



Examining Feasibility and Outcomes of the PEERS® for Preschoolers Program

Reina S. Factor^{1,2,3} · Hannah M. Rea⁴ · Elizabeth A. Laugeson³ · Angela Scarpa^{1,2}

Accepted: 23 February 2022

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Abstract

Social impairments characteristic of autism spectrum disorder (ASD) are evident in early childhood and often worsen. There is a paucity of evidence-based interventions explicitly targeting social skill development for young children with ASD and few actively integrate caregivers. The PEERS® program, an evidence-based caregiver-assisted social skills program, was extended for young children with ASD (i.e., PEERS® for Preschoolers (P4P)). This pilot study expands upon initial results by examining the feasibility of a briefer intervention period and the effectiveness in improving child social skills among 15 children with ASD. Results suggest P4P recruitment, participant retention, and implementation are feasible across clinicians and sites. Further, P4P appears to improve social skills, maintained post-intervention. Future research might examine mechanisms that lead to results.

Keywords Autism Spectrum Disorder · Social Skills Intervention · Fidelity

Introduction

Social differences are a fundamental aspect of autism spectrum disorder (ASD; American Psychiatric Association, 2013) and are often evident in early development (Paul, 2003). Social skills groups have been developed for older autistic youth and young adults, including the Program for the Education and Enrichment of Relational Skills (PEERS®; Laugeson & Frankel, 2009; 2010; 2012), which has been shown to increase social skills for autistic individuals post-intervention and 1 to 5 years later (Mandelberg et al., 2014).¹ However, few interventions, as indicated in reviews and research, exclusively target social skills in

young autistic children (DeRosier et al., 2011; Reichow & Volkmar, 2010; Tripathi et al., 2021; Wolstencroft et al., 2018). Building on the promising results of the PEERS® group-based programs, PEERS® for Preschoolers (P4P) was developed for younger children and demonstrated initial positive outcomes (e.g., increased social skills, reduction in problem behaviors) with a large effect size (Laugeson et al., 2016; Park et al., in press; Tripathi et al., 2021), though research on the feasibility of abbreviated treatment as well as replication of outcomes has yet to be examined.

Social Differences and Challenges in Autistic Children

Autistic individuals face barriers in interactions with their non-autistic peers both due to autism-specific social differences as well as due to a communication gap between autistic and non-autistic peers (Milton, 2012). Early social behaviors associated with ASD include decreased reciprocal actions (e.g., social smiling, eye contact) that can lead to more pronounced social-communication differences (Farroni et al., 2002; Messinger et al., 2001). Other social differences

¹ Many self-advocates from the autism community (Bury et al., 2020) and current research has indicated both a preference for identify first language (e.g., autistic children) or language describing the individual. Therefore, this language will be utilized throughout the present manuscript.

✉ Reina S. Factor
rfactor@mednet.ucla.edu

¹ Department of Psychology, Virginia Tech 109 Williams Hall, 890 Drillfield Drive, Blacksburg, VA 24061, USA

² Virginia Tech Autism Clinic & Center for Autism Research, 3110 Prices Fork Road, Blacksburg, VA 24061, USA

³ Semel Institute for Neuroscience and Human Behavior, University of California Los Angeles, 300 Medical Plaza, Los Angeles, CA 90095, USA

⁴ Research in Autism and the Brain Lab, University of Washington, CHDD Box 357920, Seattle, WA 98195, USA

are pragmatic (e.g., initiating or engaging in reciprocal conversations, taking other's perspectives), linguistic (e.g., perseverative speech), and emotional (White et al., 2007). As the theory of the double empathy problem explains, these social-communication differences create barriers both for autistic individuals and for their non-autistic peers, which may result in autistic children having fewer friends, friendships of diminished reciprocity, and higher loneliness than their non-autistic peers, though it is unclear if the same findings are true for neurodivergent dyads (Bauminger & Kasari, 2000; Bauminger et al., 2003; Kasari et al., 2011; Milton, 2012). As individuals mature, social challenges that result from autism-related differences can increase risk for aggressive behaviors, peer rejection, social dissatisfaction, and academic failure, among other challenges (Maag, 2006). Therefore, it is necessary to provide support as early as possible to mitigate instances that individuals perceive as socially related difficulties and result in potentially negative outcomes.

Social Skills Interventions

Despite the importance of early interventions (Watkins et al., 2017), few comprehensive social skills programs exist for young autistic children (DeRosier et al., 2011; Reichow & Volkmar, 2010). A number of interventions include skill-building in social communication domains such as language, play skills, joint attention, imitation, requesting, inclusive learning environments, etc., within a broader curriculum, and thereby may include some social skills goals as *secondary* intervention targets (e.g., Early Start Denver Model; Rogers & Dawson, 2020; LEAP; Boyd et al., 2014; Project ImPACT; Stahmer et al., 2020; JASPER; Shire et al., 2019). In contrast to these interventions that target a wide range of autism-related challenges, however, a social skills group allows children to focus exclusively on skills they need to initiate and maintain interactions with peers, which may afford opportunities to use some of the aforementioned skills (e.g., joint attention, imitation) in interactions. Relatedly, there is a paucity of social skills interventions for young autistic children, with one review of social skills interventions citing only two out of 48 studies included participants younger than 6 years (Kaat & Lecavalier, 2014).

