

Social Skills Development in Children with Autism Spectrum Disorders: A Review of the Intervention Research

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Abstract Social reciprocity deficits are a core feature of the autism spectrum disorders (ASD). This review summarizes the state of research in group-based social skills training programs for school-age children and adolescents with ASD. All published studies of group social skills interventions between 1985 and 2006 were reviewed, as well as dissertations examining group-based social skills intervention programs. To assess the state of the science, a template developed by an NIMH work group was applied to 14 identified studies. Based on this review, the empirical support for this approach is incomplete, but promising intervention strategies were identified. Recommendations for the design of future treatment trials to guide clinical practice are offered.

Keywords Autism · Asperger's Disorder · Social skills training

Introduction

Profound deficit in social reciprocity skills is the core, underlying feature of the autism spectrum disorders

(ASD), which include autistic disorder, Aspergers disorder, and Pervasive Developmental Disorder—Not Otherwise Specified (PDD-NOS). Socialization deficits are a major source of impairment regardless of cognitive or language ability for individuals with ASD (Carter, Davis, Klin, & Volkmar, 2005). Furthermore, social skill deficits do not remit with development. Indeed, impairment and distress may increase as children approach adolescence because the social milieu becomes more complex and the child becomes more aware of their social disability (Schopler & Mesibov, 1983; Tantam, 2003).

Individuals with ASD suffer direct and indirect consequences related to social interaction deficits. Youth with ASD often report a desire for more peer social interaction, and may also express poor social support and more loneliness than their typically developing peers (Bauminger & Kasari, 2000). Ironically, when integrated with typically developing peers in mainstream classrooms, children and adolescents with ASD may be at increased risk for peer rejection and social isolation (Chamberlain, 2001). There is also evidence that social skill deficits in youth with ASD contribute to academic and occupational underachievement (Howlin & Goode, 1998). Finally, social skill deficits may presage mood and anxiety problems later in development (Myles, 2003; Myles, Bock, & Simpson, 2001; Tantam, 2003).

The social impairments in individuals with ASD are diverse and involve speech, linguistic conventions and interpersonal interaction. Frequently identified problem areas include impairments in social pragmatics (e.g., turn-taking in conversation and the ability to take the listener's perspective), poor speech prosody (e.g., typical rising and falling of voice pitch and inflection

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that aids verbal communication), a tendency to dwell on certain topics, difficulty understanding and expressing emotions, and difficulty interpreting nonliteral language such as sarcasm and metaphor (Krasny, Williams, Provencal, & Ozonoff, 2003; Kerbel & Grunwell, 1998; Shaked & Yirmiya, 2003; Tager-Flusberg, 2003). Interventions based on principles of applied behavior analysis have been shown to improve functional communication skills in children with ASD and decrease problematic behaviors such as aggression (Hanley, Iwata, & Thompson, 2001; Lovaas, 1987), but therapeutic interventions targeting social deficits have not achieved the same level of attention (Bailey, 2001). Indeed, social deficits in this population remain a major treatment challenge (Weiss & Harris, 2001).

For a sizeable proportion of individuals with ASD, the social deficits are not explained by lack of social interest. Lack of social skills and an ability to determine when to use such skills also contribute to the overall disability (Mesibov, 1984; Bauminger, 2003). Given that children with ASD fail to acquire appropriate social skills and may lack opportunities for positive peer interactions, explicit training in a group format is a rational intervention. Moreover, given the increased recognition of ASD in children with average cognitive ability (Croen, Grether, J.K., Hoogstrate, J., & Selvin, 2002) and the emphasis on the inclusion of students with special needs in regular education classrooms (Williams, Johnson, & Sukhodolsky, 2005), schools and clinicians can expect to be increasingly called upon to enhance the social deficits of school-age children and adolescents with ASD.

Social skills training (SST) is one type of child-specific intervention (McConnell, 2002). This intervention involves teaching specific skills (e.g., maintaining eye contact, initiating conversation) through behavioral and social learning techniques (Cooper, Griffith, & Filer, 1999). SST has been reported to be an effective component of treatment regimens for many childhood disorders including childhood social phobia (Spence, Donovan, & Brechman-Toussaint, 2000) and specific learning disabilities (Forness & Kavale, 1999). Group-based SST is an appealing intervention approach for use with children with ASD because it provides the opportunity to practice newly learned skills in a relatively naturalistic format that may promote interaction with other children (Barry et al., 2003). The goal of this review is to provide guidance on the logical 'next steps' in research on group-based SST for ASD in service of the broader goal of establishing efficacy and promoting dissemination of effective interventions for ASD. The review is organized according to the following aims: (1) to summarize the state of empirical

research on group-based SST for ASD; (2) to identify limitations within this body of research in order to inform future treatment trials; and (3) to identify promising outcome measures and techniques that could inform the enterprise of manual development.

