

A Randomized Controlled Trial to Improve Social Skills in Young Adults with Autism Spectrum Disorder: The UCLA PEERS[®] Program

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Abstract Research suggests that impaired social skills are often the most significant challenge for those with autism spectrum disorder (ASD), yet few evidence-based social skills interventions exist for adults on the spectrum. This replication trial tested the effectiveness of PEERS, a caregiver-assisted social skills program for high-functioning young adults with ASD. Using a randomized controlled design, 22 young adults 18–24 years of age were randomly assigned to a treatment ($n = 12$) or delayed treatment control ($n = 10$) group. Results revealed that the treatment group improved significantly in overall social skills, frequency of social engagement, and social skills knowledge, and significantly reduced ASD symptoms related to social responsiveness following PEERS. Most treatment gains were maintained at a 16-week follow-up assessment with new improvements observed.

Keywords PEERS · Social skills · Autism spectrum disorder · Adults · Friendship · Dating

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Introduction

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder affecting 1.5 million individuals in the United States, with the number of adults identified with the disorder rising every year. Research suggests that impaired social skills are often the most significant challenge for those on the autism spectrum, often affecting the ability to develop and maintain meaningful relationships (Reichow and Volkmar 2010), yet few evidence-based social skills interventions exist for the growing population of adults with ASD (White et al. 2007; Rao et al. 2008). Perhaps due to a misconception that adults with adequately developed cognitive and language abilities should have better quality of life outcomes, even without ongoing intervention, there is a paucity of services available for those on the higher end of the autism spectrum (Shattuck et al. 2011; Tantam 2003; Taylor and Seltzer 2011).

Numerous studies have highlighted the poor quality of life outcomes for high-functioning adults with ASD. According to one study, approximately 26 % of adults with ASD without intellectual disabilities lead isolated and less productive lives, with a striking absence of friends and virtually no engagement in occupational, vocational, or recreational social activities (Cederlund et al. 2008). Only a small minority of adults with high-functioning ASD live independently from their families and caregivers (Burrows et al. 2001; Howlin 2003; Lawrence et al. 2010), few are engaged in full-time employment, and among those who are employed, most do not have jobs that reflect their abilities or qualifications (Cederlund et al. 2008; Howlin et al. 2004).

Poorer quality of life outcomes are often attributed to characteristics such as impaired social skills and poor social cognition (Howlin et al. 2004; Marriage et al. 2009).

Challenged by poor social skills in such basic areas as understanding social cues and initiating and maintaining social communication, many young adults with ASD initiate very few social interactions and may even withdraw from social situations altogether (Shtayermman 2007). In one study, as many as half of the young adults sampled with high-functioning ASD reported having no friends (Howlin et al. 2000), and in a separate study over one-third reported no involvement in social activities whatsoever (Jennes-Coussens et al. 2006). Similarly, in a nationally representative U.S. sample of older adolescents and young adults with ASD 17–21 years of age, Liptak et al. (2011) found that 55 % percent had not had a get-together with a friend in the past year, and 64 % had not talked on the phone with a friend in the past year. Participation in community-based recreational and leisure activities are also uncommon among young adults with ASD, with the majority of recreational pursuits revolving around solitary pastimes such as playing videogames and watching television (Jennes-Coussens et al. 2006).

Romantic relationships are even more rare for those adults on the high-functioning end of the spectrum. Despite the desire to develop romantic relationships often expressed by those with ASD, precious few ever experience romantic relationships or ultimately marry (Barnhill 2007; Cederlund et al. 2008; Howlin 2000; Jennes-Coussens et al. 2006; Stokes et al. 2007). Deficits in social skills appear to predict the inability to form romantic relationships in individuals with ASD (Mehzabin and Stokes 2011; Stokes et al. 2007), with some individuals even unknowingly behaving in an intrusive manner with potential romantic partners, sometimes perceived as stalking behavior by the object of their affection (Stokes et al. 2007).

Poor friendship quality and lack of meaningful relationships are thought to contribute to loneliness and other mental health problems for those on the spectrum. In adolescents with ASD, lack of social support positively correlates with loneliness (Humphrey and Symes 2010; Lasgaard et al. 2009), which in turn may positively correlate with depression (Whitehouse et al. 2009). Poor social competence, anxiety, and social withdrawal are also positively correlated with depression in youth with ASD (White et al. 2007). Moreover, eagerness to form social relationships, combined with social naïveté and lack of social competence, may also make young adults with ASD more vulnerable to peer victimization, and bullying (Humphrey and Symes 2010), as well as peer pressure and even sexual exploitation (Sullivan and Caterino 2008).

High risk for victimization and prevalence of poor quality of life in multiple domains (e.g., lack of independence, unemployment, lack of relationships, poor mental health outcomes, etc.) suggest the strong need for treatment to improve social relationships for this highly vulnerable

population. While peer rejection is one of the strongest predictors of poor mental health outcomes (Buhrmester 1990; Matson et al. 1998; Miller and Ingham 1976), having good social skills and adequate social support is correlated with better quality of life in adults with ASD (Jennes-Coussens et al. 2006; Wing 1983). Therefore, the development and maintenance of close meaningful relationships should be a treatment priority for this highly vulnerable and underserved population.

