuve, & Normand, 2015), and stability is a factor in the quality of a relationship (Berndt et al., 1996; Bu-

kowski, Hoza, & Boivin, 1994; Schneider, Fonzi, Tomada, & Tani, 2000). This may be because the friendships, as reported among individuals with ADHD, are more likely to involve less intimacy, help, validation, caring, and guidance compared to the friendships of their TDP (Chupetlovska-Anastasova, 2014).

Specifically, children with ADHD were observed to be more likely to violate rules and be less sensitive and altruistic during interactions with their friends compared to their TDP (Chupetlovska-Anastasova, 2014). Further, when a decision had to be made, the time it took to compromise was longer among children with ADHD compared to their typically developing peers (Chupetlovska-Anastasova, 2014). Finally, the friendships of children with ADHD were more likely to have an unequal power distribution compared to their TDP (Chupetlovska-Anastasova, 2014).

As a result, between 56 and 76% of children with ADHD do not have mutual friendships; this contrasts with between 10 and 32% of their TDP (see Hoza, 2007, for reviews) and may be due to impaired social skills and resulting difficulties in social relationships (McKee, 2014). Impaired social skills may reflect language deficits and/or poor observational learning. Language impairments—especially pragmatics, that is, the social use of language (Prutting & Kittchner, 1987)—are also common among children with ADHD (Cohen et al., 2000; Tirosh & Cohen, 1998). Pragmatics encompasses both verbal and non-verbal components used in conversational contexts. For instance, individuals with ADHD may be more likely to misinterpret facial expressions and have difficulty comprehending sarcasm and irony. This may negatively influence their social functioning (Staikova, Gomes, Tartter, McCabe, & Halperin, 2013).

Children with ADHD may also be more impaired in the observational learning needed to acquire social knowledge and related skills (Bacchini, Affuso, & Trotta, 2008, Hoza, 2007, for reviews). This deficit, in turn, may lead to misattributions regarding the intentions and behavior of their TDP (Sibley, Evans, & Serpell, 2010). Specifically,

it may lead to interpretations of social failures and/or successes that are incorrect (Gardner & Gerdes, 2015).

Failure of children with ADHD to learn social behaviors through observation may contribute to their perception that there are both fewer positive elements and more negative elements in their friendships compared to their TDP (Normand et al., 2011). Positive elements may include intimacy, conflict resolution, caring, and companionship, whereas negative elements may include aggression/conflict and friendship exclusivity (Normand et al., 2011). Nevertheless, many individuals with ADHD do have friendships; however, they are more likely to select friends who also have ADHD and/or other learning and behavioral problems (Blachman & Hinshaw, 2002). This is in line with the similarity-attraction hypothesis which proposes that individuals seek friends who are like themselves (Byrne & Nelson, 1965). However, as previously highlighted, individuals with ADHD, irrespective of the presence of friendship(s), are more likely than their TDP to engage in negative social behavior. What follows describes central domains of EF that, if impaired, may lead to social impairments, possibly compromising the quality of friendships.

### Executive Functions

The Behavior Rating Inventory of Executive Function (BRIEF) assesses various forms of EFs, including inhibition, working memory, cognitive flexibility, self-monitoring, and planning. Inhibition is described as the ability to control impulses and at the appropriate time stop a given behavior (Gioia, Isquith, Kenworthy, & Barton, 2002). Likewise, inhibitory control refers to an ability to take control of one's thoughts, emotions, attention, and/or behavior and to then suppress any internal predisposition strong enough to lead to impulsiveness (Diamond, 2013).

Cognitive flexibility or "shift" refers to the ability to move from one situation, activity, or feature of a problem to another as the situation entails. It also means to solve problems in a nimble way (Gioia et al., 2002) and to alter per-

spectives or change an approach to a certain problem. It includes adaptability in meeting novel demands or new rules or switching between activities. Cognitive inflexibility would make it difficult to attend to stimuli selectively and make a choice between what to focus on, and in doing so, suppress directing attention to alternative stimuli (Diamond, 2013). One typical example of cognitive flexibility is selectively attending to one form of stimuli, such as a person talking at a cocktail party, but tuning out other stimuli, such as music and other conversations (Diamond, 2013).

