

Social Skills Training for Young Adults with High-Functioning Autism Spectrum Disorders: A Randomized Controlled Pilot Study

Alexander Gantman · Steven K. Kapp ·
Kaely Orenski · Elizabeth A. Laugeson

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Abstract Despite the psychosocial difficulties common among young adults with autism spectrum disorders (ASD), little to no evidence-based social skills interventions exist for this population. Using a randomized controlled trial (RCT) design, the current study tested the effectiveness of an evidence-based, caregiver-assisted social skills intervention known as *PEERS for Young Adults* with high-functioning young adults with ASD (ages 18–23) using self- and caregiver-report measures. Results revealed that treated young adults reported significantly less loneliness and improved social skills knowledge, while caregivers reported significant improvements in young adults' overall social skills, social responsiveness, empathy, and frequency of get-togethers. Results support the effectiveness of using this caregiver-assisted, manualized intervention for young adults with ASD.

Keywords ASD · Autism · Adults · Social skills · PEERS

Extensive evidence demonstrates that social skills acquisition and generalization of skills often form the most significant challenges for children and adolescents with high-functioning autism spectrum disorders (ASD). A more limited body of literature demonstrates that social skills deficits remain prevalent for young adults (ages 18–23) with ASD (Barnhill 2007; Howlin 2000). While the intelligence of individuals with high-functioning ASD, on whom the literature and this study focus, often improves their outcomes in adulthood (Howlin 2000), it may also mask the significant challenges they face as adults (Barnhill 2007). Social deficits in adults with ASD may exacerbate or lead to problems with not only friendships but also romantic relationships, daily living, and vocational success (Barnhill 2007; Howlin 2000).

Research suggests that social and behavioral symptoms may improve with some consistency in children and adolescents with ASD (Shattuck et al. 2007), but this progress tends to slow as these individuals enter adulthood (Taylor and Seltzner 2010). The challenging aspects of ASD appear greatest for those in adolescence and young adulthood, possibly due to the greater salience and complexity of peer relationships; growing drive toward identity exploration; lack of availability and knowledge about appropriate services; and uncertainty about the balance of responsibility between the individuals themselves and those who support them (Tantam 2003). For example, Orsmond et al. (2004) found that young adults with ASD who live at home tend to have fewer reciprocal peer relationships and less participation in social and recreational activities, while better social skills, greater functional independence, and maternal involvement in activities predicted higher social engagement.

Like children and adolescents with ASD, young adults with ASD continue to experience social deficits that impair

A. Gantman · E. A. Laugeson (✉)
Department of Psychiatry, Semel Institute for Neuroscience and Human Behavior, University of California, 760 Westwood Plaza, Suite 48-243B, Los Angeles, CA 90024, USA
e-mail: elaugeson@mednet.ucla.edu

S. K. Kapp
Division of Psychological Studies in Education, Graduate School of Education and Information Studies, UCLA, Los Angeles, CA 90095, USA

K. Orenski
California School of Professional Psychology, Alliant International University, Alhambra, CA 91803, USA

their ability to develop and maintain friendships. Already challenged by poor social skills in such basic areas as using social cues and entering, engaging in, and exiting two-way conversations, many young adults with ASD further limit their opportunities for social success by making few social initiations or withdrawing from social interactions or settings (Shtayermman 2007). Social skill deficits and social disengagement weaken friendship quality. For instance, Orsmond et al. (2004) reported that most young adults with ASD in their sample did not participate regularly in social activities and few had any close reciprocal friendships.

Social skills also predict the ability to form romantic relationships in individuals with ASD, whose romantic functioning compares unfavorably to neurotypical peers (Stokes et al. 2007). Even though both groups report sharing similar interests in forming intimate relationships, those with ASD often lack the social skills knowledge to appropriately pursue and engage in romantic relationships and many recognize that they need more education to do so (Mehzabin and Stokes 2011). For example, these individuals sometimes naively behave in an intrusive manner with potential romantic partners, which may even be perceived as stalking behavior (Stokes et al. 2007). Perhaps for these reasons, romantic relationships appear to be infrequent (Stokes et al. 2007) and marriages are even rarer (Barnhill 2007) for adults with ASD.

The difficulties individuals with ASD experience in establishing and maintaining social relationships relate to loneliness and other mental health problems. In adolescents with ASD, the common self-perception of lack of social support from peers, friends, and parents positively correlates with loneliness (Humphrey and Symes 2010; Lasgaard et al. 2009). While these adolescents typically interact in inclusive settings with neurotypical peers, making regular social initiations an inevitability, this context may actually highlight their differences and result in unsuccessful social attempts, thus creating loneliness (Bauminger et al. 2003). Such loneliness and poor friendship quality positively correlate with depression in this population (Whitehouse et al. 2009), which in turn positively correlates with low social ability, anxiety, and social withdrawal (White and Robertson-Nay 2009). The social naïveté and oddness, yet eagerness to form social relationships, common to many individuals with ASD also render them vulnerable to peer victimization, such as bullying (Humphrey and Symes 2010) and sexual manipulation (Sullivan and Caterino 2008), which may further exacerbate asocial behavior and weaken mental health.

