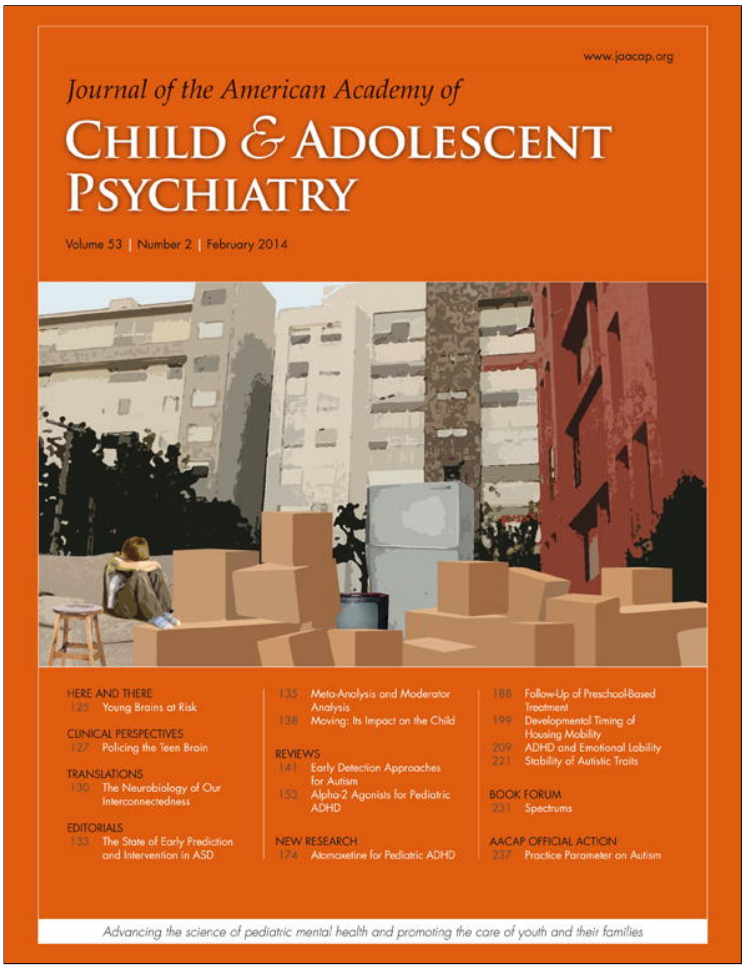

NEW RESEARCH

Preschool-Based Social Communication Treatment for Children With Autism: 12-Month Follow-Up of a Randomized Trial

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Objective: This study reports 12-month follow-up data from a randomized controlled trial of preschool-based social communication treatment for young children with autism. **Method:** A total of 61 children (48 males) with autism, 29 to 60 months of age, had earlier been randomized either to 8 weeks of preschool-based social communication treatment in addition to standard preschool program (n = 34) or to standard preschool program only (n = 27). Significant short-term effects on targeted social communication skills have previously been published. Long-term gains in social communication, language and global social functioning and communication were assessed from video-taped preschool teacher–child and mother–child interactions, Early Social Communication Scales, Reynell Developmental Language Scale, and Social Communication Questionnaire. **Results:** Compared with those in the control group, the treated children achieved significantly larger improvements in joint attention and joint engagement from baseline to 12-month follow-up. However, no effects were detected on language and global ratings of social functioning and communication. The treatment effect on child initiation of joint attention increased with increasing level of sociability at baseline, whereas nonverbal IQ and expressive language had no moderating effect. **Conclusions:** This study is the first to show that, similar to specialist-delivered treatment, preschool-based treatment may produce small but possibly clinically important long-term changes in social communication in young children with autism. The treatment did not affect language and global ratings of social functioning and communication. More studies are needed to better understand whether treatment effects may be improved by increasing the intensity and duration of the treatment. Clinical trial registration information—Joint Attention Intervention and Young Children With Autism; http://clinicaltrials.gov/; NCT00378157. J. Am. Acad. Child Adolesc. Psychiatry, 2014;53(2):188–198. **Key Words:** autism, follow-up, language, preschool-based treatment, social communication

The ability to share focus on objects or events with others is essential for the development of social communication. Social communicative acts, such as use of joint attention skills (i.e., coordinated looking between persons and objects, pointing to share, and showing objects), enable young children to establish a shared focus with their social partners. Children with typical development obtain these types of skills within the first 2 years of life, whereas the attainment of joint attention skills, especially initiation of joint attention, is delayed and atypical in children with autism.[1,2]

This article is discussed in an editorial by Dr. Connie Kasari on page 133.

Children with autism are also less likely to spend time in joint engagement,[3] a state in which the child and the social partner are involved with the same object or event.[4] Children who often engage in joint attention and joint engagement may create more optimal early social learning opportunities for themselves. Interestingly, children with autism with more joint attention skills and longer time in joint engagement are found to acquire language faster[3,5,6] and to develop better social skills.[7,8] In this sense, joint attention and joint engagement may be considered pivotal skills that may lead to interactions fostering better language development, even when language is not specifically targeted.[9] Therefore, joint attention and joint engagement are important targets in treatment of young children with autism.

The effects of treatments aiming to increase social communication, such as joint attention skills and joint engagement, have been assessed in randomized controlled trials (RCT). Kasari *et al.*[10] found an increase in joint attention skills and longer joint engagement after specialist-delivered treatment in a university-based preschool program, and Landa *et al.*[11] found an increase in socially engaged imitation in a similar setting. Significant effects have also been found in joint engagement, children's social communication initiation, and shared attention after parent-delivered treatments.[12,13]

More recent studies have moved to mainstream and special education preschool classrooms. This is an important step, as most young children with autism attend preschool. Thus, testing the effect of social communication treatments when delivered in the preschool setting is essential. Lawton and Kasari[14] reported longer duration of joint engagement and more initiation and response to joint attention after 6 weeks of social communication treatment in public preschools. Goods *et al.*[15] reported a decrease in time unengaged, and more responses to joint attention after 12 weeks of treatment in autism speciality preschools. Kaale *et al.*[16] showed an effect on children's initiation of joint attention with preschool teachers and generalization to more joint engagement with mothers after 8 weeks of social communication treatment for 2- to 4-year-old children with autism in mainstream preschools. Altogether these studies suggest that there is an effect of relatively brief preschool-based treatments. However, the studies focus only on short-term effects on directly targeted social communication abilities. Although this is important, information is also needed about course in a longer time perspective and collateral effects on nontargeted abilities.

