Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD) (Review)
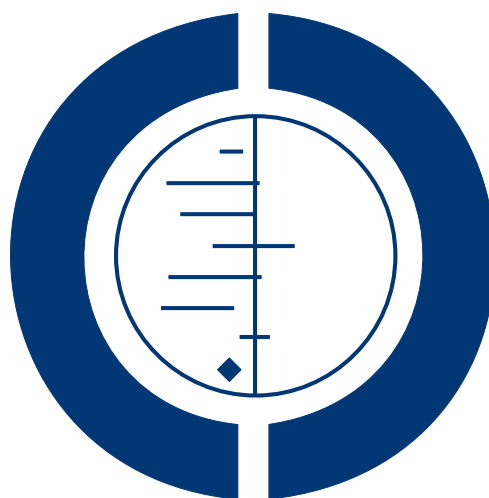
Reichow B, Steiner AM, Volkmar F

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Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD)

Brian Reichow[1], Amanda M Steiner[2], Fred Volkmar[2]

[1]AJ Pappanikou Center of Excellence on Developmental Disabilities, University of Connecticut Health Center, Farmington, CT, USA.
[2]Child Study Center, Yale University School of Medicine, New Haven, CT, USA

Contact address: Brian Reichow, AJ Pappanikou Center of Excellence on Developmental Disabilities, University of Connecticut Health Center, 263 Farmington Ave., MC-6222, Farmington, CT, 06030-6222, USA. reichow@uchc.edu. reichow@uchc.edu.

A B S T R A C T

Background

Since autism was first described, major difficulties in social interaction have been a defining feature of individuals with autism spectrum disorders (ASD). Social skills groups are a common intervention for individuals with ASD. Although a frequently recommended practice, the few studies that have addressed the efficacy of social skills groups have shown mixed results.

Objectives

To determine the effectiveness of social skills groups for improving social competence, social communication, and quality of life for people with ASD who are six to 21 years of age.

Search methods

We searched the following databases in December 2011: CENTRAL (2011 Issue 4), MEDLINE (1948 to November Week 3, 2011), EMBASE (1980 to Week 50, 2011), PsycINFO (1887 to December Week 2, 2011), CINAHL (1937 to current), ERIC (1966 to current), Sociological Abstracts (1952 to current), OCLC WorldCat (12 December 2011), Social Science Citation Index (1970 to 16 December 2011), and the metaRegister of Controlled Trials (20 December 2011). We also searched the reference lists of published papers.

Selection criteria

Randomized control trials (RCTs) comparing treatment (social skills groups) with a control group who were not receiving the treatment for participants aged six to 21 years with ASD. The control group could be no intervention, wait list, or treatment as usual. Outcomes sought were standardized measures of social competence, social communication, quality of life, emotion recognition, and any other specific behaviors.

Data collection and analysis

Two review authors independently selected and appraised studies for inclusion and assessed the risk of bias in each included study. All outcome data were continuous and standardized mean difference effect sizes (ES) with small sample correction were calculated. We conducted random-effects meta-analysis where possible.

Main results

We included five RCTs evaluating the effects of social skills groups in 196 participants with ASD aged 6 to 21 years old. The results show there is some evidence that social skills groups improve overall social competence (ES = 0.47, 95% confidence interval (CI) 0.16 to 0.78, P = 0.003) and friendship quality (ES = 0.41, 95% CI 0.02 to 0.81, P = 0.04) for this population. No differences were found between treatment and control groups in relation to emotional recognition (ES = 0.34, 95% CI -0.20 to 0.88, P = 0.21) assessed in two studies or social communication as related to the understanding of idioms (ES = 0.05, 95% CI -0.63 to 0.72, P = 0.89), which was assessed in only one study. Two additional quality of life outcomes were evaluated, with results of single studies suggesting decreases in loneliness (ES = -0.66, 95% CI -1.15 to -0.17) but no effect on child or parental depression. No adverse events were reported.

Given the nature of the intervention and the selected outcome measures, the risk of performance and detection bias are high. There is limited generalizability from the studies as they were all conducted in the US; they focused mainly on children aged 7 to 12, and the participants were all of average or above average intelligence.

Authors' conclusions

There is some evidence that social skills groups can improve social competence for some children and adolescents with ASD. More research is needed to draw more robust conclusions, especially with respect to improvements in quality of life.

P L A I N   L A N G U A G E   S U M M A R Y

Social skills groups for people aged 6 to 21 years with autism spectrum disorders (ASD)

Social deficits remain one of the most difficult areas for individuals with autism spectrum disorders, especially for those with average or above average cognitive skills. An intervention often used to treat social deficits for these individuals is social skills groups. This review synthesized the results of five randomized controlled trials of social skills groups including 196 individuals with autism spectrum disorders (aged 6 to 21 years). We found individuals receiving treatment showed some indications of improved social competence and better friendships when compared with those not receiving treatment. Participants receiving treatment also showed indications of less loneliness. The ability to recognize different emotions was measured in two studies and there was no evidence that it was improved by taking part in a social skills group. Social communication as it relates to idiomatic expressions was only reported in one study and no significant differences between treatment and control group were found. Nor was there evidence of a beneficial effect of social skills groups on parental or child depression. No adverse effects were reported in the studies. Limitations of this review include a small number of studies and participants, and a high risk of bias due to parents knowing whether their child was in the intervention group or not. The studies focused mainly on children with ASD aged 7 to 12 with average or above average intelligence, and they were all carried out in the US.

SUMMARY OF FINDINGS FOR THE MAIN COMPARISON [*Explanation*]

Social skills groups for improving social competence in people aged 6 to 21 with ASD

Patient or population: People aged 6 to 21 with ASD
Settings: Clinic
Intervention: Social skills groups

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	**Corresponding risk**				
	Control	**Social skills groups**				
Social Competence Follow-up: 5 to 20 weeks	The mean social competence score in the control groups was **0.26 standard deviations higher at post-treatment compared to pre-treatment (0.04 lower to 0.56 higher)**[1]	The mean social competence score in the intervention groups was **0.47 standard deviations higher (0.16 to 0.78 higher)**[2]		178 (4 studies[3])	⊕⊕○○ **low**[4,5,6,7]	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] This is a difference in standard deviations calculated for the control group from change scores before and after the intervention period.
[2] This is a difference in standard deviations.
[3] Laugeson 2009, Frankel 2010, Koenig 2010, Lopata 2010.

[4] 'Risk of bias' assessment shows mostly equal levels of low risk, unclear risk, and high risk. High-risk items for social competence include primary outcome informant (parents) not being blind to treatment status.

[5] One of the four studies found no difference in social competence between treatment group and wait list control.

[6] Small sample sizes with large 95% CIs.

[7] Small number of studies precludes ability to examine funnel plot and thereby cannot exclude the possibility of publication bias.

BACKGROUND

Description of the condition

Autism and the related pervasive developmental disorders are early-onset conditions characterized by delay and irregular development of social, communicative, and other skills. Lack of social interest characterizes autism, but unusual sensitivity to the inanimate environment is also typical and can take the form of motor mannerisms (stereotypies), difficulties with change, and idiosyncratic interests or preoccupations. Currently, recognized disorders in this group include autistic disorder, Rett's syndrome, childhood disintegrative disorder, Asperger's disorder, and pervasive developmental disorder not otherwise specified/atypical autism (Volkmar 2005a).