Although some high-functioning adults with ASD may live independently, obtain and maintain gainful employment, and even develop meaningful relationships with others, such accomplishments are typically rare and not easily achieved. Instead, the majority of adults with ASD remain dependent on caregivers and significant others for support in multiple areas (Howlin 2000; Howlin et al. 2004). Given the strong need for support, even individuals with ASD without intellectual disabilities still commonly require assistance from caregivers in the development of social skills and access to social opportunities (Gantman et al. 2012; Laugeson et al. 2012; Laugeson et al. 2009). Thus, a caregiver-assisted model for teaching social skills may provide the most robust treatment outcomes for young adults with ASD. Moreover, with ongoing caregiver support, ability to sustain treatment gains over time should be enhanced even when formalized treatment has ended.

The notion of parent and/or caregiver-assistance in social skills treatment has been established in multiple randomized controlled trials for those with ASD ranging from childhood (Frankel et al. 2010), to adolescence (Laugeson et al. 2009, 2012; Schohl et al. 2013; Van Hecke et al. 2015; Yoo et al. 2014), and through adulthood (Gantman et al. 2012). The durability of parent-assisted treatment gains has also been established months to years following intervention in studies with children (Mandelberg et al. 2014), and adolescents with ASD (Laugeson et al. 2012; Mandelberg et al. 2014). However, the maintenance and durability of treatment outcomes has yet to be explored in a young adult population following caregiver-assisted social skills training.

The purpose of the current study was to test the effectiveness of a caregiver-assisted social skills intervention for young adults with ASD without intellectual disabilities. The *Program for the Education and Enrichment of Relational Skills (PEERS)* (Laugeson and Frankel 2010) was originally developed as a manualized evidence-based social skills program for high-functioning adolescents with ASD (Laugeson and Frankel 2010; Laugeson 2014; Laugeson and Frankel 2014), focusing on making and keeping friends and managing peer conflict and rejection. The efficacy and effectiveness of parent/caregiver-assisted versions of the *PEERS* intervention have been established in multiple clinical trials with adolescents with ASD in

mental health settings (Laugeson et al. 2009, 2012; Schohl et al. 2013; Van Hecke et al. 2015; Yoo et al. 2014), educational settings (Laugeson et al. 2014), and with young adults with ASD (Gantman et al. 2012).

Using an adapted version of this evidence-based social skills intervention for high functioning adults with ASD, known as *PEERS for Young Adults* (Laugeson and Frankel in press), the current study sought to replicate previous research findings. In a separate randomized controlled trial (RCT) of young adults 18–23 years of age with ASD without intellectual disabilities, Gantman et al. (2012) found that in comparison to a delayed treatment control group, participants receiving caregiver-assisted social skills training using the *PEERS for Young Adults* curriculum exhibited significantly improved overall social skills, social responsiveness, empathy, and frequency of get-togethers, and less self-reported loneliness, more emotional awareness, and improved social skills knowledge.

The aims of the current replication study were to: (1) replicate the previous findings using separate independent data from a new sample of young adults with ASD, and (2) collect follow-up data to assess the maintenance of treatment gains 16-weeks following treatment. It was hypothesized that in comparison to a delayed treatment control group, participants receiving the *PEERS[®] for Young Adults* treatment (Laugeson and Frankel in press) would demonstrate greater improvement in overall social skills, social responsiveness, social skills knowledge, and peer engagement as measured by a battery of caregiver and young adult self-report measures of social functioning, and that these treatment gains would be maintained at a 16-week follow-up assessment.

Methods

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 Los Angeles based community mental health agency with specialized day school programs and outpatient programs for children, adolescents, and young adults with ASD. Using a randomized controlled design, young adults and caregivers in the treatment (TX) group attended 16 concurrent weekly 90-min social skills group sessions delivered in a community mental health setting, focused on making and keeping friends, developing and maintaining romantic relationships, and managing peer conflict and rejection. Skills were taught using didactic lessons, role-play demonstrations, behavioral rehearsal exercises, and in vivo homework assignments. Participants randomly assigned to a delayed treatment control (DTC) group

waited for treatment for 16-weeks. Treatment outcome was assessed at pre-test, post-test, and 16-week follow-up assessment across TX and DTC groups using a battery of measures of social functioning.

Participants

Participants were recruited from The Help Group and the UCLA PEERS Clinic. Twenty-two young adults ranging from 18 to 24 years of age were recruited for the study with their caregivers, who included parents, other family members, job coaches, life coaches, or peer mentors. All participants had a previous diagnosis of an autism spectrum disorder from a reliable mental health professional. Diagnoses were further confirmed using caregiver-reports on the Autism Spectrum Quotient (Baron-Cohen et al. 2001). Of the 22 participants, 17 completed all phases of the study (TX = 9 and DTC = 8). Among the TX group, 12 participants completed baseline testing (T1), 10 completed the 16-week treatment and post-testing (T2), and 9 completed the 16-week follow-up assessment (T3). Within the DTC group, 10 participants completed baseline 1 (T1) and baseline 2 (T2) assessments, and 8 completed the 16-week treatment with post-testing (T3) and 16-week follow-up assessment (T4). Among the five participants who dropped out of the study, attrition was due to various reasons including transportation and scheduling issues, health reasons, and change in treatment priorities. All participants were treated in accordance with the *APA Ethical Guidelines for Human Research* and University IRB-approved procedures. Table 1 provides mean demographic and baseline variables for participants.