Different treatment models for integrating the caregiver exist for autism-specific interventions. Manualized caregiver-administered or implemented interventions can be complex and require extensive training, expertise, and high fidelity to be effective (Rogers et al., 2012). Caregiver-mediated interventions teach caregivers how to employ strategies for supporting specific behaviors, such as promoting social engagement. This method of intervention has been found to change child behaviors that parents, teachers, other caregivers, and the child may find distressing or impairing

(Bears et al., 2013). Unlike psychoeducation or caregiver-integration intervention models, which may outline core information without providing specific strategies or hands on training, caregiver-mediated or implemented interventions teach caregivers to deliver treatment techniques with the child, and support caregivers' practice with the child actively in session and out of session (Steiner et al., 2013).

While caregiver-mediated treatments are increasing, there is still a dearth of interventions that actively integrate caregivers (Reichow et al., 2012). Moreover, targeting social skills earlier in childhood may lead to enhanced short- and long-term outcomes as well as contribute to an overall improved quality of life (Caplan et al., 2019; Watkins et al., 2017). Finally, including caregivers in social skills treatment during early childhood and teaching caregivers to support their child's social development may also enhance engagement between young autistic children and their caregivers (Gengoux et al., 2019). Therefore, a program designed for young autistic children that specifically targets social skills and includes caregiver-assistance is critical.

The PEERS® for Preschoolers Program

PEERS® is an evidence-based caregiver-assisted intervention that employs empirically-supported behavioral methods of social skills instruction (e.g., concrete didactic instruction, role-play demonstrations, behavioral rehearsal, generalization assignments outside of session), that can be used transdiagnostically, and has been found to be helpful for autistic children who desire friendships (Laugeson, et al., 2009, 2012). In addition to a structured adolescent/young adult group component, PEERS® also includes a simultaneous caregiver/social coach group that includes psychoeducation, review of ecologically valid social skills, and social coaching strategies. This method of intervention delivery has been established as efficacious in multiple clinical and randomized controlled trials (RCT) with autistic adolescents (Garbarino et al., 2020; Laugeson et al., 2009, 2012; Van Hecke et al., 2015) and young adults (Gantman et al., 2012; Laugeson et al., 2015; McVey et al., 2016), with maintained improvements 1-to-5-years after treatment (Mandelberg et al., 2014).

More recently, the PEERS® program was adapted for young autistic children to fill the aforementioned need for early social skills intervention (Park et al., in press). PEERS® for Preschoolers (P4P) addresses similar tenets using analogous methods of instruction as other PEERS® programs, but in a developmentally appropriate manner (see more details in intervention section below). In addition to a caregiver training component, P4P includes caregiver-coached play at the end of each session to facilitate skill acquisition using performance feedback through coaching. Caregiver opportunities to learn and coach their children

in using skills in session, with family, and on playdates assigned for homework are believed to facilitate frequent and authentic interactions and engagement, as well as reciprocity between caregivers and children. The goal of these teaching techniques is to promote greater generalization of skills across settings, as caregivers are familiar with social coaching techniques.

Initial P4P results indicated improvements in social skills and noted that treatment gains were maintained 1–5 years post P4P intervention (Park et al., in press; Tripathi et al., 2021). Thus, to propel social skills intervention research for young autistic children, and expand on the work conducted with PEERS®, the current pilot study aimed to demonstrate feasibility of implementation, fidelity of administration across sites (at two different locations), and administration of the intervention in a shorter amount of time (i.e., meeting two times per week vs. once per week). Specifically, our experimental question tested the hypothesis that there would be increased caregiver-reported social skills post-intervention and follow-up after a 16-session social skills P4P group. We also included descriptive analyses to assess changes in social-communication behaviors post-intervention and follow-up.

Methods

Participants

Fifteen children from 4–7 years ($M = 4.87$, $SD = 1.25$) diagnosed with ASD (based on previous evaluations) without intellectual impairment (as noted on a cognitive assessment administered) were recruited. Eligibility criteria included (1) a previous ASD diagnosis, verified by the Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) administered by a research-reliable investigator or the Social Responsiveness Scale, Second Edition (SRS-2; one child had a diagnosis of ASD and met criteria on the SRS-2, but not the ADOS-2), (2) an Intelligence Quotient (IQ) greater than 70 on the Kaufman Brief Intelligence Test, Second Edition (KBIT-2); (3) caregiver confirmation that children

be toilet trained, able to tolerate a group setting, and able to play preschool games; and (4) children and caregivers were fluent in English. Exclusion criteria included (1) active medical problems (e.g., unstable seizure disorder); (2) major mental illness (e.g., psychosis); (3) child physical aggression towards adults or children; or (4) inability to maintain current medication throughout the intervention. Of the 18 eligible families, one family started the group, but left due to medication changes resulting in child physical aggression during group. Another family did not participate due to competing time commitments. A third family joined for one session but was unable to continue due to child health difficulties. Thus, analyses are based on the 15 families who undertook the intervention. See Tables 1 and 2.

Procedure

Participants were recruited via multiple methods (e.g., university and non-university clinics, support groups, schools) in both a metropolitan and rural area, which comprised the two locations for groups. A two-stage eligibility process was used (see Fig. 1). Caregivers who expressed interest completed a phone screen and caregiver/child dyads who appeared to meet eligibility criteria were scheduled for an intake. Intakes included consent/assent, the ADOS-2, KBIT-2, a 5-min interaction task between the caregiver and child to assess their interaction styles (not examined here), and caregiver completion of forms. In addition to consent/assent, the input of stakeholders within the autistic community was provided prior to this intervention study. One research team member, who contributed to the conceptualization and writing of this manuscript and closely supervised the intervention implementation, also has an autistic child, and thus was able to provide ongoing feedback from both the caregiver and scientific perspectives. Of note, as part of screening, we ensure motivation from both the caregivers and children, as the goal of the intervention is to teach and encourage internally motivated social skills. Even at this young age, examiners waited to hear interest and buy-in from children. Motivation was determined by interest from the child in joining the group. No children were excluded at intake due