Language has been 1 of these nontargeted abilities. It is plausible that social communication treatment could facilitate language growth, as the success of adult–child dyads in establishing a shared context is related to later language development.[3,5] Actually, the specialist-delivered treatment assessed by Kasari *et al.*[17,18] showed effects on both targeted social communication skills and expressive language 1 and 5 years after the end of treatment. However, collateral effects on language development have not been demonstrated in other studies of specialist-delivered treatment[11] or in studies of parent-delivered treatments.[12,19,20]

No type of treatment works for all children with autism. Therefore, it is essential to investigate for whom preschool-based social communication treatment may be effective. Children's cognitive[21,22] and expressive language level[17,23] have been suggested to moderate treatment outcome, but we do not know whether sociability affects treatment results.

To explore the long-term effects of preschool-based social communication treatment, we extended a previously published RCT[16] in which we assessed the short-term effects the treatment. The first aim of the present study was to investigate the effects at 12 months on joint attention skills and time in joint engagement. The second aim was to examine collateral long-term effects on language and global ratings of social functioning and communication. The third aim was to investigate potential treatment moderators, with a focus on expressive language, nonverbal IQ, and sociability. Our a priori hypothesis was that, relative to the children in the control group, the children in the treatment group would show greater long-term gains in social communication, language, and social functioning and communication.

METHOD

Study Design

This study reports on the preplanned 12-month follow-up data from an RCT of a preschool-based social communication treatment for children with autism.[16] All randomized participants were included in the statistical analyses whenever possible.

Participants

The original RCT consisted of 61 children identified by child and adolescent mental health clinics (CAMHCs) from 2006 to 2008, meeting the following inclusion criteria: chronological age of 24 to 60 months; ICD-10 diagnosis of childhood autism; and attendance in preschool. Exclusion criteria were CNS disorders (e.g., epilepsy, cerebral palsy) and non–Norwegian-speaking parents. All participants were diagnosed with childhood autism by a multi-disciplinary CAMHC team, based on a comprehensive clinical evaluation (interviews and multiple observations by different professionals). A total of 49 children (80%) were tested with Autism Diagnostic Observation Schedule (ADOS)[24] and/or Autism Diagnostic Interview–Revised (ADI-R).[25] Missing ADOS/ADI-R were due to site diagnostic practices, not child characteristics. The study was approved by the Norwegian National Committees for Research Ethics. Written consent was obtained from parents and preschools.

Randomization and Treatment

The majority of the participants were in mainstream community preschools, typically serving only 1 child

with autism, whereas a few were in small units for children with autism within mainstream community preschools or in specialized autism preschools. All children received some one-to-one support and systematic training in areas such as communication, social, and adaptive skills. After baseline assessment, the children were randomized with a 1:1 ratio to the treatment group (n=34), receiving social communication treatment in addition to their ordinary preschool program, or to the control group (n=27), receiving only their ordinary preschool program. The randomization was not stratified by any child or preschool characteristics.

A modification of the social communication treatment manual developed by Kasari *et al.*[10] was used. The CAMHC counselors attended a workshop and 5 rehearsal seminars to learn the treatment method. As the children were randomized to the treatment group, a CAMHC counselor gave a 6-hour didactic training to the preschool teacher responsible for the child's program. The treatment was then delivered by the preschool teachers, in a separate room in the preschool. The treatment duration was 8 weeks with 2 daily 20-minute sessions; including 5 minutes of table-top training and 15 minutes of floor play. The main focus was on increasing duration of joint engagement and child initiation of joint attention. During the table-top training, the child was given opportunities to initiate joint attention within playful adult-driven activities. Teaching opportunities were created by using appealing toys, presenting toys in ways that encouraged initiation of joint attention, prompting when necessary, and amplifying the shared interest in the toy. Floor play was child driven. Strategies used included following the child's lead, facilitating joint engagement, creating play routines, talking about what the child was doing, prompting and responding to joint attention skills, and emphasising generalization. Counselors from the CAMHCs provided weekly supervision to the preschool teachers. The first author (A.K.) took part in the supervision at treatment weeks 2 and 5. The parents were not involved in the treatment, but they were invited to sit in during the didactic training before the treatment start.

Preschool teachers' treatment adherence was evaluated by weekly counselor-rated fidelity checklists (10 items for table-top training and 14 items for floor play). A.K. completed the same checklists at treatment week 2 and 5. Mean counselor-rated fidelity for the treatment period was 85% for table-top training, and 83% for floor play. Interrater reliability for the counselors and AK was fair (intraclass coefficient [ICC] = 0.68).

Assessment Procedure

All of the children were assessed at 4 time points. Baseline and 12-month follow-up assessments were done during 1 day at the local CAMHC, whereas assessments at treatment end and 6-month follow-up were done in the preschools. All assessments were administered by 1 of 2 testers, who were independent of the research group and blinded to the children's group allocation. Developmental abilities and language at baseline were assessed with Mullen Scales of Early Learning (MSEL)[26] and the Norwegian standardization of Reynell Developmental Language Scales (RDLS).[27] Before the baseline assessment, the parents completed a questionnaire on demographics, and the preschool teachers completed a questionnaire on education and work experiences, as well on the children's preschool program. Before the 12-month follow-up assessment, the preschool teachers again completed a questionnaire on the children's preschool program.