Working memory refers to the ability to hold information in one's mind to persist and complete an activity (Gioia et al., 2002). Specifically, working memory is a mental process whereby one simultaneously holds information in one's mind and continually updates it with incoming information. For instance, one typical working memory task is for an individual to repeat in reverse order a series of numbers that have been provided orally to them. Impaired working memory would make it difficult to follow a set of instructions or comprehend text while reading because to comprehend, the reader must both hold information of what has been read and continually update that information as he or she reads on.

Planning refers to the ability to anticipate upcoming events, establish goals, and formulate the appropriate steps needed to complete a given task, as well as the ability to comprehend and communicate central ideas (Gioia et al., 2002). Planning deficits would impair the process of thinking about and formulating the tasks necessary to accomplish a chosen goal because, in part, conceptual skills are deficient. "Monitoring" or "self-monitoring," on the other hand, involves the ability to check one's work and evaluate performance during an activity and to confirm goal achievement once the activity is complete (Gioia et al., 2002).

Self-monitoring also involves watching the effect of one's behavior on others (Gioia et al., 2002). Failure to keep track of one's influence on others can create social problems and compromise friendships. In addition to inadequate

self-monitoring, impairments in working memory, cognitive flexibility, inhibitory control, and planning can also compromise friendships. Specifically, executive dysfunctions are related to impaired social functioning among both individuals with ADHD and their TDP (Clark, Prior, & Kinsella, 2002; Huang-Pollock, Mikami, Pfiffner, & McBurnett, 2009; McQuade, Murray-Close, Shoulberg, & Hoza 2013; these are discussed in detail next).

However, first, in addition to the BRIEF, the Barkley Deficits in Executive Functioning Scale—Children and Adolescents (BDEFS-CA) is a tool that works to evaluate dimensions of executive functioning among children and adolescents. The BDEFS-CA provides a snapshot of ability centering on organization and solving problems, motivation, self-regulation, time management, self-control, and regulation of emotions. The Comprehensive Executive Function Inventory (CEFI, for children aged 5–18 years; Naglieri & Goldstein, 2013) also assesses EF domains, including inhibitory control, working memory, planning, organization, regulating emotions, and flexibility, as well as initiating and monitoring oneself. Each of the three EF checklists (i.e., the BRIEF, the CEFI, and the BDEFS-CA) is useful in research and in clinical environments. However, each centers on a fixed set of EF skills and excludes certain other areas of cognitive ability that are understood to be associated with executive functioning. The EFs indicated in the CEFI, and BDEFS-CA, when dysfunctional, will be elaborated upon next within the context of friendship and ADHD.

### Relationship Between Executive Dysfunctions and Friendships Among Individuals with ADHD

*Working Memory.* Working memory is necessary in order to form an understanding of anything that reveals itself over time (Diamond, 2013). It is critical during conversations with friends to hold information in mind from an earlier point in time and to form connections to what is coming later. To be successful socially, it is necessary to remember



what has been heard and relate that to what will be discussed later. While it is necessary in conversations to simultaneously consider alternatives to what is being discussed, it is also central to cognitively relate information to form a coherent representation of what is being said or to see the connections between ideas being discussed. Further, it is necessary to have the ability to focus attention on information in one's mind for several seconds and dismiss irrelevant thoughts and stimuli (Diamond, 2013). Individuals with ADHD may be more likely to have impairments in each of these domains due to working memory deficits, thus making smooth conversation or engaging in group activities with TDP more difficult.

Difficulty managing pieces of information will also make it a challenge to form an understanding of a friend's perspective, especially if it is different from one's own (Mikami, 2010). For instance, Marton, Wiener, Rogers, and Moore (2015) observed that children with ADHD, compared to their TDP, display a higher level of insensitive and self-centered proposals while negotiating with their friends. This may be because, compared to their TDP, children with ADHD are less able to integrate the perspectives of their friends and at times to "give up" on their own feelings (Normand et al., 2011); this is reflective of impaired working memory.