Table 1 Descriptive statistics for demographics and characterization of sample

Measure	<i>n</i>	Minimum	Maximum	<i>M</i>	<i>SD</i>
Demographics					
Caregiver age (years)	15	27	42	36.13	5.14
Child age at intake (years)	15	3	7	4.87	1.25
Diagnostic and screening measures					
ADOS-2 (comparison Score)	Mod 2 = 5 Mod 3 = 10	4	10	6.80	2.01
KBIT-2 IQ Composite	15	76	127	102.00	15.34

ADOS-2 Autism diagnostic observation schedule, second edition; KBIT-2 IQ Composite Kaufman brief intelligence test intelligence quotient total

Table 2 Descriptive statistics for categorical variables of interest

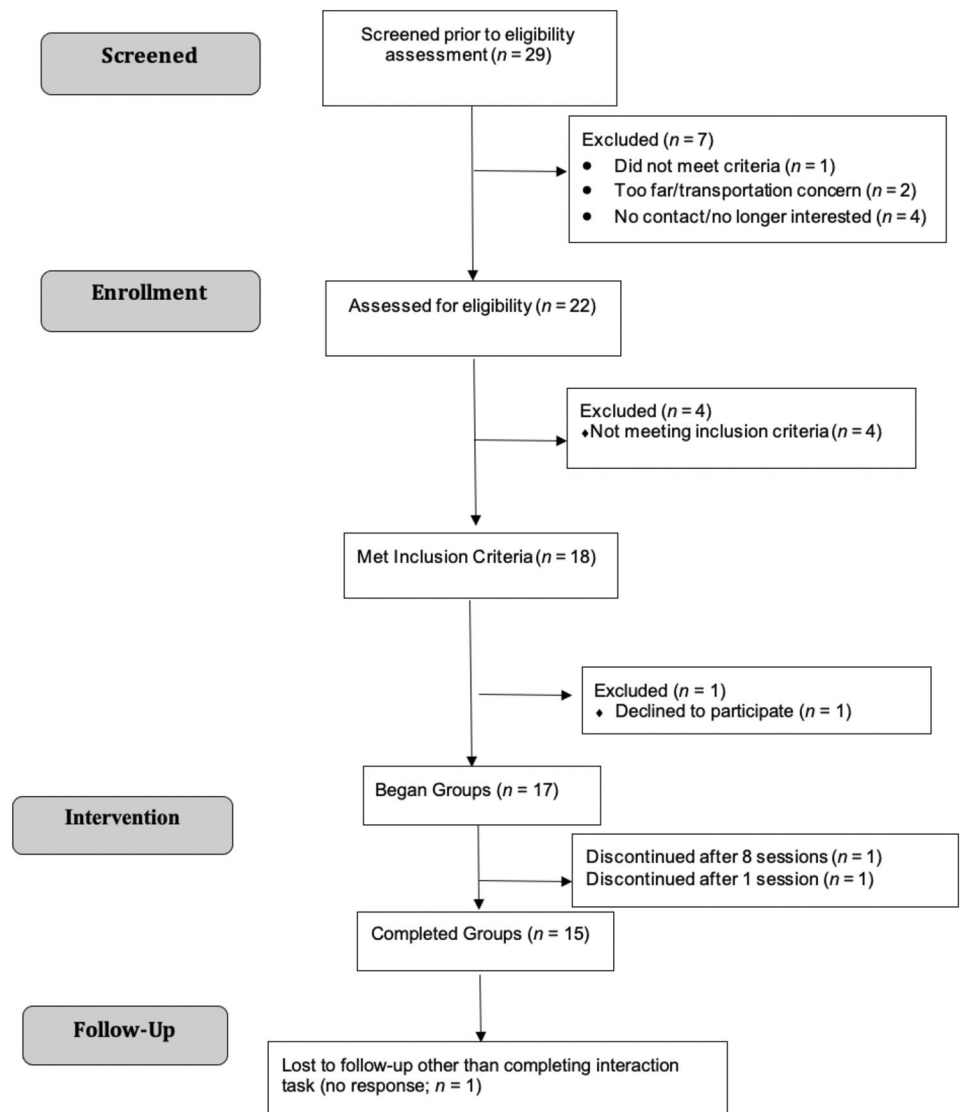
Variable	Percentage (<i>n</i>)
Child sex	
Male	73.30 (11)
Female	26.70 (4)
Caregiver sex	
Male	6.67 (1)
Female	93.30 (14)
Location	
blinded for review	66.67 (10)
blinded for review	33.33 (5)
Number of children in each group	
Group 1	13.3 (2)
Group 2	26.70 (4)
Group 3	26.70 (4)
Group 4	33.30 (5)
Diagnoses (in addition to ASD)	
Attention deficit/Hyperactivity disorder	40.00 (6)
Generalized anxiety disorder	20.00 (3)
Obsessive compulsive disorder	20.00 (3)
Developmental disability (other than ASD)	6.70 (1)
Child ethnicity	
African american	13.30 (2)
Asian	6.70 (1)
Caucasian	66.70 (10)
Mixed race	6.70 (1)
Other	6.70 (1)
Number of siblings	
None	26.70 (4)
One	46.70 (7)
Two	20.00 (3)
Three	6.70 (1)
Variable	Percentage (<i>n</i>)
Approximate yearly household income	
< \$10,000	6.70 (1)
\$10,000-\$25,000	6.70 (1)
\$50,000-\$75,000	6.7 (1)
\$100,000-\$200,000	20.00 (3)
\$200,000+	13.30 (2)
Did not report	46.70 (7)
Highest level of schooling completed by caregiver	
Graduated high school	13.30 (2)
Graduated trade school	13.30 (2)
Associate's degree	6.70 (1)
Bachelors/4-year degree	6.70 (1)
Graduate school	53.30 (8)
Did not report	6.70 (1)

to appearing distressed or exhibiting a lack of motivation. However, aggression during the child sessions did result in one family discontinuing the group (as described above).