Methods

Search Strategies

This review was based on a systematic search of published research and unpublished dissertation studies available through August 2006. The *Psych-Info* and *Medline* online databases were searched concurrently for entries containing any combination of the terms: (1) *autism* or *asperger*; (2) either *social* or *socialization*, and (3) *treatment*, *intervention*, or *training*. Abstracts of identified articles were then screened for three inclusion criteria: (a) an explicitly identified, direct SST intervention was implemented; (b) a group format was employed; (c) and the target population was school-age children or adolescents diagnosed with ASD, including autism, Asperger's Disorder, or PDD-NOS. Thus, studies of groups comprised of adults or preschoolers with ASD or children with developmental disorders not on the autism spectrum, were excluded from this review. Similarly, studies describing interventions delivered in a one-on-one format were excluded, as were studies of interventions not delivered to children with ASD (e.g., parent or peer training only). To ensure full inclusion of relevant studies, references of the articles identified through this process were reviewed to identify "ancestor" studies.

Criteria for Evaluation

An empirically supported treatment (EST) is one that has been identified as having a rigorous line of research, usually in the form of randomized clinical trials (RCTs), supporting its utility as a treatment for a particular disorder (American Psychological Association Division 12 Task Force on Promotion and Dissemination of Psychological Procedures, 1995). Empirical support for efficacy can be established through well-designed group experiments or several (>9) single case experiments. In addition, the experiments must be conducted with treatment *manuals* and the patient samples must be *clearly defined*. Establishing a psychosocial intervention as an EST clearly requires much more than preliminary evidence. The role of systematic reviews is to evaluate the state of the art and identify progress and gaps in the field.

Following a systematic assessment of the field of psychosocial intervention in ASD more broadly, an NIMH working group recommended a stepwise approach to the development, testing, and dissemination of psychosocial interventions (Smith, Scahill, Dawson et al., 2006). This starts with technique development, which may be validated by single subject design. The next step might be a case series in which a set of techniques could be examined in a pilot study. Following this pilot phase, a promising set of techniques can be assembled into a manual. A useful, though only rarely accomplished step in ASD research, is pilot testing of the manual across sites. Multi-site pilot testing of a treatment manual demonstrates that the intervention is acceptable to the patient population, can be implemented uniformly by different therapists, and provides preliminary data on efficacy. Next, RCTs are conducted to test the efficacy of the intervention under controlled conditions. The distinct advantage to multisite trials in the conduct of RCTs is their ability to show exportability of the intervention and to accrue a sufficient sample size in a timely manner. To demonstrate effectiveness, the last step is to implement the intervention in community settings (e.g., clinics, schools).

Using the template presented by Smith et al. (2006), the literature on SST was evaluated to summarize the state of the art in and to guide the next round of treatment trials. After summarizing the studies' inclusion/exclusion criteria and outcome measurement procedures used, the studies are reviewed according to the phases of research development outlined by Smith and colleagues (2006): (1) Phase I: Formulation and systematic examination of intervention techniques; (2) Phase II: Manual development; (3) Phase III: RCT; and (4) Phase IV: Community effectiveness

studies. The review also identifies specific treatment strategies that appear promising.

Results

The initial literature search resulted in over 200 citations. Ten of the studies met the stated inclusion criteria (direct SST intervention delivered in group format to school-age youth with ASD), three of which were unpublished dissertations. Many of the unselected studies from the initial pool involved samples outside the targeted age range (e.g., preschoolers) or without clear ASD diagnoses. The second phase, in which identified study's references were searched, resulted in four additional published articles for a total of 14 empirical studies of group-based SST programs for children and adolescents diagnosed with ASD. Table 1 summarizes the study designs and how well each study fulfilled specific criteria necessary for replication, including detailed subject characterization, use of an explicitly identified treatment manual, and use of a control group. Table 2 summarizes the outcomes of the 14 studies.