Overall, the research indicates that working memory impairments were predictive of social problems among children with ADHD (Huang-Pollock et al., 2009). McQuade and colleagues (2013) suggest that beyond grappling with individual pieces of information that are necessary for participating in conversations with friends and appreciating their perspectives that impaired central executive working memory (i.e., a system that chooses what working memory attends to) is related to both specific and broad social impairments that are, in part, a reflection of these deficiencies. Specific social impairments include relational aggression, physical aggression, and poor conflict resolution abilities, whereas broad social impairments include peer rejection and deficient social competence.

*Cognitive Flexibility and Problem-Solving.* Similar to working memory, cognitive flexibility involves the ability to make changes to one's interpersonal perspective (e.g., "Am I able to see this from your perspective") (Diamond, 2013). Failure or inability to do this may lead to a lower ability in social perspective-taking and less empathy (Barkley, 2015; Marton, Wiener, Rogers, Moore, & Tannock, 2009). Lower levels of social perspective-taking may also lead to becoming more controlling over a peer, another reason for friendships to end prematurely (Marton et al., 2009; Parker & Seal, 1996). Cognitive flexibility additionally involves making changes in how we go about thinking of something. For instance, if solving a problem through one approach is not working, we need to generate an alternative approach (Diamond, 2013). Cognitive flexibility means being capable of modifying and making adjustments in response to different demands (Diamond, 2013). However, individuals with ADHD may be impaired in this domain (Etchepareborda & Mulas, 2004), and may experience more difficulties in social problem-solving compared to their TDP (Gardner & Gerdes, 2015).

Social-cognitive problem-solving is understood to be the method in which we scrutinize and choose different responses to information of a social nature. It encompasses processing, holding onto, and applying the pertinent information in a social context (Kofler, Larsen, Sarver, & Tolan, 2015). It is paramount to efficaciously make choices to achieve a given goal, and is a skill that is needed from moment to moment (Borg, 2009). For instance, King and colleagues' (2009) findings suggest that children with ADHD were more likely to generate hostile and aggressive responses in reaction to hypothetical peer provocation scenarios compared to their TDP. This may reflect the finding that children with ADHD, compared to their TDP, are less able to form strategies needed to solve dilemmas of an interpersonal nature (Marton et al., 2009), and thus they display an impairment in cognitive flexibility.

*Inhibitory Control.* Inhibitory control "involves being able to control one's

attention, behavior, thoughts, and/or emotions to override a strong internal predisposition or external lure, and instead do what's more appropriate or needed" (Diamond, 2013, p.137). If not for inhibitory control, our impulses would guide our actions. Inhibitory control allows us to change our behavior and choose in which manner to react (Diamond, 2013). Specifically, we can make the voluntary choice to dismiss certain stimuli and selectively attend to others that are consistent with our social goals (Diamond, 2013).

In addition, inhibitory control allows us to resist temptation and not act impulsively (Diamond, 2013). Through focusing on information, it becomes easier for that information to guide our actions and limit the likelihood of an inhibitory error (Diamond, 2013). The ability to hold onto information in one's mind is also facilitated through working memory. Importantly, Barkley (1997) proposed that behavioral inhibition is a core deficit among many individuals with ADHD. Barkley (2015) hypothesized that a deficit in inhibitory control in those individuals may be associated with an impaired ability to inhibit their responses and to consider their peers' perspective. For instance, women with ADHD reported being impulsive and blurting out comments that could be considered hurtful (Shaw-Zirt, Popal-Lehane, Chaplin, & Bergman, 2005). Even children between the ages of 3 and 6 with poor inhibitory control may find it challenging to constrain themselves from acting in a physical or relationally aggressive manner to achieve a desired goal, such as obtaining a toy, or in response to a perceived frustration, such as teasing (Poland, Monks, & Tsermentseli 2016). Consequently, these types of behaviors may put a strain on their relationships (Ramirez et al., 1997).