Despite their “high-functioning” label, adults with less “severe” forms of ASD may possibly endure even more abuse than “lower-functioning” and younger individuals with ASD because of greater social expectations, placement in less protective settings, and higher self-awareness

(Sterling et al. 2008). Accordingly, young adults with ASD often present with more depression and anxiety than their adolescent counterparts (Shtayermman 2007). Adults with ASD with higher IQ (Sterling et al. 2008) and less ASD symptomatology (Shtayermman 2007) tend to experience more depression (Shtayermman 2007; Sterling et al. 2008), anxiety, social isolation and withdrawal, and peer victimization (Shtayermman 2007).

All of these findings strongly suggest the need for provision of social skills instruction to improve the social relationships and psychological well being of this vulnerable population. Research suggests that having good social skills and adequate social support relate to better quality of life in adults with ASD (Jennes-Coussens et al. 2006; Wing 1983). Similarly, most neurotypical individuals develop close friendships and romantic relationships by young adulthood (Collins and Madsen 2006), the latter of which correlates positively with independence (Barry et al. 2009). Moreover, having at least one or two close friends strengthens mental health outcomes and can buffer the impact of stressful life events (Miller and Ingham 1976).

A randomized controlled trial (Laugeson et al. 2009) investigated the efficacy of the UCLA PEERS Program (Laugeson and Frankel 2010), a parent-assisted, manualized social skills intervention for teens with ASD 13–17 years of age. Results revealed that in comparison with a delayed treatment control group, those receiving the PEERS intervention had significantly higher social skills knowledge, greater social contact with peers, and better overall parent-reported social skills at the end of treatment. This study supports the idea that parents can have significant effects upon their adolescent’s friendships, both in terms of direct instruction and supervision, as well as supporting their adolescent’s development of an appropriate peer network (Laugeson and Frankel 2010). Thus, parent or caregiver involvement in treatment may also be crucial to help young adults with ASD improve their social skills (Orsmond et al. 2004), most particularly since young adults with ASD are often quite dependent on their parents or other caregivers for support, even at this stage of development. Not unlike most neurotypical college students, who still rank their parents as their primary attachment figures (Fraley and Davis 1997), young adults with ASD would likely benefit from parent and/or caregiver involvement in treatment.

In spite of the wide use of social skills training as a treatment tool for children and adolescents with ASD (Williams White et al. 2007), few studies have focused on social skills treatment for young adults with ASD. To date, only two published studies appear to have tested the effectiveness of a social skills intervention. Turner-Brown et al. (2008) implemented a program developed for adults with psychotic disorders to perform social cognition and

interaction training with a group of adults with ASD ages 25–55. The intervention improved participants' social cognition but not social functioning. In addition, Hillier et al. (2007) reported that only empathy improved after an eight-week social and vocational program for young adults with ASD. It appears that no intervention study has significantly improved the overall social and psychosocial functioning of young adults with ASD, and certainly no such studies have utilized a randomized controlled trial (RCT) design.

The purpose of this study was to adapt, further develop, and test the effectiveness of a manualized evidence-based adolescent social skills training program (PEERS; Laugeson and Frankel 2010) for use with high-functioning young adults with ASD. It was primarily hypothesized that participants would have higher self- and caregiver-reported social skills, higher parent-reported social functioning, and lower self-reported loneliness than waitlisted young adults. It was also hypothesized that participants would have higher self- and parent-reported empathy, self- and parent-reported frequency of get-togethers, and self-reported social skills knowledge as a result of this caregiver-assisted treatment.

Methods

Participants

Seventeen young adult participants ranging from 18–23 years of age ($M = 20.4$; $SD = 1.62$) participated in and completed the study with their caregivers. All of the 12 male and five female participants had a previous diagnosis of an autism spectrum disorder. Four young adults had a diagnosis of autistic disorder (including three in the Treatment group), eleven had Asperger's Disorder (including seven in the Treatment group), and two had pervasive developmental disorder-not otherwise specified (PDD-NOS including one in the Treatment group). Ten participants identified themselves as Caucasian, five as Asian, and two as Hispanic/Latino. All were attending college at least part-time, and all resided with their caregivers with the exception of one young adult, who was in regular daily contact and interactions with his parents. Caregiver groups consisted primarily of parents, with only one grandparent, one aunt, and one adult sibling.

Procedures

The study was conducted under the auspices of The Help Group—UCLA Autism Research Alliance, a collaborative partnership between the UCLA Semel Institute for Neuroscience and Human Behavior and The Help Group, a

community mental health agency with specialized day school programs and outpatient programs for children, adolescents, and young adults with ASD.

Participants were recruited from The Help Group, Regional Centers, colleges and Universities throughout Southern California, community support groups, and online research announcements. Eligibility requirements were that the young adult: (a) was between 18–23 years of age; (b) had a previous ASD diagnosis from a clinical psychologist or psychiatrist; (c) had social problems as reported by the caregiver; (d) was motivated to participate in the treatment; (e) was fluent in English; (f) had a family member who was fluent in English and willing to participate in the study; (g) had a composite IQ score of greater than 70 on the Kaufman Brief Intelligence Test—Second Edition (KBIT-2; Kaufman and Kaufman 2005); (h) scored at least a 26 or greater on the Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001); (i) scored at least a 65 or greater on the Social Responsiveness Scale (SRS; Constantino 2005); (j) scored at or below 85 on the Adaptive Behavior Composite score of the Vineland Adaptive Behavior Scales—Second Edition (Vinlenad-II; Sparrow et al. 2005) indicating clinical impairment associated with ASD as reported by caregivers; and (k) had no history of major mental illness (e.g., bipolar disorder, schizophrenia, or psychosis). All participants received the intervention at no cost and could withdraw from the study at any time without penalty.