Study Samples

The most commonly reported inclusion criteria across the 14 studies were ASD diagnosis and age range. All of the reviewed studies specified an autism spectrum disorder as one of the inclusion criteria for group participants. In one study, educational eligibility for an ASD program fulfilled this criterion (Webb et al., 2004). In most, a clinical diagnosis was indicated. Only three studies (Cotter, 1997; Provencal, 2003; Solomon, Goodlin-Jones, & Anders, 2004), however, specified

Table 1 Studies of group-based social skills training programs for children with ASD

Author	N	Age range	Characteristics*			Design/Sample
			A	B	C	
Mesibov (1984)	15	14–35	No	No	No	Pre-post
Williams (1989)	10	9–15	No	No	No	Pre-post
Ozonoff & Miller (1995)	9	7–13	Yes	No	Yes	Controlled
Marriage et al. (1995)	8	8–12	No	No	No	Pre-post
Cotter (1997)	6	7–13	Yes	No	No	Single-subject
Mishna & Muskat (1998)	6	10–13	No	No	No	Pre-post
Barnhill et al. (2002)	8	12–17	No	Yes	No	Pre-post
Barry et al. (2003)	4	6–9	Yes	No	No	Pre-post
Yang et al. (2003)	6	7–9	No	Yes	Yes	Single subject
Provencal (2003) ^a	20	12–16	Yes	No	Yes	Controlled
Webb et al. (2004)	10	12–17	Yes	Yes	No	Pre-post
Trimarchi (2004) ^a	11	8–12	Yes	Yes	Yes	Controlled
Solomon et al. (2004)	18	8–12	Yes	No	Yes	Controlled
Carter et al. (2004)	10	8–15	No	No	No	Pre-post

*Study Characteristics: A, Sample described in terms of age, diagnoses, ascertainment source(s), functional level and identified inclusion criteria; B, Explicitly identified use of a treatment manual; C, Study employed a control group

^a Dissertation study

Table 2 Outcome measures used and findings

Author	Type of outcome measure ^a						Findings
	Direct	Parent	Other	Self	Observ	Accept	
Mesibov (1984)	–	x	–	x	x	–	No quantitative data. Anecdotal reports indicated that participants received positive peer social experience in group
Williams (1989)	–	–	x	–	–	–	Only significant improvement from baseline to endpoint (4 years) was in peer relations [school staff report]
Ozonoff & Miller (1995)	x	x	x	–	–	–	No change in SSRS over time or between groups. Theory of mind skills improved with SST, relative to controls (ES = 1.6)
Marriage et al. (1995)	–	x	–	–	–	–	Parent reported children's social skills showed negligible pre/post change
Cotter (1997)	–	x	x	–	x	–	Significant improvement ($P < .05$) on parent-report SSRS. No significant improvement in observed behaviors or teacher ratings
Mishna & Muskat (1998)	–	–	–	–	–	p,c	No quantitative data; 5 of 6 boys participated in post-group interview. All stated that they enjoyed group and felt safe
Barnhill et al. (2002)	x	–	–	–	–	p,c	Five of Seven assessed subjects improved scores on DANVA2; no statistically significant improvement
Barry et al. (2003)	–	x	–	x	x	–	Improvements in greeting and play skills [direct observations]. No change in SSRS (pretest = 75.7, posttest = 77.5)
Yang et al. (2003)	–	–	–	–	x	–	Improvement in frequency of positive social behavior for SST group. Group effect size: .02–.21; Control effect size: .01–.04
Provencal (2003) ^b	x	x	x	x	–	p	Large effect-symptom reduction: ADOS[$\eta_p^2 = .21$], medium effect-social skills: SSRS[$\eta_p^2 = .08$], small effect-knowledge of friendship: Friendship interview[$\eta_p^2 = .05$]
Webb et al. (2004)	x	x	–	–	x	p,c	No improvement in social competence [parent-report SSRS] Knowledge of social skills improved: pre-, $M = 2.4$, post-, $M = 8.2$
Trimarchi (2004) ^b	–	x	x	–	–	p,c	No differences in parent/teacher-report symptom severity. Parents reported at least minimal improvement on (90%) targeted skills
Solomon et al. (2004)	x	x	–	–	–	–	Significant improvement in facial recognition on DANVA2 ($F = 12.51$, $P = .003$) & problem solving ($F = 4.44$, $P < .05$)
Carter et al. (2004)	–	–	–	–	–	p,c	No quantitative data. Qualitative data indicated fair participant and parent satisfaction