Disinhibition provides an understanding as to why individuals with ADHD may be more likely than their TDP to display more negative emotions, less tolerance for frustration, and less empathy (Barkley, 2015). Moreover, disinhibition is a contributor to aggression in childhood (Allan & Lonigan, 2011; Beauchamp & Anderson, 2010; Jacobson, Williford, & Pianta, 2011; Ric-

cio, Hewitt, & Blake, 2011; Utendale, Hubert, Saint-Pierre, & Hastings, 2011; Verlinden et al., 2014, as cited by Poland et al., 2016). Inhibition is necessary to display appropriate affective reactions in order to emotionally connect with a friend. Impaired inhibitory control may lead to difficulties in emotional regulation.

*Emotional Regulation.* "Emotion regulation describes the set of processes that allow an individual to recognize and moderate the experience and expression of an emotion" (Gross & Feldman Barrett, 2011; Izard et al., 2011; Zeman, Cassano, Perry-Parrish, & Stegall, 2006, as cited by Ryan, Ross, Reyes, Kosmerly, & Rogers, 2016, p. 390). It involves first identifying, then labelling, and finally accepting one's emotions. This process allows one to engage in behaviors that are goal oriented and to control behaviors deemed impulsive, while simultaneously experiencing emotions (Gratz & Roemer, 2004). Children with ADHD may be more likely than their TDP to have difficulty in the area of self-control (Wheeler Maedgen, & Carlson, 2000). Self-control is defined by Rosen and colleagues (2014) as the capability to restrain one's immediate reactions and control one's behavior in interactions with others. The hyperactive/compulsive subtype of ADHD is associated with self-control impairments in comparison with the primarily inattentive subtype of ADHD (Rosen et al., 2014). On the other hand, irrespective of ADHD subtype, emotion regulation is also frequently compromised (Wheeler et al., 2000). As a result, emotional expressivity may result in social impairment (Eisenberg, Fabes, Guthrie, & Reiser, 2000; Lopes, Salovey, Côté, Beers, & Petty, 2005).

Deficient emotional self-regulation (DESR) is associated with emotional impulsiveness, and there are six symptoms comprising emotional impulsiveness: ease to anger, irritability, impatience, quick temper, frustration tolerance that is low and excitable pertaining to emotion (Surman et al., 2013). This symptomatology in turn leads to impaired social interactions (Surman et al., 2013). DESR existing within the core of ADHD symptomatology would

shed light on the social interaction impairments frequently experienced by individuals with ADHD (Whalen & Henker, 1992). For instance, it would help explain the impairments centering on mutuality, supportive activities, and rule following (Mrug, Hoza, Pelham, Gnagy, & Greiner, 2007; Whalen & Henker, 1992) as well as impulsiveness and quickness to anger, both verbally and physically (American Psychiatric Association, 2000; Buhrmester, Camparo, Christensen, Gonzalez, & Hinshaw, 1992; Hinshaw, 2003).

Research has demonstrated that up to 70% of adults and 45% of children with a diagnosis of ADHD have difficulty regulating their emotions (Able, Johnston, Adler, & Swindle, 2007; Barkley & Fischer, 2010; Shaw, Stringaris, Nigg, & Leibenluft, 2014; Surman et al., 2013, as cited by Ryan et al., 2016). For instance, Ramirez and colleagues (1997) determined that adults with ADHD self-reported that the way they expressed their anger is more maladaptive compared to adults without ADHD. Examples included breaking objects, verbal altercations, and negative body language. Moreover, those with ADHD were more likely to enter into a confrontation and to be aggressive in situations perceived as stressful (Kern, Rasmussen, Byrd, & Wittschen, 1999).