Following baseline assessment and randomization by the flip of a coin, ten participants immediately began treatment and nine participants received treatment after a 14-week wait period. Treatment participants were assessed a second time during the last session of the intervention, while participants in the delayed treatment control group were assessed a second time during the first session of the intervention (after the 14-week wait period). One treatment group participant was dropped from the study due to prohibitively severe behavioral problems in the group.

The *UCLA PEERS for Young Adults Program* consisted of 14 weekly 90 min sessions, delivered in the community. Young adults and caregivers attended separate concurrent sessions at The Help Group led by a licensed clinical psychologist and a post-doctoral psychology fellow. Research assistants, who were either graduate or undergraduate psychology students, monitored treatment fidelity, assisted with role-playing demonstrations, and provided social coaching with performance feedback during behavioral rehearsal exercises. All research assistants were trained and supervised throughout the intervention.

The purpose of the lessons was to provide instruction and rehearsal of social skills related to building close relationships. Didactic lessons included: (a) conversational skills; (b) electronic forms of communication; (c) developing

friendship networks and finding sources of friends; (d) appropriate use of humor; (e) peer entry strategies; (f) peer exit strategies; (g) organizing get-togethers with friends; (h) handling teasing and embarrassing feedback; (i) dating etiquette; (j) handling peer pressure and avoiding exploitation; and (k) resolving arguments with friends.

The core features of the *UCLA PEERS for Adolescents Program* were adapted toward the development of the young adult program, for which an unpublished manual was created. These features included (a) relevant portions of the social skills curriculum, (b) the use of caregiver assistance in the treatment, and (c) structural elements of the lesson format including didactic lessons, role-playing demonstrations, behavioral rehearsal exercises, performance feedback, and weekly socialization homework assignments. The adolescent program was adapted to fit the adult treatment model through modifications to the caregivers' level of involvement with social coaching of young adults outside of the groups, further emphasizing the need for the young adults' social independence with adequately graded support. The *UCLA PEERS for Adolescents Program* was also modified to remove certain elements that were not developmentally appropriate for young adults, and to include four additional treatment modules on dating etiquette and strategies for handling peer pressure, and the use of young adults' self-derived social goals to increase intrinsic motivation for treatment compliance.

Instruction of social skills for *PEERS for Young Adults* was conducted in a small-group format (i.e., 9–10 group members), matching the self-reported needs and preferences of young adults with ASD (Müller et al. 2008). Training on social etiquette was provided through the use of concrete rules and steps, which was very appealing to young adults with ASD as they tend to think in concrete, literal terms and often have a high ability to take in information, particularly a selective attention to more systematic information (Johnson et al. 2010; Remington et al. 2009). These rules and steps of social etiquette were derived from evidence of ecologically valid social skills based on the behaviors of socially accepted peers. This method of instruction intuitively appeals to adults with ASD, as they often prefer and have a higher ability to remember facts (Bowler et al. 2008). The presentation of social rules was conducted in the form of Socratic questioning, intending to promote and enhance participation in the lesson among a population that often exhibits low self-directed behavior (Anckarsäter et al. 2006). For example, when presenting the first step of peer entry, participants might be told, "The first step for entering a conversation with people you don't know well involves listening to the conversation. What do you think we're listening for?" The answer of course would be that we are listening for the topic. By using a Socratic method of instruction, young

adults were essentially generating the rules and steps of social etiquette through marked direction, making it more likely that they would believe what they and their peers were learning. In order to further enhance motivation, role-playing exercises with modeling and structured practice followed and provided context to didactic lessons, during which time participants received feedback on their performance. This design enhances generalization of didactic content, since individuals with ASD often struggle to apply prior knowledge in context (McKenzie et al. 2010).

Due to the need to practice newly learned skills in a natural setting (Williams White et al. 2007), group leaders provided socialization homework assignments. Homework review took place in both caregiver and young adult group sessions the following week, and individualized the program to each participant by allowing sufficient time to troubleshoot any problems that may have arisen. Caregivers received specific instructions on how to provide assistance with social coaching to their young adults, while promoting or maintaining their social independence. Caregivers learned that managing this balance partially involves addressing the anxious behaviors, characterized by low novelty- and reward-seeking and high harm avoidance, that many adults with ASD possess (Anckarsäter et al. 2006). During young adult and caregiver reunification at the end of every session, group leaders ensured that families had a plan to complete upcoming assignments. Such immediate assistance with planning and organization may help young adults to manage their difficulties with executive functioning (Cederlund et al. 2010; Hill 2004) and allow for further mastery of skills through the promotion of homework compliance.

Measures

Few validated and normed measures exist to assess the psychosocial functioning of young adults with ASD. Lack of age-appropriate comparable standardized assessment tools led to the use of certain measures designed for the adolescent ASD population and exploration of measures designed for the neurotypical adult populations in the current study.

