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An Israeli RCT of PEERS®: Intervention Effectiveness and the Predictive Value of Parental Sensitivity

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ABSTRACT

Objectives: A Randomized Controlled Trial was conducted to evaluate the effectiveness of the Hebrew adaptation of the Program for the Education and Enrichment of Relational Skills (PEERS®), a parent-assisted intervention. Parental sensitivity (PS), measured in conflict and support contexts, was assessed as a predictor of adolescents' intervention-related outcomes.

Design: Eighty-two Hebrew-speaking adolescents (9 females), aged 12–17 years, and their parents (62 mothers), were randomly allocated into immediate intervention (II; $n = 40$) or delayed intervention control (DI; $n = 42$) groups. Participants were tested at three time-points (Pre-Post-Follow Up for II, Pre-Pre-Post for DI). Outcome measures included behavioral assessments of adolescents' social communication (SC), a social-skills knowledge test, and self, parent, and teacher reported questionnaires. PS was assessed using support and conflict parent-adolescent interactions. Repeated measures ANOVAs were used to assess intervention effectiveness. SEM was used to examine PS pre- and post-intervention as predictors of adolescents' immediate and follow-up outcomes.

Results: The II group improved on adolescents' measured SC and social knowledge, on parent- (but not teacher-) reported social skills, and on self-reported empathy. Gains maintained at follow-up. The DI group showed similar gains following their intervention. Adolescents' intervention-related SC gains were negatively predicted by pre-intervention PS, and positively predicted by intervention-related PS changes in the support context. Pre-intervention PS in the conflict context positively predicted adolescent SC at follow-up.

Conclusions: The Hebrew-adapted PEERS® is an effective intervention for adolescents with ASD. PS plays an important role in the promotion of SC in adolescents with ASD and should receive clinical attention.

Introduction

Background

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by social communication deficits and restricted and repetitive behaviors (American Psychiatric Association, 2013). Despite the great phenotypic variability that characterizes the autism spectrum, developmental studies show that the core features of ASD persist throughout the lifespan (Drmic et al., 2017).

Adolescence is a particularly difficult period for individuals with ASD. As their Typically Developing (TD) peers switch from play-based to conversation-based social activities (Paul, 2003), adolescents with ASD may show greater social difficulties, including reduced social interaction, fewer friends, less peer

support, limited involvement in social activities, and greater peer rejection and loneliness (Barendse et al., 2018; Renno & Wood, 2013). Additional negative social experience may include bullying, victimization and perpetration (Lung et al., 2019). In view of these significant difficulties, adolescents with ASD can benefit from interventions targeting communication and social interaction, such as social skills groups.

Social-skills training groups are among the most common interventions for individuals with ASD, especially for those with no cognitive deficits (Wolstencroft et al., 2018). As demonstrated in a meta-analysis, participants in social-skills group interventions show improvement in social competence, however these improvements may fail to generalize to other settings (Gates et al., 2017). Difficulties generalizing learned skills, especially in the social domain, are characteristic

of ASD (Rosenberg et al., 2015). Different ways have been suggested to promote generalization, such as conducting the intervention within the educational system (Bauminger-Zviely et al., 2020), including peers as intervention mediators (Chang & Locke, 2016) or involving a parent as part of the intervention (Pickles et al., 2016).

The well-established Program for the Education and Enrichment of Relational Skills (PEERS[®]; Laugeson & Frankel, 2010) is a parent-assisted, manualized social skills training program for adolescents with ASD, addressing key areas of social functioning (see methods for a detailed description). Ecologically valid skills for making and maintaining friends are taught using psycho-educational and cognitive-behavioral treatment techniques. Adolescents practice target skills in between sessions. Parents serve as their adolescents' social coaches, supervise their treatment fidelity, and practice social skills with them. PEERS[®] has been evaluated in several RCTs, with its efficacy established for improving a variety of social-skills in adolescents (Laugeson et al., 2012, 2009; Matthews et al., 2020; Schohl et al., 2014). The effectiveness of the intervention was found over and above adolescents' age (Hong et al., 2019) or gender (McVey et al., 2017). Furthermore, adolescents showed reduced depression (Schiltz, et. al., 2018) and social anxiety symptoms (Schohl et al., 2014) after participating in PEERS[®]. A follow up study has shown PEERS[®]-related gains were maintained even 5 years post intervention (Mandelberg et al., 2014). PEERS[®] intervention effects have also been reflected in changes in the social brain as revealed through biomarkers of intervention outcome using EEG (Van Hecke et al., 2015).

PEERS[®] has been cross-culturally evaluated in Canada, South Korea, Japan and Hong-Kong. Its cross-cultural assessments have shown significant behavioral improvements in adolescents' communication and social interaction, as well as social skills knowledge, interpersonal skills, and a decrease in depressive symptoms (Marchica & D'amico, 2016; Shum et al., 2019; Yamada et al., 2020; Yoo et al., 2014). Preliminary findings of the current RCT, evaluating the adapted Hebrew version of PEERS[®] among adolescents with ASD in Israel, reported positive and promising changes following the intervention (Rabin, Israel-Yacov, Laugeson, Mor-Snir, & Golan, 2018). Here, we report the results of the full sample. In addition, we examine the impact parental sensitivity in different relevant contexts has on adolescents' gains in this parent-supported intervention.

The effectiveness of parent involvement in interventions for their children with ASD has shown mixed

results (Gates et al., 2017; Reichow et al., 2012), and substantial individual differences in response to intervention have been reported (Howlin & Charman, 2011). It had been suggested that possible moderators related to participants' or parents' characteristics could explain how some individuals exhibit significant progress, whereas others show no treatment gains. Identifying factors that predict treatment outcome, may assist in personalizing interventions and in boosting intervention effectiveness (Gates et al., 2017). Here, we examine the predictive value of parental sensitivity, which has a key role in child development, on the effects PEERS[®] has on adolescents.

Parental Sensitivity (PS), extended from the original formulation of maternal sensitivity, is defined as the parent's ability to provide contingent, appropriate, and consistent responses to the child's signals and needs (Lamb & Easterbrooks, 1981). Studies in typically developing children highlighted the importance of PS to a child's secured attachment (Leerkes, 2010), early language acquisition (Quittner et al., 2013), emotion regulation in childhood (Alink et al., 2009; Bigelow et al., 2010; Leerkes, 2010) and in adolescence (Van der Voort et al., 2014), and increased social and academic competence in adulthood (Raby et al., 2015). The appropriateness of a sensitive parental response has also been conceptualized in view of contextual factors. Commonly, PS has been examined in the context of parent support to the child's distress. PS in distress-context was found to be a better predictor of childhood social functioning and emotion regulation, compared to a non-distress context, in infancy (Leerkes et al., 2009) and in childhood (Davidov & Grusec, 2006). Another pertinent context, in which PS has been examined is that of parent-child conflict. PS in this context supports the child's acquisition of conflict management skills (Rubenstein & Feldman, 1993), and impacts adaptive functioning (Feldman, 2010). Developmentally, PS in conflict contexts has been shown to decrease toward adolescence in parents of TD adolescents (Feldman, 2010).