Social Communication Outcomes

Video recordings of 10-minute preschool teacher–child and mother–child interactions were used to assess joint engagement and child initiation of joint attention at baseline, at treatment end, and at 6- and 12-month follow-ups. The dyads were given a standard set of toys and instructed to play as they would typically do. The toy sets used with mothers and preschool teachers were not identical, but the number of toys and their function were the same. The adults were encouraged to keep themselves and the child positioned toward the camera. Each recorded play session was subsequently coded by research assistants, who were blinded to the study purpose, group allocation, and testing order. First, the recordings were coded for duration of 6 mutually exclusive engagement states: unengaged, onlooking, person engagement, object engagement, supported joint engagement, and coordinated joint engagement, based on the Bakeman and Adamson system.[4] Engagement states were coded when lasting for at least 3 seconds and both the adult and the child were visible on the screen. In the present study, only the coded supported and coordinated joint engagement episodes were used. Supported joint engagement was coded when the child and the adult were actively involved with the same toy but the child was not overtly acknowledging the adult, whereas coordinated joint engagement was coded when both the child and the adult were actively coordinating their attention to the shared toy and to each other. The joint engagement variable was calculated from total time in supported and coordinated joint engagement combined. Second, child initiation of joint attention, which included frequency of alternating gaze, showing, pointing, and giving to share, was coded from the same video recordings. Only spontaneous joint attention skills, not joint attention skills prompted by adult's verbalizations or gestures, were coded. Requesting gestures were not included. The observation system has been shown to be reliable and valid,[4] and has been used in studies of children with typical development and autism,[3,4] including treatment studies.[10,18] The present ICC, based on 18% of the play recordings, was 0.79 for joint

engagement with mothers and 0.75 with preschool teachers, and 0.68 for child initiation of joint attention with mothers and 0.67 with preschool teachers.

Early Social Communication Scales (ESCS)[28] was used to measure joint attention skills in a structured setting at the 4 time points. During the administration of ESCS, the child was seated at a table, and the experimenter presented different toys, 1 toy at the time. The interaction was video recorded and subsequently coded for initiation and response to joint attention and behavior regulation. The variable of interest was the frequency of child initiation of joint attention, which included alternating of gaze, showing, and pointing to share. The ESCS has shown good reliability and validity,[2] and has been used in studies of children with typical development and autism,[1] including treatment studies.[10,18,20] The present ICC, based on 19% of the ESCS recordings, was 0.74 for child initiation of joint attention.

Language and Global Social Functioning and Communication Outcomes

The RDLS was used to assess receptive and expressive language at baseline and 12-month follow-up. Raw scores were used in the statistical analyses, as these are more sensitive to change and not susceptible to floor effects. The Social Communication Questionnaire: Current Form (SCQ: C)[29] was used at 12-month follow-up to attain a more global measure of the children's social functioning and communication. Both parents and preschool teachers completed the 40-item caregiver-report measure. The sum scores from the 15 items matching the reciprocal social interaction domain and the 13 items matching the communication domain of the ADI-R were used.

Child Moderators

Three potential moderating variables were assessed, namely, baseline level of expressive language, nonverbal IQ, and sociability. Nonverbal IQ was estimated based on the mean mental age on the visual and fine motor scales on MSEL, divided by chronological age. Expressive language was based on the raw scores on the expressive part of the RDLS. A sociability score was created from the video recorded mother–child and preschool teacher–child interaction based on coding of frequency of the children's positive affect, toy expansion, and initiation of joint play during the interactions. To give equal weight to each behavior, individual Z-scores ([score − mean for the entire sample]/SD for the entire sample) were estimated, and then averaged to form a composite variable reflecting the children's sociability across the interactions. As the sociability variable was a composite of 3 core social behaviors in young children, it yields reasonable face validity. ICC, based on 20% of the video recordings, was 0.85 for positive affect, 0.86 for toy expansion, and 0.67 for initiation of joint play.

Statistical Analyses

A sample size of 60 was determined from an a priori power analysis, assuming a moderate but clinically significant group differences of 7 (SD 9) raw score points on RDLS at 12-month follow-up with an α value of 0.05 and a power of 80%. This analysis yields a more conservative estimate and a larger sample size than one based on joint attention. The estimate was based on preliminary results from Kasari *et al.*[17]

All analyses were by intention-to-treat. Linear mixed models were fitted to each of the 5 social communication outcomes (joint attention and joint engagement with preschool teachers and mothers, and joint attention during ESCS). Time was modeled using 2 slopes; 1 from inclusion to 6-month follow-up, and 1 from 6- to 12-month follow-up. Each participant's individual time point for each assessment was expressed as the number of months after study inclusion. All models included fixed effects for treatment, time, and time × treatment interaction, and a random intercept. Assessments of possible treatment moderators were performed by including fixed effects for the moderator variables and time × treatment × moderator interactions. The difference between the groups with respect to changes in receptive and expressive language (RDLS) from baseline to follow-up was estimated using linear regression models with 12-month measurements as the outcome, and treatment group and baseline level as covariates (analyses of covariance [ANCOVAs]). The differences between the groups in parent- and preschool teacher–reported social functioning and communication (SCQ: C) at 12-month follow-up were calculated using independent sample t-tests. Sensitivity analyses were done to control for the impact of missing data on SCQ: C items by extreme value imputation. No noteworthy changes in the results were observed. The statistical analyses were performed using Stata 12.1 (StataCorp, College Station, TX). All reported p values are 2-sided.