Upon completion of pre-intervention measures, eligible families were invited to join. Eighteen families were determined eligible (four screened were ineligible due to language or not meeting IQ cutoff), though the final sample included 15 dyads across four treatment groups (Fig. 1). Program completers were those who attended at least 60% of sessions (most completed more than 75%), although five families did not complete post-intervention measures ($n = 10$), despite having completed the intervention, and also completed follow-up measures. Enrollment (58.6% from screening calls) and retention throughout intervention (those who began the intervention) was 88.2%. No significant differences in demographic information were found across sites or groups and thus, all information is presented together. In this paper, data collected at only entry/pre-intervention, exit/post-intervention, and follow-up results will be reported (not mid-point, Session 8). Approval for this research was granted by the Institutional Review Board of all institutions involved. Families did not receive compensation for participation.

Randomization A nonconcurrent multiple baseline design was employed for the small sample size. Each group was randomized to a baseline condition. Groups maintained a 1.5 (Group 2), 2 (Group 3), or 2.5 week (Groups 1 and 4) baseline period, with measures completed every half week. They completed baseline measures either three (i.e., 1.5 week baseline: twice for whole week, once during half week), four (i.e., 2 week baseline: twice per week), or five times (i.e., 2.5 week baseline: twice per week, once during half week). This design (series of A-B replications) allows for ongoing enrollment over data collection and smaller samples. Single-case designs are less time intensive and more cost-effective than large scale RCTs and therefore more feasible in early stages of intervention development (Horner et al., 2005; Morgan & Morgan, 2008). This design and sample size were consistent with previous intervention studies for autistic children and deemed appropriate (Kratowchwill & Levin, 2014; Rao et al., 2008; Wang et al., 2013).

Intervention The unpublished P4P manual was made available by the UCLA PEERS® Clinic, which includes instructions and a script for each session. Groups included sixteen 90-min sessions delivered twice per week. Though traditional P4P groups typically meet once weekly, this study conducted groups twice per week over eight weeks. This change in meeting frequency was made due to time constraints of the research team and also allowed researchers to

Fig. 1 CONSORT diagram for participant flow

examine a two-session per week format, rather than meeting once per week, which may be more feasible for some families. Each group consisted of 2–5 children with 4–7 clinicians. Clinicians were trained on P4P procedures during a one-day intensive training, through receipt of materials from the unpublished P4P manual, and hour-long case conference meetings before each session. Leaders included graduate students, master’s students, and students with their bachelor’s degrees. Fidelity of administration was measured each session. Groups were supervised by an advanced graduate student clinician and licensed clinical psychologist.

P4P was adapted from the adolescent and young adult versions of the PEERS® social skills programs to target developmentally appropriate social skills for young children with social difficulties (e.g., listening to and following directions, greeting friends, sharing and giving turns, keeping cool when upset during play, being flexible, asking friends to

play, transitioning activities, maintaining appropriate body boundaries, etc.), taught through play activities such as a live puppet show and games for rehearsing and reinforcing newly learned skills. Simultaneously, caregivers engaged in a one-hour caregiver-only group in which they learned specific skills related to helping their children make and keep friends and reviewed homework assignments to individualize the successful utilization of skills in more natural social settings. As part of the developmental adaptation, the last 30 min were devoted to caregiver-coached play, in which caregivers provided social coaching to their children during in-group playdates. Simultaneously, parents received in-vivo feedback from a clinician seated next to the caregiver.

Table 3 Statistics for all variables of interest across all timepoints

Measure	Pre-Intervention		Post-Intervention		Follow-up	
	<i>n</i>	<i>M(SD)</i>	<i>n</i>	<i>M(SD)</i>	<i>n</i>	<i>M(SD)</i>
SSM – Social	10	41 (6.12)	10	51.10 (7.05)	14	49.14 (6.41)
SRS-2 – Total	15	74.67 (9.38)	10	70.00 (5.68)	14	69.36 (8.31)
Social Awareness	15	68.73 (10.05)	10	64.80 (8.52)	14	64.57 (7.84)
Social Communication	15	71.80 (8.29)	10	68.70 (8.30)	14	67.50 (6.38)
Social Motivation	15	71.33 (13.82)	10	64.40 (7.68)	14	65.21 (12.46)
Social Cognition	15	71.33 (11.24)	10	65.90 (5.30)	14	64.21 (11.58)
SCI	15	73.67 (9.63)	10	68.30 (5.74)	14	67.64 (8.20)
RRB	15	77.60 (10.01)	10	75.40 (8.18)	14	74.29 (10.31)
SSIS - Social Skills	14	72.29 (14.19)	10	79.50 (11.52)	14	82.71 (11.36)
QPQ	11	11.64 (5.50)	10	6.60 (3.66)	14	7.57 (4.67)

SSM Social skills monitoring social score; *SRS-2* Social responsiveness scale, second edition; *SCI* Social communication index; *RRB* Restrictive and repetitive behavior scale; *SSIS* Social skills improvement system social skills scale; *QPQ* Quality of play questionnaire

