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Stand-Alone Social Skills Training for Youth with ADHD: A Systematic Review

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Abstract

Attention-deficit/hyperactivity disorder (ADHD) is one of the most common childhood disorders, and its symptoms and impairment in multiple domains begin in childhood and can extend into adulthood as well. Many youth with ADHD experience impairment in the social domain, including social skills deficits and difficulties in peer relationships. Social skills interventions, or social skills training (SST), have been developed to target social impairment and improve the social skills and functioning of youth with ADHD. Previous reviews of SST for youth with ADHD have provided mixed conclusions, with many including comprehensive, multilevel interventions for ADHD and none examining stand-alone SST for ADHD in a systematic way. The present review addresses this gap in the literature by providing the first known comprehensive, systematic review of SST alone, along with ratings of methodological rigor for each evaluation of stand-alone SST. The present review provides insight into the strengths and weaknesses in the existing SST literature, and provides suggestions for improvement and future directions for SST. An outline of "specific ingredients" and characteristics of effective SST are also presented, with the goal of providing both researchers and clinicians guidance for creating and implementing effective SST for youth with ADHD.

Keywords Social skills training · ADHD · Review · Children · Adolescents · SST

Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder of childhood characterized by symptoms of inattention, hyperactivity, and/or impulsivity, which persist across multiple domains and confer impairment in social, academic, or occupational functioning [American Psychological Association (APA), 2013]. An estimated 8.7–10.6% of children and adolescents meet diagnostic criteria for ADHD (APA 2013; Wolraich et al. 2014). Social impairment is particularly common among children with ADHD, with difficulties appearing early in childhood and both enduring and intensifying across development (see Antshel and Remer 2003; Ros and Graziano 2018). Social impairment has been associated with difficulties in other domains of functioning (e.g., academics) and with negative outcomes, including substance use (see Antshel and Remer 2003; Mikami & Henshaw 2006). Social skills training (SST) is a frequently-used approach to improve social functioning in children with ADHD (Mrug et al. 2001) that is often implemented in concert with other behavioral or psychosocial programming. However, previous reviews have reported mixed conclusions regarding the extent to which SST is a well-established treatment for children with ADHD. A key concern is that previous reviews have not differentiated treatment effects found in studies evaluating SST as a stand-alone approach to improve social functioning versus SST as part of a comprehensive multilevel intervention targeting multiple domains of functioning. Thus, conclusions reported in previous reviews may not be specific to SST but instead may reflect effects of various programming inclusive of SST. To clarify what is known about the SST evidence base, the present review provides a comprehensive,

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systematic review of studies evaluating SST as stand-alone intervention for social impairment in children with ADHD. Further, by assessing the methodological quality of these studies, conclusions reported in the present review are based on findings from studies with high methodological rigor.

Social Functioning Among Youth with ADHD

Social functioning is multifaceted and includes social skills, social information processing, and peer functioning (see Ros and Graziano 2018). It is well established that children with ADHD experience deficits across these domains of social functioning (King et al. 2009; Landau and Moore 1991; McConaughy et al. 2011; Ros and Graziano 2018). Children with ADHD often exhibit undesirable behaviors, such as disruptive and/or developmentally inappropriate social behaviors, and often display more negative behaviors (e.g., being impulsive, self-centered) and demonstrate less sharing, turn-taking, and other cooperative behaviors compared to children without ADHD (Barkley 2006; Wehmeier et al. 2010). Children with ADHD also frequently exhibit deficits in social cognition, perspective taking, and social problem solving, which may contribute to negative attributions regarding the intentions and social behaviors of peers (Barkley 2006; Sibleyet al. 2010). Although children with ADHD commonly *attempt to* initiate contact and social interactions with peers, these efforts are often perceived by peers to be immature, intrusive, and/or inept (Ronk et al. 2011). Further, children with ADHD are often unaware of their peers' perceptions of their social behaviors and are likely to overestimate their own social competence (Hoza et al. 2002; Owens et al. 2007).

Although children with ADHD experience deficits across multiple domains of social functioning, a recent meta-analysis found that these children have the greatest impairments in the peer functioning domain (Ros and Graziano 2018). Peer relationship difficulties among children with ADHD are well-documented in the literature (see Antshel 2009; Diamantopoulou et al. 2005; Strine et al. 2006), with evidence indicating that these relational problems are often serious (Pelham and Bender 1982; Wehmeier et al. 2010). In community samples of children, ADHD symptoms have been associated with greater peer dislike (Diamantopoulou et al. 2005; Pelham and Bender 1982), neglect, and rejection. Compared to their typically developing peers, children with ADHD have an almost threefold increase in parent-reported peer problems and a nearly tenfold increase in difficulties that interfere with friendships (Strine et al. 2006).

In addition to encountering peer neglect, rejection, and dislike, youth with ADHD are at an increased risk of experiencing a variety of friendship difficulties, including having fewer dyadic and mutual friendships, difficulty maintaining friendships, and friendships characterized by negative attributes and instability (Blachman and Hinshaw 2002; Gardner and Gerdes 2015; Hoza et al. 2005; Hoza 2007; MTA Cooperative Group 1999). Friendships that are present are often characterized by negative attributes. For example, among girls with ADHD, mutual friendships have been shown to be of lower quality and characterized by increased conflict and relational aggression (Blachman and Hinshaw 2002). Children with ADHD have also been shown to perceive their friendships as having few positive features and more negative features and to be less satisfying (Normand et al. 2011).

The social impairment experienced by children with ADHD is associated with a number of negative outcomes. Youth with ADHD tend to have fewer mutual friendships, and as a result, have fewer opportunities to benefit from the buffering effects that friendships may provide. Having a friend has been shown to be an important protective factor for children who may be at increased risk of having problems with peers (Rubin et al. 2008). For example, among girls 6–12 years of age attending a summer camp, low social competence was found to predict peer victimization at the summer camp (Cardoos and Hinshaw 2011); however, friendship was found to moderate the relation between behavioral risk and victimization for girls both with and without ADHD, and the presence of at least one mutual friend reduced the risk of experiencing victimization.

The peer problems experienced by children with ADHD also include bullying, both as the victim and the perpetrator. For example, Holmberg and Hjern (2008) found that fourth graders with ADHD were significantly more likely to bully other students as well as be bullied themselves. Bacchini et al. (2008) found that ADHD had a strong, direct association with bullying behavior in males and experiencing victimization in females, and that both bullies and victims were less well-accepted, compared to peers who were neither. They also found some similarities between bullies and victims, in that both had characteristics of poor problem-solving skills and emotion regulation ability (Bacchini et al. 2008).

Social Skills Training for Youth with ADHD

Given the multiple social deficits experienced by children with ADHD and the severity and pervasiveness of the outcomes associated with social impairment, there is a critical need for evidence-based treatments to improve social functioning in this population. SST is commonly used to address social impairment and to *attempt to* improve peer functioning in children with ADHD (Mrug et al. 2001). SST typically involves didactic instruction from an adult to a child about specific, target social skills and opportunities for the child to practice the new skills (e.g., role

plays, behavior rehearsal) and to receive reinforcement and feedback about his or her performance during rehearsal (Mrug et al. 2001).

Previous studies examining SST aimed at improving social functioning in children and adolescents have been the focus of a number of published reviews. Some reviews have concluded that SST is an efficacious or promising treatment for social impairment in children and adolescents with ADHD (de Boo and Prins 2007; Fabiano et al. 2009; Gardner and Gerdes 2015; Mikami et al. 2014), whereas others have found traditional, clinic-based SST to not be a well-established treatment approach (Evans et al. 2014; Pelham and Fabiano 2008). Importantly, however, the studies included in previous reviews have varied widely with regard to methodology as well as intervention content and implementation.