Among parents of young children with ASD, PS has been linked to increased expressive language (Baker et al., 2010) and elevated secure attachment (Koren-Karie et al., 2009). The PS of parents of children with ASD was found to be similar to that of parents of TD children (Hirschler-Guttenberg et al., 2015; Maljaars et al., 2014). However, a distinct trajectory of PS in children with ASD was found in the transition to adolescence. Whereas parents of TD adolescents showed a reduction in PS, compared to childhood levels, PS of parents of adolescents with ASD remained high (Maljaars et al., 2014). Specifically for conflict

situations, two recent studies showed that parents of adolescents with ASD demonstrated higher levels of PS, compared to parents of TD adolescents (Rabin et al., 2019; Van Esch et al., 2018). This differential trajectory can be explained through the continued reliance of adolescents with ASD on their parents and their need for continued support, a role that in typical development is handed over from parents to peers (Seltzer et al., 2004). Therefore, parents of adolescents with ASD who wish to continue encouraging them to develop their social and adaptive skills while promoting their independence (Maljaars et al., 2014; Meirsschaut et al., 2011), are in need of high levels of age- and context-appropriate PS.

Unlike the growing corpus of research findings on parental involvement in interventions for toddlers and young children with ASD (e.g., Ben Itzhak & Zachor, 2011; Rogers et al., 2019), and on the role of PS in such interventions (Green et al., 2010; Siller et al., 2013), research examining these questions in adolescents with ASD is scarce. Due to the key role that parents maintain as generalization agents in the lives of their children with ASD in adolescence (Koegel et al., 1992; Orsmond et al., 2006), we argue that adolescents whose parents have high levels of age and context appropriate PS would benefit more from psycho-educational interventions, since skills taught in the interventions would be further consolidated through parent-teen interaction. In addition, when PS is reduced, the involvement of parents in an intervention that (1) exposes them to their adolescents' experiences and challenges, and (2) guides them to support the adolescent's coping according to his/her unique needs, would affect parents' sensitive age- and context-dependent support of their adolescent. These would, in-turn, contribute to the intervention-related gains made by the adolescent.

Objectives

The current study is a randomized controlled trial, which examined the effectiveness of a Hebrew adaptation of the PEERS[®] social skills program among Israeli adolescents with ASD, using behavioral measures, as well as parent, teacher, and self-report questionnaires. In addition, we examined how PS predicts adolescents' outcomes following the PEERS[®] intervention. PEERS[®] places parents as their adolescents' social coaches and thus exposes them to the adolescents' coping with social challenges. Furthermore, through its parent-coaching group, group leaders encourage parents to coach their adolescents not only according to their weekly homework assignments, but also in view of their child's unique strengths and difficulties, thus indirectly promoting PS. As social coaches, parents

are expected to provide support during the homework practice, but also to supervise homework completion and to challenge their adolescents, when needed. Therefore, PS was examined in two contexts – support and conflict – reflecting the multifaceted position parents may hold in the intervention. We hypothesized:

(1) greater improvements in adolescent outcomes in an immediate intervention group, compared to a delayed intervention control group from Time 1 to Time 2

(2) significant improvements in adolescent outcomes in the delayed intervention control group and maintenance of treatment effects in the immediate intervention group from Time 2 to Time 3.

In addition, for the immediate intervention group, for which data was available on intervention immediate effects as well as on maintenance at follow-up, we hypothesized:

(3) Pre-intervention PS in both support and conflict contexts will positively predict adolescents' SC gains immediately following the intervention, and at follow up. As this examination has not been done before, we will explore how PS in each context impacts adolescents' gains.

(4) Changes in PS in both contexts following PEERS[®] will positively predict adolescents' SC gains following the intervention and at follow-up. Since parents' involvement in PEERS[®] was viewed as more supportive than conflictual in nature, the predictive effect of PS changes in the support context was expected to be stronger than that of PS changes in the conflict context.

Method

Recruitment and Participants

One hundred and three families were recruited through ASD professionals around the country. Eligibility criteria were: (1) age of 12–17 years, (2) a clinical ASD diagnosis by a psychiatrist or a neurologist, according to DSM-IV-TR (American Psychiatric Association, 2000) or DSM-5 (American Psychiatric Association, 2013) criteria, which was validated by ADOS-2 (Lord et al., 2012), (3) no co-occurring intellectual impairment (IQ >70); (4) personal motivation to take part in the group; (5) no severe behavioral problems, (6) having a parent who was willing to serve as a social coach and attend all group sessions, and (7) consent not to participate in another intervention study, throughout the RCT period.

Trained and licensed psychologists met the families at the *Bayit Eched* tertiary clinical centers of the Israeli Association for Children at Risk for a 3-hour assessment to ensure they meet the inclusion criteria. The

assessment included an administration of the ADOS-2 and a brief cognitive abilities examination (using 2 verbal [Vocabulary, Similarities] and 2 nonverbal [Block Design, Matrix reasoning] Wechsler subtests), as well as a semi-structured clinical interview with the adolescent and his/her parent, to confirm the adolescent's motivation to participate in the group and to rule out severe behavioral problems that might prevent participation in a group intervention.

Based on this pre-assessment, twenty-one participants were excluded from the study, eleven due to an intellectual impairment, six due to poor adolescent motivation, two due to severe behavioral problems reported by parents, one due to participation in another intervention and one due to domestic issues. These families were referred to other individual and/or group-based clinical interventions.

Eighty-two adolescents with ASD (9 females), without an intellectual disability, aged 12–17 ($M = 14.40$, $S. D. = 1.75$) and their parents (62 mothers) were accepted to the study.

Design and Procedure

The study was a crossover randomized control trial of the PEERS® program in Israel. Simple randomization was conducted, allocating participants equally to one of two conditions: an Immediate Intervention group (II, $n = 40$), or a Delayed Intervention control group (DI, $n = 42$) which received PEERS® immediately after the II group completed its intervention. The randomization was conducted by the research coordinator using a computerized program (www.randomizer.org/). Randomization concealment was supervised by the principal investigator. Group allocation was concealed from the rest of the research team. The groups were comparable on participating adolescents' age, gender, education, cognitive abilities, and ADOS-2 comparison scores, and on parent's age, gender, years of education and baseline scores (See [Table 1](#)). The study took place between July 2016–August 2018. Interventions were conducted by two clinical teams at the *Bayit Echad* tertiary clinical centers in Tel Aviv and Kfar Saba, in two rounds of recruitment, randomization and intervention. These rounds were required to reach the designated sample size (40 and 42 participants at year 1 and 2 respectively). On each round, half of the sample was allocated to the II group and half to the DI group.