^a *Type of social functioning outcome measure:* Direct, direct testing or assessment of child's skills or knowledge; Parent, parent-report measure; Other, other-report (e.g., teacher); Self, self-rating; Observ, coded behavioral observations; Accept, parent (p) or child (c) ratings of acceptability, or satisfaction with group

Note: x = measure used; – = measure not used

use of widely used and standardized diagnostic tools for ASD that are considered reliable and valid (i.e., Autism Diagnostic Interview-Revised: ADI-R; Lord et al., 1994; Autism Diagnostic Observation Schedule: ADOS; Lord et al., 2000) to confirm diagnoses. It should be noted, however, that some of the studies were published prior to the publication of these diagnostic tools. Some studies used additional entry criteria based on dimensional cutoffs (e.g., minimum standard scores on language or intellectual ability measures). Other studies required placement in a mainstream classroom. Collectively, participants in these studies ranged in age from 6 years to 35 years, with some studies accepting a wide age range (e.g., Mesibov, 1984: ages 14–35). Of note, although this review is focused on SST for minors, the Mesibov

(1984) study was included because its participants comprised both adolescents and adults.

Subjects were drawn from multiple sources, including research databases (e.g., Barry et al., 2003), schools (e.g., Webb et al., 2004), parent support groups (e.g., Carter et al., 2004), and local autism societies (e.g., Ozonoff & Miller, 1995). Some studies specifically mentioned that subjects were selected based on a desire for more social interaction (Barry et al., 2003). Inclusion criteria were sometimes ambiguous, referring to “level of commitment” and “appropriateness of participation” (Barnhill et al., 2002; p. 113) or “features of Asperger” and “average cognitive reasoning” (Mishna & Muskat, 1998; p. 103), or not reporting any inclusion criteria beyond the ASD diagnosis (Yang et al., 2003).

Outcome Measurement

A variety of outcome measures were employed in these 14 studies, including parent-report measures of social skills, teacher reports, child self-reports of knowledge of social skills, and direct behavioral observations (Table 2). The most frequently used parent-report quantitative measure of social skills was the Social Skills Rating System (SSRS; Gresham & Elliott, 1990). The SSRS was developed to help screen for social behavior difficulties in typically developing children. Five studies reported using the SSRS as an outcome measure (Cotter, 1997; Barry et al., 2003; Ozonoff & Miller, 1995; Provencal, 2003; Webb et al., 2004). Provencal (2003) also used the adolescent self-rating form of the SSRS and teachers were occasionally used as reporters (Cotter, 1997; Yang et al., 2003).

Child self-report was used in some of the studies. Barry et al. (2003) evaluated children's self-reported feelings of loneliness (Asher & Wheeler, 1985), and Solomon et al. (2004) included self-reported depressive symptoms in the children. Webb et al. (2004) used a paper and pencil measure concerning knowledge of social skills. Some studies used formal assessment instruments that specifically addressed the skills targeted in the intervention. For instance, Barnhill and colleagues (2002) employed the Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2; Nowicki, 1997), as did Solomon et al. (2004). This measure assesses nonverbal communication skills including emotion recognition through facial expressions and tone of voice. Ozonoff and Miller (1995) used several theory of mind tasks in addition to the SSRS. Theory of mind tasks were included to assess social cognition abilities, such as false beliefs and second-order attributions. These measures were apparently selected because the intervention focused on teaching theory of mind skills and perspective taking. Feasibility and acceptability of the interventions were assessed in two studies (Trimarchi, 2004; Webb et al., 2004), with parent and child-report surveys of satisfaction with the group experience.

Four studies reported direct observational assessments. Barry et al. (2003) assessed the presence or absence of specific skills during 5-minute play sessions with typical peers. Yang et al. (2003) had teachers do event recording of socially appropriate behaviors (e.g., playing with classmates). Mesibov (1984) rated socially appropriate behaviors, such as number of questions asked, during role-plays with a confederate. Cotter (1997) used an observational coding system to record behaviors during videotaped dyadic play assessment sessions with a peer. A strength of the Cotter study was

that the coders were blind to the hypothesis of the study. In the Yang et al. (2003) study, teachers were aware of the program but did not know when the intervention was implemented. Barry et al. (2003) used student raters who were not blind to the treatment goals or study hypotheses; the Mesibov (1984) study did not specify who conducted the observations.