Autistic disorder is by far the best known of the pervasive developmental disorders, and diagnostic guidelines state is apparent before the age of three years (Volkmar 2005a). The condition is frequently associated with an unusual pattern of strengths and difficulties and with intellectual disability. Autism was not recognized as a disorder in diagnostic manuals until 1980 but since that time, research has grown dramatically with over 1000 peer-reviewed publications devoted to the topic in 2009. A growing body of work has clarified the strongly genetic nature of the condition (Gupta 2007) and its association with various neurobiological factors - including increased risk for seizures (Minshew 2005). Asperger's disorder and pervasive developmental disorder, not otherwise specified (PDD-NOS) share many features with autism but differ in that in Asperger's disorder early verbal skills are preserved and there may be an even stronger genetic contribution (Klin 2005). In PDD-NOS, the severity of social and other difficulties is less than that of either Asperger's disorder or autistic disorder, although some features suggestive of these conditions must be present for this diagnosis to be made (Towbin 2005).

Given the centrality of social skills, both as a defining feature of the condition and a critical area for intervention, development and assessment of social skills treatments has been an important area of emerging research over the past decade. In parallel with this growing body of work (see Reichow 2011), there also have been significant advances in research that have clarified the major contribution of autistic social dysfunction to learning difficulties. For example, studies using fMRI (functional magnetic resonance imaging) procedures have shown differences in the ways children with autism process the most salient social feature in the environment - the human face (Schultz 2000). Another line of work has used innovative eye tracking methods, which suggest that perhaps 90% of available social-affective information is lost to individuals with autism (Klin 2002a; Klin 2002b). Various attempts have been made to provide theoretical overviews of these difficulties and their close connection to learning and behavioral challenges (see Klin 2003 for a review).

Advances in treatment have occurred over the past decade and prognosis appears to be improving. Whereas the earliest outcome studies suggested, at best, that 5% of individuals with autism spectrum disorders (ASD) became independent as adults, more recent studies estimate these figures to be in the region of 20% to 25%, even for 'classical' autism (Howlin 2005). Several factors appear involved in this change including a greater number of individuals being diagnosed with higher functioning ASD (for example, high functioning autism, Asperger's disorder, PDD-NOS), although the improvement predates the implementation of the current DSM-IV-TR (APA 2000) or ICD-10 (WHO 1994) approach; earlier detection and intervention; and the mandate, in many developed countries, for educational services (see Volkmar 2005b for a description of international perspectives and mandates on treatments). In the USA, for example, the Education of All Handicapped Children Act in 1975 established the right of all children to education. Before these legislative changes, few individuals with autism received school-based service (Volkmar 2009). Significant advances have been made in educational intervention programs as well as in pharmacotherapy (Volkmar 2009).

Social skills of individuals with ASD

Since autism was first described (Kanner 1943), major difficulties in social interaction have been a defining feature of individuals with ASD (Carter 2005). These difficulties have been identified as the single most powerful predictor of diagnostic status (Siegel 1989). The social impairments shown by individuals with autism spectrum disorders have considerable heterogeneity. For example, an individual with Asperger's disorder might have strong motivation to interact with their peers and often stay in close proximity to talk to his peers, yet lack the skills to effectively navigate social interactions, for instance by talking incessantly without monitoring others' interest in the topic or participation in the conversation. On the other end of the spectrum, a child might have very little desire to interact with others and avoid social interactions altogether. Difficulties in the social arena typically remain an area of great vulnerability even for the most cognitively able individuals with ASD (Howlin 2005; Shea 2005). Therefore, social skills training is an important aspect of intervention planning. There are a number of treatment methods including social stories, peer-mediated interventions, scripts and script fading, social skills group, video modeling (see Paul 2003; Reichow 2010). However, total amelioration of social skills deficits has not been demonstrated, and social difficulties remain even in individuals with successful treatment.

Description of the intervention

Social skills groups are a commonly used intervention for people with ASD, especially for individuals with average and above average cognitive skills. Several protocols have now been published (for

example, McGinnis 1997; Goldstein 2000; Frankel 2003; Dunn 2006; Painter 2006; Cotugno 2009; Laugeson 2010). The intervention is characterized by participation of between two and six individuals with ASD in therapy sessions led by one to three therapists. Participants in social skills groups are usually at least age six. The group typically meets once per week for 12+ weeks, with each session lasting 60 to 90 minutes, although a relation between treatment intensity, duration, or both, has not been established. A social skills group session typically includes a structured lesson on a specific skill, modeling of the skill, role playing with rehearsal/practice of the modeled skill, discussion, and individualized performance feedback. Common topics for the groups vary with respect to the age and functioning level of the group members, but often include emotional recognition and regulation, social competence, social problem solving, and social communication (White 2007; Rao 2008). Groups also differ with respect to parent education and training.

How the intervention might work

The exact mechanism through which social skills groups change behavior is not known, but is theoretically based on learning theory. Social skills groups for people with ASD are thought to affect an individual's social functioning by providing instruction on specific social skills in a group format that allows for immediate rehearsal and practice of the learned skills. The social skill group format also allows for immediate reinforcement for using the targeted skill (in an unstructured setting, the reinforcement for using a social skill might be social reinforcement, which may or may not be a reinforcer for an individual with autism). Providing immediate reinforcement for displaying the desired (targeted) social skill should increase the likelihood of the skill being used again, thereby providing the individual with additional repetitions and practice.

Why it is important to do this review

As noted previously it does appear that the outcome for individuals with autism, Asperger's disorder, and PDD-NOS has significantly improved over the last several decades. This appears to result from several factors including earlier diagnosis, explicit teaching of skills critical to learning, and agreement on many aspects of effective intervention programs (National Research Council 2001). The growing body of work on very young children at risk for autism, such as siblings, has helped to clarify important aspects of early difficulties that are likely to have a severe impact on subsequent learning, for example, problems with social attention and joint attention, and difficulties with social versus nonsocial environmental salience (Volkmar 2009). The enhancement of learning is likely expressed in multiple contexts, for example, with peers, in schools, and in generalization of skills across settings and in the commu-

nity. Although a frequently recommended practice, only a handful of studies have addressed the issues of efficacy of social skills group interventions, and these have shown mixed results (White 2007; Rao 2008; Reichow 2010). The reasons for the mixed results are unknown, but malleable factors such as intervention density, age of participants, degree of psychopathology, pre-treatment functioning, and the ratio of the number of therapists to group members are plausible moderators of effect. Development of effective social interventions is a high priority. Given the frequent recommendation of social skills group interventions, the growing body of empirical evidence, and the mixed results not uncommon in these studies, a systematic review investigating the most effective methods of conducting social skills group interventions for individuals with ASD seems an important and timely undertaking.

OBJECTIVES

1. To systematically review the evidence for the effectiveness of social skills groups for improving social competence, social communication, and quality of life in individuals with ASD.

2. To identify the characteristics of the social skills training that are most effective.

3. To identify those subsample(s) of children with ASD for whom social skills groups are most successful.

METHODS

Criteria for considering studies for this review

Types of studies

Randomized controlled trials of social skills groups.

Types of participants

Children and young adults aged 6 to 21 with ASD (that is, autistic disorder, Asperger's disorder, PDD-NOS, Rett's syndrome, childhood disintegrative disorder), defined by diagnosis according to DSM-IV-TR (APA 2000) or ICD-10 (WHO 1994).