Descriptive Measures

Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001)

The AQ is a 50-item self- and parent-report scale that measures autistic traits along five subscales: social skills, attention shifting, attention to detail, communication, and imagination. Adolescents and adults with ASD and neurotypical college students reported good internal consistency (.82) and test-retest reliability (.70) in a validation study. The AQ has good discriminative validity and

screening properties for ASD in clinical samples at a threshold score of 26 (Woodbury-Smith et al. 2005). Higher scores represent more autism related traits. The AQ was administered to caregivers and young adults at baseline only to confirm diagnosis.

Kaufman Brief Intelligence Test: Second Edition (KBIT-2; Kaufman and Kaufman 2005)

Administered to young adult participants at baseline only, the KBIT-2 is a brief screening tool used to assess cognitive functioning. It generates Verbal, Nonverbal, and Composite IQ standard scores ($M = 100$, $SD = 15$). The KBIT-2 has very strong convergent validity with Wechsler Adult Intelligence Scale-Third Edition test scores (Walters and Weaver 2003). It was administered to participants at baseline assessment. Only those with KBIT-2 composite scores of greater than 70 were included in the study.

Vineland Adaptive Behavior Scales: Second Edition, Survey Form (Vineland-II; Sparrow et al. 2005)

The Vineland-II measures adaptive behavioral skills and functioning within the domains of communication, daily living skills, and socialization ($M = 100$, $SD = 15$). Reliability coefficients for the Adaptive Behavior Composite score are in the mid 90 s. The Vineland-II was administered to caregivers at baseline only. Participants with Adaptive Behavior Composite scores at or below 85 were eligible for the study.

Primary Outcome Measures

Social Responsiveness Scale (SRS; Constantino 2005)

The SRS is a 65-item rating scale of the severity of ASD symptoms as they occur in natural social settings. It provides a clinical representation of an individual's social impairments, assessing social awareness, social information processing, capacity for reciprocal social communication, social avoidance, and autistic mannerisms using T-scores ($M = 50$; $SD = 10$). Higher scores represent more autism related traits. SRS scores were examined as raw scores, due to lack of normed data for the adult population at the time of this study. The SRS was administered to caregivers at pre- and post-test and was considered to be a main caregiver-reported outcome measure for the current study.

Social Skills Rating System (SSRS; Gresham and Elliott 1990)

The SSRS is a 52-item, caregiver-report questionnaire using standard scores ($M = 100$; $SD = 15$). It assesses the

frequency of the display of a variety of social skills at home, in the classroom, and in interactions with peers. SSRS subscales include cooperation, assertion, responsibility, and self-control, and has been found to have high internal consistency (.87). Higher scores represent better social skills. Previous reports demonstrated the appropriateness of parents assessing high-functioning adolescents with ASD ages 11–17 (Laugeson et al. 2009; Koning and Magill-Evans 2001; Ozonoff and Miller 1995). The SSRS was administered to caregivers at pre- and post-test and was considered to be a main caregiver-reported outcome measure for the current study.

Social and Emotional Loneliness Scale for Adults (SELSA; DiTommaso and Spinner 1993)

The SELSA is a 37-item self-report measure of romantic, social, and family loneliness, the internal consistencies for which range from .89 to .93, validated on neurotypical college students. Higher scores represent more loneliness. The SELSA has not been normed for individuals with ASD and does not appear to have been previously completed by individuals with ASD. The SELSA was administered to young adults at pre- and post-test and was considered the main self-report outcome measure for the current study.

Secondary Outcome Measures

Empathy Quotient (EQ; Baron-Cohen and Wheelwright 2004)

The EQ is a caregiver-report measure of empathy. Eighty-one percent of adolescents and adults with ASD score less than 30 on the EQ, compared to 12 percent of controls; the groups together report excellent internal consistency (.92) and test-retest reliability (.97). Higher scores represent greater empathic abilities. The EQ was administered to caregivers and young adults at pre- and post-test.

Quality of Socialization Questionnaire (QSQ; Adapted from Frankel et al. 2010)

The QSQ is a 12-item self- and caregiver-report measure adapted from the Quality of Play Questionnaire for children with ASD (QPQ; Frankel et al. 2010). The QSQ assessed the young adults' frequency of hosted and invited get-togethers over the previous month. It was administered to caregivers and young adults at pre- and post-test.

Social Skills Inventory (SSI; Riggio 1989)

The SSI is a 90-item self-report measure of social skills for adults, validated on neurotypical college students. It yields

a total score and six sub-scales scores measuring emotional expressivity, emotional sensitivity, emotional control, social expressivity, social sensitivity, and social control. The subscales' internal consistency ranges from .75 to .88, and the SSI overall has a test-retest reliability of .94. Higher scores mean better social skills and functioning. The SSI does not appear to have been tested on an ASD population prior to this study. It was administered to young adults at pre- and post-test.

*Test of Young Adult Social Skills Knowledge (TYASSK;
Adapted from Laugeson et al. 2009)*

The TYASSK is a 23-item criterion-referenced measure based on the Test of Adolescent Social Skills Knowledge (TASSK; Laugeson et al. 2009) and modified for this study to assess young adults' knowledge about the specific social skills taught during the intervention. The TYASSK was administered to young adults at pre- and post-test.