Qualitative and observational data from these studies generally indicate beneficial effects. For instance, Barnhill et al. (2002) reported that, at the endpoint of the intervention, all of the parents wanted their children to continue in the group. Mishna and Muskat (1998) reported that subjects enjoyed being in the group. Evidence for the efficacy of these interventions as measured by quantitative skill-based measures, on the other hand, is inconsistent. Some studies showed no improvement (Ozonoff & Miller, 1995; Webb et al., 2004) and others reported small to moderate improvements (Cotter, 1997; Provencal, 2003). Change was infrequently observed on parent-reported skill-based measures of children's behavior in naturalistic settings, despite generally high levels of satisfaction with the groups and reported gains in knowledge. Another consideration in synthesizing the findings is the possibility of differential improvement in various skills. For instance, Barry et al. (2003) found that play skills and greeting skills (based on coded observations) improved when they were specifically taught. Despite specific instruction, however, improvement in conversation skills showed smaller effects. This difference in improvement across skills may indicate that some skills are more amenable for teaching using scripts and concrete rules, while perhaps 'higher level' skills (e.g., maintaining a conversation) require different teaching approaches (Barry et al., 2003).

Of the studies employing quantitative data analysis, many did not report effect sizes or data with which to compute effect sizes, making comparison across studies and intervention approaches difficult. Ozonoff and Miller (1995) found that performance on theory of mind tasks improved substantially, reporting an effect size for a group difference (treatment versus control) of 1.6. Unfortunately, this degree of improvement was not realized in actual social skill use as measured by the SSRS (Ozonoff & Miller, 1995). The intervention conducted by Solomon and colleagues (2004) also targeted theory of mind, along with emotion recognition/understanding and executive functioning. They reported statistically significant improvements in the treatment group in facial expression recognition and problem solving, but did not include measures of day-to-day social functioning, other than parent logs of problem behavior (Solomon et al., 2004).

Webb et al. (2004) targeted five core social skills in their SCORE Skills Strategy Program. Results indicated that participants increased their knowledge of the targeted social skills and demonstrated improved proficiency in four of the five skills, as measured by non-blinded behavior ratings. However, similar to Ozonoff and Miller (1995) and Solomon et al. (2004), parent reported SSRS showed no significant improvement, indicating that parental perceptions of social competence did not change. The Cotter (1997) study reported statistically significant improvements in parent reported SSRS scores for their six participants; however, inadequate data was provided with which to calculate effect size. Provencal (2003), calculating effects sizes based on the strength of association between the intervention and the outcome measures, reported a fairly large effect for the ADOS (.21) as well as on the SSRS (.19).

Phase I: Technique Refinement

As discussed by Smith et al. (in press), the goal of this first phase is to refine treatment strategies and test the efficacy of these techniques. This may be accomplished through single-case studies. In the single-case design, data are collected continuously through direct observation, in order to evaluate the change in a specific behavior following the implementation of the intervention under study. This can also be accomplished via between-group studies, though the single-subject design is more sensitive to detecting effects of specific techniques.

Using single-subject methodology, Yang et al. (2003) assessed their SST program with an AB design. The baseline was established by repeated measures in the week prior to intervention. Once the baseline was established, the SST program was initiated. Four children received the training program and two were in the education control condition. Based on the report of teachers who were unaware of when the intervention began, the frequency of positive social behaviors increased for those in SST, compared to students in the control condition (Yang et al., 2003). Cotter (1997) employed a single-subject, repeated-measures design with six children. Six pre-identified target behaviors were coded during repeated, eight-minute dyadic play sessions with typically developing peers. Raters were blind to the study hypothesis, child identity, and assessment session. This study showed the children did not improve significantly in naturalistic interactions with peers, although they did demonstrate improved use of targeted social skills within adult directed activities in the training setting. The other studies in

Table 1 used a pre-post design or comparison of SST to a control condition, but no studies used random assignment. As shown in Table 1, sample sizes were small. The largest sample included 10 in the experimental group and 10 in the control group (Provencal, 2003).

Phase II: Manual Development

Treatment manuals, which assemble and organize intervention procedures, are necessary prerequisites for conducting and replicating clinical trials. Although treatment manuals do not guarantee uniform delivery of the intervention, standardization of the intervention cannot be assured without them (Smith et al., 2006). Most of the studies in this review did not use a treatment manual. Two of the studies (Trimarchi, 2004; Yang et al., 2003) used published manuals developed specifically for use with children with ASD. Two studies adapted treatment manuals from other populations such as children with learning disabilities (Barnhill et al., 2002; Webb et al., 2004). Several studies (Barry et al., 2003; Cotter, 1997; Mesibov, 1984; Ozonoff & Miller, 1995; Provencal, 2003; Williams, 1989) provided detailed descriptions of specific activities, while others did not (Marriage et al., 1995; Mishna & Muskat, 1998). The absence of a clear description of the full curriculum or the group activities used in the program renders replication in a clinical trial or practice impossible.