A key concern is the extent to which the conclusions reported in previous reviews reflect findings that may be attributed to SST rather than other aspects of the treatment. Although SST may be implemented as a stand-alone treatment to improve social functioning in children with ADHD, previously published reviews have included studies that have implemented SST as part of a broader intervention designed to address multiple domains of functioning that are commonly impaired in this population (e.g., social skills, academic performance, organizational skills). For example, of the six interventions examined by de Boo and Prins (2007), only three were implemented without additional programming. Of the studies included in a comprehensive meta-analysis of 174 studies evaluating behavioral treatments for youth with ADHD conducted by Fabiano et al. (2009), only three studies evaluated SST as stand-alone intervention. A select number of studies implementing SST without additional treatment components were also included in reviews by Mikami et al. (2014) and by Gardner and Gerdes (2015) but were not differentiated from multilevel SST interventions.

While including SST as part of a comprehensive, multilevel intervention may be beneficial for children/adolescents with ADHD, it is difficult to ascertain the extent to which any observed improvements in social functioning should be attributed to SST rather than to the combined effects of the overall intervention. Thus, there remains a need to better understand the extent to which SST contributes to improved social functioning and to identify study features (e.g., participant characteristics, intervention components) that may facilitate best outcomes in children with ADHD when implemented in the absence of additional programming that specifically targets outcomes other than social skills/functioning. To advance this goal, it is important to differentiate studies that implemented SST as part of a broader, multilevel intervention from those in which SST was as a stand-alone treatment.

The Present Study

The present study is a comprehensive and systematic review of SST programs aimed at improving social functioning in children/adolescents with ADHD. The goal of this review is to elucidate the study features and conditions under which SST may facilitate best outcomes in this population. To meet this objective, studies included in the present review are characterized as "stand-alone SST," indicating that the intervention was aimed at improving social behaviors and was not implemented in conjunction with additional, non-pharmacologic treatments designed to enhance other areas of functioning (e.g., academic performance). This narrowed focus eliminates the potential for additional non-pharmacological treatments to introduce spill-over effects on social outcomes.

Given the population of interest in the present review (i.e., children and adolescents with ADHD), it was anticipated that concurrent pharmacological treatment (i.e., prescription medication) for ADHD would not be uncommon in studies that were otherwise eligible for inclusion in the present review as a stand-alone SST. Although prescription medication for ADHD is a well-validated treatment for the core symptoms of ADHD, there is limited evidence to support its efficacy to improve peer relationships (Hoza et al. 2005; MTA Cooperative Group 1999). As expected, the majority of studies selected for inclusion in the present review included children and adolescents who were taking a prescription medication for ADHD at the time of their participation (see Study Characteristics). Excluding these studies would render it impossible to conduct a meaningful review of the literature. Therefore, as discussed further below, studies that included participants who received a pharmacological treatment for ADHD in conjunction with SST remained eligible for inclusion in the present review. When possible, the potential role of pharmacological treatment on SST outcomes is discussed.

Consistent with other reviews of psychosocial and behavioral intervention research (Kim 2008; Metzger et al. 2013), the methodological rigor of studies included in the present review was evaluated based on criteria established by the APA Task Force on Promotion and Dissemination of Psychological Procedures (1995) to assess empirically validated programs. Components of the SST interventions tested in the studies included in this review are described and features of effective SST are identified. Conclusions derived in this review may guide future research, with the goal of supporting effective SST implementation and identifying promising SST components to further enhance social functioning in children and adolescents with ADHD.

Method

Literature Search

A comprehensive literature search was completed using PsycINFO and Medline to identify intervention studies examining SST for children and adolescents with ADHD conducted through 2017. Keyword search terms included *social skills, ADHD, training*, and *intervention*. Database filters were used to exclude dissertations and limit search results to studies published in English and in peer-reviewed journals. References of selected articles were reviewed to identify additional relevant studies.

Inclusion and Exclusion Criteria

Identified studies were selected for inclusion in the present review if the following criteria were satisfied. (1) Studies were required to examine SST as a stand-alone intervention for children and/or adolescents (4–18 years of age) with ADHD. Studies were considered for inclusion in the present review regardless of whether the intervention content was delivered directly to child/adolescent participants, indirectly via a parent or other familiar adult (e.g., teacher), or some combination of these approaches. (2) Study samples had to include children/adolescents with an ADHD diagnosis. Samples with only children/adolescents diagnosed with ADHD as well as those comprising both children/adolescents with and without ADHD met this criterion. Studies were considered for inclusion regardless of whether participants' ADHD diagnostic status was based on a reported previous diagnosis or determined following an assessment of ADHD symptoms as part of study procedures. As previously noted, study inclusion was also not contingent on participants' use (or non-use) of stimulant and/or non-stimulant medication for the treatment of ADHD symptoms. (3) Studies had to examine child/adolescent participants' social skills and/or social functioning as a post-treatment outcome using quantitative measures.

Studies were excluded from the present review if the intervention did not aim to improve social relationships in children/adolescents with ADHD using SST or if the intervention addressed this aim using a treatment approach other than SST (e.g., a token system to reinforce good sportsmanship). Studies were also excluded if SST was not implemented as a stand-alone intervention, but instead was part of a multilevel treatment approach (e.g., programming to improve academic skills and working memory delivered in conjunction with SST) or that otherwise made it difficult or impossible to isolate SST treatment effects. Given the potential for differential SST treatment effects in the presence of a comorbid developmental delay, studies with samples comprising children with comorbid autism spectrum disorder (ASD) or pervasive developmental delay were excluded from the present review. However, studies examining SST effects in participants with other comorbid diagnoses, such as oppositional defiant disorder (ODD), conduct disorder, anxiety, depression, learning disorder, and tic disorder, were not subject to exclusion unless the presence of the comorbidity was the definitional feature of the study population of interest rather than ADHD. Studies in the present review were not excluded based on whether or not the child participant was taking medication to treat ADHD. Previous research has yielded different conclusions regarding the extent to which medication may facilitate intervention effects in children receiving SST. For example, Huang et al. (2015) reported that, across conditions, greater medication compliance was associated with better outcomes on some behavioral and social skills measures. However, other studies have found SST to be equally effective for children taking and not taking medication to treat ADHD (MTA Cooperative Group 1999; Mikami et al. 2010b). While some questions remain about the potential role of ADHD medication on SST treatment outcomes, it is clear that excluding children on ADHD medication reduces the external validity of the study, and altering children's medication status could create difficulties in numerous other domains.

Methodological Rigor Rating

The methodological rigor of each study was determined by the first author according to a coding system that has been applied in previously published reviews of psychosocial and behavioral interventions (Kim 2008; Metzger et al. 2013) and that is based on standards set forth by the APA Task Force on Promotion and Dissemination of Psychological Procedures (1995). Each study was assessed for the presence or absence of six criteria: (1) comparison with other treatments, standard services, waitlist control, or no-treatment control, (2) definition of a specific problem and a specific population, (3) randomization of the sample, (4) large sample size ($n > 25$), (5) reported use of treatment manuals or curriculum, and (6) reported use of validated and reliable outcomes measures. Based on the number of criterion met, each study was scored 0–6 and ranked into one of four rigor type (RT) categories to reflect overall methodological rigor. Studies missing three or more elements of rigor were labeled RT-1 programs, indicating the least methodological rigor. Programs missing two elements of methodological rigor were labeled RT-2 programs. Programs that met all but one of the rigor criteria were labeled as RT-3 programs. Programs meeting all of the rigor criteria were labeled as RT-4 programs, indicating the greatest methodological rigor.