Further, among college students, those poorer at regulating their emotions receive more negative peer nominations and fewer friendship nominations compared to their TDP who are better at regulating their emotions (Lopez, Stahl, & Tchanturia, 2010). In addition, among youth with ADHD, impulsivity and emotion dysregulations also contribute to their difficulties with peer relationships (Bacchini et al., 2008). Examples of emotional dysfunction among youth might include lower tolerance for frustration, less empathy, and more negative emotions (Barkley, 2015). In a study by Melnick and Hinshaw (2000), it was observed that males with ADHD demonstrated more difficulty in regulating their emotions ("strong venting" and aggression) while engaging in a model-building activity compared to typically developing males Gardner & Gerdes, 2015). Likewise, perhaps be-

cause of emotional dysregulation in their friendships, females with ADHD also reported a higher level of conflict and relational aggression compared to typically developing females (Blachman & Hinshaw, 2002; Mikami, 2010).

If one cannot match arousal and the affect of a peer, that in turn leads to less intimacy with those peers (Mikami, 2010). Emotional dysregulation may explain Heiman's (2005) finding that among children with ADHD, friendship was defined as having companions that are fun to be with, whereas their TDP defined their friendships as having partners that were "emotionally supportive" to exchange their thoughts with. Additionally, in a predominantly male sample, only 15% of children with ADHD considered their friendships to be "emotionally stable," as opposed to 45% among their TDP (Heiman, 2005). However, it is possible that coexisting externalizing or internalizing disorders played a role in this figure (Jensen, Martin, & Cantwell, 1997).

*Self-Monitoring and Planning/Organization.* Intact self-monitoring allows one to monitor one's cognition in order to ensure the maintenance of appropriate behavior. Unfortunately, children with ADHD, compared to their TDP, display lower levels of self-monitoring (Hoza, Waschbusch, Pelham, Molina, & Milich, 2000). Impairments in self-monitoring may mean that individuals with ADHD have difficulty accurately evaluating their own social skills. This reflects the finding that individuals with ADHD may be less able to assess their social behavior and typically over-report their perceived social competence (Hoza et al., 2000; Hoza et al., 2004). This phenomenon is called "positive illusory bias" (PIB). As a result, children with ADHD report having more friends compared to reports by their teachers and parents (Bagwell, Molina, Pelham, & Hoza, 2001; Heiman, 2005). Further, it is possible that friendship quality is overestimated (Mikami, 2010). Recently, McQuade, Mendoza, Larsen, and Breaux (2017) suggested it is possible that the relationship between a PIB and EF is a result of the relationship between EFs and an impairment in social functioning.

Self-monitoring is related to planning/organization because both involve evaluating and anticipating one's behavior. The impairments in planning/organization as well as working memory that individuals with ADHD have make it challenging for them to manage large amounts of varied information, thus compromising their ability to comprehend perspectives other than their own (Mikami, 2010). It is necessary to be able to plan and organize information in one's mind to support a friend's needs, resolve differences, and be considerate. (Mikami, 2010). Rinsky and Hinshaw (2011) determined that impaired planning skills in childhood were predictive of comorbid internalizing and externalizing problems as well as poor social functioning upon reaching adolescence (Schei et al., 2015). In respect to peer relations, weak planning skills are associated with displaying greater levels of proactive relational aggression (PRA). One example of PRA is getting what one wants through telling another that he or she won't continue to be their friend. An example of a younger child with poor planning skills is his or her inability to generate a plan of action for achieving a certain goal, such as obtaining a toy, and instead resorting to aggression (Poland et al., 2016).

## Interventions

This article explored how executive dysfunctions may compromise friendships among individuals with ADHD. Given that it is common for individuals with ADHD to have at least one impairment in EF, it is necessary to highlight interventions that may improve their social skills and EFs to inform friendship interventions. First-line treatment is typically stimulant medication and behavioral contingency, which have been shown to reduce aggressive, disruptive, and intrusive behaviors among individuals with ADHD (Chronis, Jones, & Raggi, 2006; Hinshaw, Henker, Whalen, Erhardt, & Dunnington, 1989). Moreover, these treatments led parents and teachers to rate these individuals more positively in the domain of social skills (Klein & Abikoff, 1997).