Participants were assessed at three time points: In the II group, pre-assessment (T1) took place prior to the intervention, post-assessment (T2) was conducted immediately following the intervention, and follow-up assessment (T3) was conducted 16 weeks after T2.

Participants of the DI group were assessed at (T1) 16 weeks prior to intervention, reassessed (T2) immediately prior to intervention, and then assessed again (T3) immediately after the intervention. Families' assessments took place at the Autism Research Lab in Bar-Ilan University, while teachers filled out online questionnaires. Families and teachers were compensated for assessment time.

Ethical Considerations

The study was ethically approved by the *Beer-Yaacov-Ness-Ziona* mental health center's Helsinki committee (#537-2016) and registered at the NIH www.clinicaltrials.gov database (Unique identifier: NCT03354923). Written consent was obtained from all participants' parents and verbal assent was obtained from participating adolescents.

Intervention

PEERS® is a manualized, evidence-based, parent-assisted social-skills intervention group for adolescents with ASD and no intellectual impairment, which aims to teach how to make and maintain friendships (For the published manual, see Laugeson & Frankel, 2010). The original program comprises fourteen 90-min sessions which cover ecologically valid social-skills through didactic lessons, using concrete behavioral rules, role-playing demonstrations, rehearsal exercises with another group member, performance feedback and social homework assignments. The Hebrew adaptation of PEERS® was extended to 16 weeks since families and clinicians reported that two lessons are packed with too much information, and that there is a need for elaborating the taught material. In addition, some cultural adaptations of the original examples and rules were required. Full details of the trial protocol outline, as well as cultural adaptations and changes, can be found in the [supplementary material](#).

Adolescent groups were administered by a clinician and two behavioral coaches, who provided didactic and emotional support, when necessary. In parallel, parents attended their own sessions, in which they were taught how to coach their children on the skills they learned, went over previous weeks' homework and worked through difficulties regarding adolescents' task completion. Parents groups were led by a clinician, who was supported by a trainee. Both adolescent and parent groups were supervised by clinicians trained at the UCLA PEERS® clinic who made sure the intervention followed the adapted protocol. Team leaders and

Table 1. Group background and baseline statistics.

	Immediate Intervention	Delayed Intervention Control	
	Mean (SD)	Mean (SD)	
<i>Demographics</i>			
Adolescent gender (m:f)	36:4	37:5	$\chi^2(1) = .07$
Adolescent education (Mainstream: mainstream with aid: special education class)	17:12:11	14:13:13	$\chi^2(2) = .50$
Parent gender (m:f)	12:28	8:34	$\chi^2(1) = 1.33$
			t(80)
Parent age (years)	46.97 (5.84)	47.93 (4.94)	-0.81
Parent education (years)	15.97 (3.77)	15.89 (1.92)	0.11
Adolescent age (years)	14.35 (1.81)	14.45 (1.721)	-0.52
Wechsler Block Design	11.25 (3.60)	9.98 (3.03)	1.73
Wechsler Similarities	11.65 (3.11)	11.33 (2.85)	0.48
Wechsler Vocabulary	10.68 (2.85)	10.43 (2.83)	0.39
Wechsler Matrix Reasoning	10.90 (3.57)	9.67 (3.17)	1.64
ADOS comparison score	6.83 (1.75)	7.02 (1.54)	-0.54
<u>Observational measure</u>			t(80)
CASS- total score	12.65 (5.60)	12.50 (5.57)	0.11
<u>Adolescent self-report</u>			t(80)
TASSK	14.33 (2.47)	12.97 (2.46)	2.43*
EQ	34.15 (9.88)	36.95 (12.25)	-1.12
<u>Parent report</u>			t(80)
SSIS- social skills	74.37 (15.23)	77.50 (12.73)	-0.89
SSIS- behavior problems	34.25 (12.51)	35.76 (10.38)	-0.72
SRS-2 total score	88.30 (38.85)	81.98 (23.16)	1.09
<u>Teacher report</u>			t(74)
SSIS- social skills	62.11 (23.03)	61.87 (24.08)	0.04
SSIS- behavior problems	25.76 (10.95)	25.64 (14.17)	0.04
SRS-2 total score	85.36 (28.26)	80.74 (28.17)	0.70

P >.1 for all comparisons, except Wechsler Block Design ($p = .09$) and TASSK ($p = .02$). ADOS – Autism Diagnostic Observation Scale, CASS – Conversational Assessment of Social Skills, SSIS- Social Skills Improvement Scale, SRS- Social Responsiveness Scale, TASSK- Test of Adolescent Social-Skills Knowledge, EQ- Empathy Quotient.

parents (as social coaches) supervised adolescents' treatment fidelity.

Measures

Treatment Outcome Measures

The adolescent behavioral SC measure was defined as the primary outcome measure. Parent, teacher, and adolescent questionnaires were defined as secondary outcome measures. All measures were employed at the three assessment time points. Since all the measures include a large number of scales, and in order to prevent redundancy, we have reported instruments' total scores.

Contextual Assessment of Social Skills

(CASS; Ratto et al., 2011). This observational assessment is a videotaped interaction, aimed to assess social interaction abilities among adolescents and young adults with ASD. The adolescent was introduced to an unfamiliar confederate, and the two were asked to get to know each other. The confederate was instructed to participate in an engaging and interesting manner throughout the interaction. The CASS also includes interactions with "bored" confederates, but these were not included as they stand in contrast with the PEERS® protocol, which stresses that friendships should be made between peers with shared interests who are motivated to communicate with each other. The confederates were five female undergraduates,

trained to administer the CASS by the research coordinator and the PI. They were provided with corrective feedback routinely throughout the trial, based on administration videos, to maintain fidelity. Participants were matched with confederates based on confederate availability, while making sure participants meet different confederates over the 3 assessment points. Confederates were naive to participants' group allocation, as well as to the research questions and to the CASS scoring system. The interactions' first 3 minutes were coded by two reliable raters ($Kappa = .87$), who were naive to participants' group allocation and to study hypotheses. Measures included the number of questions asked and the number of topic changes made by the participant, as well as ratings on a 1–7 Likert scale of participants' vocal expressiveness, gestures, positive affect, posture, kinesic arousal, social anxiety, involvement in the conversation and quality of the overall rapport. In addition, a CASS total score was calculated. Higher scores indicate better SC. Previous studies found the CASS to be a valid, reliable, and intervention-sensitive measure among adolescents (Dolan et al., 2016; Rabin et al., 2018) and adults (White et al., 2015) with ASD. Internal consistency for CASS, which was based on items measured through Likert ratings, was $\alpha = .89$ at T1.

Test of Adolescent social skills Knowledge (TASSK; Laugeson & Frankel, 2010). Completed by the adolescent, the TASSK is a criterion referenced measure

designed to assess adolescent's knowledge of the specific social communication skills taught during the PEERS® intervention. Two items were derived from each of the PEERS® didactic lessons making a total of 26 forced-choice items. Prior PEERS® studies found the TASSK to be a reliable measure among adolescents with ASD, which is sensitive to intervention related change (Schohl et al., 2014; Yoo et al., 2014). The TASSK scores have been correlated with observational measures of social communication among adolescents with ASD (Dolan et al., 2016).