Types of interventions

Social skills groups, delivered by professional personnel in groups of at least two individuals, in any setting at any frequency and for any duration (see Background for description of social skills groups). Participants may or may not have received standard treatment in addition to the social skills group intervention. We did

not include studies evaluating support group and psychodynamic group therapies in this review.

Eligible comparison groups were standard treatment groups or wait list control groups.

Types of outcome measures

Primary outcomes

1. Social Competence

This outcome was typically measured through parent report on a standardized assessment scale, for example, Vineland Adaptive Behavior Scale (Sparrow 1984; Sparrow 2005) or the Social Skills Rating System (Gresham 1990).

Secondary outcomes

1. Social communication
2. Quality of life
3. Emotion recognition
4. Individual specific behaviors
5. Adverse effects

The secondary outcomes were measured using a variety of different techniques. Social communication, quality of life, and emotion recognition were measured using standardized assessments and/ or parent- or teacher-rated scales. We included individual specific behaviors as a secondary outcome due to the inclusion of measures (such as rate of initiations to peers, duration of communicative exchanges) because they were often included in early studies of social skills groups. However, no individual specific behaviors were reported in the studies we located for this review. Finally, we examined the included studies for evidence of adverse events but did not locate any reported adverse events. Due to the likely variability in quality, we considered all measures and discussed the evidence of their reliability and validity to ensure valid measures were included (as above).

If data had permitted, we planned to group outcome time points as follows: immediately post-intervention, one to five months post-intervention, six to 11 months post-intervention, 12 to 23 months post-intervention, 24 to 35 months post-intervention, etc. Only post-intervention scores were reported, and thus, this is the only time point included in this review.

We determined the clinical relevance of each outcome measure, for example, by discussing how well the measure approximates real life social skills.

We reported the outcomes social competence, social communication, emotion recognition, and quality of life in the 'Summary of findings' tables.

Search methods for identification of studies

Initially we ran the searches in March 2011 without a methods filter, with the intention of identifying randomized and quasi-randomized studies during the screening process. However, because of the large number of records found (11,891 after deduplication), we decided to exclude quasi-randomized studies and re-run the searches with the addition of an RCT filter. Searches were run in March 2011, and again in December 2011. The database suppliers for PsycINFO and Sociological Abstracts changed during this time and the search strategies were adapted appropriately.

Electronic searches

The following electronic databases were searched, with no date limits or language restrictions.

Cochrane Central Register of Controlled Trials, part of *The Cochrane Library*, (2011 Issue 4), last searched 19 December 2011

MEDLINE (1950 to November Week 3, 2011), last searched 19 December 2011

EMBASE (1980 to Week 50, 2011), last searched 19 December 2011

CINAHL PLUS (1937 to current), last searched 19 December 2011

PsycINFO via OVID (1806 to December Week 2, 2011), last searched 19 December 2011

PsycINFO via EBSCOhost, last searched 1 March 2011

Sociological Abstracts via PROQUEST (1952 to current), searched 20 December 2011

Sociological Abstracts via CSA (1952 to current), searched 1 March 2011

ERIC (1966 to current), last searched 20 December 2011

Social Science Citation Index (SSCI) (1970 to 16 December 2011), last searched 20 December 2011

WorldCat (all available years), last searched 20 December 2011

metaRegister of Controlled Trials (all available years), last searched 21 December 2011

The search strategies for each database are in Appendix 1.

Searching other resources

Gray Literature

Our list of electronic databases included at least three sources (WorldCat, PsycINFO, and ERIC) which index theses and dissertations. Conference papers are included in the scope of EMBASE, ERIC, and the Social Science Citation Index.

Reference lists

We searched the reference lists of the studies included in this review and relevant papers to identify additional studies in the published or unpublished literature.

Correspondence

We contacted the authors of the included studies to identify any unpublished or ongoing trials.

Data collection and analysis

Selection of studies

Two review authors (BR and AS) independently screened the titles and abstracts yielded by the search against the inclusion criteria listed above. We obtained and independently screened the full text of papers or reports for trials that appeared relevant or for which more information was needed to determine relevance and to determine whether they meet the criteria for inclusion. We resolved disagreement about eligibility through discussion. We contacted study authors for additional information as necessary to resolve questions about the relevance or methodology of a trial. We recorded the reasons for excluding trials. Neither of the review authors was blind to the study authors, institutions, or the journals of publication of the articles.

Data extraction and management

Two review authors (BR and AS) independently extracted data for each trial using a data extraction form. Data were extracted about the population, the intervention, randomization methods, blinding, sample size, outcome measures, follow-up duration, attrition and handling of missing data, and methods of analysis. We resolved disagreements through discussion. When information was missing, one review author (BR) contacted the authors to request additional information. If further information could not be obtained, the variables in question were coded as "unsure".

Assessment of risk of bias in included studies

We independently assessed the risk of bias in the studies using The Cochrane Collaboration's tool for assessing risk of bias (Higgins 2008). We resolved any disagreements by discussion. We used the tool to assess the following domains: sequence generation, allocation concealment, baseline measurement, blinding of participants and personnel, blinding of outcome assessment, assessing incomplete outcomes, selective reporting, and other sources of bias.
We present these assessments in a 'Risk of bias' table where the review authors' judgment ('low risk,' 'high risk,' or 'unclear') was followed by a text box providing details on the available information that led to each judgment.

Sequence generation

Randomization received the following judgments:

'low risk' when participants were allocated to treatment conditions using randomization such as computer-generated random numbers, a random numbers table, or coin-tossing;
'unclear' when randomization method was not clearly stated or unknown;
'high risk' when randomization did not use any of the above methods or randomization was not used (that is, for quasi-randomized trials).

Allocation concealment

Allocation concealment received the following judgments:
'low risk' when participants and researchers were unaware of participants' future allocation to treatment condition until after decisions about eligibility were made and informed consent was obtained;
'unclear' when allocation concealment was not clearly stated or unknown;
'high risk' when allocation was not concealed from either participants before informed consent or from researchers before decisions about inclusion were made or allocation concealment was not used.

Baseline measurements

Whether participants in the treatment and control groups were similar prior to treatment received the following judgments:
'low risk' when participant performance on outcomes were measured prior to the intervention and no important differences were present across study groups;
'unclear' when no baseline measures of outcome were reported or it was difficult to determine if baseline measures were substantially different across study groups;
'high risk' when important differences were present and were likely to undermine any post intervention differences.

Blinding of participants and personnel

Whether blinding to treatment conditions was adequate for participants and treatment personnel, received the following judgments:
'low risk' when blinding of participants and key personnel was ensured;
'unclear' when blinding of participants and key personnel was not reported;
'high risk' when there was no, or incomplete, blinding of participants and key personnel or blinding of participants and key personnel was attempted but likely to have been broken .

Blinding of outcome assessment

Whether outcome assessors had knowledge of the treatment group of the participants received the following judgments:
'low risk' when blinding of outcome assessment was ensured;

'unclear' when there was inadequate information provided in the study report or blinding of outcome assessment was not addressed; 'high risk' when blinding of outcome assessment was not ensured.

Addressing incomplete outcomes

The adequacy of the way the authors of the trials dealt with missing data received the following judgments:

'low risk' when the number of participants randomized to groups was clear and it was clear that all participants completed the trials in all participant groups;

'unclear' when information about which participants completed the study could not be acquired by contacting the researchers of the study;

'high risk' when there is clear evidence that there was attrition or exclusion from analysis in at least one participant group.