This article also suggests that interventions that develop and improve self-evaluation, self-monitoring, as well

as the ability to appropriately respond to social cues may be beneficial among individuals with ADHD. Teaching emotion regulation strategies to individuals with ADHD may also promote better social functioning. Finally, addressing pragmatics may be useful in interventions designed to improve social impairments and aid in the development of friendships among individuals with ADHD that arise from language deficits (Staikova et al., 2013). Beyond promoting friendships through direct approaches, promoting friendships through targeting executive dysfunctions indirectly will be described next.

Indirect approaches through promoting EFs may lead to healthy friendships among individuals with ADHD. Computerized training (Bergman Nutley et al., 2011; Holmes, Gathercole, & Dunning, 2009; Klingberg et al., 2005; Thorell, Lindqvist, Nutley, Bohlin, & Klingberg, 2009) including task-switching computerized training (Karbach & Kray, 2009) and Taekwondo traditional martial arts (Lakes & Hoyt, 2004) are examples of activities with the most research support for improving children's EFs (Diamond, 2013). Other studies have also examined the benefits of mindfulness (Flook et al., 2010), aerobics (Davis et al., 2011; Kamijo et al., 2011), and yoga (Manjunath & Telles, 2001) for improving EFs.

One specific domain of EF that has generated much research attention is working memory. Working memory may be developed through computer training programs (Klingberg et al., 2005; Prins, Dovis, Ponsioen, Ten Brink, & Van der Oord, 2011). Because of working memory training, parents and teachers report greater levels of attentiveness and less hyperactivity and impulsivity in individuals with ADHD (Klingberg et al., 2005; Spencer-Smith & Klingberg, 2015). However, despite the research findings citing the usefulness of working memory training, there exists controversy centered on the scope of its relative usefulness (e.g. Melby-Lervåg & Hulme, 2016). Specifically, working memory training may not promote more generalized cognitive abilities (Shipstead, Redick, & Engle, 2012). It is also unclear whether working memory training would promote

the development of healthy friendships among individuals with ADHD. However, if working memory training helps to diminish the symptomatology of ADHD, it could facilitate the development of healthier friendships.

Exercise also improves the cognition and behavior, including EFs, of children with ADHD (Den Heijer et al., 2017; Masley, Roetzheim, & Gualtieri, 2009) that may indirectly promote their friendships. For instance, physical activity promotes cognitive flexibility (Masley et al., 2009). This was determined through the Shifting Attention Test (SAT) that measures the ability of an individual to alternate from one instruction set to another as precisely and rapidly as possible. The physical activity included engaging in 30 to 45 minutes of aerobic exercise five to six days a week for 10 weeks. The goal was for participants to reach 70–85% of their expected maximum heart rate. To facilitate this, participants worked individually with a trainer for an hour each week to help ensure that adequate effort and technique were put forth.

Chang, Hung, Huang, Hatfield, and Hung (2014) also assessed whether an 8-week (twice a week, 90 minutes each) aquatic exercise intervention involving aerobic and coordinative exercise components improves restraint inhibition among children with ADHD between the ages of 5 and 10. Based on performance on a go/no-go task, it was concluded that this form of exercise facilitated restraint inhibition as it improved reaction time and accuracy. This finding is consistent with Smith and colleagues (2013) as well as Verret, Guay, Berthiaume, Gardiner, and Béliveau (2012), who found that physical exercise promotes response inhibition among children with ADHD. Next, Bruhn, McDaniel, and Kreigh, (2015) studied self-monitoring interventions for students with behavior problems including ADHD through a systematic review of the current literature. Self-monitoring interventions included promoting self-recordings that facilitate accuracy as well as training and reinforcement. The interventions determined that such methods promoted on-task behavior leading to task completion as well as decreased emotional outbursts. Prompt interven-



tions directed at reducing externalizing behavior among children with ADHD towards promoting functioning with their TDP are essential. Through reducing externalizing behaviors, intervention methods can focus on reducing the influence on previous externalizing behaviors on the present peer standing and functioning in a peer setting. This notion is congruent with Mrug and colleagues' (2007) results demonstrating that behaviors indicative of rule-following were predictive of advancement in sociometric ratings among children with ADHD. An alternative means to promote self-control and regulate the emotions of those with ADHD may be stimulant medication (De Boo & Prins, 2007).