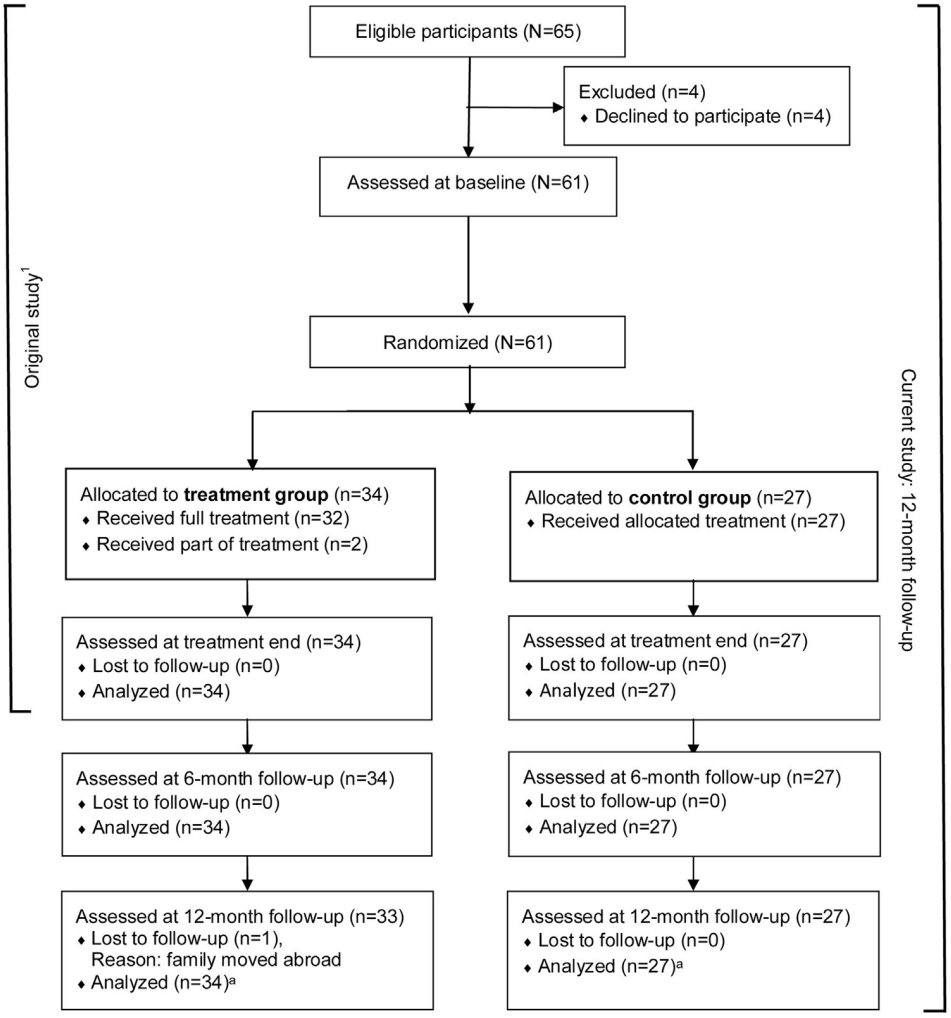
RESULTS

Sample

All 61 children from the original study participated at 6-month follow-up, but 1 child (treatment group) did not return for 12-month follow-up because the family had moved abroad. Figure 1 shows the participant flow through the study.

The study groups were relatively well matched on background variables, such as chronological age, gender, socioeconomic status, as well as type and content of the preschool programs. However, the children in the treatment group scored 4.7, 4.9, and 6.1 months lower, respectively, on mental age and on receptive and expressive language at baseline (Table 1).

FIGURE 1 Participant flow through the study. Note: [a] some analyses included < 34 and <27 children.



Services Received From Treatment End to 12-Month Follow-Up

There were no group differences in type and content of the children's preschool programs at 12-month follow-up. The number of preschool hours per week, hours in one-to-one support, and hours of systematic training were stable (Table 1). The majority of the preschool teachers involved in the treatment reported to use the treatment strategies in natural situations (not in one-to-one sessions) after treatment end.

Effects on Social Communication

The children in the treatment group showed significantly more gains than those in the control group from baseline to 12-month follow-up on 2 of the 5 social communication outcomes (Table 2). The increase in initiation of joint attention with preschool teachers was 2.92 (95% CI = 0.47 to 5.37) for children in the treatment group and −0.76 (95% CI = −3.39 to 1.87) for those in the control group (mean group difference, 3.68 [95% CI = 0.09 to 7.28], $p = .045$). In addition, the increase in time in joint engagement during interaction with mothers was 83.1 (95% CI = 37.6 to 129) seconds for children in the treatment group and 13.1 (95% CI = −36.2 to 62.3) seconds for those in the control group (mean group difference, 70.0 [95% CI = 3.0 to 137] seconds, $p = .041$). There was also a tendency toward more gains for the children in the treatment group in initiation of joint attention with mothers, time in joint engagement with preschool teacher, and initiation of joint attention during ESCS. However, these improvements were not significantly different from those

TABLE 1 Participant, Family, and School Characteristics at Baseline (N = 61) and 12-Month Follow-Up (N = 60)

Characteristic	Treatment Group	Control Group
Baseline	(n = 34)	(n = 27)
Child age, mo, m (SD)	47.6 (8.3)	50.3 (8.3)
Gender, male, n (%)	26 (76.5)	22 (81.5)
Mental age from MSEL, mo, m (SD)	25.6 (10.8)	30.3 (12.0)
Receptive language age[a], mo, m (SD)	21.0 (10.3)	25.8 (11.7)
Expressive language age[a], mo, m (SD)	18.8 (10.5)	24.9 (12.8)
Sociability, Z-score, m (SD)	−0.03 (0.52)	0.07 (0.50)
Parents education level[b], m (SD)	3.2 (1.3)	3.5 (1.0)
Type of preschool placement, n (%)		
Mainstream preschool	30 (88.2)	24 (88.9)
Autism unit in mainstream preschool	2 (5.9)	2 (7.4)
Autism preschool	2 (5.9)	1 (3.7)
Program philosophy, n (%)		
ABA-based program	20 (58.8)	12 (44.4)
Eclectic program	14 (41.2)	15 (55.6)
Hrs/week in preschool, m (SD)	36.4 (5.7)	38.4 (3.6)
1:1 training h/wk	11.0 (5.2)	10.7 (6.9)
1:1 support in group h/wk	19.2 (7.6)	19.0 (7.3)
Ordinary group h/wk	6.1 (7.9)	10.0 (7.7)
Teacher years of autism experience, m (SD)	1.2 (1.2)	1.6 (2.9)
Preschool received some supervision from CAMHC or similar[c], n (%)	32 (94.1)	21 (77.8)[d]
12-Month follow-up	(n = 33)	(n = 27)
Child age, mo, m (SD)	62.9 (9.1)	66.0 (8.9)
Child's teacher was the same as at baseline, n (%)	19 (55.9)	10 (37.0)
Child was in the same preschool as at baseline, n (%)	29 (87.9)	20 (74.1)
Child had changed preschool since baseline, n (%)	2 (6.0)	3 (11.1)
Child had started school during the last 6 months, n (%)	2 (6.0)	4 (14.8)
Hours per week in preschool/school, m (SD)	37.0 (5.1)	36.5 (5.8)
1:1 training h/wk	10.6 (6.6)	9.6 (5.2)
1:1 support in group h/wk	21.6 (6.9)	21.3 (7.1)
Ordinary group h/wk	3.7 (5.0)	5.5 (5.4)
Preschool/school received some supervision from CAMHC or similar[c], n (%)	31 (93.9)	24 (88.9)