Inclusion and Exclusion Criteria

Eligibility appointments and baseline assessments were conducted at the UCLA PEERS Clinic by trained members of the research team, including graduate students and post-doctoral fellows specializing in psychology. Inclusion criteria were that the young adult was between 18 and 24 years of age; had a previous diagnosis of ASD from a licensed mental health or medical professional; had social problems as reported by the caregiver; was willing and motivated to participate in the treatment; was fluent in English; had a caregiver who was fluent in English and willing to participate in the study; had a composite IQ score >70 on the Kaufman Brief Intelligence Test—Second Edition (KBIT-2; Kaufman and Kaufman 2005); and scored ≥ 26 on the caregiver-reported Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001), indicating clinical impairment associated with ASD. Exclusion criteria included a history of major mental illness (e.g., bipolar disorder, schizophrenia, or psychosis); or visual

Table 1 Mean demographic and baseline variables (standard deviations in parentheses)

Variable	Group		<i>p</i>
	TX (<i>n</i> = 12)	DTC (<i>n</i> = 10)	
<i>Demographics</i>			
Age (years)	21.01 (1.73)	19.71 (2.01)	0.11
Percent male	77.8	75.0	0.89
Percent Caucasian	44.4	62.5	0.46
K-BIT-2 composite	107.44 (18.80)	102.13 (13.93)	0.52
AQ total score	32.67 (9.82)	37.00 (5.48)	0.29
<i>Young adult measures</i>			
TYASSK	13.22 (2.95)	13.25 (3.45)	0.99
QSQ hosted get-togethers	0.56 (0.53)	0.25 (0.46)	0.23
QSQ invited get-togethers	0.56 (0.73)	0.50 (1.07)	0.90
<i>Caregiver measures</i>			
SRS total score	72.11 (6.49)	72.25 (7.17)	0.97
SSRS social skills score	78.89 (8.84)	80.63 (12.26)	0.74
QSQ hosted get-togethers	0.44 (1.01)	0.25 (0.46)	0.63
QSQ invited get-togethers	0.56 (0.73)	1.13 (2.80)	0.58

impairment and/or hearing impairment that would preclude participation in group-based social activities.

Procedures

Following baseline assessment (T1; Week 1) during the eligibility appointments, participants were randomly assigned by the flip of a coin, with 12 participants assigned to receive treatment immediately (TX group) and 10 participants assigned to receive treatment after a 16-week wait period (DTC group). TX participants were assessed a second time during the last session of the 16-week intervention (T2; Week 16), while DTC participants were assessed a second time after the 16-week wait period (T2; Week 16). Follow-up assessments were conducted with TX participants 16 weeks following treatment (T3; Week 32). Post-treatment assessments were conducted with DTC participants immediately following treatment (T3; Week 32) and at a 16-week follow-up assessment (T4; Week 48). Figure 1 provides an overview of the study design.

Measures

Descriptive Measures

Autism Spectrum Quotient (AQ; Baron-Cohen et al. 2001). The AQ is a 50-item 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). The AQ was administered to caregivers at baseline to confirm diagnosis and only those with scores ≥ 26 were included in the study.

Kaufman Brief Intelligence Test-Second Edition (KBIT-2; Kaufman and Kaufman 2005). 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 (WAIS-III; Wechsler 1997) test scores (Walters and Weaver 2003). It was administered to young adult participants at baseline and only those with KBIT-2 composite scores >70 were included in the study.