Results

Literature Search

Details of the search results are provided in Fig. 1. The majority of excluded articles did not report an SST for children/adolescents with ADHD. Articles that described an SST for children/adolescents with ADHD were excluded for the following reasons: SST was not implemented as a stand-alone intervention ($n = 26$), social skills were not assessed as a treatment outcome measure ($n = 3$), or social skills were not assessed using a quantitative measure ($n = 1$).

In total, 24 articles met criteria for inclusion in the present review. Together, these articles provide information about 16 distinct SST interventions. Primary outcomes of these interventions are described in 16 of the 24 articles. The remaining eight articles describe preliminary and/or follow-up results for the 16 interventions. These secondary articles are referenced when warranted to supplement results reported in the corresponding primary article. Information regarding study characteristics, outcomes, and methodological rigor of each intervention is presented in the Online Supplemental Table (study characteristics and outcomes) and in Table 1 (rigor ratings) and summarized in the sections below based on descriptions provided in the 16 primary outcome papers. When relevant, results derived from the eight secondary studies are presented in conjunction with primary outcomes.

Study Characteristics

Participant Samples

Studies included in the present review had total sample sizes ranging from three to 124 child/adolescent participants. The majority (56%) had a total sample size of more than 25 participants; however, only five of the 16 studies included more

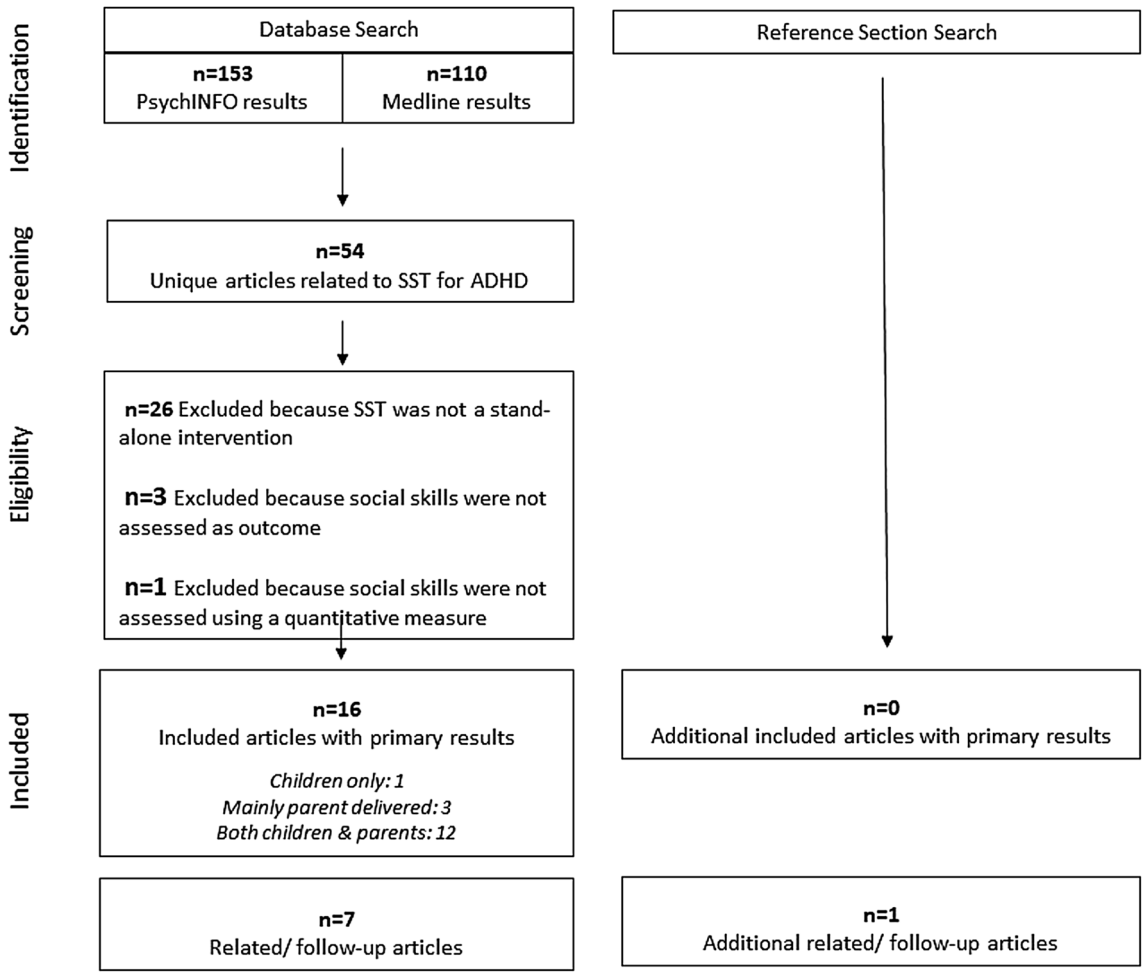

Fig. 1 Overview of literature search process and results

Table 1 Intervention elements and methodological rigor of stand-alone SST interventions

	Intervention elements						Rigor	
	Comparison or control	Problem and population	Randomized sample	Sample size > 25/group (total *N*)	Manualized treatment	Reliable and valid measures	RS	RT
SST targeting children exclusively								
Fenstermacher et al. (2006)*	No	Yes	No	No (4)	Yes	Yes	3	1
SST targeting parents								
Mikami et al. (2010b)*[A]	Yes	Yes	Yes	Yes (124)	Yes	Yes	6	4
Colton & Sheridan (1998)*	No	Yes	No	No (3)	Yes	Yes	3	1
Wilkes-Gillan et al. (2016a)*[B]	No	Yes	No	No (18)	Yes	Yes	3	1
SST targeting children and parents								
Pfiffner & McBurnett (1997)*	Yes	Yes	Yes	No (27)	Yes	Yes	5	3
Wilkes-Gillan et al. (2016b)*	Yes	Yes	Yes	No (29)	Yes	Yes	5	3
Antshel & Remer (2003)	Yes	Yes	Yes	Yes (120)	Yes	Yes	6	4
Storebø et al. (2012)[C]	Yes	Yes	Yes	Yes (56)	Yes	Yes	6	4
Frankel et al. (1997)*	Yes	Yes	NR	Yes (74)	Yes	Yes	5	3
Hantson et al. (2012)*	Yes	Yes	No	No (48)	Yes	Yes	4	2
Huang et al. (2015)*	Yes	Yes	No	Yes (97)	Yes	Yes	5	3
Schuck et al. (2013)*	Yes	Yes	Yes	No (24)	Yes	Yes	5	3
Corkum et al. (2010)*	No	Yes	No	No (16)	Yes	Yes	3	1
Gardner et al. (2015)*	No	Yes	No	No (20)	Yes	Yes	3	1
Sheridan et al. (1996)*	No	Yes	No	No (5)	Yes	Yes	3	1
Wilkes et al. (2011)*[D]	Yes	Yes	No	No (28)	NR	Yes	3	1

Methodological rigor ratings are based on the presence or absence of 6 intervention elements, with 1 point given for each element present

RS = Rigor score: Total intervention elements present (range 0–6); RT = Rigor type: Category indicating overall methodological rigor based on the total element count (1 = 0 to 3 elements; 2 = 4 elements; 3 = 5 elements; 4 = 6 elements); NR = Not reported.

*Indicates significant outcomes

Superscripts denote the availability of additional intervention information/outcomes: [A]Lerner et al. (2011); Mikami et al. (2010a), [B]Cantrill et al. (2015); Wilkes-Gillan et al. (2015); Wilkes-Gillan et al. (2016c), [C]Storebø et al. (2011; 2015), [D]Docking et al. (2013)

than 25 participants per condition. Three studies had a total sample size of five or fewer participants.