Selective reporting

The likelihood that the authors of the trial omitted some of the collected data when presenting the results received the following judgments based on a comparison of the measures described in the methods and the measures on which data were reported in the results:

'low risk' when all collected data seem to be reported and all anticipated outcome measures were reported;

'unclear' when it is not clear whether other data were collected and not reported;

'high risk' when the data from some measures used in the trial are not reported or key outcomes expected were not reported.

Other bias

Assessment determined no other sources of bias were present in the trials, such as stopping the trial early, changing methods during the trial, or other anomalies.

Measures of treatment effect

Dichotomous data

Where dichotomous data are presented, we calculated a risk ratio (RR) with a 95% confidence interval (CI) and the number needed to treat for an additional beneficial outcome (NNTB) with a 95% CI for each outcome in each trial (Higgins 2008).

Continuous data

We analyzed continuous data when means and standard deviations (SDs) were presented in the study papers, were made available by the authors of the trials, or were calculable from the available data. Because studies reported different measures on different scales for similar outcomes, we calculated a standardized mean difference (SMD) using Hedges g with small sample correction (Hedges 1985).

Unit of analysis issues

The inclusion of cross-over trials could be ruled out, but was not encountered in the included studies. Where appropriate, we would have combined the results of the cross-over trials with the results of the parallel-group trials. Had data from a cross-over trial been restricted or could be obtained from the authors, we would have used the presented data within the first phase up to the point of cross-over. We would have pooled data from cross-over trials according to the methods described by Higgins and Green (Higgins 2008) and Elbourne and colleagues (Elbourne 2002). Issues of studies using more than two experimental groups, such as if a study includes a wait list control, and an alternative treatment to social skills groups could have also been encountered, but was not in the included studies. Had this occurred, precedence would have been given to making comparisons of trials that were run concurrently (for example, comparison of treatment and wait list control). If a study compared social skills group interventions with another type of social skills intervention and a third group not receiving treatment, the comparison would have been made between the social skills group intervention group and the no treatment control.

Dealing with missing data

We assessed missing data and dropouts in the included studies. We investigated and reported reasons, numbers, and characteristics of dropouts. Since little missing data were found across studies, we did not need to contact the authors of trials for further information or data. The meta-analysis of social competence used data from all original participants. Because little missing data were found, we did not conduct a sensitivity analysis to assess potential bias in the analysis or discuss the extent to which the results might be biased by missing data. Due to the heterogeneity shown by individuals with ASD, we did not impute missing data.

Assessment of heterogeneity

We examined heterogeneity among included studies through the use of the Chi^2 test, where a low P value indicates heterogeneity of treatment effects. We also used the I^2 statistic (Higgins 2002) to determine the percentage of variability that was due to heterogeneity rather than sampling error or chance. We examined estimates of the between studies variance components using τ^2. Since low heterogeneity was found, data did not permit us to conduct sensitivity analyses or subgroup analyses as described below.

Assessment of reporting biases

If more than 10 studies had been located, we would have used funnel plots to investigate the relationship between effect size and

standard error. If a relationship was found, we would have conducted sensitivity analyses to determine what, if any, impact the biases had on the results.

Data synthesis

We conducted a meta-analysis when event rates or means and SDs were available or could be calculated and studies included similar interventions and outcome measurements. The meta-analysis was conducted using SMDs. We used a random-effects meta-analysis due to the variability in outcome measurement instruments and social skills group curricula that were used across studies. When meta-analysis was inappropriate, we provided only a narrative description of the study results. In such cases, conclusions about the effectiveness of social skills group interventions were not possible.

Subgroup analysis and investigation of heterogeneity

Had the data permitted further exploration, further investigation of the causes of heterogeneity would have been conducted using subgroup analyses. Possible subgroups that would have been examined were: type of trial if we had included multiple types of research designs, intervention density and duration, age of participants, diagnostic category, and level of pre-treatment cognitive, communicative, and social functioning.

Sensitivity analysis

In order to explore the impact of varying aspects of methodological quality that might impact on the robustness of the results of the review, we would have liked to conduct sensitivity analyses by removing studies with particular characteristics and re-analyzing the remaining studies to determine whether the relevant factors affect the results. However, due to the small number of included studies, such analyses were not possible. We planned to conduct analyses to examine the effects of the following.

1. The removal of studies with variability across studies in the definition, measurement, or reporting of results (for example, if the number of participants varied in the report or if measures were not taken at consistent time points for all participants).

2. The removal of studies with variability across studies in treatments comparison groups were receiving.

3. The removal of studies that did not make efforts to ensure treatment fidelity (for example, use of treatment manual, training, supervision).

4. Reanalyzing the data using different statistical approaches (for example, using a fixed-effect model instead of a random-effects model) (Higgins 2008).

R E S U L T S

Description of studies

Results of the search

We conducted electronic searches in March 2011 and updated them in December 2011, returning a total of 4302 records after deduplication. Initial screening reduced the number of papers to 62 potential studies. We evaluated the full papers of these 62 studies. Five studies were identified for inclusion; 42 studies were excluded because they were not RCTs, six were excluded because they did not evaluate social skills group, six were excluded because they did not evaluate children with ASDs, and three were excluded because they did not contain a no treatment group or wait list control group. No additional studies were identified in the search of reference lists. Figure 1 shows a flow diagram of search results.

Figure 1. Study flow diagram
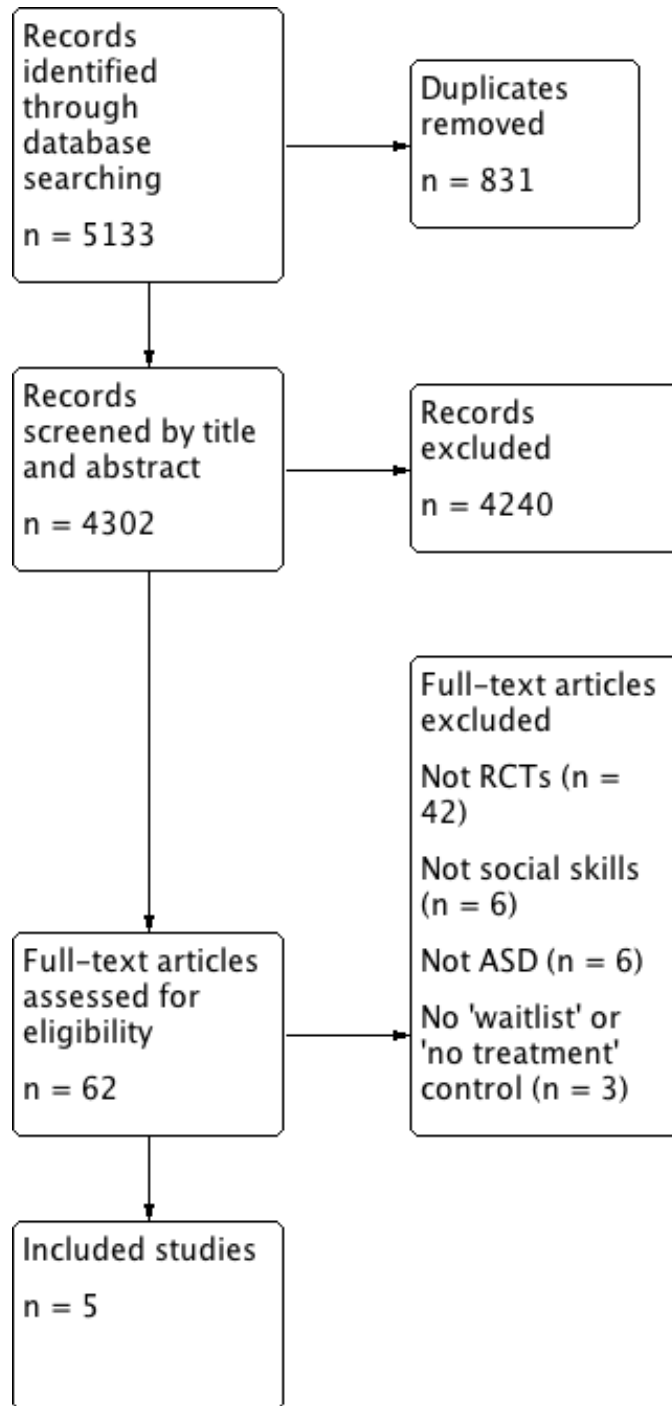
Included studies

Five studies examining social skills groups for people with ASD aged 6 to 21 years are included in this review (Solomon 2004; Laugeson 2009; Frankel 2010; Koenig 2010; Lopata 2010).