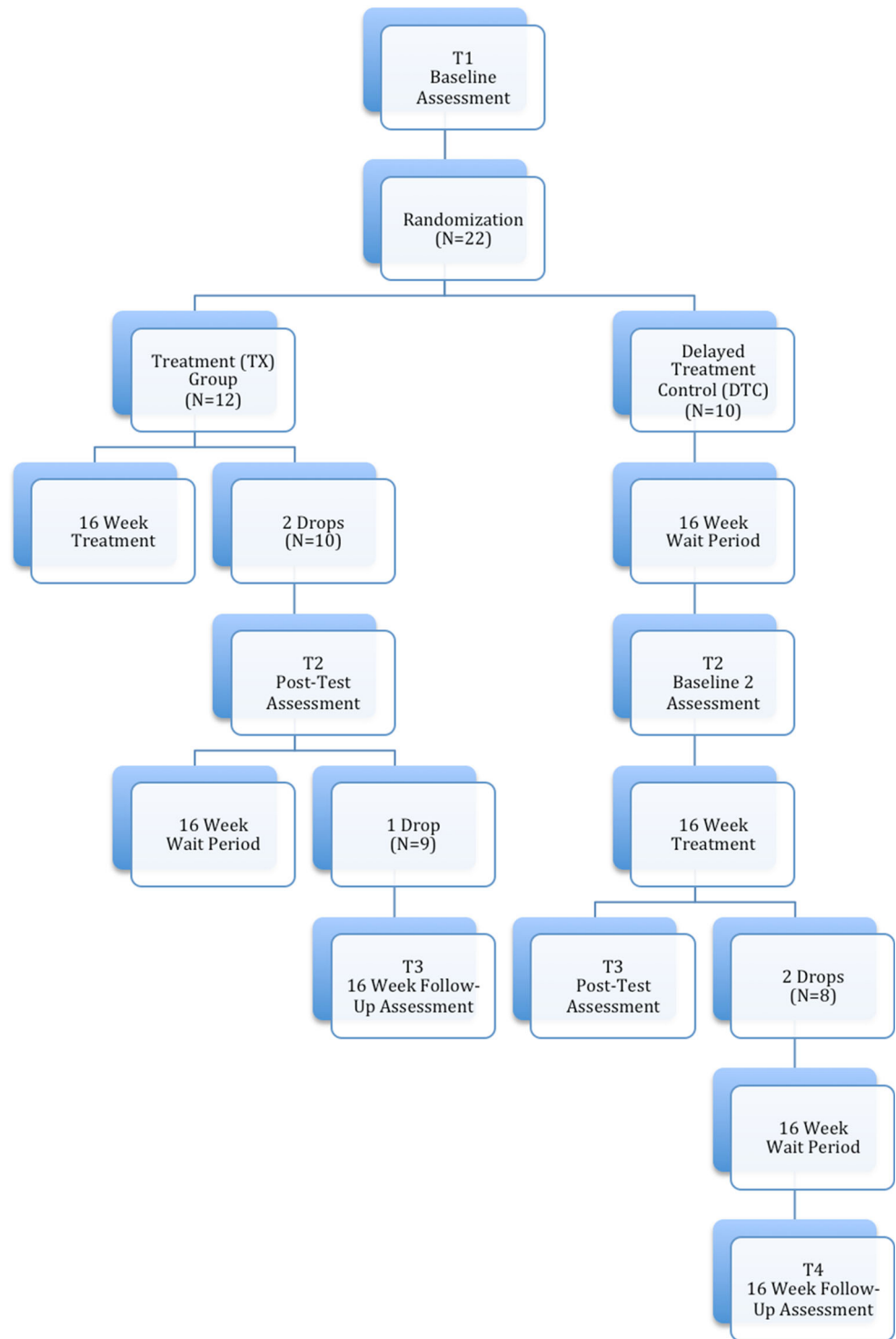
Outcome Measures

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 on the SRS reflect greater impairment and autistic symptoms with scores ≥ 60 in the clinical threshold. The SRS was administered to caregivers at T1, T2, T3, and T4 as a primary outcome measure for the study.

Social Skills Rating System (SSRS; Gresham and Elliott 1990). The SSRS is a 52-item, parent-report questionnaire using standard scores ($M = 100$; $SD = 15$). It assesses the frequency of social skills at home, in the classroom, and in interactions with peers. SSRS subscales include cooperation, assertion, responsibility, and self-control, and have been found to have high internal consistency (.87). Although the SSRS was originally developed for adolescents, previous reports have demonstrated the appropriateness of its use in assessing the social skills of high-functioning adults with ASD (Gantman et al. 2012). The SSRS was administered to caregivers at T1, T2, T3, and T4 and was considered to be a primary outcome measure for the current study.

Quality of Socialization Questionnaire (QSQ; Laugeson and Frankel 2010). The QSQ is a 12-item self- and parent-report measure adapted from the Quality of Play Questionnaire for children with ASD (QPQ; Frankel and Mintz 2011). The QSQ has been successfully used to assess frequency of social engagement among adolescents with ASD (Laugeson et al. 2009, 2012) and young adults with ASD

Fig. 1 Study design



(Gantman et al. 2012). The QSQ assesses the young adults' frequency of hosted and invited get-togethers over the previous month. It was administered to caregivers and young adults at T1, T2, T3, and T4 to assess treatment outcome.

Empathy Quotient (EQ; Baron-Cohen and Wheelwright 2004). The EQ is a parent-report measure of empathy. Eighty-one percent of adolescents and adults with ASD score less than 30 on the EQ, compared to 12 % of controls; the groups together report excellent internal

consistency (.92) and test–retest reliability (.97). The EQ was administered to caregivers at T1, T2, T3, and T4 to assess treatment outcome.

Test of Young Adult Social Skills Knowledge (TYASSK; adapted from Laugeson and Frankel 2010). The TYASSK is a 30-item criterion-referenced measure based on the Test of Adolescent Social Skills Knowledge (TASSK; Laugeson and Frankel 2010) 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 T1, T2, T3, and T4 to assess treatment outcome.

Social Skills Training

The *PEERS for Young Adults Intervention* consisted of 16 weekly 90-min sessions delivered in the community at The Help Group. Young adults and their caregivers attended separate concurrent sessions led by a licensed clinical psychologist and a post-doctoral psychology fellow, respectively. Behavioral coaches, comprised of graduate and undergraduate students in psychology and education, monitored treatment fidelity throughout the sessions, conducted role-play demonstrations of targeted skills, and provided social coaching with performance feedback during young adult behavioral rehearsal exercises. All members of the treatment team, including behavioral coaches, were trained and supervised throughout the intervention by a licensed clinical psychologist, who was also the young adult group leader and developer of the intervention.

Weekly 90-min didactic lessons were provided to deliver instruction and rehearsal of social skills related to developing and maintaining friendships and romantic relationships, and to manage peer conflict and rejection. Didactic lessons included content related to conversational skills; electronic forms of communication; developing friendship networks and finding sources of friends; appropriate use of humor; peer entry and exiting strategies; organizing and having successful get-togethers with friends; handling teasing and chronic bullying in the school or work place; managing peer pressure; conflict resolution; and strategies related to dating etiquette including showing romantic interest, asking someone on a date, handling rejection, and general dating guidelines.