Phase III: Randomized Clinical Trials

After initial feasibility studies demonstrate that an intervention manual can be delivered as planned and is acceptable to clinicians and subjects, the manual is ready for a RCT to evaluate efficacy (Smith et al., 2006). Of the 14 studies reviewed, five included a comparison group and none of these used random assignment to condition. Provencal (2003) assigned the first 10 adolescents enrolled in the study to the experimental group and the next 10 to the control group. Yang et al. (2003) reported that subjects were divided into two trials based on cognitive ability, one with mental retardation and the other with high functioning autism. Within each trial, one child was in the control condition but treatment assignment procedures were not described. In the Ozonoff et al. (1995) trial, placement of the five subjects in the treatment group was determined by subject availability. The four control subjects were not able to attend the weekly sessions at the set time. Trimarchi (2004) and colleagues attempted to conduct a randomized

study. Unfortunately, most of the subjects randomized to the wait-list control withdrew. In response to this attrition, the investigator recruited additional control subjects from other sources (e.g., local support groups), which clearly undermines cross-group comparisons. The withdrawal of subjects in the wait-list control group raises questions about this approach in an RCT. If wait-list control is used, specific steps may be required to guard against attrition.

Phase IV: Effectiveness Studies

Once an intervention demonstrates efficacy via a large-scale RCT, effectiveness studies show if similar outcomes can be achieved in settings other than specialized research centers (Smith et al., 2006). Community-based effectiveness studies, in which the intervention is delivered by practitioners in “real world” settings represent an important step in dissemination. These studies test whether an intervention can achieve similar results when delivered by clinicians in non-research settings. The interventions described in this review took place in a variety of settings including schools (Williams, 1989; Yang et al., 2003), public community agencies available for research (Webb et al., 2004), private practice clinics (Trimarchi, 2004), university classrooms (Barnhill et al., 2002), university-based specialty treatment clinics (Barry et al., 2003), and university-based research clinics

(Mesibov, 1984; Provencal, 2003; Cotter, 1997). In some studies, it was unclear where the intervention took place (Marriage et al., 1995; Mesibov, 1984; Mishna & Muskat, 1998; Ozonoff & Miller, 1995).

Several of the studies implemented intervention programs developed by the authors (e.g., Yang et al., 2003) but this was not always the case. For example, Webb and colleagues (2004) evaluated the *SCORE Skills Strategy Program* (Vernon, Schumaker, & Deshler, 2001) in children with ASD. This program had been developed and tested in children with learning disabilities. Trimarchi (2004) evaluated a curriculum developed for youth with ASD and related conditions, *SST for Children and Adolescents with Asperger Syndrome and Social-Communication Problems* (Baker, 2003). None of the studies in this review can be described as an effectiveness trial.

Promising Treatment Strategies

Specific treatment components that comprise SST interventions for children with ASD have not been systematically evaluated. However, several intervention strategies show promise. Frequently cited intervention strategies implemented in the reviewed studies are included in Table 3. These strategies may be considered to be promising, or meriting further investigation, based on theoretical and logical links to characteristics of youth with ASD (e.g., framing

Table 3 Promising teaching strategies for social skills training in ASD

Goal	Strategies
Increase social motivation	Foster self-awareness and self-esteem Develop nurturing, fun environment Intersperse new skills with previously mastered skills Start with simple, easily learned skills (errorless teaching)
Increase social initiations	Make social rules clear and concrete (e.g., stay one arm’s length from other person) Model age-appropriate initiation strategies Use natural reinforcers for social initiations (e.g., follow child’s conversation lead/interest) Teach simple social ‘scripts’ for common situations
Improve appropriate social responding	Teach social response scripts Reinforce response attempts Use modeling and role-play to teach skills
Reduce interfering behaviors	Make teaching structured & predictable Differentially reinforce positive behaviors Keep behavior charts (e.g., checkmarks or stars) for positive behavior Review socially appropriate and inappropriate behaviors of the participants as a group, via video or audiotape segments
Promote skill generalization	Orchestrate peer involvement (e.g., prompting & initiating social interactions, physical proximity) Use multiple trainers & individuals with which to practice skills Involve parents in training Provide opportunities to practice skills in safe, natural settings (e.g., field trips) Use time between session to practice skills (e.g., via ‘homework’)

complex social conventions as rules that can be learned, to build on proclivities for structure) as well as the preliminary efficacy data presented in these studies.