The Social Skills Improvement System (SSIS; Gresham & Elliott, 2008). Completed in the current study by parents and teachers, the SSIS is a 75-item rating scale, assessing global social competence among children aged 3–18 years. This standardized measure is designed to evaluate improvements following treatment in social-skills (including communication, cooperation, assertion, responsibility, empathy, engagement, and self-control) and problem behaviors (including externalizing, hyperactivity/inattention, bullying and internalizing, and ASD symptoms). The SSIS has been used to assess social difficulties among youth with ASD (Gillis et al., 2011), social anxiety (Gresham et al., 2013), and behavioral/emotional problems (Porter et al., 2017). In addition, the SSIS has been used to assess long term effects of intervention among adolescents with ASD (Mandelberg et al., 2014) and with severe problem-behavior (Sheridan et al., 2019). The SSIS social-skill scale has been correlated with observational measures assessing various social communication skills among adolescents with ASD (Rabin et al., 2018). Internal consistency for SSIS scales, calculated at T1 were high for the social-skills scale ($\alpha = 0.91$ for parents and $\alpha = 0.90$ for teachers) and for problem behaviors scale ($\alpha = 0.88$ for parents and $\alpha = 0.91$ for teachers).

Social Responsiveness Scale, 2nd edition (SRS-2; Constantino & Gruber, 2012). Completed in the current study by parents and teachers, the SRS-2 is a 65 item rating scale, evaluating the severity of ASD symptoms, in various social dimensions such as awareness, cognition, communication, motivation and mannerisms. The SRS-2 was found reliable and sensitive to changes in social functioning among adolescents with ASD (Corona et al., 2019). In addition, it has shown acceptable validity among children (Rodgers et al., 2019) and adolescents (Barbosa et al., 2015) with ASD. The Internal consistency measures for the SRS-2 in the current study, calculated at T1, were $\alpha = 0.93$ for parents and $\alpha = 0.92$ for teachers.

Empathy Quotient (EQ; Baron-Cohen & Wheelwright, 2004). The EQ is a 40-item questionnaire evaluating levels of empathy. It was filled out in the

current study by the adolescents. This self-reported measure was found to be sensitive to changes among adolescents (Johnson et al., 2009) and adults with ASD (McVey et al., 2016). The EQ was found to have an acceptable concurrent validation (Lawrence et al., 2004). The internal consistency for this sample, calculated at T1, was $\alpha = 0.84$.

Context-related Parental Sensitivity

In addition to the RCT outcome measures, the following measures were used to assess the impact of parental context-related sensitivity on adolescents' primary measure outcomes.

Parental sensitivity was assessed using two contexts from the *Coding of Interactive Behavior* observational assessment (CIB; Feldman, 1998): a conflict context and a support context.

During the support context, the adolescent was asked to tell the parent about an event in which s/he had experienced difficulty. In this context, sensitive parenting was expressed by validation and containment of the adolescent's negative affect, helping the adolescent organize and regulate his experience, and attempting to clarify and expand the adolescent's perspective, rather than suggesting how to solve his problems (e.g., "It sounds like you did all you could, and I hear you feel very frustrated. How else could you view this situation?").

During the conflict interaction, parents and their adolescents were asked to choose and discuss a common disagreement. Here, the focus shifts from the adolescent to the dyad, and negative affect may be directed to the parent. In this context, sensitive parenting was expressed by empathic listening to the adolescent's perspective, acknowledging and elaborating his arguments, followed by a presentation of the parent's perspective in a way that seeks a mutual solution, rather than avoiding or oversimplifying the conflict (e.g., "I understand your need to play computer games when you come back tired and stressed from school, though I would prefer for us to spend some time together. Are there other ways which could help you chill out while being with us?").

Each interaction lasted about 7 minutes, was videotaped and coded by two trained, reliable raters (Kappa = .90), who were naive to participants' group allocation and study hypotheses, using the *Coding Interactive Behavior* manual (CIB; Feldman, 1998). The CIB is a global rating system for social interactions that includes 52 codes, rated on a scale of 1 to 5, which group into parent, child, and dyadic factors. Age and context are taken into account while coding. The CIB was found to be valid and reliable among toddlers

(Hirschler-Guttenberg et al., 2015) and adolescents (Rabin et al., 2019) with ASD and their parents. For the current study, the parental sensitivity factor was used. This factor included 5 codes which address the extent to which the parent acknowledges adolescent's difficulties, employs adolescent's perspective, elaborates adolescent's statements, regulates adolescent's emotional states, and provides empathy and appropriate affective response (at T1, $\alpha = .89$ for the conflict context and $\alpha = .86$ for the support context).

Analytic Procedure

Power analysis for the primary efficacy tests was conducted using G-Power (v.3.1.9.2). The minimal sample size for significant effects (two tailed $\alpha = .05$, $1-\beta = .95$) of the repeated measures' between-within interactions were calculated for each dependent measure. Effect sizes were elicited from the results of the first year of the study ($n = 36$) and ranged between $\eta^2 = 0.03-0.49$. The analysis yielding these effect sizes included team (i.e., the two teams that administered the intervention) as an additional independent factor, in order to control for cluster effects. No main effect of team or interaction of team with time or with group was found. Based on the group by time interaction effects found in these analyses, the minimum sample size required ranged between 8 (for TASSK) and 56 (for parents SRS-2). Hence, the second year of the study replicated the same design of the first year, i.e. – 2 groups conducted per site, with 10–12 participants in each group. Based on the first year of the study, as well as on previous PEERS® studies, the anticipated dropout rate was 10%. Therefore, a total sample of $n = 82$ was recruited.

The adolescent outcomes (hypotheses 1, 2) were examined for both II and DI groups, using repeated measures ANOVAs on IBM SPSS 20 (IBM Corp.). In each analysis, α threshold was corrected, to account for the number of dependent variables (i.e., $\alpha = .05$ for the CASS analysis, $\alpha = .025$ for the adolescent's analysis and $\alpha = .017$ for parents' and for teachers' analyses). Based on previous PEERS® RCTs, we expected medium to large effect sizes.

Analysis of the parental sensitivity predictors (hypotheses 3, 4) was conducted for the II group only ($n = 40$), using structural equation modeling (SEM) with AMOS 23 (Arbuckle, 2014). Missing data of 4 participants from the II group who dropped out at T2 were handled with the maximum likelihood (ML) estimation procedure. The SEM model allows to explore complex models which include multiple covariates, predictors, mediators and outcomes simultaneously. The expected fitting data of the

model are non-significant χ^2 , NFI, CFI and TLI $>.9$, and RMSEA $<.08$ (Kline, 2015).