The core features of the *UCLA PEERS Program* were adapted for young adults with ASD as described in Gantman et al. 2012. Instruction was conducted in a small group setting using evidence-based methods of social skills instruction (Laugeson and Park 2014). Didactic instruction was provided using concrete rules and steps of ecologically valid social behavior (Laugeson 2013). Within the young adult group, social rules and steps were presented using a Socratic method of questioning, intending to promote and

enhance participation in the lesson. Role-play demonstrations of targeted behaviors were also used to model appropriate and inappropriate examples of the rules and steps. In order to enhance social cognition, role-play demonstrations were followed by perspective taking questions in which participants were asked to take on the perspective of the receiver of the appropriate or inappropriate social behavior. Questions such as, “*What was that like for the other person?*” and “*What did they think of me?*” and “*Will they want to talk to me again?*” were asked of the participants after each role-play demonstration. Structured practice followed each lesson through a behavioral rehearsal exercise in which young adult participants practiced the appropriate newly learned skills while receiving performance feedback through social coaching by the treatment team. Socialization homework assignments were given for each of the targeted social skills to aid generalization of skills outside of the treatment setting. Homework review took place in both the caregiver and young adult group sessions in the following week, with sufficient time to troubleshoot any issues that may have arisen and to individualize the treatment to participants as needed.

Within the caregiver group, homework review comprised the majority of the session in order to include specific instructions on how to provide assistance with social coaching to young adults during weekly homework assignments. Didactic instruction followed homework review in the caregiver group through the distribution and review of Social Coaching Handouts, which provided an outline of the rules and steps of the targeted social skills, along with a comprehensive description of the upcoming homework assignments. Within the didactic lesson, caregivers were also given specific instruction on how to provide social coaching to young adults outside of the treatment setting. These strategies were tailored to the specific needs of each young adult as necessary. The use of caregiver-assistance in treatment was utilized in order to enhance generalization of social skills through in vivo social coaching in natural social settings (when appropriate) and increase homework compliance and practice of newly learned skills. Caregivers were also expected to enhance the durability of treatment gains through continual social coaching even after the PEERS intervention had ended. Thus, caregiver attendance in weekly group sessions was a mandatory component of the treatment.

A 10-min reunification between young adults and caregivers occurred at the end of every session in order to highlight the skills taught in the lesson and assign homework for the coming week. With the help of group leaders, young adults briefly summarized the skills taught in the session, and were then assigned corresponding homework, the details of which were privately negotiated with each

young adult-caregiver dyad to ensure homework completion. In order to ensure 100 % fidelity to the *PEERS for Young Adults Treatment Manual* (Laugeson and Frankel in press), trained behavioral coaches monitored treatment fidelity in every session and notified group leaders immediately if any aspect of the treatment was missed during the lesson and before concluding the session.

Results

Data were analyzed using SPSS 20 (SPSS Inc., Chicago, IL, USA). Table 1 presents the mean demographic and baseline variables for both groups. *T*-tests for age, KBIT-2 Composite IQ, AQ, and outcome variable baseline scores all failed to reach significance, suggesting group equivalence across conditions. Box's Test of Equality of Variance Matrices showed that the assumption of homogeneity of covariances was not violated ($p = .20$).

Primary Analyses

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

Results of a MANOVA of outcome measures revealed a multivariate main effect of group differences in that the TX group improved significantly more than the DTC group [Wilks' Lambda = 0.14; $F(5, 11) = 12.43, p < .001$].

Outcome measures showed significance in their total scores for the TX group over the DTC group according to young adult self-reports: knowledge of social skills as measured by the TYASSK significantly improved as a result of treatment [$F(1, 16) = 27.13, p < .001, d = 2.57$], as did number of monthly get-togethers as measured by the QSQ [$F(1, 16) = 6.35, p < .03, d = 0.92$]. Caregiver reports of social functioning also showed significant improvement post-treatment in the TX group over the DTC group for social responsiveness as measured by the SRS total score [$F(1, 16) = 7.44, p < .02, d = 1.32$]; social skills as measure by the SSRS [$F(1, 16) = 6.12, p < .03, d = 1.23$]; and number of monthly get-togethers as measured by the QSQ [$F(1, 16) = 31.40, p < .001, d = 1.76$]. Caregiver reports of change in empathy as measured by the EQ did not differ significantly between the TX and DTC groups.

Given the significance of the MANOVA, univariate main effects were examined. Greater reduction in ASD symptoms relating to social responsiveness on the SRS were found in the TX group in comparison to the DTC group, with

significant improvement in Social Motivation [$F(1,16) = 6.57, p < .03, d = 1.25$], significant decrease in Autistic Mannerisms [$F(1,16) = 10.26, p < .01, d = 1.53$], and a trend-level improvement in Social Communication [$F(1,16) = 3.77, p < .08, d = 0.95$]. There were no significant differences between the two groups on the subscales of Social Awareness and Social Cognition on the SRS. Significant univariate main effects were also found on the SSRS subscales, revealing significant improvements for the treatment group in Cooperation [$F(1, 16) = 4.58, p < .05, d = 1.06$] and Assertion [$F(1, 16) = 8.01, p < .02, d = 1.40$]. Responsibility and Self Control subscales of the SSRS did not reveal significant change differences between the two groups. Univariate analyses of the QSQ revealed a significant increase in hosted get-togethers in the TX group in comparison to the DTC group according to caregiver-report [$F(1, 16) = 7.47, p < .02, d = 1.37$] and a trend level increase according to young adult self-report [$F(1, 16) = 3.51, p < .09, d = 0.93$]. Caregivers in the TX group also reported an increased number of invited get-togethers at trend-level significance [$F(1, 16) = 3.98, p < .07, d = 0.99$] in comparison to the DTC group, but this was not replicated according to young adult self-report.