Finally, Boyer, Geurts, Prins, and Van der Oord (2015) put together a planning intervention for adolescents with ADHD called solution-focused treatment (SFT). As opposed to focusing on where the adolescents were doing poorly, the focus centered on what the adolescents were doing well. Specifically, in each session the adolescent and therapist engaged in a discussion relating to a problem that was presented to the adolescent. To reach a solution, the therapist would ask a set of fixed questions, such as, "What are solutions you used in the past and what are other possible solutions to the problem?" (Boyer et al., 2015, p. 1080). Parents were also involved in this intervention and were asked identical questions about parental problems. In sessions with both the adolescents and the parents, the therapist did not tell them what to do or teach them skills; instead he or she led them to a solution using fixed questions. To facilitate this approach, motivational interviewing (MI) was included. Both neuropsychological measures of EF and parent and adolescent ratings of planning suggested that this approach led to improvement. In another intervention, to improve planning/organization among those with ADHD, Soorya and Halpern (2009) put together an 8- to 12-week psychosocial course through computerized attention-training programs (Stevenson, Whitmont, Bornholt, Livesey, & Stevenson, 2002). Unfortunately, the benefits of this program did not gener-

alize to day-to-day settings (Soorya & Halpern, 2009). In a manner similar to that used in working memory training, future research should assess whether approaches to improving EFs, other than computerized training, promote the development and maintenance of high-quality friendships among individuals with ADHD.

An example of an intervention that recognized the link between the development of EFs and friendships is by Hannesdottir, Ingvarsdottir, and Bjornsson (2017). This intervention examined the efficacy of a program called OutSMARTers that instructed children between the ages of 8 and 10 with ADHD on social skills, EFs, and self-regulation. The program involves 10 afternoon sessions lasting two hours per session twice a week for five weeks. A group of six children per class would work at different training stations with a predetermined order, and a reward system was put in place for following rules and finishing assignments. The therapist's role was to lead discussions centering on solving the problems that the children would encounter at each station. The stations included the Emotion Station, the Friendship Station, the Brain Training Station, the Stopping Station, and the Problem-Solving Station.

The Emotion Station encouraged the children to learn how to accurately identify facial expressions, when to hide one's feelings, relaxing and managing one's anger as well as how to go about interpreting situations that are ambiguous in a neutral or positive manner. The Friendship Station involved, for instance, entering into a discussion and practicing meeting other children for the first time, understanding non-verbal communication, compromising, and working together on a project. The Stopping Station had the children participate in different games designed to be fun but also to help them think prior to acting or speaking. Finally, the Problem-Solving Station had children solving problems they may encounter on a day-to-day basis with a focus on family, school, and friendship. To improve problem-solving abilities, the use of a mentor or counseling may be efficacious. This technique uses an

older child with developed problem-solving skills to provide feedback and guidance as well as to engage in discussion and practice through role-playing (Gentschel & McLaughlin, 2000). It was also helpful that OutSMARTers included a parent training program that consisted of instructions, exercises, and homework assignments. The OutSMARTers program led to improved social skills and emotion regulation at post-treatment of children with ADHD compared to the wait-list group. Most of the improvements were maintained three months later.

### Concluding Remarks

This article centered on examining the executive dysfunctions underlying unhealthy friendships among individuals with ADHD. It then described social skills and EF training interventions that may promote healthy friendships among this group. However, it is necessary to highlight, as previously noted, that not all individuals with ADHD are unable to form friendships. Specifically, many individuals with ADHD can develop and maintain high-quality friendships. This is corroborated by the findings of Marton and colleagues (2015) that children with ADHD fell within an average range for the number of friendships that were mutually agreed upon by a pair of friends. Moreover, this group of participants demonstrated stability in their friendships that was deemed satisfactory. One rationale for this is that those with ADHD who can maintain high-quality stable friendships have intact EFs. Nevertheless, it is hoped that more research will be directed at understanding friendships among individuals with ADHD from an EF perspective, as this may inform the design and implementation of friendship interventions that are much needed.

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