Study location

All five studies were conducted in the United States.

Study design

Four of the five studies (Laugeson 2009; Frankel 2010; Koenig 2010; Lopata 2010) used a randomized wait list control trial method; one study (Solomon 2004) used a randomized controlled trial design with a no treatment control.

Participants

Four of the five studies (Solomon 2004; Frankel 2010; Koenig 2010; Lopata 2010) examined social skills groups in children between the ages of eight to 11 years; one study (Laugeson 2009) examined social skills groups in adolescents between the ages of 11 and 17 years. All studies had an inclusion criteria that the participants have IQs that were above the cut-off for intellectual disability, which was typically the only inclusion criteria. Across studies, all samples reported mean full scale IQ to be in the average range (range of mean full scale IQ 84.8 to 106.9).

Interventions

The duration of the social skills groups across studies was five to 20 weeks or 12 to 125 sessions. Four of the five studies had one session per week with a duration of 60 or 90 minutes; Lopata 2010 had 25 weekly sessions that were 70 minutes each. Multiple social skills group curricula were used across studies, all of which focused on a broad array of social skills that were taught and rehearsed during the sessions. Four of five studies (Solomon 2004; Laugeson 2009; Frankel 2010; Lopata 2010) included a parent component to the social skills group.

Comparisons

All five studies compared the treatment group with a group not partaking in a social skills group. Individuals with autism typically receive many treatments (Green 2006; Goin-Kochel 2007), thus we did not have an included study in which participants were receiving no treatment.

Outcomes assessed

Outcome measures were assessed immediately following treatment; no long-term outcome data were reported. Additional study characteristics are provided in the Characteristics of included studies table.

Excluded studies

Of those studies for which full papers were retrieved, 57 were excluded from this review (42 were not RCTs, 6 did not evaluate social skills groups, 6 did not include children with ASDs, and 3 did not contain a no treatment control group or wait list control group. Key characteristics of studies we felt were seminal work in this area and exemplars of each reason for exclusion are shown in the Characteristics of excluded studies.

Risk of bias in included studies

Random sequence generation (selection bias)

All included studies were randomized controlled trials. The risk of bias from inadequate sequence generation was low in two studies (Frankel 2010; Koenig 2010) and unclear in the remaining three.

Allocation

Risk of bias from poor allocation concealment was unclear in four studies and low in one (Koenig 2010).

Baseline measurements

The risk of important differences between groups before treatment was low in all five studies.

Blinding

Participants and personnel (performance)

Due to the nature of the intervention, in which participants and study personnel interact in group sessions, risk of bias from lack of blinding of participants and study personnel was high for all five studies.

Outcome assessors (detection bias)

Outcome assessors were not blind to treatment status in four studies (Laugeson 2009; Frankel 2010; Koenig 2010; Lopata 2010) and so we rated these as at high risk of bias. These four studies were the studies that contributed data for the analysis of the primary outcome measure (social competence). It was unclear if the outcome assessors were blind to treatment in the remaining study (Solomon 2004), which did not report data on the primary outcome (data were only reported for secondary outcome measures). Given that the primary outcome measure in the four studies in which assessors were not blind to treatment involved parent report, there is significant potential for bias.

Incomplete outcome data

Risk of bias from incomplete outcome data was low for four studies (Solomon 2004; Laugeson 2009; Koenig 2010; Lopata 2010). One study (Frankel 2010) had significant attrition and therefore had a high risk of bias for incomplete outcome data.

Selective reporting

In all five studies the risk of selective outcome reporting bias was low.

Other potential sources of bias

We did not find any other potential sources of bias in the included studies.

A visual representation of the risk of bias in each study for each domain is shown in Figure 2 and Figure 3.

Figure 2.   Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies
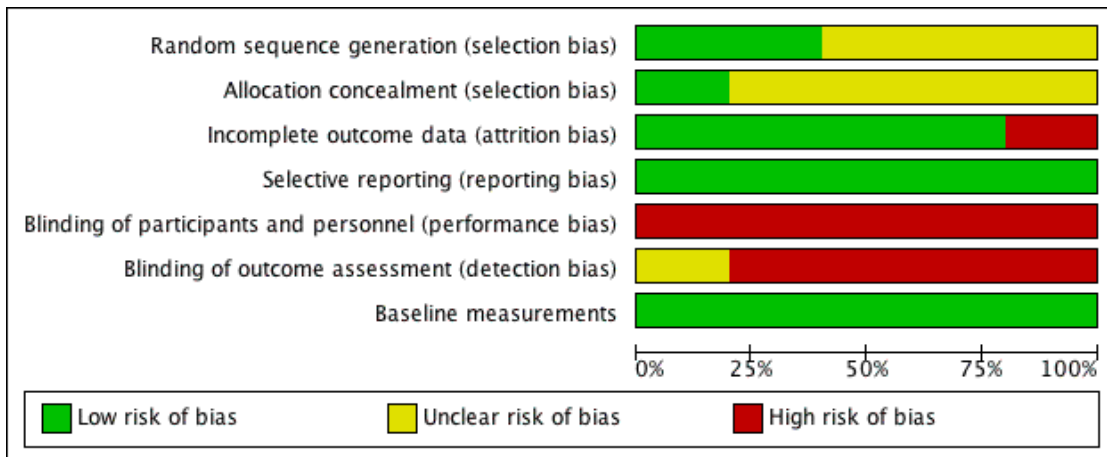
Figure 3.   Risk of bias summary: review authors' judgements about each risk of bias item for each included study
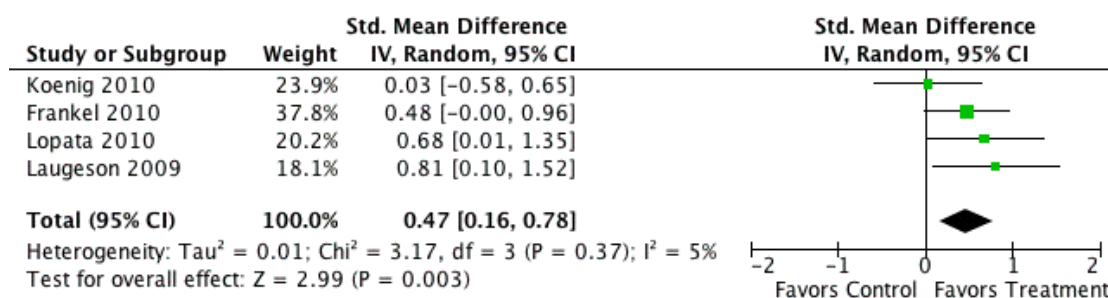
Effects of interventions