Results

Participant Flow, Losses and Exclusion

During protocol administration, eleven participants dropped out of the study: Four participants from the II group dropped out during the intervention period; seven participants dropped out of the DI group; 2 during the waiting period, and 5 during the intervention. Comparing the 11 dropouts to the rest of the sample on all pre-intervention measures, including the outcome measures, revealed that the average ages of dropout adolescents ($M = 15.39$ S.D. = 1.64) and their parents ($M = 50.45$, S.D. = 5.84) were significantly older than those of participants ($M = 14.24$, S.D. = 1.72; $t[80] = 2.05$, $p < .05$) and their parents ($M = 47.00$, S.D. = 5.20; $t[80] = 2.01$, $p < .05$) who completed the protocol. No other differences were found. Hence, 71 participants were included in this per protocol analysis (see Figure 1).

Treatment Effectiveness

In order to examine hypotheses 1 and 2 regarding the RCT outcomes, repeated-measures analyses of variance were conducted for the CASS behavioral measure, and for adolescent, parent and teacher reports, with group (II, DI) as the between group variable and time (T1, T2, T3) as the within subject variable. Significant group by time interaction effects were found for the CASS behavioral measure, for adolescents' TASSK scores, for parent reports on the SSIS social skills scale, and on the SRS-2 total score, and for adolescents' EQ self-reports. Contrary to our hypotheses, no significant group by time effects were found for parents' report on the SSIS behavior problem scale, or for any teacher report. The interaction effects of the different measures and effect-sizes are detailed in Table 2.

Post-hoc comparisons (Bonferroni corrected) of the univariate CASS total score ratings indicated that as hypothesized, immediately following the intervention, adolescents from the II group scored higher on CASS total score, compared to DI wait-list group. These gains were maintained at the 16-week follow-up. CASS scores of participants in the DI group did not change while waiting, and significantly improved following the PEERS® intervention.

Post-hoc analyses of the adolescents' measures indicated that, as hypothesized, following PEERS® adolescents from the II group exhibited improved social-skills knowledge (TASSK) and reported

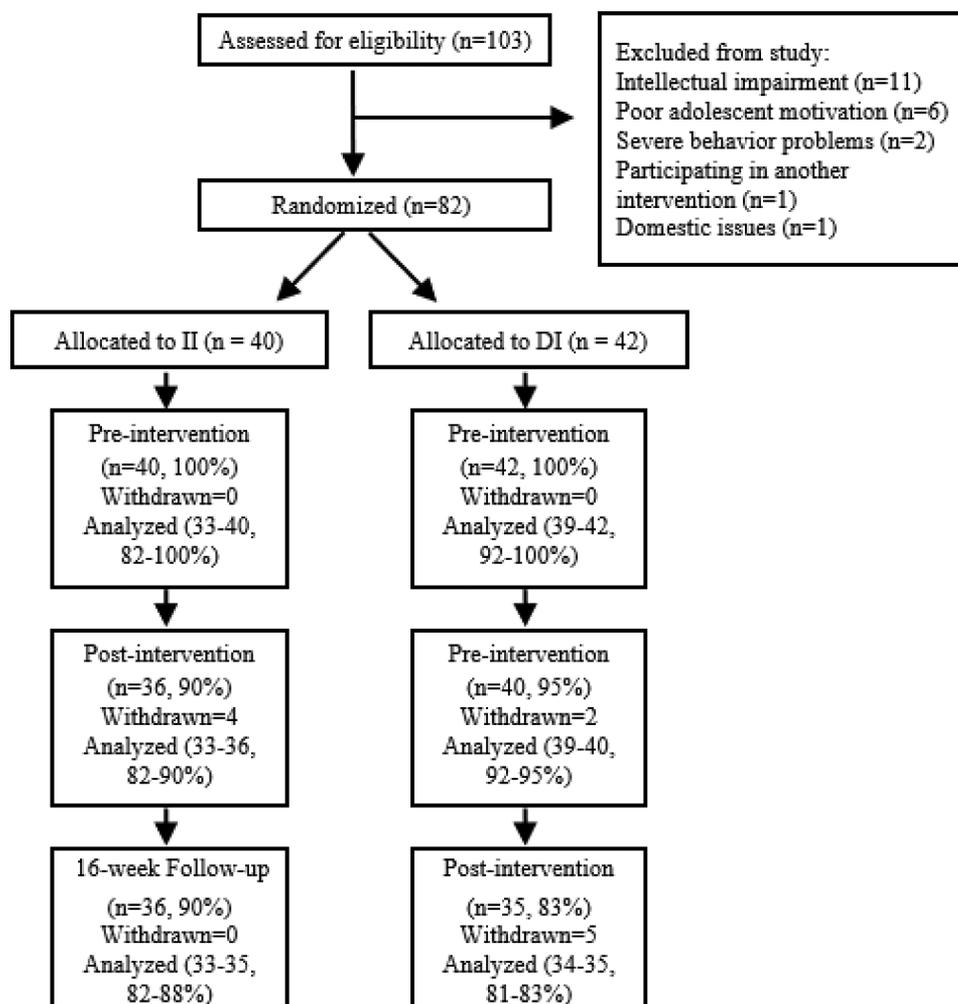


Figure 1. Design of the randomized controlled trial.

increased empathy (EQ) compared to the DI waiting-list group. These gains were maintained at follow up. Adolescents from the DI group exhibited the same gains following their PEERS® intervention.

Post-hoc analyses (Bonferroni corrected) of parent reports revealed that, as hypothesized, the II group showed gains immediately following the intervention on the SSIS social skills scale, as well as significant reductions on the SRS-2 total score. These gains were maintained at the 16-week follow-up. In the DI group, no significant changes were reported by parents while waiting, whereas significant gains were reported following the PEERS® intervention. The RCT effects are illustrated in Figure 2.

The Effects of Context-related Parental Sensitivity on Adolescents' SC

Hypotheses 3 and 4 were analyzed using structural equation modeling (SEM). The analysis was conducted

on the II group, as it was the only group that had follow-up data. The model included CASS total score at post-assessment and CASS total score at follow-up as outcome measures, controlling for CASS total score at baseline, so intervention-related gains were beyond initial performance. Parental sensitivity in the conflict context and in the support context pre and post intervention (controlling for baseline performance) were set as predictors of the CASS path. Prior to the examination of the model, we have examined the associations of pre-intervention CASS total score and parent sensitivity in the two contexts, with adolescents' ASD symptomatology, cognitive ability (averaging the four Wechsler subtests), and age. We found that adolescents' pre-intervention CASS total score was negatively correlated with ASD symptomatology ($r = -.41, p < .001$), and marginally positively correlated with adolescents' age ($r = .21, p = .06$). Pre-intervention parental sensitivity in the conflict context was marginally negatively correlated with adolescents' ASD symptomatology ($r = -.20, p = .08$). No significant correlations were found with

Table 2. RCT adolescent outcome measures: Means (S.D.), confidence intervals (90%) and post hoc comparisons of the immediate and the delayed intervention groups at Times 1-3.