Sample Demographics

Samples were comprised of children/adolescents ranging in age from five to 16 years. In the majority of studies (88%), participants were 12 years of age or younger,

and in all studies, the youngest participant was less than 12 years of age. With the exception of one study conducted in Taiwan, 12 of 13 studies that reported participant race included samples that were predominantly white (55–100%). There was a male preponderance in all study samples, with percentages of boys ranging from 63 to 100%. The majority (88%) of studies described the socioeconomic status (SES) of the participant sample, but the metric of SES reported varied (e.g., parental education/qualifications, social status). Studies were largely conducted with samples that were predominantly characterized as average to above average SES, though one study was inclusive of a wide range of SES with roughly equally mixed composition and a few studies were predominantly lower SES. All studies included children/adolescents with ADHD.

Prescription Medication for ADHD Symptoms

The majority of studies (88%) reported including children and/or adolescents who were taking a prescription medication for the treatment of ADHD symptoms at the time of participation. Ongoing pharmacological treatment was reported as an exclusionary criterion in one study, and one study did not indicate whether or not prescription medication was an eligibility criterion or otherwise provide information about the medication status of participants. Of the 14 studies that reported the inclusion of participants receiving a concurrent pharmacological treatment, all but one indicated what percentage of participants was taking a prescription medication. In four of the studies, 100% of the participants were taking a prescription medication either as a continuation of their standard pharmacological treatment for ADHD ($n=3$) or as a requirement for participation in an intervention targeting children with ADHD but without a prior pharmacological treatment history. The percentage of participants taking an ADHD medication in the remaining studies ranged from 25 to 93%. Parents in those studies were asked to maintain their child's medication status for the duration of their participation.

Study Design

The majority of studies (63%) included two or more conditions, including at least one treatment group and one comparison group (e.g., standard treatment, waitlist, or no-treatment control). The remaining studies used a single-group design. Although the majority of single-group studies (71%) included only participants with ADHD, two studies had samples that included both children with and without ADHD allowing for within-group post-treatment comparisons.

SST Interventions

In all studies included in the present review, the primary targets of change were children/adolescents with ADHD who were experiencing or at risk of having social difficulties. Features of each SST intervention that were intended to effect change varied across studies, including the agents of change, intervention content, and the format, frequency, and duration of intervention delivery.

Agents of Change Agents of change are individuals with the potential to influence factors that are thought to play a role in the problematic behavior that an intervention aims to modify. In all but one intervention, parents played an important role as agents of change. In most of these studies, parents completed SST sessions with an intervention facilitator who was typically a doctoral student in psychology or other professional with extensive training. Intervention content was delivered to parents and to child/adolescent participants concurrently in 12 studies and to parents and/or teachers without direct child/adolescent participation in three studies. One study targeted children exclusively using a computer-facilitated SST program.

Intervention Content There was considerable variability in the amount of detail reported regarding the content of the SST interventions. In general, however, content descriptions indicated a nearly exclusive focus on macro-level social skills (e.g., perspective taking, managing and expressing difficult emotions, assertiveness, social problem solving). Four studies noted the inclusion of some micro-level skills, including techniques to initiate conversations with peers (e.g., volume, smiling), eye contact, body cues, and other non-verbal communication. The content included in parent training generally fell into one of the following categories: general parenting considerations, specific parenting/behavior management strategies, topics regarding children's social skills specifically, and topics related to ADHD.

Intervention Delivery: Format, Frequency, and Duration Across all studies, treatment duration ranged from 2 to 12 weeks. The majority of interventions (69%) lasted for at least 8 weeks. The most common delivery format was small groups of 4–9 children, with concurrent group parent training. Participants in these studies typically met weekly for a 60–90 min session.

Assessments

A key issue in the evaluation of SST programs is the selection of appropriate outcome measures to adequately capture intervention effects. The ostensible aim of SST is to improve social behaviors that have been identified as important for

effective interpersonal interactions. In practice, however, operational definitions of target social behaviors vary across interventions and this variability is reflected in the diverse array of outcome assessments used to evaluate program efficacy across the studies included in the present review. The measures used in the included studies assessed treatment outcomes related to child/adolescent social skills/functioning and included both questionnaires and direct observations by trained observers. Many studies used multiple measures and the majority (69%) collected data from at least two sources (e.g., parent-, teacher-, and/or child/adolescent self-report). The most commonly-used measures were the Social Skills Rating System (SSRS; Gresham and Elliot, 1990) and the Child Behavior Checklist (CBCL; Achenbach 1991). The most commonly-used observational assessment was the Test of Playfulness (ToP; Bundy 2004), a valid and reliable measure for children (both with and without disabilities) of ages 15 months–10 years (Bundy et al. 2001). None of the studies used sociometric ratings.

Administering outcome assessments to multiple respondents who represent the different contexts in which children's social behavior occurs (e.g., home, school) provides important information about the extent to which treatment effects are perceived by individuals other than study participants and are apparent outside the delivery setting, indicating generalization of effects across contexts. The benefits of multiple respondents notwithstanding, previous research has demonstrated a great deal of divergence between children's self-reported social skills and direct measures, such as behavioral observation and behavior rating scales (Merrell 2001). This divergence may reflect the tendency for children with ADHD to overestimate their social skills and underscores concerns about the validity of self-reported social skills in this population.

Methodological Rigor

Detailed information about the methodological rigor of studies included in the present review is provided in Table 1. Half (50%) of the studies met criteria for categories RT-3 and RT-4, indicating high methodological rigor. Studies in the RT-4 category ($n=3$) included all six elements of methodological rigor. Studies in the RT-3 category ($n=5$) were lacking one of the six methodological rigor elements, with adequate sample size and randomization being most commonly absent. Although all of the studies in the RT-3 and RT-4 categories included a control group (no-treatment, waitlist, or standard treatment), only six of these studies used random assignment. The remaining studies met criteria for either the RT-1 ($n=7$) or RT-2 ($n=1$) category, indicating low methodological rigor. All of the studies in the RT-1 category lacked a control group and randomization, and in all but one study, the total sample included fewer than 25 participants.

Treatment Outcomes

The majority of studies included in the present review reported at least initial evidence to support the efficacy of stand-alone SST aimed at reducing social impairment in children with ADHD (see Table 1). Conclusions in these studies were largely based on the statistical significance of post-test outcomes. The potential for these studies to strengthen evidence-based SST notwithstanding, statistically significant outcomes may not provide sufficient evidence to conclude that SST is efficacious treatment for social impairment in children with ADHD. Other pieces of information, including the maintenance and generalization of treatment effects, are important considerations. However, a number of studies reported findings that were inconsistent across respondents (e.g., parent, teacher, peer) and that often indicated limited generalization of treatment effects across contexts (e.g., Huang et al. 2015; Mikami et al. 2010b; Pfiffner and McBurnett 1997). Further, findings showed maintenance of effects at a follow-up assessment in some studies (Wilkes-Gillan et al. 2016a), whereas in others, treatment effects were not maintained at follow-up (e.g., Huang et al. 2015; Pfiffner and McBurnett 1997).

Methodological concerns may contribute to some of the inconsistencies across studies. High methodological rigor fosters replicability, which affords opportunities for comparison of results across studies (Gingerich and Eisengart 2000; Kim 2008). Of the three studies with the highest methodological rigor, only one found sufficient evidence to support the efficacy of SST for children/adolescents with ADHD. The remaining 13 studies all found sufficient evidence to support the efficacy of SST, but were rated as being either in the second highest ($n=4$) or in the lowest ($n=7$) of the four rigor rating categories. Statistically significant outcomes and clinically relevant findings of studies with the highest methodological rigor are further reviewed in the following sections.