Secondary Analyses

Follow-up Outcomes in TX Group

The effect of treatment on outcome variables at a 16-week follow-up assessment was evaluated with two-tailed paired samples *T* tests (T1–T3). Results of the follow-up analyses indicate that treatment gains were maintained for the TX group for all outcome measures except QSQ hosted get-togethers and the SSRS Cooperation subscale (see Table 3). According to young adult self-report, improvements in TYASSK social skills knowledge ($p < .01$) and QSQ total ($p < .01$) and invited ($p < .05$) get-togethers were maintained. According to caregiver report, reduction in ASD symptoms relating to social responsiveness on the SRS was maintained at follow-up, with significant improvements from T1 to T3 in Social Motivation ($p < .01$), Social Cognition ($p < .03$), and Social Communication ($p < .05$), and a significant decrease in Autistic Mannerisms ($p < .01$). Caregiver-reported total ($p < .01$) and invited ($p < .03$) get-togethers as measured by the QSQ remained significantly higher than baseline report. Significant improvements on the SSRS were maintained for overall social skills ($p < .01$) and the Assertion subscale ($p < .01$). Two additional outcomes not initially observed from T1 to T2 were an increase on the SSRS subscale of Responsibility ($p < .05$) and an increase in caregiver-reported empathy as measured by the EQ ($p < .001$) 16-weeks following treatment.

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

Variable	Group		<i>p</i>	<i>d</i>
	TX (<i>n</i> = 9)	DTC (<i>n</i> = 8)		
<i>Young adult measures</i>				
TYASSK	8.22 (3.46)	0.87 (2.10)	<.001**	2.57
QSQ total get-togethers	3.56 (2.40)	1.13 (1.36)	<.03*	0.92
QSQ hosted get-togethers	1.55 (2.13)	0.13 (0.35)	<.09 ⁺	0.93
QSQ invited get-togethers	2.00 (2.06)	1.00 (1.41)	>.10	0.57
<i>Caregiver measures</i>				
SRS total score	-9.22 (6.18)	-0.13 (7.57)	<.02*	1.32
SRS social motivation	-7.00 (6.76)	1.38 (6.67)	<.03*	1.25
SRS autistic mannerisms	-11.67 (5.45)	2.25 (11.65)	<.01**	1.53
SRS social communication	-9.00 (7.63)	-2.00 (7.17)	<.07 ⁺	0.95
SRS social awareness	-6.33 (6.96)	-2.38 (7.69)	>.10	0.54
SRS social cognition	-6.56 (7.55)	0.38 (9.44)	>.10	0.81
SSRS social skills score	12.00 (1.00)	11.64 (4.96)	<.03*	1.23
SSRS cooperation	2.22 (2.82)	-0.13 (1.36)	<.05*	1.06
SSRS assertion	4.22 (3.60)	0.38 (1.41)	<.02*	1.40
SSRS responsibility	1.78 (2.91)	0.00 (1.60)	>.10	0.76
SSRS self-control	1.78 (3.42)	0.38 (2.56)	>.10	0.46
QSQ total get-togethers	3.78 (1.64)	0.38 (0.52)	<.001**	1.76
QSQ hosted get-togethers	2.00 (2.00)	0.00 (0.53)	<.02*	1.37
QSQ invited get-togethers	1.78 (1.86)	0.38 (0.74)	<.07 ⁺	0.99
EQ total score	2.67 (5.74)	1.50 (6.57)	>.10	0.19

Difference scores measure change in scores from T1 to T2

* $p < .05$; ** $p < .01$; ⁺ $p < .1$

Post-treatment and Follow-up Outcomes in DTC Group

The effect of treatment on outcome variables from pre-post treatment (T2–T3) and post-follow-up (T3–T4) was evaluated with two-tailed paired samples *T*-tests for the DTC group ($n = 8$). As shown in Table 4, significant improvements from pre-post treatment were demonstrated in young adult self-reported TYASSK social skills knowledge ($p < .01$), QSQ number of total get-togethers ($p < .03$), and QSQ number of hosted get-togethers ($p < .01$). Significant change was not found for QSQ invited get-togethers. Treatment gains were also maintained at the 16-week follow-up assessment for the self-reported TYASSK ($p < .01$), QSQ total get-togethers ($p < .01$), and QSQ hosted get-togethers ($p < .03$). According to pre-post caregiver report, ASD symptoms relating to social responsiveness on the SRS were significantly reduced ($p < .02$), with significant improvement in the areas of Autistic Mannerisms ($p < .01$) and Social Cognition ($p < .01$) and trend-level significant improvements in Social Motivation ($p < .06$) and Social Communication ($p < .08$). The only SRS subscale that did not demonstrate improvement was Social Awareness. Caregiver-reported

total ($p < .04$) and hosted ($p < .05$) get-togethers, as measured by the QSQ, significantly increased from pre-post treatment, and empathy as measured by the EQ ($p < .09$) and social skills as measured by the SSRS ($p < .06$) increased at trend-level significance. Caregiver-reported QSQ invited get-togethers and SSRS subscales were not significantly different from pre to post-test. Treatment gains were maintained at the 16-week follow-up for all outcome measures with two additional outcomes not initially observed from pre-post revealing a significant increase in caregiver-reported Responsibility ($p < .03$) and a trend-level significant increase in Assertion ($p < .10$) as measured by the SSRS 16-weeks following treatment.