Note: ABA = applied behavioral analyses; CAMHC = child and adolescent mental health clinic.

[a] *Primary based on Reynell Developmental Language Scales (RDLS), but for those scoring < 4 on the stanine scale for 1.5 years on RDLS, language age were based on Mullen Scales of Early Learning (MSEL).*

[b] *Mean mother/father education level (1 [elementary school]–5 [>4 years university]).*

[c] *Received supervision was not related to the present study.*

[d] *Missing data from 2 preschools.*

in the control group. Figure 2 shows mean observed values (including 95% CI) across the 4 time points.

Effects on Language

We found no significant group differences on language measures. The gains from baseline to 12-month follow-up on RDLS receptive language were 13 raw score points in the control group and 14 raw score points in the treatment group, whereas both groups gained 14 raw score points on RDLS expressive language (Table 2).

Effects on Global Social Functioning and Communication

We found no significant group differences on parent and preschool teacher ratings of social functioning and communication on SCQ: C at 12-month follow-up. The mean of parent/preschool teacher ratings on the social functioning subscale was 5.3/6.3 for the treatment group and 4.1/5.2 for the control group. The mean of parent/preschool teacher ratings on the communication subscale was 4.1/4.9 for the treatment group and 4.5/4.1 for the control group (Table 2).

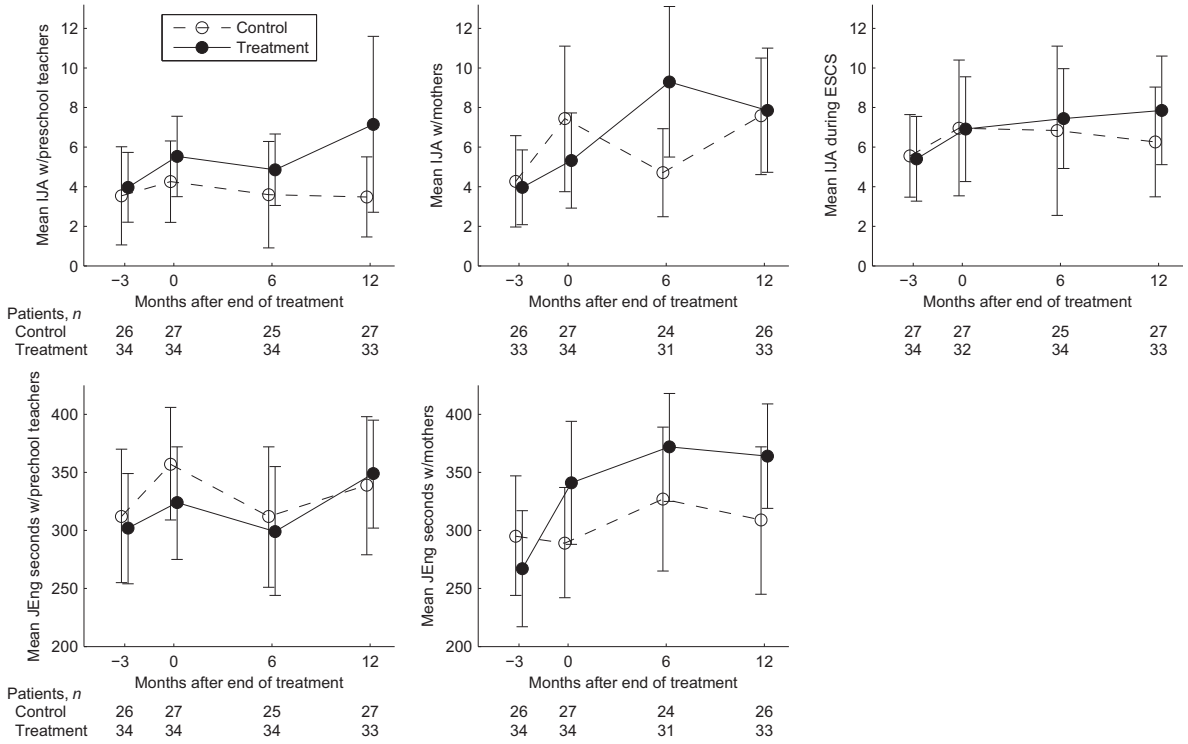
TABLE 2 Estimated Mean Values Obtained From Linear Mixed Models for Child Initiation of Joint Attention and Time in Joint Engagement, Analysis of Covariance (ANCOVA) Models for Reynell Developmental Language Scale (RDLS), and t-Test for Social Communication Questionnaire: Current Form (SCQ: C)