Measures

Diagnostic and Screening Measures (to determine inclusion and exclusion criteria)

Autism Diagnostic Observation Schedule, Second Edition (ADOS-2; Lord et al., 2012) The ADOS-2 is a semi-structured, observational assessment of characteristics of ASD and is one of the gold standard ASD assessment tools, with different modules determined by age and language ability. For this study, Modules 2 and 3 were employed. Module 2 assesses children with little or phrase speech and Module 3 is designed for children with fluent speech. The ADOS-2 demonstrates moderate to high internal consistency, moderate test–retest reliability, and acceptable interrater reliability, as well as comparable or higher sensitivity and specificity compared to the first ADOS edition (McCrimmon & Rostad, 2014). This assessment was administered at pre-intervention to verify each child met ASD criteria.

Kaufman Brief Intelligence Test (KBIT-2; Kaufman & Kaufman, 2004) The KBIT-2 is an abbreviated measure of general intelligence that provides Verbal and Non-Verbal Intelligence scores, a composite Intelligence Quotient (IQ) score, and percentile ranks by age. The KBIT-2's IQ Composite internal consistency coefficient is 0.93 across ages (0.89 to 0.96), with reliabilities increasing with age. The Verbal (0.91) and Nonverbal (0.88) coefficients were within acceptable ranges (Kaufman & Kaufman, 2004). The composite score verified children met inclusion criteria for the current study ($IQ \geq 70$).

Demographic Questionnaire This questionnaire included general information such as child age, gender, ethnicity, caregiver education, family history, the child's developmental and medical history, other diagnoses, and current medications.

Outcome Measures for Hypothesis Testing and Exploratory Analyses

Social Skills Monitoring (SSM) Progress monitoring forms were completed by caregivers during the pre-intervention, post-intervention, and follow-up stages. Forms included 28 questions on a 4-point Likert-scale to track skill acquisition and improvement in child social-based behaviors over intervention. Higher scores indicate more skillful ability. Though the SSM also measures caregiver concerns, only the Social Skills domain (sum of 18 questions) was examined in the current study, as this relates to the primary outcome of examining social skills. Means at the three main timepoints (i.e., not weekly) are reported in Table 3. Cronbach's alphas were 0.43 for pre-intervention, 0.95 for midpoint, 0.86 for post-intervention, and 0.87 for follow-up.

Social Responsiveness Scale, 2nd Edition (SRS-2; Constantino & Gruber, 2012) The SRS-2 is a 65-item questionnaire that measures ASD-related traits, although it has been shown to measure social communication challenges in a range of clinical diagnoses (e.g., anxiety, Attention Deficit/Hyperactivity Disorder (ADHD); Factor et al., 2017; South et al., 2017). Though the SRS-2 was used to confirm an ASD diagnosis for one participant, it was considered an outcome measure for all participants. The preschool version was used for children up to 4.5 ($n=3$) and the school-age version was used for other participants ($n=12$). Each question is rated from 1 to 4 (1 = "not true," 4 = "almost always true"). The SRS-2 is usually based on the child's behavior in the last 6 months, but the time range was modified at post-intervention and at follow-up in that caregivers were instructed to think about behavior at the given timepoint. The measure yields a total score, with higher scores indicating higher levels of autistic traits. The measure also includes the Restricted Interests and Repetitive Behavior

(RRB) and Social Communication (SCI) indexes, the latter of which includes the following subscales: Social Awareness, Social Cognition, Social Communication, Social Motivation (Grzadzinski et al., 2011). T-scores are generated for the total score and each subscale, with a mean of 50 and a standard deviation of 10. Higher scores indicate greater impairment in social responsiveness. Cronbach's alpha for the total score at pre-intervention was 0.94, 0.92 at post-intervention, and 0.95 at follow-up. Subscale reliabilities during each timepoint ranged from 0.44 to 0.91, with low values at exit for the social cognition, social awareness, and social motivation subscales and also for the social awareness follow-up subscale.

Social Skills Improvement System (SSIS; Gresham & Elliot, 2008) The parent-reported SSIS Rating Scales include a Social Skills Scale based on seven subscales (Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-Control) and a Problem Behaviors Scale comprised of five subscales (Externalizing, Bullying, Hyperactivity/Inattention, Internalizing, and ASD). Standard scores are generated for the Social Skills Scale with a mean of 100 and a standard deviation of 15. Higher scores indicate greater over all social skills. The SSIS was administered at pre-intervention, post-intervention, and follow-up. Only the Social Skills Scale was examined for the present study. Cronbach's alphas for the Social Skills Scale were 0.77 at pre-intervention, 0.84 at post-intervention, and 0.76 at follow-up.

The Quality of Play Questionnaire (QPQ; Frankel & Mintz, 2008). The QPQ consists of 12-items to assess the frequency of invited and hosted playdates over the previous month (2 items) and the level of conflict during these playdates (10 items). This measure was administered at pre-intervention, post-intervention, and follow-up. Only the Conflict Scale was examined. Cronbach's alphas were 0.86 at pre-intervention, 0.76 at post-intervention, and 0.74 at follow-up.

Fidelity of implementation Two members of the intervention team (e.g., one in caregiver group, one in child group) rated therapist fidelity of implementation each session. Observers were trained on the meaning of each rating. The rater answered questions regarding the clinician leading the group (e.g., behavior, therapeutic relationship), the session as a whole, and session components and goals, specified in the session outline. Fidelity was assessed on a Likert scale from 0–5 (0 = not at all, 3 = well, 5 = very well).