See: **Summary of findings for the main comparison** Social skills groups for improving social competence in people aged 6 to 21 with autism spectrum disorders (ASD); **Summary of findings 2** Social skills groups for improving social communication for people aged 6 to 21 with autism spectrum disorders (ASD); **Summary of findings 3** Social skills groups for improving emotion recognition for people aged 6 to 21 with autism spectrum disorders (ASD); **Summary of findings 4** Social skills groups for improving quality of life for people aged 6 to 21 with autism spectrum disorders (ASD)

Social competence

Four studies (Laugeson 2009; Frankel 2010; Koenig 2010; Lopata 2010) measured social competence using standardized measures. Multiple measures were used: the Social Skills Rating System (SSRS) (Gresham 1990) was used in two studies (Laugeson 2009; Frankel 2010), the Social Responsiveness Scale (SRS; Constantino 2005) was used in one study (Lopata 2010), and the Social Competence Inventory (SCI; Rydell 1997) was used in one study (Koenig 2010). The results of the studies were synthesized in a random-effects meta-analysis using the standardized mean difference

(SMD) effect size with small sample correction (Hedges 1985). The weighted mean effect size for difference in social competence between treatment and control groups was g = 0.47 (95% confidence interval (CI) 0.16 to 0.78; P = 0.003). To assess the clinical significance of a 0.47 effect size, we extrapolated that a child aged 8.5 years with a Vineland (Sparrow 2005) Standardized Socialization score of 66.0 (age and Vineland score are mean pretreatment values from Frankel 2010) would gain up to 24 additional social skills (for example, saying sorry after hurting someone else's feelings, meeting with friends regularly, asking permission before using objects belonging to someone else) with a 0.50 standard deviation increase in their standardized score. A weighted mean effect size (ES) of 0.47 is also comparable, albeit slightly lower, to the mean ES for psychotherapy (ES = 0.63; Burlingame 2003) and child and adolescent group treatments (ES = 0.61; Hoag 1997). We assessed heterogeneity using the Q-statistic (Q(3) = 3.17, P = 0.37), I^2 (5%), and τ^2 (0.01). Although our ability to detect heterogeneity is limited by the small sample of studies, the measures of heterogeneity we calculated suggest the results were homogeneous with little between-study variance and do not support examination of moderators. The effect of social skills groups on social competence for the included studies is shown in Figure 4.

Figure 4.   Forest plot of social skills groups versus wait list control: Social competence (analysis 1.1)

Study or Subgroup	Weight	Std. Mean Difference IV, Random, 95% CI
Koenig 2010	23.9%	0.03 [−0.58, 0.65]
Frankel 2010	37.8%	0.48 [−0.00, 0.96]
Lopata 2010	20.2%	0.68 [0.01, 1.35]
Laugeson 2009	18.1%	0.81 [0.10, 1.52]
Total (95% CI)	**100.0%**	**0.47 [0.16, 0.78]**

Heterogeneity: Tau² = 0.01; Chi² = 3.17, df = 3 (P = 0.37); I² = 5%
Test for overall effect: Z = 2.99 (P = 0.003)

Social communication

Social communication was only measured as an outcome in one study (Lopata 2010), which used the Idiomatic Language subtest of the Comprehensive Assessment of Spoken Language (Carrow-Woolfolk 1999). Although statistically significant gains were made by the treatment group, there were no post-treatment differences between the treatment and control groups (g = 0.05; 95% CI -0.63 to 0.72; P = 0.89).

Emotion recognition

Two studies (Solomon 2004; Lopata 2010) involving a total of 54 participants used the Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA-2) (Nowicki 1997) child faces subtest to examine the effects of social skills groups on participant ability to recognize emotions. The results of the studies were synthesized in a random-effects meta-analysis using the SMD effect size with small sample correction (Hedges 1985). The weighted mean effect size for

difference in emotion recognition between treatment and control groups was g = .34 (95% CI -0.20 to 0.88; P = 0.21). We assessed heterogeneity using the Q-statistic (Q(1) = 0.23, P = 0.63), I^2 (0%), and τ^2 (0.00).The effect of social skills group on emotion recognition is shown in Figure 5.

Figure 5.   Forest plot of social skills groups versus wait list control: Emotion recognition (analysis 3.1)

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Solomon 2004	12.7	1.8	9	12.4	1.8	9	33.8%	0.16 [-0.77, 1.08]
Lopata 2010	99	11.4	18	91.9	19.4	18	66.2%	0.44 [-0.23, 1.10]
Total (95% CI)			27			27	100.0%	0.34 [-0.20, 0.88]

Heterogeneity: Tau² = 0.00; Chi² = 0.23, df = 1 (P = 0.63); I² = 0%
Test for overall effect: Z = 1.25 (P = 0.21)

Favors control   Favors treatment
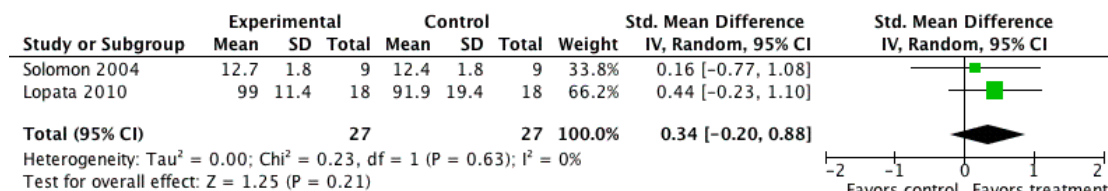
Quality of life

There were multiple measures of quality of life in the studies included in this review, which suggest small to modest improvement in quality of life for the children receiving treatment. Friendship quality was measured by self-report in two studies. The Friendship Qualities Scale (Bukowski 1994) was used in Laugeson 2009 and the popularity subscale of the Piers-Harris Self-Concept Scale (Piers 1984) was used in Frankel 2010. The results of the studies were synthesized in a random-effects meta-analysis using the SMD effect size with small sample correction (Hedges 1985). The weighted mean effect size for difference in friendship quality between treatment and control groups was g = 0.41 (95% CI 0.02-0.81; P = 0.04). We assessed heterogeneity using the Q-statistic (Q(1) = 0.96, P = 0.33), I^2 (0%), and τ^2 (0.00) (see Figure 6).

Figure 6.   Forest plot of social skills groups versus wait list control: Quality of life - friendship (analysis 4.2)

Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Laugeson 2009	17.2	4	17	16.6	4.6	16	33.5%	0.14 [-0.55, 0.82]
Frankel 2010	8	2.8	33	6.4	2.9	35	66.5%	0.55 [0.07, 1.04]
Total (95% CI)			50			51	100.0%	0.41 [0.02, 0.81]

Heterogeneity: Tau² = 0.00; Chi² = 0.96, df = 1 (P = 0.33); I² = 0%
Test for overall effect: Z = 2.05 (P = 0.04)

Favors control   Favors treatment
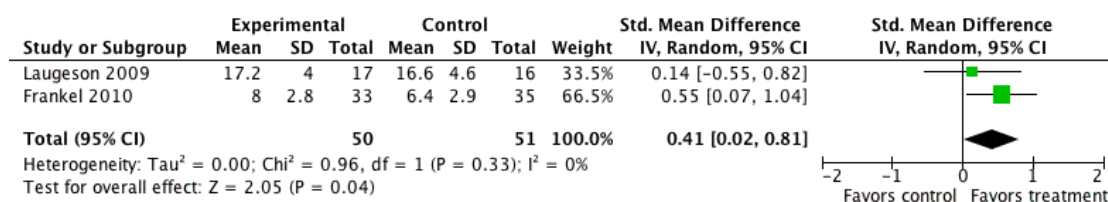
Loneliness was measured in one study (Frankel 2010) using the Loneliness Scale (Asher 1984), which indicated that children receiving treatment reported themselves to be less lonely after treatment than children in the control group (g = -0.66; 95% CI -1.15 to -0.17; P = 0.008).