Outcome Variable	Baseline Mean (95% CI)	12 mo Mean (95% CI)	Changes from Baseline to 12 Months Mean (95% CI)	Between-Group Differences in Changes from Baseline to 12 Months Mean (95% CI), *p* Value
Seconds in joint engagement with preschool teachers				
Control (n = 27)	335 (286 to 385)	335 (284 to 386)	−0.64 (−53.5 to 52.2)	45.9 (−26.3 to 118), 0.21
Treatment (n = 34)	309 (266 to 352)	354 (304 to 404)	45.3 (−3.96 to 94.5)	
Frequency of child initiation of joint attention with preschool teachers				
Control (n = 27)	4.31 (1.87 to 6.75)	3.54 (1.04 to 6.05)	−0.76 (−3.39 to 1.87)	3.68 (0.09 to 7.28), 0.045
Treatment (n = 34)	4.47 (2.36 to 6.58)	7.39 (4.93 to 9.86)	2.92 (0.47 to 5.37)	
Seconds in joint engagement with mothers				
Control (n = 27)	285 (237 to 333)	298 (248 to 348)	13.1 (−36.2 to 62.3)	70.0 (2.98 to 137), 0.041
Treatment (n = 34)	278 (236 to 321)	361 (313 to 410)	83.1 (37.6 to 129)	
Frequency of child initiation of joint attention with mothers				
Control (n = 27)	5.37 (2.65 to 8.08)	7.32 (4.52 to 10.1)	1.96 (−0.67 to 4.59)	2.47 (−1.11 to 6.05), 0.18
Treatment (n = 34)	3.66 (1.29 to 6.04)	8.09 (5.42 to 10.8)	4.43 (2.00 to 6.86)	
Frequency of child initiation of joint attention during ESCS				
Control (n = 27)	5.90 (3.26 to 8.54)	6.17 (3.45 to 8.88)	0.27 (−2.31 to 2.84)	2.15 (−1.38 to 5.68), 0.23
Treatment (n = 34)	5.71 (3.40 to 8.03)	8.13 (5.50 to 10.8)	2.42 (0.00-4.84)	
RDLS, receptive raw scores				
Control (n = 27)	25.1 (18.6 to 31.5)	39.4 (32.1 to 46.7)	14.3 (10.5 to 18.2)	−0.99 (−6.23 to 4.25), 0.71
Treatment (n = 32)	20.0 (14.5 to 25.4)	32.8 (25.4 to 40.3)	12.9 (9.28 to 16.5)	
RDSL, expressive raw scores				
Control (n = 27)	20.1 (13.5 to 26.8)	34.1 (25.8 to 42.4)	14.0 (9.70 to 19.3)	0.67 (−4.95 to 6.29), 0.81
Treatment (n = 32)	14.2 (9.17 to 19.3)	27.9 (20.4 to 35.3)	13.7 (9.80 to 17.5)	
SCQ: C, social subscale, parents				
Control (n = 23)		4.13 (2.67 to 5.59)		−1.15 (−3.31 to 1.02), 0.29[a]
Treatment (n = 29)		5.28 (3.68 to 6.87)		
SCQ: C, social subscale, preschool teachers				
Control (n = 26)		5.19 (3.63 to 6.75)		−1.11 (−3.05 to 0.83), 0.26[a]
Treatment (n = 33)		6.30 (5.04 to 7.57)		
SCQ: C, communication subscale, parents				
Control (n = 23)		4.52 (3.65 to 5.40)		0.42 (−0.79 to 1.63), 0.49[a]
Treatment (n = 29)		4.10 (3.24 to 4.92)		
SCQ: C, communication subscale, preschool teachers				
Control (n = 26)		4.12 (3.29 to 4.94)		−0.76 (−1.94 to 0.41), 0.20[a]
Treatment (n = 33)		4.88 (4.04 to 5.72)		

Note: ESCS = Early Social Communication Scales.

[a]*Between-group difference in 12-month measures.*

FIGURE 2 Observed mean values with 95% CI at baseline, treatment end, and 6- and 12-month follow-up for the treatment and the control group. Note: ESCS = Early Social Communication Scales; IJA = child initiation of joint attention; JEng = joint engagement.



Moderators of Treatment Effects

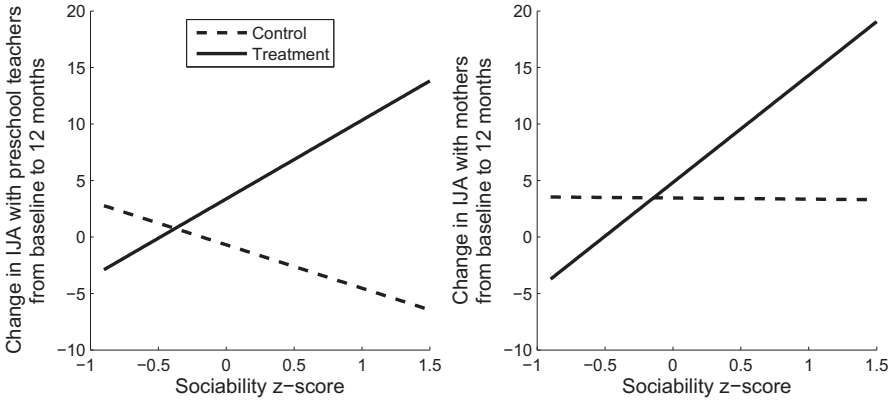
There was an interaction between sociability at baseline, change over time, and treatment on child initiation of joint attention during mother–child interaction ($p = .001$) and preschool teacher–child interaction ($p = .006$). Higher sociability was associated with increased gains in child initiation of joint attention during mother–child and preschool teacher–child interaction in the treatment group, but not in the control group. Figure 3 illustrates how change in child initiation of joint attention from baseline to 12-month follow-up, stratified by treatment group, changes with the sociability Z scores. Nonverbal IQ and expressive language level had no moderating effect.

DISCUSSION

This study reports 12-month follow-up data from an RCT of a preschool-based social communication treatment for young children with autism. Significant effects were found on some of the targeted social communication skills, whereas no significant effects were identified on language skills and global ratings of social functioning and communication.