Community Involvement The autistic community and autism allies (i.e., parents and caregivers of young children) were involved in the development of the intervention during previous stakeholder focus groups with program developers and the implementation of the current study through ongoing feedback regarding feasibility of the

group meetings (e.g., consistency and timing of meetings, locations). Further, the PEERS® developers have a long history of involving autistic self-advocates and stakeholders in the development and testing of all PEERS® social skills interventions, including P4P.

Data Analytic Plan

Preliminary analyses determined if assumptions of normality, linearity, and homoscedasticity were met. Thus, appropriate statistical analyses were employed based on the non-normal distribution. Changes in social skills (SSM Social Skills subscale, SSIS Social Skills Scale), social responsiveness (SRS-2 Total score, index scores), and conflict during social engagement (QPQ conflict scale) were analyzed using Friedman tests across all timepoints. Post-hoc Wilcoxon tests compared specific timepoints (i.e., pre-intervention to post-intervention and to follow-up) to determine when changes occurred. To calculate effect size, the following formula was used ($r = Z / \sqrt{N}$). The interpretation of effect sizes (r values) are as follows: 0.5 = large effect, 0.3 = medium effect, 0.1 = small effect (Fritz et al., 2012). A sample size of 27 would have been necessary to detect a large effect ($r = 0.5$) and 648 for a small effect ($r = 0.1$). Thus, the results here are under-powered and should be interpreted cautiously.

A reliable change index (RCI), a measure of individual significant change, was calculated to analyze social skills changes for each child on validated measures (i.e., SSM excluded). Consistent with the literature, RCI values above 1.96 suggest statistically significant and meaningful change, above and beyond standard error (Jacobson & Truax, 1991). Results were based on those who completed measures at the specified timepoints.

Results

Preliminary Analyses

Data were non-normally distributed, thus non-parametric tests were used. As mentioned above, groups did not differ on demographic information, therefore data were collapsed for analyses.

Therapist fidelity of intervention implementation Groups did not vary in fidelity, which was verified by Chi-squared tests $X^2(18, n = 59) = 0.22, p = 22.23$. Most sessions were rated 90–100% completion of outlined components, with only one session with 75% completion due to a late start and therefore shortened session. This was identified as an outlier and not included in analyses ($M_{child\ group} = 99.37$,

$SD_{child\ group} = 2.06$; $M_{caregiver\ group} = 99.63$, $SD_{caregiver\ group} = 1.84$). Raters noted success of implementation of specific session content across all groups (Likert scale from 0 – 5; $M_{child\ group} = 4.89$, $SD_{child\ group} = 0.20$; $M_{caregiver\ group} = 4.92$, $SD_{caregiver\ group} = 0.18$).

Intervention Efficacy: Experimental Outcome Measures

On the SSM Social Skills subscale, there were significant changes across all timepoints ($\chi^2(3) = 13.603$, $p = 0.003$; results presented in Table 4). Post-hoc Wilcoxon tests revealed significant, large effect size differences from pre-intervention to post-intervention ($Z = -2.37$, $p = 0.018$, $r = 0.89$) and pre-intervention to follow-up ($Z = -2.67$, $p = 0.008$, $r = 0.89$).

Though there were no significant differences on the SRS-2 Total Score from pre- to post-intervention ($\chi^2(3) = 3.62$; $p = 0.31$), possibly due to lack of power, Wilcoxon tests suggested significant reductions from pre-intervention to follow-up ($Z = -2.043$, $p = 0.041$, $r = 0.55$). There were significant reductions on SRS-2 Social Communication Index (SCI) at each timepoint ($\chi^2(3) = 8.39$; $p = 0.039$), with Wilcoxon tests revealing significant differences on SCI between pre-intervention to follow up ($Z = -2.59$, $p = 0.010$, $r = 0.69$). Friedman tests were also significant for Social Communication ($\chi^2(3) = 7.77$; $p = 0.051$). Wilcoxon tests indicated significant reductions on the Social Communication subscale between pre-intervention and follow-up ($Z = -2.073$, $p = 0.038$, $r = 0.55$). These are all large effect sizes, demonstrating improvements across numerous domains of social responsiveness.

Table 4 Comparison of experimental and descriptive variables across timepoints

Measure	Friedman test (χ^2)
Experimental variables	
SSM	13.603*
Descriptive variables	
SRS-2—total	3.62
Social awareness	5.96
Social communication	7.77*
Social motivation	7.026
Social cognition	4.62
SCI	8.39*
RRB	0.792
SSIS—social Skills	8.31*
QPQ	3.237

SSM Social skills monitoring social score; SRS-2 Social responsiveness scale, second edition; SCI Social communication index; RRB Restrictive and repetitive behavior scale; SSIS Social skills improvement system social skills scale; QPQ Quality of play questionnaire

On the SSIS Social Skills Scale, there were improvements across all timepoints ($\chi^2(3) = 8.31$; $p = 0.040$) and Wilcoxon Rank tests revealed significant differences from pre-intervention to follow-up ($Z = -2.51$, $p = 0.012$, $r = 0.84$) and from post-intervention to follow-up ($Z = -2.56$, $p = 0.011$, $r = 0.85$), all of which reveal large effect sizes.

On the QPQ conflict scale, there were no significant changes across all timepoints ($\chi^2(3) = 3.24$; $p = 0.36$) and Wilcoxon Rank tests were not conducted.