In addition to the studies reviewed here, other researchers have proposed strategies used in a variety of contexts (e.g., single subject studies), which may be beneficial in group-delivered social skills instruction for individuals with ASD (Brent, Rios, Happe, & Charman, 2004; Krasny et al., 2003; Weiss & Harris, 2001). Techniques based on Pivotal Response Training (Koegel, Koegel, & Brookman, 2005), for example, can be incorporated into group-based programs (e.g., child choice of activities). Conducting a functional analysis of interfering behaviors to identify maintaining factors, an approach often used in applied behavior analysis, can also be applied in a group teaching format. These strategies may be helpful when integrated into group-based SST programs for children with ASD, but they require further empirical investigation in this context.

Discussion

This comprehensive review had two goals: (1) to summarize the state of the research on group-based SST programs for youth with ASD, and (2) to provide recommendations for how to proceed in the scientific advancement and evaluation of this type of intervention. With regard to the first goal, it appears that considerable progress has been made on the first two phases of treatment research development: technique identification and manual development. Many of the studies demonstrated that targeted skills can be improved in youth with ASD. However, this improvement may be confined to those skills that are directly and explicitly taught. Further, there is evidence that skills may be displayed in laboratory/clinic settings, but not necessarily applied in the child's daily life at school or home. Generalization and flexible skill use in natural environments continues to be a challenge, based on parent reported social competency.

Several promising intervention strategies were identified. By and large, these strategies were developed based on knowledge of the literature, including characteristic learning styles and specific deficits associated with ASD, as well as knowledge of the individual participants in the groups. With some exceptions (e.g., Ozonoff & Miller, 1995), few of the intervention programs included in this review were based on a defined theoretical conceptualization of ASD. Some investigators adapted general theoretical approaches

(e.g., social learning theory; Cotter, 1997) for the intervention. It is clear that further refinement and evaluation of the strategies is needed. Future studies will also need to compare the relative impact of these strategies and develop treatment manuals that operationalize how to most effectively implement them.

With regard to the second goal, this review identified several methodological weaknesses in group-based SST trials for children with ASD. Major weaknesses include inadequate measurement of social skills and deficits associated with ASD, small and poorly characterized samples, and minimal examination of the degree to which learned skills generalize. Several investigators have cited the need for reliable and socially valid outcome measures that are sensitive to change in treatment studies with this population (Krasny et al., 2003; Ozonoff & Miller, 1995; Scahill & Lord, 2004; Wolery & Garfinkle, 2002). Such measures should not only assess whether a child learned a specific skill in the context of treatment, but also the degree to which the child then actually uses and adapts new skills in natural environments (e.g., at school). At minimum, this calls for ratings from multiple informants. This review shows that there is little consensus on outcome measures for SST.

This lack of consensus may reflect the simple fact that appropriate measures are not available. For instance, the Social Skills Rating System (SSRS; Gresham & Elliott, 1990) is a commonly used measure of actual skill use. However, most studies that used the SSRS did not show change with treatment. This could be due to small sample sizes, the use of an ineffective treatment, or perhaps this measure is not appropriate for assessing the impact of such interventions in children with ASD. The SSRS measures broad-based behaviors associated with developing social skills but does not assess the nuances of behavior associated with social reciprocity that are lacking in children with autism. Indeed, the SSRS was created to assess change in typically developing children with disruptive behavior problems, not children with ASD (Gresham & Elliott, 1990). Other measures (e.g., Social Responsiveness Scale; Constantino, Przybeck, Friesen, & Todd, 2000; Social Competence Inventory; Rydell, Hagekull, & Bohlin, 1997), which are more relevant to ASD and may be sensitive to change with treatment, could be useful but have not been employed thus far.