	Immediate Intervention group (n = 36)			Delayed Intervention group (n = 35)			Time X Group F (2,67)	η^2 (CI of 90%)	
	T1	T2	T3	Contrasts	T1	T2			T3
<u>Observational measure</u>									
CASS- total score	12.51 (5.11) 10.51-14.19	16.65 (6.07) 14.69-18.83	15.80 (5.20) 14.04-17.66	T1 < T2*** = T3	11.95 (5.63) 9.96-13.64	13.22 (5.95) 11.01-15.16	16.02 (5.23) 14.24-17.87	T1 = T2 < T3**	.15 (.03-.26)
<u>Adolescent self-report</u>									
TASSK	14.41 (2.53) 13.45-15.13	20.79 (2.47) 20.13-21.80	19.88 (3.00) 18.98-20.95	T1 < T2*** = T3	13.12 (2.48) 12.19-13.86	13.75 (2.46) 12.78-14.45	19.75 (2.79) 18.89-20.86	T1 = T2 < T3**	.73 (.63-.78)
EQ	33.00 (9.84) 29.36-36.40	38.08 (12.23) 33.81-41.84	37.73 (13.16) 33.61-41.47	T1 < T2* = T3	36.56 (11.26) 33.07-40.31	34.78 (11.80) 30.77-39.04	40.31 (9.88) 36.65-44.74	T1 = T2 < T3**	.17 (.03-.28)
<u>Parent report</u>									
S/S- social skills	75.29 (15.44) 70.52-80.06	81.58 (15.02) 76.57-86.89	81.30 (15.93) 75.52-86.70	T1 < T2*** = T3	78.85 (12.05) 73.26-82.81	79.78 (14.63) 74.32-84.65	83.86 (16.06) 78.09-89.27	T1 = T2 < T3*	.10 (.00-.20)
S/S- behavior problems	33.58 (12.75) 28.78-36.91	29.25 (11.44) 24.33-32.84	28.08 (10.55) 24.70-32.17		35.97 (10.94) 31.93-40.07	33.12 (13.56) 29.16-37.67	28.93 (11.15) 25.60-33.07	1.42	.04 (.01-.12)
SRS-2 total score	87.00 (27.84) 78.33-96.07	69.50 (22.18) 61.33-77.01	69.80 (26.15) 63.22-79.83	T1 > T2*** = T3	79.63 (23.56) 71.69-89.43	72.25 (23.90) 65.51-81.19	65.49 (22.99) 58.05-74.67	T1 = T2 < T3*	.09 (.01-.19)
<u>Teacher report</u>									
S/S- social skills	57.39 (21.01) 49.23-65.55	76.54 (15.23) 70.39-82.67	81.25 (16.05) 75.05-87.44		65.77 (22.05) 58.01-73.53	77.94 (17.08) 72.09-83.77	81.61 (16.66) 75.72-87.50	T1 = T2 < T3*	.01 (.00-.05)
S/S- behavior problems	26.25 (11.88) 21.59-30.90	27.86 (13.48) 22.78-32.93	25.25 (13.30) 20.63-29.86		24.90 (12.68) 20.47-29.33	25.68 (13.35) 20.85-30.50	27.39 (11.10) 23.00-31.77	1.85	.06 (.00-.15)
SRS-2 total score	86.04 (26.32) 75.65-96.41	80.50 (25.61) 69.65-91.34	76.39 (28.87) 65.78-86.99		81.84 (28.37) 71.97-91.70	81.45 (31.15) 71.14-91.76	80.54 (27.24) 70.46-90.62	1.40	.05 (.00-.13)

*P < .05, **P < .01, ***P < .001; CASS - Conversational Assessment of Social Skills, SSIS- Social Skills Improvement Scale, SRS- Social Responsiveness Scale, TASSK- Test of Adolescent Social-Skills Knowledge, EQ- Empathy Quotient. Post hoc comparisons, with Bonferroni corrections, were conducted for significant group by time interaction effects.

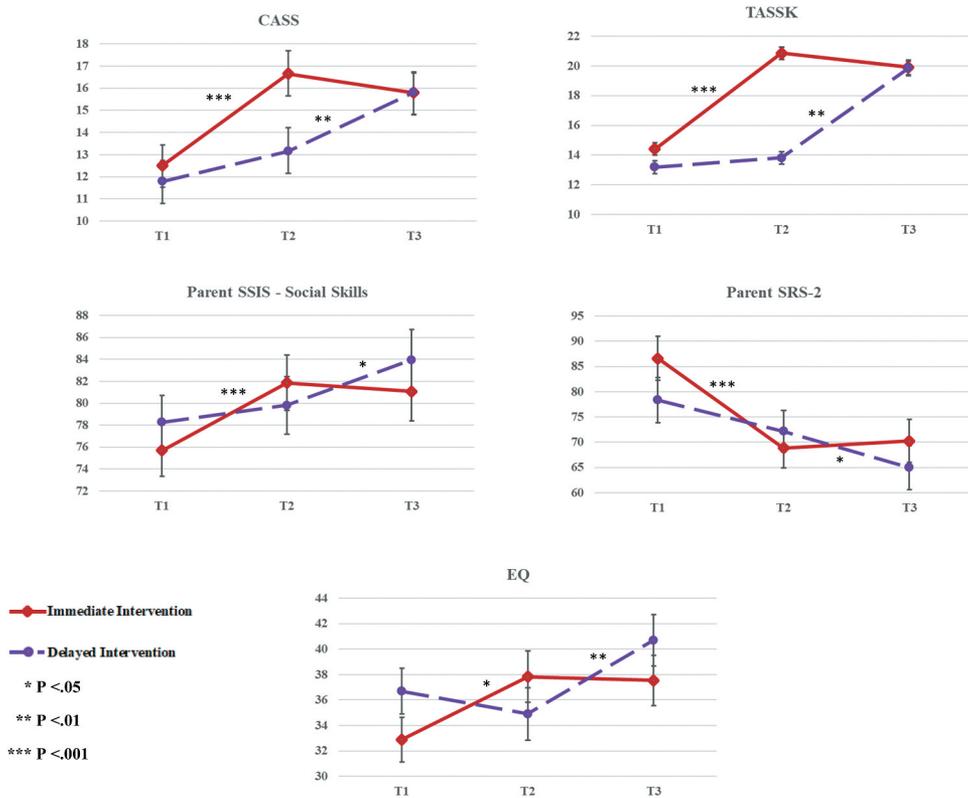


Figure 2. Significant effects of the RCT.

adolescent cognitive ability. Nevertheless, in order to ensure that the SEM pathways were not confounded by adolescents' age, cognitive ability, or autism symptomatology, the analysis controlled for these variables. To achieve a more parsimonious model we trimmed the non-significant paths.