Individual Outcomes

A reliable change index (RCI) was calculated to analyze social skills changes at an individual, rather than group level, on validated measures (i.e., SSM excluded). Percentages for each measure and subscale are presented in Table 5. This analysis adds another measure of change in single-subject design and adds to rigor of statistical outcomes as group-level analyses may obfuscate some individual changes.

On the SRS-2, 7.14% children showed reductions from pre-intervention to follow-up (1/14), 20% of children showed reductions on SCI from pre-intervention to post-intervention (2/10) and 21.43% from entry/pre-intervention to follow-up (3/14 children). Subscale scores are reported in Table 5. On the SSIS Social Skills Scale, 50% improved from entry/pre-intervention to exit/post-intervention (5/10 children) and 50% maintained or showed improvements at follow-up (7/14 children). On the QPQ, 71.42% (5/7 children) significantly improved from entry/pre-intervention to exit/post-intervention, while 80% significantly improved from entry/pre-intervention to follow-up (8/10 children).

Table 5 Reliable change index (RCI) scores (percent change for each measure)

Measure	Number improved at exit/post-intervention (%)	Number improved at Follow-up (%)
SRS-2—Total	0/14 (0%)	1/14 (7.14%)
Social awareness	4/10 (40%)	5/14 (35.71%)
Social communication	1/10 (10%)	4/14 (28.57%)
Social motivation	4/10 (40%)	5/14 (35.71%)
Social cognition	2/10 (20%)	5/14 (35.71%)
SCI	2/10 (20%)	3/14 (21.43%)
RRB	2/10 (20%)	4/14 (28.57%)
SSIS—social skills	5/10 (50%)	7/14 (50%)
QPQ	5/7 (71.42%)	8/10 (80%)

SRS-2 Social responsiveness scale, second edition; SCI Social communication index; RRB Restrictive and repetitive behavior scale; SSIS Social skills improvement system social skills scale; QPQ Quality of play questionnaire

Discussion

This pilot study adds to the growing literature on social skills interventions for young autistic children and examines the feasibility and outcomes of an abbreviated version of the PEERS® for Preschoolers program. Results suggest group-level experimental higher scores in some social skills, with some newly emerging or maintained social skills at a 4–6 week follow-up. There were also descriptive changes in social behaviors following intervention, although RCI scores were low.

This study provides support for the feasibility of an abbreviated version of the PEERS® for Preschoolers intervention as practical to administer across sites and group leaders. Groups were implemented with fidelity following training by a lead clinician, pre-session case conferences, and review of the unpublished manual. Clinicians anecdotally reported ease of following scripts, implementing the intervention, and flexibility in leading different activities. Though 3 families did not complete the study for reasons mentioned above, enrollment (58.6% from screening) and retention throughout intervention (88.2%) also support feasibility for the majority of participants. Modification from one session per week to two per week proved feasible and acceptable by families. Anecdotally, caregivers indicated they felt this group “changed their lives” and teachers at their children’s schools noticed positive changes as well.

Results also indicated improvements in child social skills over the 16-session intervention, with newly emerging skills and some maintenance of skills 4–6 weeks following the intervention at group and individual levels. In particular, significant improvements in specific social functioning domains, including the child’s use of skills taught in groups, frequency and intensity of social behavior (measured via SSM Social Skills domain), and maintenance of gains, which may suggest skill generalization, even after intervention ended was observed. Further, additional measures (e.g., SRS-2, SSIS) indicated more social communication, though further follow-up is needed to establish that the intervention led to these changes. Social skill gains were not evident on the QPQ, a measure of peer relationships on playdates, which may be due to inappropriate selection of playmates (e.g., behavioral problems, not of a similar age, no common interests), although high RCI rates may indicate an increase in the frequency of playdates. These social skill changes may suggest potential benefits from P4P, though a causal relationship cannot be determined due to the nature of the study (i.e., no control group and small sample size).

Although social skill interventions are a burgeoning area of treatment research, it is necessary to address the perspectives of the autistic community. Current research has suggested that some social skills interventions may perpetuate

a cycle of masking or camouflaging (i.e., stifling one’s traits to fit into society) within the autistic community (e.g., Bottema-Beutel et al., 2018; Happé & Frith, 2020; Kapp et al., 2019; Russell et al., 2019). As a clarifying point, the goal of all PEERS® programs is not to decrease neurodiversity or to change the autistic person, but rather to expand their social skill set so that socially motivated individuals may engage within neurodiverse populations. Helping caregivers to identify play groups based on their child’s interests is one example of how the PEERS® programs seek to identify potential sources of friends where youth can be themselves and find others who share common interests. In order to alleviate social-communication differences that may become barriers to achieving social relationships within these social contexts, children and their caregivers are taught ecologically valid skills that may be beneficial in navigating the social world for any individual who struggles to make and keep friends. PEERS® emphasizes the importance of finding friends who share common interests and are accepting, and we highlight personal choice in implementing these skills, even from a young age. This program is intended for children who desire friendships, but have difficulty navigating their social worlds and desire skills to help them do so. Thus, motivation to learn these skills and respect for neurodiversity is key to all PEERS® groups.

While the population in this specific study included only young autistic children, PEERS® has also been researched and is used clinically for youth with a variety of presenting diagnostic concerns (e.g., ADHD, anxiety, depression, other social difficulties), and beyond social skills has indicated reductions in depression, suicidality, and anxiety following PEERS® from preschool to young adulthood (Gardner et al., 2019; Laugeson et al., 2012; Lordo et al., 2017; McVey et al., 2016; Schiltz et al., 2018; Schohl et al., 2014). Overall, these preliminary findings are encouraging for providing autistic children foundational skills to help navigate the social world (Watkins et al., 2017). It is possible that intervening at this early age, particularly with caregiver involvement, may facilitate enhanced future social engagement. More research is needed to examine the impact of teaching these skills to young autistic children, however initial P4P results indicate positive maintenance of social gains 1 to 5 years after treatment (Tripathi et al., 2021), which may be a critical ingredient to healthy social interactions later in life. Thus, we hope this work will engage families and autistic individuals, as well as community members to increase neurodiversity across all settings, as this work is disseminated.