Discussion

These findings suggest that *PEERS for Young Adults* (Laugeson and Frankel, in press) is effective in significantly improving overall social skills (SSRS), frequency of social engagement (QSQ), and social skills knowledge (TYASSK), and in significantly reducing ASD symptoms related to social responsiveness (SRS) in pre- to post-test comparisons with a delayed treatment control group. In

Table 3 Comparison of pre-test, post-test, and follow-up measures in TX group (standard deviations in parentheses)

Variable	Time			p	
	Pre-test T1 (n = 12)	Post-test T2 (n = 10)	Follow-up T3 (n = 9)	T1–T2	T1–T3
<i>Young adult measures</i>					
TYASSK	13.22 (2.95)	21.44 (3.88)	20.63 (4.10)	<.001**	.001**
QSQ total get-togethers	1.11 (1.17)	4.67 (2.45)	5.25 (3.06)	.002**	.005**
QSQ hosted get-togethers	0.56 (0.53)	2.11 (1.97)	1.75 (1.75)	.060 ⁺	.135
QSQ invited get-togethers	0.56 (0.73)	2.56 (2.07)	3.50 (2.67)	.020*	.013*
<i>Caregiver measures</i>					
SRS total score	72.11 (6.49)	62.89 (6.90)	61.50 (6.23)	.002**	.004**
SRS social motivation	67.44 (7.68)	60.44 (11.65)	56.75 (9.92)	.015*	.001**
SRS autistic mannerisms	72.56 (5.29)	60.89 (5.06)	60.88 (7.16)	<.001**	.005**
SRS social communication	69.33 (8.31)	62.78 (7.92)	60.75 (6.50)	.031*	.032*
SRS social cognition	71.44 (7.91)	62.44 (8.69)	62.25 (7.67)	.008**	.016*
QSQ total get-togethers	1.00 (1.50)	4.77 (1.92)	4.67 (1.63)	<.001**	.002**
QSQ hosted get-togethers ^b	0.44 (1.01)	2.44 (1.94)	1.50 (1.64)	.017*	.419
QSQ invited get-togethers	0.56 (0.73)	2.33 (1.50)	3.17 (2.23)	.021*	.023*
EQ total score ^a	18.22 (9.90)	20.89 (11.16)	25.50 (9.90)	.201	<.001**
SSRS social skills score	78.89 (8.84)	90.89 (14.00)	90.88 (15.12)	.015*	.004**
SSRS cooperation ^b	9.22 (3.99)	11.44 (5.10)	10.13 (4.88)	.046*	.135
SSRS assertion	5.56 (3.32)	9.78 (3.93)	10.13 (4.82)	.008**	.003**
SSRS responsibility ^a	13.00 (2.12)	14.78 (2.11)	15.13 (2.42)	.104	.049*

T1–T2 measures immediate treatment effect and T1–T3 measures long-term effect after follow-up period

* $p < .05$; ** $p < .01$; ⁺ $p < .1$

^a Additional gains at follow-up

^b Gains not maintained at follow-up

particular, improvements in social motivation, cooperation, and assertion were observed in standardized measures of social functioning, as were increased frequency of peer interactions through organized get-togethers. Decreases in restricted interests and repetitive behaviors, such as perseverating on topics of interest, were also observed following treatment (SRS Autistic Mannerisms). Most treatment gains were maintained at a 16-week follow-up assessment with new improvements observed in the areas of increased social communication, assertion, responsibility and empathy in the treatment group, and improvements in responsibility and assertion in the delayed treatment control group.

These findings are in accordance with independent results from a previously published RCT using the *PEERS for Young Adults* curriculum, which found that treated young adults demonstrated significant improvements in overall social skills, social responsiveness, social skills knowledge, empathy, and frequency of get-togethers (Gantman et al. 2012). The current study not only replicated these original main findings with an independent sample of young adults with ASD, but also examined treatment effects in the treatment and delayed treatment

control groups 16-weeks following completion of the program. Results are encouraging and highlight the effectiveness and durability of the intervention in improving the social skills of high-functioning young adults with ASD, using caregiver assistance.

Maintenance of treatment gains 16-weeks following intervention in the current study is also in accordance with previous studies using *PEERS* with adolescent samples. Laugeson et al. (2012) found that upon completion of a parent-assisted version of *PEERS*, adolescents with ASD significantly improved their knowledge of social skills, increased the frequency of hosted get-togethers with friends, and improved in their social responsiveness and overall social skills in the areas of improved social communication, social cognition, social awareness, social motivation, assertion, cooperation, and responsibility, and decreased autistic mannerisms. Examination of durability of improvement in the treatment group revealed that improvement on most measures maintained at a 16-week follow-up assessment with additional treatment gains in the areas of decreased problem behaviors and externalizing behavior, and improved self-control and social awareness. Likewise, in a long-term follow-up study of a parent-assisted

Table 4 Comparison of pre-test, post-test, and follow-up measures in DTC group (standard deviations in parentheses)