The final SEM model fitted the data well ($\chi^2(10) = 5.98$, $p = .817$, NFI = .96, CFI = 1.00, TLI = 1.23, RMSEA = .00).

As illustrated in Figure 3, pre-intervention parental sensitivity in a support context negatively predicted intervention-related changes in CASS total score. However, change in parental sensitivity in a support context from pre- to post- intervention was a positive predictor of adolescents' intervention-related SC changes. Parental sensitivity in the support context did not predict adolescents' SC at follow-up. In contrast, parental sensitivity in a conflict context

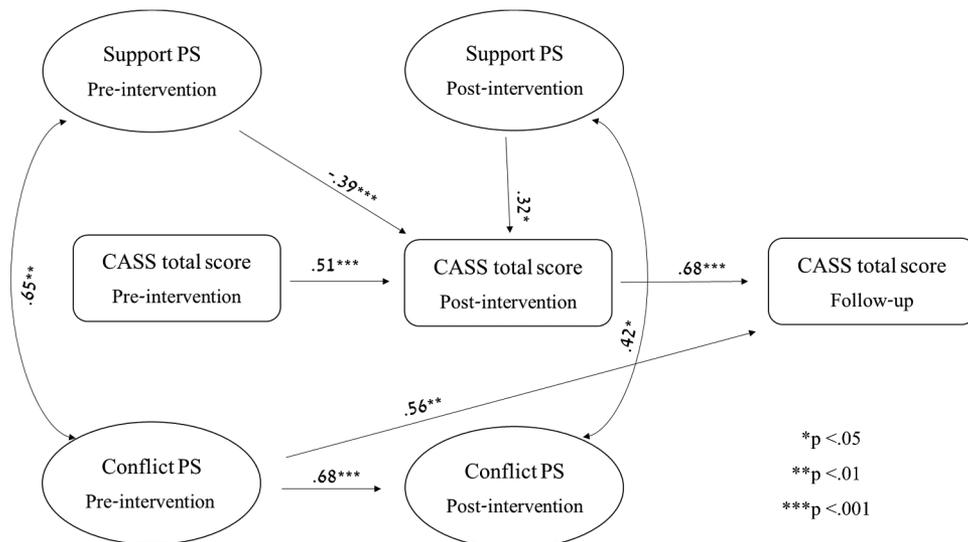


Figure 3. Parental sensitivity in support and conflict contexts as predictors of adolescents' SC outcomes.

showed only one significant path: a positive prediction of CASS total score at the 16-week follow-up by pre-intervention parent conflict-related sensitivity.

In addition, adolescents' autism symptomatology at baseline came out as a significant predictor of treatment outcomes, showing a negative effect on CASS total score at baseline ($\beta = -.38, p < .05$) as well as immediately following the intervention ($\beta = -.25, p < .05$). In addition, adolescents' age positively predicted adolescents' CASS total score immediately following the intervention ($\beta = .27, p < .05$). Cognitive ability showed no significant effects.

Discussion

This study reports the results of a randomized controlled trial, which examined the efficacy of the adapted and translated Hebrew version of the PEERS® social skills intervention for adolescents with ASD. Intervention outcomes and maintenance were examined behaviorally, in addition to the use of parent, teacher and self-report questionnaires. Our findings supported the effectiveness of the adapted Hebrew version of PEERS® in Israel, indicating improvements of the immediate intervention group, compared to waitlist (delayed-intervention) controls, in adolescents' measured social communication (SC) and social knowledge, as well as in parent, but not teacher, reported social skills, and in adolescent self-reported empathy, with medium to large effect sizes. All gains maintained at follow-up and were also replicated by the delayed intervention group. In addition, the study aimed to examine the value of context-related parental sensitivity (PS) as a predictor of adolescent outcomes, following this parent supported intervention. Adolescents' intervention-related SC gains were negatively predicted by pre-intervention PS, and positively predicted by intervention-related PS changes in the support context. Pre-intervention PS positively predicted adolescent SC at follow-up.

RCT Effects

The RCT examined the effects of an immediate intervention (II) group, compared to those of a delayed intervention waiting-list group (DI). Intervention-related gains in the II group were found on several levels: TASSK effects indicated that adolescents acquired new knowledge on social skills and social communication. Improvements on the CASS behavioral measure indicated improvements in applied SC skills (Ratto et al., 2011). These effects were also

supported by parents' reports on their adolescents' social-skills in everyday life on the SSIS, suggesting that the intervention has a significant impact on various aspects of adolescents' SC, such as improving social skill knowledge and increasing communication abilities. Moreover, our findings revealed that according to parental report, the PEERS® intervention played an important role in reducing participants' ASD symptoms, as indicated by lower SRS-2 scores. Finally, an intervention-related gain was found on adolescent-reported empathy. Improvement of self-reported empathy following the PEERS® intervention has been found so far only for adults with ASD (Gantman et al., 2012), and this is the first replication of this finding with adolescents. Although PEERS® does not directly target empathy, this effect could result from the discussion of others' emotional and mental states, which is a key component of the intervention.

The examination of the maintenance of treatment effects in the II group has shown that the behavioral improvements on social communication skills, as well as reported gains on social skills and knowledge, increased reported empathy and reduction of ASD symptoms have maintained 16 weeks after the adolescents completed the intervention, supporting treatment durability. Moreover, the analysis of the DI groups' intervention-related effects has shown similar improvements on these measures. These findings replicate previous literature, indicating that, according to parents' reports, PEERS® has an immediate and a long term effect on the improvement of social skills and on the reduction of ASD symptoms (Laugeson et al., 2009; Mandelberg et al., 2014; Marchica & D'amico, 2016; Schohl et al., 2014; Shum et al., 2019; Yamada et al., 2020; Yoo et al., 2014). Our findings provide further cross-cultural support to the effectiveness of PEERS®, which was found to be both acceptable and efficacious with relatively minor amendments.

Contrary to our hypothesis and to previous studies, the RCT showed no effects of the teacher measures. This may indicate that intervention effects were not generalized to the school environment. An alternative explanation is that measures employed in the current study (and in other studies), i.e., the SRS-2 and the SSIS, may have not been sensitive enough to reflect change, when reported by teachers. Indeed, some of the teachers involved in the current study reported of their poor familiarity with specific social behaviors, included in the instruments, that may be more common outside the classroom. Noteworthy, covarying for different aspects of familiarity (years of acquaintance with the adolescent, hours per week of teaching the adolescent) in the analyses of teacher reports, did not

reach significance and did not affect RCT results. Our null findings on teacher reports stand in contrast with the significant outcomes of our lab-based behavioral measure, the CASS. Therefore, evaluating school-based social behavior through behavioral measures (e.g., Kasari et al., 2011), may be needed.

Our study did not replicate previous findings indicating a reduction of problem behaviors among adolescents with ASD following PEERS® (Laugeson et al., 2009; Mandelberg et al., 2014; Schohl et al., 2014; Yoo et al., 2014). This missing effect could be related to the current study's inclusion criteria, which excluded participants with severe behavioral problems. Narrowing down the potential range of behavior problems among our participants may have generated this null effect, and in addition limited the generalizability of our findings to the wider population of adolescents with ASD.