Studies with High Methodological Rigor and Evidence of Efficacy

Only one study that met criteria for the highest methodological rigor rating category reported finding initial evidence to support the efficacy of an SST pilot intervention targeting parents as primary agents of change to improve outcomes in children with ADHD (Mikami et al. 2010b). Parents of children with ADHD were randomized to either parental friendship coaching (PFC) or a no-treatment control group. Parents of typically-developing children without ADHD served as a no-treatment comparison group. PFC

was delivered exclusively to parents (i.e., without a child treatment component) who received training to be a friendship coach for their child with ADHD during eight weekly, 90-min group sessions.

Mikami et al. (2010b) reported that, compared to controls, SST predicted post-test improvements in children's social skills, playdate quality, and social acceptance. These treatment effects were qualified by significant interactions with demographic covariates, including ODD comorbidity, medication status, and gender. SST-related improvement in social skills was evidenced by parent-reported SSRS (with a small to medium effect size) but not teacher-reported SSRS. However, a significant interaction between treatment and child ODD was found, indicating positive effects of SST on teacher-reported SSRS for children without ODD but not those with this comorbidity. In contrast, the effects of SST on playdate quality, as indicated by reduced parent-reported conflict and disengagement, were strongest for children with ODD. SST effects on social acceptance were indicated by teacher-reported increases in liking/acceptance and decreases in dislike/rejection by classroom peers. Significant interactions indicated that SST effects on dislike/rejection were stronger for girls than for boys and for children with ADHD who were taking medication than those who were not. Despite these interactions, Mikami et al. (2010b) concluded that, overall, the SST was equally effective across ODD comorbidity, medication status, and gender subgroups. Further, preliminary findings showed that parent-reported gains were maintained at a 1-month follow-up assessment. Analyses of secondary outcomes examined the importance of parental behaviors in relation to child social functioning and SST outcomes. For example, at baseline, observed parental criticism during child peer interaction was associated with lower parent-reported social skills among children with ADHD (Mikami et al. 2010a). At post-test, SST was found to decrease observed parental criticism, which mediated improvements in teacher-reported social acceptance (Mikami et al. 2010b). In a separate analysis, Lerner et al. (2011) provided preliminary evidence suggesting the importance of the parent–therapist alliance for changes in parent behaviors and child outcomes in this SST.

Three additional studies tested the efficacy of SST using a randomized, controlled trial design but did not have an adequate sample size to meet criteria for the highest rigor rating category (Pfiffner and McBurnett 1997; Schuck et al. 2013; Wilkes-Gillan et al. 2016b). Nonetheless, these studies, which were categorized in the second highest methodological rigor type (RT-3), reported promising results that warrant mention. First, Pfiffner and McBurnett (1997) randomly assigned children with ADHD to one of the three conditions: child-only group SST, child SST plus parent generalization training (SST-PG), or a waitlist control group. Outcomes included composite scores representing parent- and teacher-rated child social skills and child disruptive behavior as well as child self-reported social skills knowledge. Planned comparison of the pooled treatment groups (i.e., SST and SST-PG) versus control revealed a statistically significant improvement in social skills at post-test based on parent report (with a large effect size). In contrast, the pooled treatment versus control comparison was not significant for teacher-reported social skills at post-test, though the effect size was moderate and in the expected direction. Differences between the two treatment groups in parent- and teacher-reported social skills were not significant at post-test (and effect sizes were in the small to medium range). However, children in SST-PG showed significant improvement in parent- and teacher-reported social skills from baseline to post-test, with gains sustained at a 3–4-month follow-up (with large effect sizes). Similarly, children in SST-only showed significant improvement in social skills from baseline to post-test and at follow-up based on parent report (with large effect sizes) but not teacher report. Tempering the finding that parent-reported social skills improvements were maintained at follow-up for both treatment groups, parent-reported social skills were also found to increase from baseline to follow-up for children in the control group. Pfiffner and McBurnett (1997) also examined the clinical significance of their findings using reliable improvement and recovery to non-dysfunctional states. Pooled treatment groups had higher rates of both reliable improvement and recovery at post-test and follow-up on parent ratings and at post-test for teacher ratings. Although teacher ratings at follow-up suggested maintenance of pooled SST effects, a number of control participants showed spontaneous recovery. Despite having high methodological rigor and producing statistically significant and clinically meaningful results, the sample size was small ($n = 27$), particularly given that participants were randomized to one of the three conditions. Further, the high level of compliance found in this study may have been unique to the characteristics of the study sample (e.g., high SES) but not representative of the broader population of children with ADHD.

Another RT-3 that randomized participants was conducted by Schuck et al. (2013) who used a treatment group versus treatment plus canine-assisted intervention (CAI) group with participants of each group assigned to either waitlist control or immediate treatment (i.e., four conditions). Children attended two group-based sessions totaling 4.5 h per week for 12 weeks. Group-based parent training sessions met one time per week for a total of 2 h during the time allotted for one of the child sessions. Results indicated that both the CAI and non-CAI groups had significant improvement in parent-reported social skills and 'prosocial orientation behaviors,' as well as reduction in problematic behaviors, at post-treatment compared to the waitlist control

groups. A methodological limitation of this study was the small sample size ($n = 24$).

The third RT-3 that randomized participants was conducted by Wilkes-Gillan and colleagues (2016b) who tested the efficacy of a play-based intervention to improve social functioning in children with ADHD. Participants were randomized to either treatment or a waitlist control. Parents and their children attended seven weekly sessions in which child dyads (i.e., child with ADHD and non-ADHD familiar peer or sibling) engaged in free play in a therapist-facilitated clinical setting. Video feedback was used during clinic play sessions to help instruct children and parents. The intervention also incorporated a home-based manualized video program (described in Wilkes-Gillan et al. 2016a) that parents and children watched and discussed together as well as at-home play dates for the child dyad. Results showed that children with ADHD who received the intervention had significantly greater improvement in overall play skills at post-test based on ToP scores (with large treatment effect sizes) compared to the waitlist control group. Significant gains in overall ToP scores at post-test were maintained at a 1-month follow-up.

Studies with High Methodological Rigor and Limited Evidence of Efficacy

Two interventions that were categorized as having high methodological rigor did not produce expected social skills improvements (Antshel and Remer 2003; Storebø et al. 2012). Antshel and Remer (2003) examined outcomes in an SST treatment group versus a no-treatment control group. Participants were randomized within diagnostic subtype to condition. Children assigned to the treatment group participated in weekly SST, whereas parents attended sessions scheduled periodically throughout the intervention to assess progress and/or discuss behavior management techniques. Intervention effects were evaluated using parent- and child-reported SSRS. Significant increases in parent- and child-reported assertion were observed at post-test and 3-month follow-up for children in the treatment group compared to control. No other effects reached statistical significance. Noting that group differences may obscure important individual effects, Antshel and Remer examined the clinical significance of their findings by calculating a reliable change index (RCI; Christensen and Mendoza 1986). This statistic was used to compare parent- and child-reported SSRS composite scores at baseline and 3-month follow-up based on the percentage of participants with each ADHD subtype (ADHD-Inattentive and ADHD-Combined) showing improvement following SST. Both parent and child report indicated no change in SSRS scores for the majority of children with ADHD-I (65% and 70%, respectively) and with ADHD-C (90% and 50%, respectively). Only a minority (30%) of children showed reliable improvement based on parent report, regardless of ADHD subtype. Further, 15% of children with ADHD-I had worse parent-reported SSRS ratings at follow-up than at baseline. Thus, Antshel and Remer concluded that these results did not provide strong evidence to support the efficacy of SST, particularly among children with ODD (which accounted for about 44% of the sample). It is worth noting that when ODD diagnostic status was covaried, significant intervention effects were found for several SSRS subscales, including parent-reported assertion, cooperation, and responsibility and child-reported self-control and empathy. These results suggest that this SST intervention had more apparent benefit for children without comorbid ODD.