Child and parent depression were measured in one study (Solomon 2004), using the Beck Depression Inventory, with results showing

no statistically significant difference between the pre- and post-treatment scores for the children taking part in a social skills group (g = -0.07; 95% CI -0.99 to 0.86; P = 0.88) or their mothers (g = 0.34; 95% CI -0.59 to 1.27; P = 0.46).

We chose not to conduct a meta-analysis on quality of life because different aspects of life were measured across studies (for example, loneliness, depression), and we did not feel combining these constructs would produce a meaningful result.

Individual (specific) behaviors

No study measured individual behaviors (for example, frequency of social initiations, number of conversational turns).

Adverse events

No adverse events were reported as a result of treatment in any study.

A D D I T I O N A L   S U M M A R Y   O F   F I N D I N G S   [Explanation]

Social skills groups for improving social communication for people aged 6 to 21 with ASD						
Patient or population: People aged 6 to 21 with ASD **Settings:** Clinic **Intervention:** Social skills groups						
Outcomes	**Illustrative comparative risks* (95% CI)**		**Relative effect (95% CI)**	**No of Participants (studies)**	**Quality of the evidence (GRADE)**	**Comments**
	Assumed risk	**Corresponding risk**				
	Control	**Social skills groups**				
Social Communication Comprehensive Assessment of Spoken Language Follow-up: 5 to 20 weeks	The mean social communication score in the control groups was **0.12 standard deviations higher at post-treatment compared to pre-treatment (0.57 lower to 0.82 higher)**[1]	The mean social communication score in the intervention groups was **0.05 standard deviations higher (0.63 lower to 0.72 higher)**[2]		34 (1 study[3])	⊕⊕◯◯ **low**[4,5,6]	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval;

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] This is a difference in standard deviations calculated for the control group from change scores before and after the intervention period.
[2] This is a difference in standard deviations.
[3] Lopata 2010.
[4] 'Risk of bias' assessment shows mostly equal levels of low risk, unclear risk, and high risk.

[5] Outcome only assessed in 1 of 5 studies included in review.
[6] Small number of studies precludes ability to examine funnel plot and thereby cannot exclude the possibility of publication bias.

Social skills groups for improving emotional recognition for people aged 6 to 21 with ASD

Patient or population: People aged 6 to 21 with ASD
Settings: Clinic
Intervention: Social skills groups

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Control	Social skills groups				
Emotion Recognition Diagnostic Analysis of Nonverbal Accuracy-2: Child Faces Follow-up: 5 to 20 weeks	The mean emotion recognition score in the control groups was **0.10 standard deviations lower at post-treatment compared to pre-treatment (0.63 lower to 0.44 higher)**[1]	The mean emotion recognition score in the intervention groups was **0.34 standard deviations higher (0.2 lower to 0.88 higher)**[2]		54 (2 studies[3])	⊕⊕◯◯ **low**[4,5,6]	

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval;

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] This is a difference in standard deviations calculated for the control group from change scores before and after the intervention period.
[2] This is a difference in standard deviations.
[3] Solomon 2004, Lopata 2010.
[4] 'Risk of bias' assessment shows mostly equal levels of low risk, unclear risk, and high risk.
[5] Small sample sizes with large 95% CIs.

[6] Small number of studies precludes ability to examine funnel plot and thereby cannot exclude the possibility of publication bias.

Social skills groups for improving quality of life for people aged 6 to 21 with ASD

Patient or population: People aged 6 to 21 with ASD
Settings: Clinic
Intervention: Social skills groups

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	Control	Social skills groups				
Friendship Piers-Harris Self-Concept Scale or Friendship Qualities Scale Follow-up: 12 to 16 weeks	The mean friendship score in the control groups was **0.21 standard deviations lower at post-treatment compared to pre-treatment (0.59 lower to 0.18 higher)**[1]	The mean friendship score in the intervention groups was **0.41 standard deviations higher (0.02 to 0.81 higher)**[2]		101 (2 studies[3])	⊕⊕◯◯ **low**[4,5]	
Loneliness Loneliness Scale Follow-up: mean 12 weeks	The mean loneliness score in the control groups was **0.08 standard deviations lower at post-treatment compared to pre-treatment (0.54 lower to 0.39 higher)**[1]	The mean loneliness score in the intervention groups was **0.66 standard deviations lower (1.15 to 0.17 lower)**[2]		68 (1 study[6])	⊕⊕◯◯ **low**[5,7]	
Child Depression Beck Depression Index	The mean child depression score in the control groups was not reported.[8]	The mean child depression score in the intervention groups was **0.07 standard deviations lower (0.99 lower to 0.86**		18 (1 study[9])	⊕⊕◯◯ **low**[5,7]	

		higher)[2]		
Maternal Depression Beck Depression Index	The mean maternal depression score in the control groups was not reported.[8]	The mean maternal depression score in the intervention groups was **0.34 standard deviations higher (0.59 lower to 1.27 higher)**[2]	18 (1 study[9])	⊕⊕◯◯ **low**[5,7]

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).
CI: Confidence interval;

GRADE Working Group grades of evidence
High quality: Further research is very unlikely to change our confidence in the estimate of effect.
Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very low quality: We are very uncertain about the estimate.

[1] This is a difference in standard deviations calculated for the control group from change scores before and after the intervention period.

[2] This is a difference in standard deviations.

[3] Laugeson 2009, Frankel 2010.

[4] Outcome only assessed in two studies.

[5] Small number of studies precludes ability to examine funnel plot and thereby cannot exclude the potential of publication bias.

[6] Frankel 2010.

[7] Outcome only assessed in one study.

[8] Not reported due to poor response rate.

[9] Solomon 2004.

DISCUSSION

Summary of main results

We found five RCTs evaluating the effects of social skills groups for individuals aged 6 to 21 with an ASD. The results of this review provide some evidence that social skills groups may improve social competence (ES = 0.47, P = 0.003) and friendship quality (ES = 0.41, P = 0.04) for this population. No differences were found between treatment and control groups in relation to emotional recognition (ES = 0.34, P = 0.21) assessed in two studies by Solomon 2004 and Lopata 2010 or social communication as related to idioms (ES = 0.05, P = 0.89), which was assessed in only one study (Lopata 2010). Two additional quality of life measures were evaluated, with results of single studies suggesting decreased loneliness (Frankel 2010) due to social skills groups but no effect on child or parental depression (Solomon 2004). No adverse events were reported.