In line with our hypothesis the short, but focused treatment produced a significant long-term change in children's initiation of joint attention with the preschool teachers. This finding extends the results of previous studies showing short-term effects of preschool-based treatment.[14-16] Also, the duration of joint engagement during play with mothers, who not were involved in the treatment, was significantly longer in the treatment group. This suggests that the generalized effect identified at the treatment end[16] was maintained over a longer period. Together, these findings suggest that social communication treatment delivered by preschool teachers can produce long-term changes in some core symptoms of autism. The same has previously been shown for specialist-delivered treatment.[17] The children in the treatment group also had larger gains on the other measures of joint attention and joint engagement (initiation of joint attention with mothers, time in joint engagement with preschool teachers, and initiation of joint attention assessed on ESCS). Thus, the measures of social communication skills all point in the

FIGURE 3 Sociability *Z*-scores and change in child initiation of joint attention from baseline to 12-month follow-up for the treatment and the control group. Note: IJA = child initiation of joint attention.



direction of skill enhancement in the treatment group, but as none of the last 3 differences were statistically significant, we have no evidence that this represents true treatment effects.

Children in both groups showed improved language skills; however, in contrast to our hypothesis, we found no significant difference between the groups. The average receptive and expressive language gains were about 14 raw score points from baseline to 12-month follow-up. Similar results have been reported in other studies of social communication treatment.[12,19,20] Parallel to our results, neither of these studies have shown significant language gains in favor of the treatment group. So far, only Kasari *et al.*[17,18] have found an effect on language after social communication treatment.

As in the present study, most social communication treatments are based on assumptions that social communication skills are pivotal for language development.[10-12,19,20,23] However, the lack of noticeable treatment effects on language despite changes in social communication skills raises the question of why the presence of such skills does not necessarily lead to interactions fostering better language development in children with autism. One explanation may be treatment dose. It is plausible that treatments delivered by nonspecialists, such as preschool teachers and parents, need to have greater intensity and longer duration. In fact, Kasari *et al.*[18] explain the uniqueness of their findings with "the density of the experimental treatments and the additional background of significant hours of early intervention" (p. 494). Another potential explanation is that joint attention and joint engagement are only parts of a set of pivotal skills that are necessary to produce shifts in the developmental trajectory of children with autism. An impetus to communicate and to understand others' minds, which is often lacking in children with autism, may also be important.[30]

In contrast to our hypothesis, we found no treatment effects on more global measures of social functioning and communication. Parents and preschool teachers rated the children in the treatment group and the control group quite similarly on SCQ:C, suggesting that this type of treatment does not affect global social functioning and communication. It is, however, possible that SCQ is too broad to detect differential skills emerging among young children with autism.

Interestingly, we found a significant moderating effect of children's sociability on gains in initiation of joint attention with preschool teachers and mothers. Children with more advanced sociability (i.e., showing more smiling, toy expansion, and initiations of joint play) seemed to benefit more from the treatment. This finding is noteworthy, as the baseline levels of sociability and initiation of joint attention were only moderately related. Some studies have shown that children with lower initial expressive language improved most in language development when assigned to social communication treatment.[17,23] However, we did not find moderating effects of expressive language and nonverbal IQ. Essentially, the moderator analyses suggest that the magnitude of the treatment effect in our study was more related to initial sociability than cognitive and language levels. These findings should be interpreted with caution, as the study sample is small for these types of inquiries, and the reliability and validity of the sociability measure need to be tested in others studies.

Strengths of the study include that it was carried out in a naturalistic setting with a relatively large sample size and a low attrition rate. Intention-to-treat analyses were applied, and multi level analyses handling dependency in the data as well as missing data were used. The study participants were probably representative of the population of preschoolers with childhood autism, as children with a variety of cognitive and language levels, as well as differential socioeconomic backgrounds, were enrolled. As the outcome assessment included both targeted and nontargeted skills, as well as assessment in settings outside the treatment arena, the validity of the study results is strengthened. The study also has limitations. Although the testers initially were blind to group allocation, parents and preschool teachers may unintentionally have revealed the children's group affiliation. However, a potential leakage would have had little impact on the video-recorded measures of joint attention and joint engagement, as these were blind-coded. Furthermore, potential group differences in global social functioning and communication at baseline are unknown because the SCQ: C was administered only at 12-month follow-up. There may also be some potential confounding effects related to the small group differences at baseline in mental age and language. Furthermore, some of the changes in the treatment group could come from posttreatment improvements, as some preschool teachers continued to use the treatment strategies in natural situations (which is also the intention for this kind of treatment). The ages of the children ranged from 2 to 4 years at the start of the study, but the majority of children were 4 years of age. Therefore, we do not know to what degree the results are relevant for the youngest children.

The gains of 3 joint attention initiations and 83 seconds in joint engagement during 10 minutes of play may seem small. However, these changes may be enough to improve the quality of the interaction between the children and their caretakers, as they presumably represent a general increase in joint attention and joint engagement throughout the day. Thus, the effects may be clinically meaningful, and the implementation of the treatment justified, even though no significant effect was shown on language. Furthermore, the treatment method seems to be feasible in the clinical setting. The counselors were able to learn, and then subsequently to teach the preschool teachers to successfully implement the treatment.

In summary, this study shows that similar to specialist-delivered treatment, preschool-based treatment may produce some clinically meaningful long-term changes in social communication in young children with autism. However, more studies are needed to better understand how to stimulate development in language and global social functioning and communication. Of particular interest is whether treatment effects may be improved by increasing the intensity and duration of treatment, or by combining preschool teacher–delivered and parent-delivered treatments. Large multisite studies allowing for more sophisticated analyses of moderators and mediators would be important. &

Accepted October 14, 2013.

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This study was supported by grants (no. 2005069) from South-Eastern Norway Regional Health Authority, Oslo University Hospital, Regional Center for Child and Adolescent Mental Health, East and South Norway, and Regional Resource Center for Autism, Attention-Deficit/Hyperactivity Disorder (AD/HD), Tourette Syndrome and Narcolepsy.

Dr. Fagerland served as the statistical expert on this research.

The authors gratefully acknowledge the participating families, preschools, and child and adolescent mental health clinics (CAMHCs).