Storebø and colleagues (2012) compared SST with parent training plus standard treatment (i.e., ADHD medication and psychoeducation) to a standard treatment control. Significant improvements in social functioning were found for both treatment and control groups, possibly reflecting the beneficial effects of the standard treatment and regression to the mean. Teachers were unaware of condition and served as the only source of social functioning outcome data using the Conner's 3 and Conner's Comprehensive Behavior Rating Scale (CBRS; Waschbusch and Willoughby 2008). Gathering data from multiple sources may have yielded more nuanced information and revealed group differences not captured by teacher report alone. Further, the social skills groups were relatively large, comprising 12–16 children each compared to groups of 4–9 children in many other studies included in this review.

Summary

Although the majority of studies included in the present review found statistically significant outcomes to support SST efficacy, findings were often inconsistent across respondents and not maintained at follow-up. Focusing on studies with high methodological rigor revealed a more nuanced view of SST that highlights the importance of balancing compliance and generalizability, considering the presence of comorbid disorders, and utilizing reliable and valid outcome assessments. These studies also shed light on the potential role of participants' ADHD medication status and bring attention to the role of parents in SST. With regard to ADHD medication status, four of the six studies with high rigor and a randomized sample (described above) included participants who were taking an ADHD medication prior to and for the duration of the intervention (Antshel and Remer 2003; Mikami et al. 2010b; Pfiffner and McBurnett 1997; Wilkes-Gillan et al. 2016b). In these studies, the percentage of children with ADHD who were taking an ADHD medication at the time of the intervention ranged from 44 to 92%. One study excluded participants with a history of ADHD medication treatment but required the initiation of a supervised medication treatment plan as

part of the intervention (Storebø et al. 2012), and one study excluded children who were taking an ADHD medication at the time of the intervention (Schuck et al. 2013). Three of the studies that allowed participants to take ADHD medication reported some positive intervention effects (Mikami et al. 2010b; Pfiffner and McBurnett 1997; Wilkes-Gillan et al. 2016b). Two of these studies examined medication status as an intervention moderator but found no compelling evidence to suggest differential treatment effects (Mikami et al. 2010b; Wilkes-Gillan et al. 2016b). Both studies that reported no expected social skills improvements (Antshel and Remer 2003; Storebø et al. 2012) allowed concurrent ADHD medication treatment, suggesting that medication status did not have a beneficial effect on intervention outcomes. Taken together, these studies do not yield compelling evidence to indicate that SST intervention outcomes differ by ADHD medication status. However, additional empirical research is warranted to clarify the role of pharmacological treatment for ADHD on treatment outcomes in the context of SST.

The summary of studies with high methodological rigor also brings attention to the role of parents in SST for children with ADHD. Although parents played an important role in all six of the high rigor studies, Pfiffner and McBurnett (1997) was the only study in the present review that examined outcomes of SST with and without parent training to isolate the effects of the parent component. Findings in that study support the role of parent training in SST for parent-reported outcomes but not for teacher-reported outcomes. Thus, additional work is need to identify best practices for parent training to improve children's social functioning across domains.

Discussion

To advance what is known about SST as an effective treatment for social impairment in youth with ADHD, the present review focused on studies that implemented SST as a stand-alone intervention (i.e., not combined with other non-pharmacological treatments). The majority (88%) of the 16 SST interventions reviewed were found to improve various aspects of social functioning in children/adolescents with ADHD. However, findings were often inconsistent across respondents and not maintained at follow-up assessments. Further, evidence to support the efficacy of SST was limited among studies with the highest methodological rigor, with only one study finding sufficient evidence to conclude that SST was efficacious for children/adolescents with ADHD. Finally, although the majority of studies included participants who were taking a prescription medication for ADHD, the results did not yield compelling evidence to indicate that SST intervention outcomes differed by participants' medication status.

These limitations notwithstanding, the results reported in the studies included in the present review suggest that stand-alone SST is a promising approach to improve social functioning in children and adolescents with ADHD. These studies have the potential to guide future SST development and refinement by providing a foundation upon which future SST may be constructed. However, given that this collection of studies is characterized by considerable heterogeneity with regard to participant samples, methods (e.g., study design, intervention content, and delivery), and outcome assessments, it is important to identify and optimize features of studies that demonstrated positive treatment effects. To this end, the following sections present a summary of elements that were common across effective SST interventions and describe areas for methodological improvement (see also Table 2).

Components of Effective SST Interventions

Despite the methodological heterogeneity of the studies included in the present review, some elements were common across many of the effective interventions. Together, these elements represent important considerations in SST development and implementation. One key consideration for SST is the inclusion of parent training. Findings summarized in the present review suggest that parent involvement in SST is beneficial. The most helpful type of parent involvement may be a parent training component that incorporates social skills-focused content in combination with positive parenting and behavioral management strategies. These skills should be presented in the context of the importance of the parental role in the development of children's social skills and peer relationships, with the expectation that parents will act as their children's social skills educator or "coach" long after SST ends. Studies included in the present review commonly implemented parent training sessions and child social skills groups concurrently, which had the practical advantage of maximizing the time parents would likely spend waiting for their children to complete the group.

Another important consideration is the target population of the SST intervention. Although studies in the present review focused on social functioning in children with ADHD, various inclusion and exclusion criteria were applied to further define participant samples (e.g., gender, age, presence of comorbid diagnoses, prescription ADHD medication status). Almost all studies excluded children with ASD or intellectual impairment, but many samples included children with other comorbidities (e.g., ODD). Several studies tested for differences among participant subgroups and found some evidence of differential treatment effects. For example, prescription ADHD medication was associated with better

Table 2 Common characteristics of effective stand-alone SST interventions to improve social functioning in children with ADHD

Duration and format		
Weekly 60–90 min sessions for 8–12 weeks		
Small group format (4–9 children per group)		
Concurrent parent training sessions		
Skills and vocabulary taught to parents mirrored child content		
Parents given feedback on child's performance		
Implementation	Child sessions	Parent sessions
Content	Problem solving and communicating	General parenting and behavior management
	Assertiveness	Importance of positive parent–child relationship
	Conflict resolution	Positive reinforcement
	Negotiating/compromising	Discipline and time-out
	Dealing with frustrating situations	Problem solving
	Accepting undesirable outcomes and consequences	Social skills training
	Responding to teasing/provocation	Psychoeducation about child social behavior
	Dealing with anger	Importance of social skills/status
	Avoiding arguments/trouble	Importance of child friendships and creating space, time, and resources for play dates
	Self-awareness	Strategies to support child's social skills
	Self-control	Teaching/prompting/reinforcing child's social skills
	Identifying/expressing emotions	Identifying child's specific needs
	Thinking of others	Tailoring strategies to support child's emerging skills
	Perspective taking	Providing positive feedback to appropriate peer social interactions
	Identifying/responding to/empathizing with others' emotions	Encouraging friendships
	Being helpful/supporting others' needs	ADHD-specific topics
	Responding to others' verbal and non-verbal cues	ADHD symptom identification and psychoeducation
	Positive interpersonal behaviors	Pharmacological treatments
	Sharing/reciprocity/cooperation	
	Group entry/joining in	
	Praising/complimenting peers	
	Initiating/maintaining conversation	
	Sportsmanship	
	Taking turns	
	Following rules/directions	
Process	(1) Review of previous week's assigned homework	(1) Review of previous week's homework; troubleshooting
	(2) Introduction of new target social skill, along with discussion of how, when, and why to use skill	(2) Skill(s) of the week didactic instruction using the same vocabulary as children to promote generalization
	(3) Therapist modeling of new target social skill	(3) Assignment of homework to practice the skill of the week with their children
	(4) Behavior rehearsal and role plays of new target skill	
	(5) Free play, with positive reinforcement of target social skill(s) use	
	(6) Assignment of homework to practice the skill of week	