Results

Table 1 presents the mean demographic and baseline variables for both groups. T-tests for age, KBIT-2 Composite IQ, Vineland-II Adaptive Behavior Composite scale, AQ, and outcome variable baseline scores all failed to reach significance. Box's Test of Equality of Variance

Matrices showed that the assumption of homogeneity of covariances was not violated ($p = 0.61$).

Outcome measure scores were converted to difference scores (DS; Post-test—Baseline). Negative DS indicated improvement for the SELSA and SRS scales, and positive DS showed improvement for TYASSK, SSRS, EQ, and QSQ. Table 2 presents the results for those measures that showed statistically significant findings.

Results of a MANOVA of outcome measures revealed multivariate main effect of group differences in that the Treatment group (TX) improved significantly more than the Delayed Treatment Control group (DTC) [Wilks' Lambda = 0.34; $F(1, 16) = 4.27, p < .02$].

Outcome measures also showed significance in their total scores for the TX group over the DTC group according to young adult self-reports: social and emotional loneliness as measured by the SELSA significantly improved as a result of treatment [$F(1, 16) = 4.73, p < .05$]; as did knowledge of social skills as measured by the TYASSK [$F(1, 16) = 17.03, p < .01$]. Caregiver-reports of social functioning also showed significant improvement post-treatment for social responsiveness as measured by the SRS Total score [$F(1, 16) = 5.17, p < .04$]; social skills as measure by the SSRS [$F(1, 16) = 10.28, p < .01$]; and empathizing as measured by the EQ [$F(1, 16) = 4.93, p < .04$].

Given the significance of the MANOVA, univariate main effects were examined. Greater reduction in ASD

Table 1 Mean demographic and baseline variables

Variable	Group		<i>p</i>
	Treatment (<i>n</i> = 9)	Delayed treatment (<i>n</i> = 8)	
<i>Demographics</i>			
Age (years)	19.9 (1.2)	20.9 (2.0)	0.22
Percent male	55.6	75.0	0.43
Percent Caucasian	55.6	75.0	0.83
KBIT-2 composite	96.7 (11.8)	108.5 (17.4)	0.12
Vineland-II composite	69.6 (7.5)	65.4 (8.0)	0.28
AQ	35.9 (5.2)	32.8 (4.3)	0.22
<i>Young adult measures</i>			
SELSA	132.6 (33.7)	133.2 (30.2)	0.97
TYASSK	14.0 (2.7)	13.0 (3.1)	0.49
QSQ hosted	1.00 (1.3)	0.50 (1.1)	0.41
QSQ invited	2.22 (4.9)	0.88 (1.8)	0.48
SSI Total score	237.4 (31.2)	243.4 (42.7)	0.75
<i>Caregiver measures</i>			
SRS Total score	110.8 (22.6)	102.6 (18.3)	0.43
SSRS social skills	78.7 (11.4)	83.6 (10.8)	0.37
QSQ hosted	0.78 (1.1)	0.38 (0.7)	0.40
QSQ invited	2.22 (5.2)	0.63 (0.9)	0.40
EQ	17.0 (8.4)	17.5 (8.4)	0.90

Table 2 Mean difference scores, standard deviations and significance for outcome variables

Variable	Group		<i>p</i>
	Treatment <i>n</i> = 9	Delayed treatment <i>n</i> = 8	
<i>Young adult measures</i>			
SELSA total score	−12.67 (17.6)	4.50 (14.6)	<.05
TYASSK	6.11 (3.26)	0.38 (2.53)	<.01
<i>Caregiver measures</i>			
SRS total score ^a	−18.7 (23.7)	6.25 (21.2)	<.04
SRS social communication ^a	−6.11 (7.75)	2.25 (7.59)	<.04
SRS autistic mannerisms ^a	−3.22 (4.32)	2.13 (3.60)	<.02
SSRS social skills ^b	6.67 (9.50)	−5.63 (5.50)	<.01
SSRS cooperation	2.56 (3.05)	−1.00 (2.27)	<.02
SSRS self-control	1.22 (3.99)	−2.38 (2.56)	<.05
SSRS assertion	2.00 (2.50)	−0.22 (1.39)	<.05
EQ	7.00 (9.75)	−1.13 (3.60)	<.04
QSQ invited get-togethers ^c	0.89 (0.93)	−0.13 (0.64)	<.03
QSQ hosted get-togethers ^c	1.00 (1.41)	0.00 (0.75)	<.05

^a Raw scores^b Standard scores^c Mann Whitney *U* Test of significance (2-tailed)

symptoms relating to social responsiveness on the SRS was found in the TX group in comparison to the DTC group, with significant improvements in Social Communication [$F(1,16) = 5.02, p < .04$] and decreased Autistic Mannerisms [$F(1,16) = 7.55, p < .02$]. Significant univariate main effects were also found on the SSRS subscales, revealing significant improvements for the treatment group in Cooperation [$F(1, 16) = 7.28, p < .02$], Self Control [$F(1, 16) = 4.74, p < .05$], and Assertion [$F(1, 16) = 4.42, p < .05$].

Finally, due to a violation of the normal distribution assumption, a non-parametric Mann–Whitney *U* Test of significance was used to assess change in frequency of get-togethers in both groups. The TX group showed a significantly greater increase in caregiver-reported invited get-togethers (QSQ Invited; $z = -2.20, p < .03$), and hosted get-togethers (QSQ Hosted; $z = -1.99, p < .05$) over the previous month.