Several studies used coded behavioral observations as an outcome measure. This approach, though appealing because of its reduced risk of reporter-bias, is vulnerable to problems such as faulty recording equipment and uncertain stability of the observed behavior even in the absence of treatment (Scahill &

Lord, 2004). In addition, in a large trial, direct observational measurement would be time-consuming and expensive. Another approach to obtaining data across settings is the use of multiple informants (e.g., parent, teacher, and child). Teachers may be particularly informative because they can provide behavioral ratings that are blind to the intervention, at least when the intervention is not delivered at school. Child self-reports may be useful in gathering data on closely related outcomes such as severity of anxiety or depression (Stallings & March, 1995). Future studies should also consider the use of blinded, independent evaluators. In most of the studies reviewed here, the principal investigator or group leader was responsible for administering and scoring outcome measures, introducing undue potential bias. At present, there are no clinician ratings of social skills for youth with ASD. In the absence of such measures, global measures such as the clinical global improvement (CGI) score could be used. Future studies should include examination of outcome measures as well as measurement strategies such as using multiple informants and independent evaluators.

Equally as important as sensitive and valid outcome measures is subject characterization, including documentation of diagnosis and intellectual and adaptive functioning (Scahill & Lord, 2004). Subject characterization provides essential information on who was in the trial and indicates for whom the treatment is relevant. Adequate subject characterization is also essential for replication. Three of the 14 studies reported using either the ADI-R or ADOS for subject selection (Cotter, 1997; Provencal, 2003; Solomon et al., 2004). Barry et al. (2003) reported use of structured play sessions and parent interviews, but did not identify the instruments used. In some studies, the diagnosis was based on parent report or school program eligibility. In evaluating the appropriateness of a given program for use with a defined group of children, consideration must be given to how the sample was ascertained. Discrepancies between clinical diagnosis of ASD and educational classification or class placement are common. Ideally, programs that are intended to be implemented in schools should include some type of school-based criteria (e.g., a special needs classification of autism). Some students have clinical ASD diagnoses, but do not have an educational classification of autism or receive school-based services (Williams, Scahill, Klin, Koenig, & Volkmar, in press). Treatment providers and clinical investigators, as well as parents, need to be aware of these discrepancies.

Another limitation in the studies included in this review is the lack of control groups with random

assignment. Uncontrolled trials do not permit attribution of observed effects to the intervention (i.e., improvement may be due to the passage of time alone). Furthermore, without random assignment to groups, it is impossible to assume group equivalence. Clinical research with this population poses special challenges. Given the variability in the expression of ASD across children, investigators need to consider other variables (e.g., level of cognitive functioning) in case ascertainment and group assignment, to ensure that group assignment is balanced as well as random. A practical dilemma must be faced when making decisions of how heterogeneous a sample should be. Indeed, if inclusion criteria are too stringent, recruitment can lag and generalizability may be threatened (Scahill & Lord, 2004).

Conclusion

Despite the pervasive socialization deficits in youth with ASD and the negative impact that such deficits have on other aspects of development, we know relatively little about efficacious psychosocial intervention approaches. Unfortunately, only preliminary evidence is available regarding the efficacy of structured curricula and specific treatment strategies. Group-based SST is an under-studied, but worthy, candidate for further development and testing.

This review synthesized available research on group-based SST programs for children with ASD to establish the state of the art and to guide the next step for treatment trials. Based on this review, several recommendations are offered. First, there is a need to develop and test structured, manual-based curricula. Structured interventions are essential for replication and are amenable to evaluation of treatment fidelity. Multi-site feasibility studies demonstrating that the structured intervention can be applied uniformly across sites is another important step toward formal testing and dissemination. Second, future studies should use control groups, with random assignment whenever possible. Third, as in other fields of empirical research, social skills intervention trials in ASD should identify a primary outcome measure. However, multiple informants and the use of independent raters who are blind to treatment assignment should become the standard. Clearly, the progress of treatment research rests on the application of reliable and valid outcome measures that are practical to use and sensitive to change. The uncertain state of outcome measures in ASD suggests that new measures are needed. Alternatively, available measures

may be adapted for use in the ASD population. The utility of new or adapted outcome measures should be evaluated for reliability and validity, as well as the cost and ease of interpretation.

Fourth, in order to accrue sufficient sample sizes to evaluate the impact of a treatment in a randomized study, multi-site treatment trials are needed. A mainstay in medical research, multi-site RCTs will be increasingly important to psychosocial intervention research (Lord, Wagner, & Rogers et al., 2005; Smith et al., 2006). Indeed, the National Institute of Mental Health has issued a call for more RCTs to be conducted to test the efficacy and safety of both pharmacological and psychosocial treatments (Vitiello & Wagner, 2004). In conclusion, group-based social skill training approaches may be a useful intervention for children with ASD, based on evidence provided by several small initial efficacy studies. The field now requires the development of manual-based curricula that can be evaluated in a stepwise fashion in feasibility studies and in large-scale RCT.

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