Variable	Time			<i>p</i>	
	Pre-test T2 (<i>n</i> = 10)	Post-test T3 (<i>n</i> = 8)	Follow-up T4 (<i>n</i> = 8)	T2–T3	T2–T4
<i>Young adult measures</i>					
TYASSK	14.63 (3.20)	22.00 (2.73)	20.44	.001**	.002**
QSQ total get-togethers	1.14 (1.68)	6.86 (5.79)	6.67 (3.78)	.020*	.005**
QSQ hosted get-togethers	0.29 (0.49)	4.57 (3.21)	3.67 (2.42)	.009**	.020*
QSQ invited get-togethers	1.50 (2.33)	2.40 (3.21)	2.80 (3.03)	.129	.294
<i>Caregiver measures</i>					
SRS total score	69.50 (7.69)	60.25 (9.85)	61.56 (8.63)	.010**	.007**
SRS social motivation	66.50 (7.69)	59.38 (12.16)	60.11 (10.87)	.058 ⁺	.057 ⁺
SRS autistic mannerisms	68.50 (10.09)	59.38 (8.28)	61.00 (6.71)	.005**	.019*
SRS social communication	67.13 (6.83)	60.13 (10.41)	59.89 (9.37)	.073 ⁺	.019*
SRS social cognition	72.13 (11.05)	61.63 (9.81)	63.22	.002**	.006**
SRS social awareness	65.25 (10.07)	57.50 (8.02)	59.14 (10.46)	.154	.174
QSQ total get-togethers	1.00 (1.29)	3.43 (2.51)	7.17 (3.82)	.035*	.010**
QSQ hosted get-togethers	0.57 (0.98)	2.14 (1.46)	4.50 (2.59)	.042*	.009**
QSQ invited get-togethers ^a	0.43 (0.79)	1.29 (1.38)	2.67 (1.37)	.111	.015*
EQ total score	18.38 (6.26)	25.13 (11.96)	26.67 (12.75)	.086 ⁺	.052 ⁺
SSRS social skills score	82.75 (13.38)	91.50 (13.51)	95.67 (14.71)	.058 ⁺	.055 ⁺
SSRS assertion ^a	6.63 (2.72)	8.75 (4.27)	9.44 (4.45)	.143	.094 ⁺
SSRS responsibility ^a	14.63 (3.38)	15.75 (2.60)	16.67 (2.45)	.161	.020*
SSRS cooperation	9.00 (4.07)	10.17 (4.45)	11.14 (4.06)	.421	.376
SSRS self-control	11.13 (4.22)	12.67 (3.44)	14.43 (3.21)	.287	.194

T2–T3 measures immediate treatment effect and T2–T4 measures long-term effect after follow-up period

* $p < .05$; ** $p < .01$; ⁺ $p < .1$

^a Additional gains at follow-up

PEERS program, Mandelberg and colleagues (2014b) found that 1–5 years after completing treatment, durability of treatment gains were maintained for adolescents with ASD in the general areas of improved overall social skills, social responsiveness, frequency of social engagement, and social skills knowledge. Durability of treatment gains in all studies, including the present, is thought to be the result of active parent and/or caregiver involvement in the program. Caregivers are trained to provide social coaching in multiple settings and to carry forward with their social coaching even after treatment has terminated. Thus, by including parents, family members, and other caregivers in treatment, we enhance the likelihood that the program continues on long after treatment has ceased.

Despite the overwhelmingly positive results reported here, a few limitations warrant discussion. Lack of standardized diagnostic measures such as the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al. 2012) or the Autism Diagnostic Interview—Revised (ADI-R; Le Couteur et al. 2003), which were not administered due to the financial constraints of the study, would have been helpful for confirming diagnoses.

However, previous diagnoses of ASD from qualified mental health and medical professionals were corroborated using the AQ, which has been found to have good convergent validity with the other standardized autism diagnostic tools (Baron-Cohen et al. 2001).

Another limitation of the current study is the lack of blinded behavioral observation of targeted behavior and/or independent ratings of social skills. Although the current study attempted to include independent rater reports of social functioning (e.g., teachers, professors, coaches, supervisors), most participants were unable to identify a third party familiar enough with them to be able to provide an accurate judgment of their social functioning. Moreover, standardized observational measures of social skills do not yet exist for this population, to our knowledge, and were also prohibitive due to the financial constraints of the study. Thus, standardized rating scales of social functioning completed by young adults and caregivers were relied upon for the present study—possibly resulting in subject expectancy effects. Future studies might include project developed observational behavioral ratings of social skills and/or adapted versions of observational scales for adolescents with

ASD, such as the Contextual Assessment of Social Skills (CASS; Ratto et al. 2011), which assesses conversational skills through coded behavioral observations.

Findings from the current study are also limited due to small sample size and lack of an active treatment control group. Larger clinical trials examining treatment response in comparison to another social skills intervention may strengthen validity and guide future treatment adaptation and development. Independent replication of these findings would also strengthen the literature in this area and enhance the current findings and previous findings (Gantman et al. 2012) using the *PEERS for Young Adults* curriculum.

Despite these limitations, findings from the current study strongly support the effectiveness of the *PEERS for Young Adults* program in the improvement, generalization, and durability of social skills related to the development and maintenance of relationships for high-functioning young adults with ASD. This research is important in that it represents one of the only RCTs of a social skills training program for young adults with ASD (Reichow et al. 2013) and highlights the effectiveness of community-based treatment using caregiver support to improve the social functioning, and ultimately the quality of life, of a highly vulnerable and sorely underserved population.

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