Discussion

Findings support the effectiveness of the *PEERS for Young Adults* Program, a caregiver-assisted manualized social skills intervention aimed at promoting the development of close relationships and improving the social and psychosocial functioning of young adults with ASD.

The SSRS results revealed an overall improvement in social skills as reported by caregivers in the Treatment group in comparison to the Delayed Treatment Control group. This included increases in cooperative social behavior with peers and caregivers, social assertiveness (possibly due to the encouragement of independence in

social functioning), and self-control, which would likely lead to more appropriate social behaviors and thus social acceptance.

SRS results also demonstrated significant improvements in social responsiveness. The program's attention to receptive and expressive social communication skills may explain the rise in social communication. Similarly, change on the autistic mannerisms subscale, which measures repetitive behavior and restricted interests (e.g., “Thinks or talks about the same thing over and over”), may stem from the intervention's focus on skills for bidirectional social communication and interactions. Such marked progress has highly important implications for people with ASD. The SRS, a diagnostic screening instrument for ASD, measures core areas of deficits, which ultimately affect social functioning. Gains in these domains may change clinical presentation, which itself can be a treatment goal.

Similarly, the EQ can function as a marker of ASD presentation (Spek et al. 2010). Caregivers reported that their young adults significantly improved by the end of the treatment on this measure. These results suggest that the social cognitive abilities of these adults may have improved, as empathy involves theory of mind, or the ability to attribute mental and emotional states to other people to make sense of and predict their behavior (Baron-Cohen and Wheelwright 2004). In describing the EQ's design, Baron Cohen and Wheelwright (2004) define cognitive empathy as “the drive or ability to attribute mental states to another person/animal,” and emotional empathy as, “an appropriate affective response in the observer to the other person's mental state” (p. 168). The current intervention also may have raised participants' ability to empathize by having them learn, attend to, and assess

verbal and non-verbal social cues, through in-session role play exercises that demonstrated new social skills and required participants to take another person's perspective in a social situation.

Self-reported loneliness also decreased as a result of the intervention, as shown by the young adults' SELSA scores. Young adults' greater participation in social activities and hobbies, as well as the development of friendships may have caused social loneliness to decline. More frequent, appropriate attempts toward romantic interests may have reduced romantic loneliness. Social coaching provided by trained caregivers to assist young adults with their social functioning may also have resulted in a decline in family loneliness.

Furthermore, frequency of invited get-togethers (i.e., social invitations extended to the participant from non-PEERS friends) increased greatly according to caregiver report. Although hosted get-togethers (i.e., social invitations extended to non-PEERS friends by the participant) were also significantly improved, the frequency of invited get-togethers may better indicate treatment success, as it signifies social reciprocity in the relationship and would not be expected to be a direct product of homework compliance during the intervention (i.e., participants are assigned to arrange get-togethers with non-PEERS friends during the program, but having invitations extended to the participant from non-PEERS friends is not a program element and likely reflects social acceptance and friendship reciprocity).

The results of the current study resemble the success of *PEERS for Adolescents*. Both Laugeson et al. (2009) and the current study found an improvement on one of the main outcome measures, the SSRS, reflecting significant improvement in overall social skills as reported by parents and caregivers. Similarly, in Laugeson et al. (2009), adolescents reported an increase in hosted get-togethers, while in the current study caregivers reported an increase in both hosted and invited get-togethers. New findings related to caregiver-reports of social responsiveness (SRS) and empathy (EQ) were also observed in the present study, constructs that were not assessed by Laugeson et al. (2009), the former of which was not yet published when the previous study commenced. In addition, new findings related to young adult self-reported socio-emotional loneliness were also revealed, representing another construct which had not been examined in adolescents in the previous research.

Despite the significantly positive results reported here, a few limitations warrant attention. One is the lack of use of comprehensive standardized measures like the Autism Diagnostic Interview—Revised (ADI-R; Le Couteur et al. 2003) or the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2001), which were not administered due to financial constraints, but which would have been useful for confirming and corroborating diagnoses.

Similarly, assessment tools specifically designed or adapted for adults with ASD would be expected to improve the specificity of the findings, yet few such instruments exist for this population, or are still in the development phase, as is the case with the SRS-Adult Version (Constantino and Todd 2005). Another limitation to the current study is the lack of third party assessments for primary outcome measures, such as blinded assessment of treatment results or behavioral observations. Although the current study attempted to include independent rater reports of social functioning (e.g., teachers, professors, coaches, supervisors), most participants and their families failed to find such individuals. Behavioral observations were prohibitive due to financial constraints and due to the risk of imposing artificial context and thereby stress on the participants. Finally, findings from the current study are limited in their generalizability due to small sample size ($N = 17$). Therefore, larger clinical trials may strengthen external validity and guide future treatment adaptation and development. Moreover, stability of treatment gains is unknown; thus, future research might include follow-up studies to assess treatment outcomes over time.

In summary, findings from the current study strongly support the effectiveness of the *PEERS for Young Adults* Program for the acquisition and generalization of social skills, as well as the development of social relationships, in high-functioning young adults with ASD. This research serves as an example of a community-based effectiveness study using a randomized controlled trial design to meet the clinical needs of a highly underserved and arguably under-studied population (Williams White et al. 2007). Yet, additional investigation through subsequent trials is needed to provide further support for these findings, as well as follow-up data to assess the treatment's durability over time.