Table 2 (continued)

Outcome evaluation	
Measures	Social skills rating system (SSRS)[a]
	Child behavior checklist (CBCL)[b]
	Test of playfulness (ToP)[c]
Data sources	Parent-, teacher-, or child self-report
	Researcher observational ratings
Assessment schedule	Baseline and post-treatment, with 1–6-month follow-up

[a]Gresham and Elliot (1990)

[b]Achenbach (1991)

[c]Bundy (2004)

outcomes on some behavioral and social skills measures (Huang et al. 2015; Mikami et al. 2010b). Overall, however, there was not compelling evidence to indicate that SST was not equally effective in children with and without prescription medication for ADHD. Studies included in the present review also found some evidence to suggest that intervention outcomes may differ in the presence of a comorbid disorder, though the direction of the observed effects was inconsistent both within and across studies. Whereas Antshel and Remer (2003) did not observe treatment benefits for children with comorbid ODD, Mikami et al. (2010b) found both positive and negative differential treatment effects associated with this comorbidity depending on the respondent (i.e., parent vs. teacher).

Inconsistent results such as these may reflect, in part, methodological differences that shape the composition of the participant sample in each study (e.g., recruitment approach, inclusion/exclusion criteria). For example, recruitment procedures that rely on referrals from providers in clinical settings rather than a broader, more inclusive recruitment approach may yield a sample comprised of participants with greater impairment and comorbidity. Such a sample may present with a greater need for social intervention (and thus room for improvement) but may also present challenges not addressed by and that may interfere with SST. Conversely, study recruitment that targets children with ADHD but that does not assess peer difficulties or other social impairments may be insufficient to identify a sample that has the potential to benefit from SST. Therefore, it is important to identify relevant comorbidities, prescription medications, or other individual characteristics (e.g., fluency in language used for intervention delivery) that may impact intervention outcomes and to assess the presence of these factors as eligibility criteria using an intake interview or other prescreening tools as was done in many of the reviewed studies.

A third consideration centers around SST intervention content and delivery protocol. Studies in the present review generally focused on more abstract, macro-level social skills but some included at least minimal instruction on more concrete, micro-level social skills (e.g., voice volume, eye contact, physical distance). Content was commonly delivered in small social skills groups of 4–9 children, with concurrent parent training groups. Groups generally met weekly for 60–90 min for 8–12 weeks, with programs lasting 10 weeks or longer generally having briefer sessions (i.e., 60 min) than those that were shorter in duration. During these sessions, participants and an intervention facilitator often reviewed the previous week's target skill and homework, engaged in didactic instruction of the new target social skill, and modeled and rehearsed the skill. Positive reinforcement via verbal praise and token economy systems and weekly homework assignments were also common. To ensure adherence to the treatment protocol, program manuals should be developed and process evaluation plans, including assessment of implementation fidelity (e.g., standardized checklists, video recordings, observer ratings), should be clearly articulated and carried out.

A final consideration concerns the evaluation of intervention effectiveness. Among the studies included in the present review, the SSRS was the most commonly-used assessment of children's social skills, followed by the CBCL. Including these measures in the assessment batteries of future SST interventions would allow meaningful comparisons to extant findings. Studies in the present review often reported unique findings across assessments and data sources, highlighting the importance of gathering data using multiple measures and sources (i.e., parent, teacher, child, researcher) to ensure a comprehensive and nuanced account of children's social functioning. For, example, in addition to child self-report and teacher and/or parent report, peer sociometric data or direct observations/video ratings would offer an additional perspective and may be beneficial for capturing subtle intervention effects.

Addressing Limitations of Existing SST Interventions

Despite evidence indicating that SST is a promising approach to improve social functioning in children/

adolescents with ADHD, the methodological rigor ratings applied to studies in the present review suggest room for improvement. Nearly half of the studies (i.e., 7 of 16) lacked a control or comparison group (e.g., waitlist, standard treatment, or no-treatment), and less than half (i.e., 6 of 16) of the studies randomized participants to a condition. Controlled, randomized SST studies are needed to support the detection of intervention effects and bolster confidence that observed effects should be attributed to the intervention and are not the result of a third, unmeasured variable (Sibbald and Roland 1998). Further, given the clinical nature of SST research, randomizing participants to either SST or a delayed treatment group (e.g., waitlist control) would support methodological rigor and afford all participants the opportunity to benefit from the intervention.

Other methodological limitations include sample sizes and outcome measures. A majority of studies (i.e., 11 of 16) had a sample size of less than 25 participants per condition, with three of those studies having total sample sizes of five or less participants. Studies with a small sample size may lack sufficient statistical power to detect effects and have a limited ability to generalize treatment findings to the overall population. While the studies in the present review generally used validated and reliable measures for their main outcome variables (most commonly the SSRS and CBCL), numerous secondary outcome measures were used that were not well validated or lacked evidence of reliability. Even with psychometrically sound measures, meaningful comparisons of intervention effects are difficult to make when a wide variety of measures was used across studies. Having a common assessment toolkit from which researchers could select valid, reliable measures of social functioning in children would facilitate outcome comparisons across studies and enhance the likelihood of detecting effects.

There are a number of additional opportunities to enhance SST assessment, development, and implementation that warrant discussion. A key concern is the lack of sociometric assessments in studies testing SST. Peer sociometric assessments yield information about social status rather than specific social behaviors. Children within an identified social group may be nominated as representative of or rated according to a given criterion (e.g., best friends or most liked, respectively). Sociometric procedures have been shown to be reliable and valid and to be highly predictive of social outcomes in children (Gresham 1983). However, the use of sociometrics to assess children's social skills may be limited by measurement concerns and pragmatic constraints (Merrell 2001). Findings in some previous studies have revealed limited correspondence between changes in peer nominations/ratings and in rates of interpersonal behaviors among target children (Hansen et al. 1996). Peer ratings also raise issues concerning the relative importance of children engaging in targeted social behaviors versus peer acceptance/liking. Further, sociometric assessment presents a number of pragmatic challenges. For example, accurate ratings require consent from all parents rather than just the parents of targeted children. Concerns among parents and school personnel regarding the potential for further social rejection as a result of participation in the assessment may pose a challenge to obtaining consent. Further, some studies have not demonstrated changes in peer acceptance using sociometrics (Hansen et al. 1996). Taken together, the pragmatic difficulties presented by sociometric procedures and the null findings in previous work may contribute to their limited use as an outcome measure in SST. Nonetheless, sociometric procedures are socially valid. As noted by Gresham (1983), children are not typically referred for SST due to low frequencies of specific social behaviors (such as making eye contact, failing to say please and thank you) but instead for issues such as peer rejection. Thus, assessing peer sociometrics would provide information about whether SST yields improvements in an important domain of functioning, yet is a critical missing piece in SST research.