Parental Context-related Sensitivity Effects on Adolescents' Outcomes

Another aim of the current study was to examine the role of PS on adolescents' SC outcomes, following the intervention. The predictive effects of PS in infancy and early childhood on children's social-developmental trajectories have been widely supported by the literature (Leerkes, 2010; Van der Voort et al., 2014), as has the important role of PS in promoting early interventions for children with ASD (Green et al., 2010; Siller et al., 2013). Hence, in view of the central role of parents in the lives of adolescents with ASD, and the higher levels of PS described in this group, compared to typically developing adolescents (Rabin et al., 2019; Van Esch et al., 2018), the effects of PS in parent-supported interventions for adolescents with ASD were examined here for the first time. We examined PS in two relevant contexts – parent's support of adolescent's distress, and parent-adolescent conflict.

Our findings showed that pre-intervention PS in the support context negatively predicted adolescents' SC outcomes following PEERS®. In other words, an adolescent whose parent started the intervention with lower supportive PS had made more progress than an adolescent whose parent had high supportive PS to begin with. This effect may indicate that when sensitive parental support is high to begin with, the adolescent can gain mostly from the intervention's curriculum. However, when pre-intervention PS is lower, the parent's involvement in the intervention (i.e., his/her exposure to the adolescent's experiences and the intervention team's support of the parent's coaching that is tailored around the child's unique needs) enhances the gains the adolescent makes through the

intervention's curriculum. Indeed, the negative association between PS in the support context and adolescents' gains was complemented by the hypothesized positive association between intervention-related changes of PS in the support context and adolescents' SC outcomes. Indeed, adolescents' intervention-related SC gains were predicted by PS changes made by their parents.

A similar pattern of results was found in a parent-supported CBT intervention for emotion regulation in children with ASD, in which children's gains were associated with greater pre-intervention parental anxiety (Tajik-Parvinchi et al., 2020), suggesting that parents who experience greater difficulty for their child as well as for themselves, may show good treatment adherence. Similarly, in our case it is possible that parents who experienced greater difficulties in providing support to their adolescents were more strongly motivated to enroll in a program like PEERS®. Unlike other social skills programs, PEERS® offers the benefit of facilitating adolescents' social skills and supporting parents' social coaching, providing the opportunity for parents to fine-tune their support skills. The lack of association between parents' intervention related changes in PS and adolescents' longer-term SC may suggest the indirect effects of PEERS® on parents' PS are only valid while both attend the group. However, in order to examine the durability of parents' PS changes and their association with adolescents' SC changes, a follow-up assessment of parental PS may be needed.

With regards to the conflict context, PS had no effect on the intervention's immediate outcomes. Since parent coaching in PEERS® focuses more on supporting already motivated adolescents than on challenging resisting ones, it was hypothesized that PS in this context would have a weaker effect on adolescents' intervention-related outcomes. Indeed, the lack of a significant effect may suggest this context is of less relevance for the PEERS® intervention, or that its relevance is reduced when inclusion criteria require evident adolescent motivation. Future studies should examine the role of conflict-related PS for adolescents with ASD in interventions that involve conflict management, such as those targeting anger management (Sofronoff et al., 2007) or externalizing behaviors (Ting & Weiss, 2017). Importantly, pre-intervention PS in the conflict context positively predicted adolescents SC at follow-up. This finding highlights the developmental significance of PS in the conflict context for adolescents with ASD, as found in younger TD children (Feldman, 2010). It also suggests that adolescents with ASD whose parents are more able to sensitively manage conflicts with them may show better social communication skills when interacting with others. In other words, parents who sensitively manage conflicts

with their adolescents with ASD give them an opportunity to practice important perspective taking, exchanging information, negotiation, and conflict resolution skills in a secure and enabling environment, which could potentially be utilized in other social contexts (Rabin et al., 2019; Van Esch et al., 2018).

Limitations

This per protocol RCT compared an active intervention group to a waitlist control, thus potentially overstating treatment effects. Future studies should compare the PEERS® intervention to an active control group (e.g., a social skills group with no parent support component) to elucidate its unique active ingredients.

A generalizability limitation lies in the drop-out rate of 13% of participants, who were not followed up after leaving the study. As shown above, these participants were, on average, older than participants who had completed the study, suggesting these adolescents could benefit from a more homogeneous group for older adolescents, or from an intervention that targets young adults, such as PEERS-YA® (Laugeson et al., 2015).

The diversity and generality of our sample was limited by our focus on motivated adolescents, with no behavior problems and no cognitive impairments. An examination of the effects of this Hebrew adaptation of PEERS® in a more heterogeneous sample is warranted. Furthermore, the small number of female adolescents and male parents in our study did not allow us to examine gender-differences in the analysis. In view of the current findings on the different manifestation of ASD in males and females (Mandy et al., 2012), the different effects of parental involvement and of social skills interventions on females vs. males with ASD should be examined.

Limitations should also be discussed with regards to the CASS, which was used as our primary outcome measure for adolescents' SC. This instrument was originally meant to be administered with a confederate who is at the same age as the participant. Our reliance on undergraduate confederates, who interacted with teenagers who were 12–17 years of age may have limited the CASS' ability to represent a social interaction with similar-aged peers. Indeed, the positive association found between adolescents' age and their intervention-related SC gains on the CASS may be attributed to this age gap. It is possible that the conversation between older adolescents and the confederates resembled an interaction between peers, and was thus affected by the PEERS® intervention, which targets same-age interaction. However, the conversation of the younger adolescents with the confederates may have been more similar to an

interaction between an adult and a child, which is not the focus of PEERS®. Thus, reliance on same (or close) aged confederates in future studies may be advisable.

Finally, our examination of the effects of parental sensitivity on adolescents' SC at the three time points were examined in the II group only, since the control group had received PEERS® in between T2 and T3. This limited the sample size and may have underpowered some of the predictive effects examined. In addition, to examine the effects of parental sensitivity over time, future studies may need to include a no-intervention control group.

Conclusions

We conclude that the Hebrew adaptation of PEERS® is an effective social skills training for adolescents with ASD, yielding significant behavioral and questionnaire-based medium to large effects that maintain at follow-up. Clinical implementation may require adaptations for individuals with reduced motivation, behavior problems, or cognitive impairments. Parental sensitivity plays a significant role in promoting the development of SC of individuals with ASD into adolescence. The involvement of parents in the social experiences of their adolescents with ASD, and promotion of parents' sensitive support of adolescents' attempts to cope with their social challenges, complement the effects of social skills interventions. In view of the complexity of adolescents' parents' role and their need to combine support and containment with promotion of independence, our findings highlight the importance of parental guidance as an integral part of psychological interventions provided for adolescents with ASD.

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