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References

- Anckarsäter, H., Stahlberg, O., Larson, T., Hakansson, C., Jutblad, S. B., Niklasson, L., et al. (2006). The impact of ADHD and autism spectrum disorders on temperament, character, and personality development. *American Journal of Psychiatry*, 163, 1239–1244.

- Barnhill, G. P. (2007). Outcomes in adults with Asperger syndrome. *Focus on Autism and Other Developmental Disabilities*, 22, 116–126.
- Baron-Cohen, S., & Wheelwright, S. (2004). The empathy quotient: An investigation of adults with Asperger's disorder or high functioning autism, and normal sex differences. *Journal of Autism and Developmental Disorders*, 34, 163–175.
- Baron-Cohen, S., Wheelwright, S., Skinner, R., Martin, J., & Clubley, E. (2001). The autism spectrum quotient (AQ): Evidence from Asperger syndrome/high functioning autism, males and females, scientists and mathematicians. *Journal of Autism and Developmental Disorders*, 31, 5–17.
- Barry, C. M., Madsen, S. D., Nelson, L. J., Carroll, J. S., & Badger, S. (2009). Friendship and romantic relationship qualities in emerging adulthood: Differential associations with identity development and achieved adulthood criteria. *Journal of Adult Development*, 16, 209–222.
- Bauminger, N., Shulman, C., & Agam, G. (2003). Peer interaction and loneliness in high-functioning children with autism. *Journal of Autism and Developmental Disorders*, 33, 489–507.
- Bowler, D. M., Gaigg, S. B., & Gardiner, J. M. (2008). Subjective organization in the free recall learning of adults with Asperger's syndrome. *Journal of Autism and Developmental Disorders*, 38, 104–113.
- Cederlund, M., Hagberg, B., & Gillberg, C. (2010). Asperger syndrome in adolescent and young adult males. Interview, self- and parent assessment of social, emotional, and cognitive problems. *Research in Developmental Disabilities*, 31, 287–298.
- Collins, W. A., & Madsen, S. D. (2006). Personal relationships in adolescence and early adulthood. In A. L. Vangelisti & D. Perlman (Eds.), *The Cambridge handbook of personal relationships* (pp. 191–209). New York: Cambridge University Press.
- Constantino, J. N. (2005). *Social responsiveness scale*. Los Angeles: Western Psychological Services.
- Constantino, J. N., & Todd, R. D. (2005). Intergenerational transmission of subthreshold autistic traits in the general population. *Biological Psychiatry*, 57, 655–660.
- DiTomaso, E., & Spinner, B. (1993). The development and initial validation of the social and emotional loneliness scale for adults (SELSA). *Personality and Individual Differences*, 14, 127–134.
- Fraley, R., & Davis, K. E. (1997). Attachment formation and transfer in young adults' close friendships and romantic relationships. *Personal Relationships*, 4, 131–144.
- Frankel, F., Myatt, R., Sugar, C., Whitham, C., Gorospe, C. M., & Laugeson, E. (2010). A randomized controlled study of parent-assisted children's friendship training with children having autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 40, 827–842.
- Gresham, F. M., & Elliott, S. (1990). *The social skills rating system*. Minnesota: American Guidance Service.
- Hill, E. L. (2004). Executive dysfunction in autism. *Trends in Cognitive Sciences*, 8, 26–32.
- Hillier, A., Fish, T., Cloppert, P., & Beversdorf, D. Q. (2007). Outcomes of a social and vocational skills support group for adolescents and young adults on the autism spectrum. *Focus on Autism and Other Developmental Disabilities*, 22, 107–115.
- Howlin, P. (2000). Outcome in adult life for more able individuals with autism or Asperger syndrome. *Autism*, 4, 63–83.
- Humphrey, N., & Symes, W. (2010). Perceptions of social support and experience of bullying among pupils with autistic spectrum disorders in mainstream secondary schools. *European Journal of Special Needs Education*, 25, 77–91.
- Jennes-Coussens, M., Magill-Evans, J., & Koning, C. (2006). The quality of life of young men with Asperger syndrome: A brief report. *Autism*, 10, 511–524.
- Johnson, S. A., Blaha, L. M., Hourt, J. W., & Townsend, J. T. (2010). Systems factorial technology provides new insights on global-local information processing in autism spectrum disorders. *Journal of Mathematical Psychology*, 54, 53–72.
- Kaufman, A. S., & Kaufman, N. L. (2005). *Kaufman brief intelligence test—second edition (K-BIT-2)*. Circle Pines: American Guidance Service.
- Koning, C., & Magill-Evans, J. (2001). Social and language skills in adolescent boys with Asperger syndrome. *Autism*, 5, 23–36.
- Lasgaard, M., Nielsen, A., Eriksen, M. E., & Goossens, L. (2009). Loneliness and social support in adolescent boys with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 40, 218–226.
- Laugeson, E. A., & Frankel, F. (2010). *Social skills for teenagers with developmental and autism spectrum disorders: The PEERS treatment manual*. New York: Routledge.
- Laugeson, E. A., Frankel, F., Mogil, C., & Dillon, A. R. (2009). Parent-assisted social skills training to improve friendships in teens with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 39, 596–606.
- Le Couteur, A., Lord, C., & Rutter, M. (2003). *The autism diagnostic interview—revised (ADI-R)*. Los Angeles: Western Psychological Services.
- Lord, C., Rutter, M., DiLavore, P. D., & Risi, S. (2001). *Autism diagnostic observation schedule*. Los Angeles: Western Psychological Services.
- McKenzie, R., Evans, J. S. B. T., & Handley, S. J. (2010). Conditional reasoning in autism: Activation and integration of knowledge and belief. *Developmental Psychology*, 46, 391–403.
- Mehzabin, P., & Stokes, M. A. (2011). Self-assessed sexuality in young adults with high-functioning autism. *Research in Autism Spectrum Disorders*, 5, 614–621.
- Miller, P. M., & Ingham, J. G. (1976). Friends, confidants and symptoms. *Social Psychiatry*, 11, 51–58.
- Müller, E., Schuler, A., & Yates, G. B. (2008). Social challenges and supports from the perspective of individuals with Asperger syndrome and other autism spectrum disabilities. *Autism*, 12, 173–190.
- Orsmond, G. L., Krauss, M. W., & Seltzer, M. M. (2004). Peer relationships and social and recreational activities among adolescents and adults with autism. *Journal of Autism and Developmental Disorders*, 34, 245–256.
- Ozonoff, S., & Miller, J. N. (1995). Teaching theory of mind: A new approach to social skills training for individuals with autism. *Journal of Autism and Developmental Disorders*, 25, 415–433.
- Remington, A., Swettenham, J., Campbell, R., & Coleman, M. (2009). Selective attention and perceptual load in autism spectrum disorder. *Psychological Science*, 20, 1388–1393.
- Riggio, R. (1989). Assessment of basic social skills. *Journal of Personality and Social Psychology*, 51, 649–660.
- Shattuck, P., Seltzer, M., Greenberg, M. M., Orsmond, G. I., Bolt, D., Kring, S., et al. (2007). Change in autism symptoms and maladaptive behaviors in adolescents and adults with an autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 37, 1735–1747.
- Shtayerman, O. (2007). Peer victimization in adolescents and young adults diagnosed with Asperger's syndrome: A link to depressive symptomatology, anxiety symptomatology and suicidal ideation. *Issues in Comprehensive Pediatric Nursing*, 30, 87–107.
- Sparrow, S., Balla, D., & Cicchetti, D. V. (2005). *The Vineland adaptive behavior scales* (2nd ed.). Circle Pines: American Guidance Service.
- Spek, A. A., Scholte, E. M., & Van Berckelaer-Onnes, I. A. (2010). Theory of mind in adults with HFA and Asperger syndrome. *Journal of Autism and Developmental Disorders*, 40, 280–289.