Another limitation in SST research is that the participant samples in the reviewed studies were largely not representative of the broader population of children with ADHD. There was a male preponderance in all studies, with several including no female participants. Although the ADHD prevalence rate is higher in boys than girls, examining treatment efficacy of SST in females is still necessary to understand potential gender differences. Further, study participation should aim to be accessible to families from a wide range of SES backgrounds and samples should be representative of the racial/ethnic composition of the broader population. Three studies in the present review included samples with only Caucasian/white participants, and two studies only reported the percentage of Caucasian/white participants in the sample. Several studies did not report any information about the racial/ethnic composition of the participant sample. Among studies that did include more racially diverse samples, people of color were represented at rates below the national estimates for all races/ethnicities (except for biracial/multiracial). Including more racially/ethnically diverse samples would yield greater generalizability and also provide opportunities to identify culturally relevant approaches.

Another opportunity to enhance SST concerns the age of children in the study sample. In the studies included in the present review, all but one targeted children (< 12 years old). In the one study that focused on adolescent social functioning, the majority of participants were 11–13 years old. SST for adolescents, especially adolescents over 13 years, is lacking. Research is needed to address this gap, particularly given that many children with ADHD continue to experience difficulties with social functioning into adolescence and beyond (Shaw-Zirt et al. 2005; Sibley et al. 2010). The social behaviors that facilitate peer interaction and acceptance and

those that are likely to engender peer dislike and rejection change with age (Bierman et al. 2010). Similarly, the cognitive abilities necessary to engage in effective social problem solving undergo considerable change across childhood into adolescence as do the social contexts in which youth spend their time (Bierman et al. 2010). A developmental perspective is of critical importance and should inform the design, implementation, and evaluation of SST in youth with ADHD.

In applying a developmental perspective to the evaluation of SST, future studies should aim to gather data from child participants and their peers to garner a more nuanced perspective on social functioning than is afforded by adult sources alone. Peer- and child self-reported data were not commonly collected in the reviewed studies, but both could yield important data regarding the types of skills taught in SST that are most relevant in a given social context and the extent to which participants are generalizing their skills across contexts and improving their relationships with peers in naturalistic settings.

A developmental perspective is also relevant to how parent training is incorporated into SST. Parents play a crucial role in the development of children's social competencies. Parents can influence their children's social skills and development through (1) childrearing practices and relational styles within the family context, (2) serving as the direct instructor, educator, or coach of their children's social skills, and (3) managing their children's social lives and providing opportunities for social interactions with peers outside of the family context (Parke et al. 1994). Given the great importance of the parental role in children's social competency development, emphasis on parental involvement in SST is paramount. In the studies included in the present review, the content of parent training varied. Some engaged parents as social skills coaches for their children. In other studies, parent training occurred concurrently with child training. Still others focused more on positive parenting and discipline strategies with some attention given to social skills. Importantly, however, the ways in which parents guide and monitor their children's social development change as the child ages; therefore, parent training to support children's social skills should also be tailored to be age appropriate. Future SST studies would likely benefit from including parent training that incorporates corresponding social skills-focused content in combination with positive parenting strategies and acknowledges the important development changes that shape parent–child interactions and the evolving role that parents play in the development of children's social skills and peer relationships. Similarly, such training could be expanded to include teacher training to maximize opportunities for positive peer interactions in the school setting.

Given the apparent importance of including parent training in SST for children with ADHD, it seems equally important to evaluate the extent to which such training results in actual change in parents' social knowledge and/or behaviors. Interestingly, however, although most of the studies in the present review included a parent training component, parental outcomes were only reported in one study (Sheridan et al. 1996). Improvements in parenting, behavior management skills, and parental facilitation of children's social skills should be assessed in the future so that the mechanisms for how SST affects change can be better understood.

Finally, SST may be further enhanced by maximizing opportunities for positive peer interactions. Having a friend may serve as a protective factor for youth who are at risk of experiencing peer problems (Hodges et al. 1999; Rubin et al. 2008). Therefore, identifying novel ways to create positive friendship opportunities for children with ADHD may be important within the context of SST. Previous work supports the potential utility of this approach within a classroom intervention (Mikami et al. 2013). Designed to increase peers' social inclusion of elementary-aged children with ADHD as an adjunct component to traditional interventions, this program was found to improve peers' sociometric ratings of children with ADHD and to increase reciprocated friendships and positive messages from peers compared to a traditional intervention. This research suggests that targeting the peer group to increase inclusiveness may reduce peer problems experienced by children with ADHD, which contrasts with traditional methods that put the onus only on the child with ADHD.

Alternative Approaches to SST

Traditional group-based SST as described in the articles reviewed here will continue to benefit from additional comprehensive reviews and rigorous clinical research. However, it is also pertinent to consider alternative treatment approaches that have shown promise in this population, as well as those that have yet to be studied in children with ADHD. For example, in a review of treatments addressing difficulties (broadly defined) experienced by children with ADHD, Pelham and Fabiano (2008) concluded that Behavioral Classroom Management programs (utilizing a contingency management approach through teacher-implemented reward and point systems and time-out) and peer-focused behavioral interventions in recreational settings (e.g., summer treatment programs) were both efficacious in improving social skills as well as reducing other symptoms of ADHD.

In addition to these well-established treatments for children with ADHD, promising preliminary results have been found in non-ADHD child samples using novel approaches to address social functioning difficulties. For example, Lunch Buddy mentoring is a school-based program aimed at reducing peer victimization (Gregus et al. 2015). Beginning in 4th

grade, each participating child (who was experiencing peer victimization) was paired with a trained adult mentor who sat with the child at lunchtime twice per week, with the goals of (1) promoting positive interactions between the child and nearby classmates and (2) enhancing the child's social reputation. Results showed declines in self- and teacher-rated victimization after one semester of mentoring and after three semesters of mentoring when the children were in 5th grade. Other novel approaches to improve social functioning include virtual reality and mindfulness. Virtual reality is a computer-based, interactive experience that, when applied to intervention research, allows participants to practice skills and receive immediate feedback in an immersive, simulated environment that is realistic yet non-threatening. Promising results have been found in studies using virtual reality to promote positive social outcomes in children with ASD (Didehbani et al. 2016; Ke and Moon 2018). Mindfulness-based interventions have been shown to improve social outcomes in a classroom setting among elementary school children in Grades 4 and 5 (Schonert-Reichl et al. 2015) and among high school students with a learning disability (Beauchemin et al. 2008). Each of these approaches warrants further investigation as a potential alternative to or supplemental enhancement of traditional SST for children and adolescents with ADHD.

Conclusions

Social impairment associated with ADHD presents a considerable challenge in interpersonal social interactions and confers increased risk of negative outcomes across multiple domains. The present review is a comprehensive, systematic review of SST implemented as a stand-alone intervention to improve social functioning in children/adolescents with ADHD. Findings in the studies included in this review provide evidence that SST implemented without additional intervention components (e.g., academic supports) may be a promising approach to address ADHD-related social impairment. Although some studies did not show improvements in all outcomes, the majority of studies demonstrated improvements in important areas of social functioning. Importantly, however, there is limited evidence of long-term effects of SST on social functioning and many of these studies were not as rigorous as would be ideal for replicability and cross-study comparisons. Future work should aim to address methodological limitations of published studies and to create opportunities for generalization across contexts to maximize impact of SST treatment. The overview of studies provided in this review may be a useful tool to identify elements of effective SST and may serve to guide the development of improved SST for children/adolescents with ADHD.

Compliance with Ethical Standards

Conflict of interest Danielle Willis, E. Rebekah Siceloff, Melanie Morse, Emily Neger, and Kate Flory each declare that they have no conflicts of interest.

Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

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