Limitations and Future Directions

Although the current study presents meaningful results, it is not without limitations. As in much of the autism intervention research, group sizes were small, which limited

detection of medium or small effect and a number of analyses were exploratory (e.g., SRS-2 subscales). Relatedly, missing data further limited sample size. Though analyses of individual changes accounted for the small sample, this study did not include a control group. Consequently, we are unable to rule out other variables potentially related to these findings (e.g., changes due to familiarity with peers or the intervention setting). Thus, including measures at follow-up is an accurate depiction of generalization with other peers not in the intervention group. Further, while using a multiple baseline design added to the rigor of the design (Kratowill & Levin, 2014), this format also increases vulnerability to internal validity threats (Clearinghouse, W. W., 2017). Low RCIs may be the result of sleeper effects, which suggest caregivers may notice more changes at follow-up and beyond intervention, when they have had additional time to master skills (Bristol et al., 1993; Iadarola et al., 2018; Kazdin, 1997). Additionally, the low Cronbach's alpha of 0.43 on the SSM pre-intervention especially, suggests results should be interpreted with caution. This low value may be due to the fact that this form was specifically created for the current study, and caregivers might not have been clear about how to complete this form initially. Interpreting scores with caution and considering possible causes is also true for low values on the SRS-2 exit scores for the social cognition, social awareness, and social motivation subscales and also the social awareness follow-up subscale. Finally, the fact that the intervention was not feasible, based on completion of the intervention, for a few eligible families might be something to explore in future studies to improve feasibility for more families. Given these limitations, future research might examine the treatment impact of P4P through a RCT using an active treatment control group with a larger sample size.

Generalizability of results is another limitation of the current study. First, it will be important to assess generalizability of skills in other settings to understand if this intervention facilitates authentic interactions outside of the intervention setting. Relatedly, another limitation of the study is the reliance on caregiver-report measures rather than observational measures (Whittingham et al., 2009). Caregiver involvement may bias post-treatment assessment of their child's social functioning (White et al., 2007) and reports of family or relationship outcomes. Consequently, response bias may have been present in the current study, as families were aware they were receiving an intervention previously shown to be effective. Thus, behavioral observation measures would add to the robustness of future findings and provide more objective measurement of changes in social skills.

Previous research on PEERS® has shown decreases in parenting stress following treatment (Corona et al., 2019), therefore, examining distinct experiences of family members in future studies may be especially informative. Additionally, future studies might examine family factors as predictors of

treatment outcome. For example, analysis of caregiver traits, including Broader Autism Phenotype or stress, could be an important step in tailoring interventions to be most efficacious for each child-caregiver dyad.

Longitudinal studies may provide information regarding the impact of teaching social skills early in childhood as well as further exploring mechanisms of change to determine if P4P accounts for social skill changes over the long-term. Finally, as P4P continues to gain evidence, adaptations for individuals with different needs (e.g., intellectual disability, nonspeaking), and generalizability related to socioeconomic status (SES), race, and other demographics, also need to be considered. To that end, the inclusion of more diverse samples (e.g., race, SES, gender) should also be integrated in future studies to account for any necessary adaptations (e.g., modification to skills provided, variation in structure of groups, etc.). Future work through the PEERS® program could be complemented by working on autism acceptance among the non-autistic community.

Finally, it is essential this work take a more holistic view examining quality of life, well-being, and ensuring individuals in the autistic community feel respected and included. In fact, quality of life is not tied to autistic behaviors (Bottema-Beutel et al., 2016) and future iterations should be sure to strengthen confidence in one's autistic identity (McConachie et al., 2020). Thus, future work should delve more into other aspects of an individual's life and truly develop a reciprocal relationship with autistic young children, their caregivers, and clinicians (Gengoux et al., 2019).

Conclusions

This pilot study provides support for the adaptation and abbreviation of PEERS® for Preschoolers. Preliminary findings address a gap in the literature by demonstrating the potential benefit of early social skills interventions to improve friendship skills for young autistic children.

Acknowledgements The authors would like to thank the Virginia Tech Autism Clinic & Center for Autism Research, the Georgia Autism Center, and the Emory Autism Clinic for assistance with recruitment for this study and in running the groups, as well as all group leaders and research assistants. Finally, we are especially grateful to the families and children who participated.

Author Contributions RF: conceived of the study, trained clinicians, finalized its design, completed all analyses, and coordination and drafted the manuscript; HR: helped draft the manuscript; EL: consulted on and created intervention and study coordination; AS: participated in the design and coordination of the study and statistical manuscript.

Funding The work was supported by the Virginia Tech Center for Autism Research under the SEED Student Grant (RF) as well as the Psi Chi Honor Society under the Mamie Phipps Clark Diversity Research Grant (RF; neither funding sources had Grant Numbers).

Data Availability Patients signed informed consent regarding publishing their data. Data is available upon request.

Declarations

Conflict of interest The authors have no relevant financial or non-financial interests to disclose.

Ethical Approval All procedures performed involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by the Virginia Tech Institutional Review Board and all other organizations involved.

Informed Consent Informed consent was obtained from legal guardians.

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