- Sterling, L., Dawson, G., Estes, A., & Greenson, J. (2008). Characteristics associated with presence of depressive symptoms in adults with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 38, 1011–1018.
- Stokes, M., Newton, N., & Kaur, A. (2007). Stalking, and social and romantic functioning among adolescents and adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 37, 1969–1986.
- Sullivan, A., & Caterino, L. C. (2008). Addressing the sexuality and sex education of individuals with autism spectrum disorders. *Education and Treatment of Children*, 31, 381–394.
- Tantam, D. (2003). The challenge of adolescents and adults with Asperger syndrome. *Child and Adolescent Psychiatric Clinics of North America*, 12, 143–163.
- Taylor, J. L., & Seltzner, M. M. (2010). Changes in the autism behavioral phenotype during the transition to adulthood. *Journal of Autism and Developmental Disorders*, 40, 1431–1446.
- Turner-Brown, L. M., Perry, T. D., Dichter, G. S., Bodfish, J. W., & Penn, D. L. (2008). Brief report: Feasibility of social cognition and interaction training for adults with high functioning autism. *Journal of Autism and Developmental Disorders*, 38, 1777–1784.
- Walters, S., & Weaver, K. (2003). Relationships between the Kaufman brief intelligence test and the Wechsler adult intelligence scale-third edition. *Psychological Reports*, 92, 1111–1115.
- White, S. W., & Robertson-Nay, R. (2009). Anxiety, social deficits, and loneliness in youth with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 39, 1006–1013.
- Whitehouse, A. J., Durkin, K., Jaquet, E., & Ziatas, K. (2009). Friendship, loneliness and depression in adolescents with Asperger's syndrome. *Journal of Adolescence*, 32, 309–322.
- Williams White, S., Keonig, K., & Scahill, L. (2007). Social skills development in children with autism spectrum disorders: A review of the intervention research. *Journal of Autism and Developmental Disorders*, 37, 1858–1868.
- Wing, L. (1983). Social and interpersonal needs. In E. Schopler & G. Mesibov (Eds.), *Autism in adolescents and adults* (pp. 337–354). New York: Plenum Press.
- Woodbury-Smith, M. R., Robinson, J., Wheelwright, S., & Baron-Cohen, S. (2005). Screening adults for Asperger syndrome using the AQ: A preliminary study of its diagnostic validity in clinical practice. *Journal of Autism and Developmental Disorders*, 35, 331–335.