Disclosure: Drs. Fagerland, Martinsen, and Smith, and Ms. Kaale report no biomedical financial interests or potential conflicts of interest.

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http://dx.doi.org/10.1016/j.jaac.2013.09.019

REFERENCES

1. Chiang CH, Soong WT, Lin TL, Rogers SJ. Nonverbal communication skills in young children with autism. J Autism Dev Disord. 2008;38:1898-1906.
2. Mundy P, Sigman M, Kasari C. Joint attention, developmental level, and symptom presentation in autism. Dev Psychopathol. 1994;6:389-401.
3. Adamson LB, Bakeman R, Deckner DF, Romski M. Joint engagement and the emergence of language in children with autism and Down syndrome. J Autism Dev Disord. 2009;39:84-96.
4. Bakeman R, Adamson LB. Coordinating attention to people and objects in mother-infant and peer-infant interaction. Child Dev. 1984;55:1278-1289.
5. Charman T, Baron-Cohen S, Swettenham J, Baird G, Drew A, Cox A. Predicting language outcome in infants with autism and pervasive developmental disorder. Int J Lang Commun Disord. 2003;38:265-285.
6. Thurm A, Lord C, Lee LC, Newschaffer C. Predictors of language acquisition in preschool children with autism spectrum disorders. J Autism Dev Disord. 2007;37:1721-1734.

7. Sigman M, Ruskin E. Continuity and change in the social competence of children with autism, Down syndrome, and developmental delays. Monogr Soc Res Child Dev. 1999;64:1-108.
8. Meek SE, Robinson LT, Jahromi LB. Parent-child predictors of social competence with peers in children with and without autism. Res Autism Spectr Disord. 2012;6:815-823.
9. Charman T. Why is joint attention a pivotal skill in autism? Philos Transact R Soc London Ser B Biol Sci. 2003;358:315-324.
10. Kasari C, Freeman S, Paparella T. Joint attention and symbolic play in young children with autism: a randomized controlled intervention study. J Child Psychol Psychiatry. 2006;47:611-620.
11. Landa RJ, Holman KC, O'Neill AH, Stuart EA. Intervention targeting development of socially synchronous engagement in toddlers with autism spectrum disorder: a randomized controlled trial. J Child Psychol Psychiatry. 2011;52:13-21.
12. Green J, Charman T, McConachie H, *et al*. Parent-mediated communication-focused treatment in children with autism (PACT): a randomised controlled trial. Lancet. 2010;375:2152-2160.
13. Kasari C, Gulsrud AC, Wong C, Kwon S, Locke J. Randomized controlled caregiver mediated joint engagement intervention for toddlers with autism. J Autism Dev Disord. 2010; 40:1045-1056.
14. Lawton K, Kasari C. Teacher-implemented joint attention intervention: pilot randomized controlled study for preschoolers with autism. J Consult Clin Psychol. 2012;80:687-693.
15. Goods KS, Ishijima E, Chang YC, Kasari C. Preschool based JASPER intervention in minimally verbal children with autism: pilot RCT. J Autism Dev Disord. 2013;43:1050-1056.
16. Kaale A, Smith L, Sponheim E. A randomized controlled trial of preschool-based joint attention intervention for children with autism. J Child Psychol Psychiatry. 2012;53:97-105.
17. Kasari C, Paparella T, Freeman S, Jahromi LB. Language outcome in autism: randomized comparison of joint attention and play interventions. J Consult Clin Psychol. 2008;76:125-137.
18. Kasari C, Gulsrud A, Freeman S, Paparella T, Hellemann G. Longitudinal follow-up of children with autism receiving targeted interventions on joint attention and play. J Am Acad Child Adolesc Psychiatry. 2012;51:487-495.
19. Oosterling I, Visser J, Swinkels S, *et al*. Randomized controlled trial of the focus parent training for toddlers with autism: 1-year outcome. J Autism Dev Disord. 2010;40:1447-1458.
20. Carter AS, Messinger DS, Stone WL, Celimli S, Nahmias AS, Yoder P. A randomized controlled trial of Hanen's 'More Than Words' in toddlers with early autism symptoms. J Child Psychol Psychiatry. 2011;52:741-752.
21. Ben-Itzchak E, Zachor DA. The effects of intellectual functioning and autism severity on outcome of early behavioral intervention for children with autism. Res Dev Disabil. 2007;28:287-303.
22. Wodka EL, Mathy P, Kalb L. Predictors of phrase and fluent speech in children with autism and severe language delay. Pediatrics. 2013;131:e1128-e1134.
23. Siller M, Hutman T, Sigman M. A parent-mediated intervention to increase responsive parental behaviors and child communication in children with ASD: a randomized clinical trial. J Autism Dev Disord. 2013;43:540-555.
24. Lord C, Risi S, Lambrecht L, *et al*. The Autism Diagnostic Observation Schedule–Generic: a standard measure of social and communication deficits associated with the spectrum of autism. J Autism Dev Disord. 2000;30:205-223.
25. Lord C, Rutter M, Le Couteur A. Autism Diagnostic Interview–Revised: a revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. J Autism Dev Disord. 1994;24:659-685.
26. Mullen E. Mullen Scales of Early Learning. Circle Pines, MN: American Guidance Service; 1997.
27. Hagtvet B, Lillestøen R. Reynell Språktest. Oslo: Universitetsforlaget; 1985.
28. Mundy P, Delgado C, Block J, Venezia M, Hogan A, Seibert J. A Manual for the Abridged Early Social Communication Scale (ESCS): Preliminary Manual. University of Miami; 2003. Available at: http://www.ucdmc.ucdavis.edu/mindinstitute/ourteam/faculty_staff/ESCS.pdf. Accessed May 1, 2013.
29. Rutter M, Bailey A, Lord C. Social Communication Questionnaire (SCQ). Los Angeles, CA: Western Psychological Services; 2003.
30. Baron-Cohen S, Leslie AM, Frith U. Does the autistic child have a "theory of mind"? Cognition. 1985;21:37-46.