Overall completeness and applicability of evidence

The number of studies meeting our inclusion criteria was few; more studies examining social skills group interventions for children with ASD were excluded than were included. Data for our primary outcome variable (social competence) was gathered using multiple instruments across studies, which likely decreases the precision of our results. Finally, the included studies covered a narrow age range. Four of the five studies (Solomon 2004; Frankel 2010; Koenig 2010; Lopata 2010) involved participants aged seven to 12 years old. One study (Laugeson 2009) evaluated a social skills group intervention for adolescents, making generalization of the results to adolescents and younger children difficult. Limited evidence was located with respect to other outcomes (for example, social communication, quality of life). Additional research using rigorous methods measuring a broad array of outcomes is needed before more specific generalizations and recommendations about who will benefit most from social skills group interventions can be made with confidence.

Three published curricula were used or adapted for use in the studies included in this review (Goldstein 2000; Frankel 2003; Laugeson 2010), which might also limit the generalizability of the findings. This limitation is amplified since the curricula were written in the US and all studies were conducted in the US; it is not clear how well the social skills group curricula and methods might work in other countries, especially areas with social norms that differ significantly from the US. Finally, the samples of the studies were all individuals with average cognitive ability, thus limiting our ability to determine what effects social skills groups might have on individuals with an ASD and intellectual disability.

Quality of the evidence

The quality of the evidence, as rated using the GRADE software (GRADEpro 2012), was low, suggesting further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. The quality of the evidence for social competence is shown in Summary of findings for the main comparison; for social communication is shown in Summary of findings 2; for emotion recognition is shown in Summary of findings 3, and for quality of life is shown in Summary of findings 4. This rating reflects serious concerns with inconsistency (one of the four studies measuring social competence reported it was not improved by social skills groups), indirectness (multiple social skills group intervention curricula were used across studies), imprecision (multiple measures of social competence were used across studies), and publication bias, which could not be ruled out. Given the nature of the intervention and the selected outcome measures, the risk of performance and detection bias are high. Group leaders and participants were aware that they were leading/attending the social skills groups, thus they were aware of treatment status. Parental report was the method of data collection for all studies reporting data on social competence (primary outcome measure). Parent report is not considered the most reliable method of measurement, and this was further compounded in the studies in this review by the fact that the parents were aware of treatment status in both the treatment and control groups (that is, the assessors of the primary outcome measure were not blind to treatment status). Given this high risk of bias, the results should be interpreted cautiously. The risk of publication bias is unclear since it could not be assessed due to the small number of studies included in the review.

Potential biases in the review process

Although the systematic nature of Cochrane Reviews, including the use of peer referees and publication of review protocols, decrease the potential for bias, there still remain risks of bias in the review process. The greatest risk of bias of our review was the selection of studies, or more specifically, the fact we included all studies evaluating social skills groups and excluded studies evaluating a different treatment approach that might be similar in content (for example, cognitive behavioral therapy). Additional bias might have been introduced with our decision to limit our inclusion criteria to randomized studies and the additional outcome that we added post hoc.

Agreements and disagreements with other studies or reviews

This review presents the results of the first meta-analysis of social skills group interventions for children and adolescents with ASD. Most previous reviews concluded there was not enough evidence

to make a decision regarding the efficacy of social skills group interventions (White 2007; Rao 2008; Cappadocia 2011) for improving social competence, social communication, and quality of life for individuals with ASDs. The results of this review and meta-analysis suggest there is emerging evidence about the effectiveness of social skills group interventions, which was a conclusion in two recent reviews (Reichow 2010; Dawson 2011). Thus, the results of this review are consistent with previous reviews suggesting more research is needed although emerging evidence is suggesting positive effects.

AUTHORS' CONCLUSIONS

Implications for practice

Social skills groups are one of the most widely used and recommended treatments to improve the social skills of higher functioning individuals with ASD. The results of the meta-analyses in this review suggest that participants in social skills groups may make modest gains in social competence, have better friendships, and experience less loneliness. To put these gains in more concrete terms, if measuring everyday social skills using the Vineland (Sparrow 2005), for example, an average participant from these studies would increase their repertoire of social skills from 123 to 147 after participating in the social skills group, which is a clinically significant increase.

This review is not without limitations however. It includes only five studies with relatively small sample sizes that evaluated different social skills group curricula and assessed effects using different measures of social competence and a narrow range of additional outcomes. Given these limitations, we cannot formulate specific practice guidelines on the characteristics of the most successful social skills groups.

Implications for research

The results of this review suggest much work remains to be done in establishing the efficacy of social skills group interventions. Although many quasi-experimental studies of social skills group interventions have been conducted (for example, pre-/post-treatment comparison, non-randomized group comparison), we located only five RCTs. Future research should be conducted using true experimental designs with adequate power to detect clinically important effects. Research should also focus on expanding the participant age range (that is, also including participants under 7 years of age and participants above 13 years of age) and cognitive

functioning levels (that is, including individuals with below average cognitive abilities) to increase the generalizability of findings. Finally, although non-randomized studies have been conducted outside of the US, well designed RCTs are needed in settings outside of the US to evaluate how well social skills group interventions work in different social and cultural contexts.

Three published curricula were used, or were adapted, in the studies included in this review (Goldstein 2000; Frankel 2003; Laugeson 2010) and there are multiple other social skills curricula now available (for example, Dunn 2006; Cotugno 2009). It is unclear what effect, if any, the use of different social skills curricula had on the results of this review. Future research should seek to validate the efficacy of each curricula, and after the efficacy for each curricula has been established, comparisons of the curricula that seek to identify participant characteristics (for example, age, social competence, communication skills) for whom the intervention is most likely to have the greatest likelihood of success will be beneficial. We found only one study reporting data on the impact of social skills group interventions on social communication skills, and that study only reported the effects on a narrow aspect of social communication, that being the ability to understand and interpret idiomatic language. More research is needed to help determine if social skills group interventions have a positive impact on this aspect of social functioning. Moreover, little is known about the effects of social skills group interventions on the neurosignatures of brain activity. Finally, the studies included in this review measured social competence using multiple outcome measures (for example, Social Skills Rating System (SSRS), Social Skills Rating System (SRS), Social Competence Inventory (SCI)). As with having multiple curricula, multiple outcome measures should be considered a confound of this review. Future research should consider using and reporting the results of multiple outcome measures within a construct (for example, using the SSRS and SRS). Future studies should also consider collecting data on a broad array of measures associated with socialization (for example, social communication, friendship, loneliness).

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by year of study]*

Solomon 2004

Methods	Randomized controlled trial
Participants	18 boys with autism spectrum disorders aged 8-12 years (mean age = 9.4 years)
Interventions	Social skills group (curriculum: reported as social adjustment enhancement) with concurrent parent training 20 week duration (one 90 min session per week) Control condition: wait list
Outcomes	Primary outcome: social competence not measured Secondary outcomes: emotion recognition (Diagnostic Analysis of Nonverbal Accuracy 2 - child faces); quality of life - child and parent depression
Notes	Participants needed FSIQ > 75 to be included (Mean FSIQ = 105.2)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of randomization not specified
Allocation concealment (selection bias)	Unclear risk	Method of allocation concealment not specified
Incomplete outcome data (attrition bias) All outcomes	Low risk	0% attrition
Selective reporting (reporting bias)	Low risk	All collected data appear to be reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to nature of intervention, participants and key personnel likely not blind to treatment status
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	All assessment done by one author (unclear if he/she was blind to group status)
Baseline measurements	Low risk	No significant differences between groups at baseline

Laugeson 2009

Methods	Randomized wait list control trial
Participants	33 adolescents with autism spectrum disorders aged 11-17 years old (28 M, 5 F; mean age = 14.6 years)
Interventions	Social skills group (curriculum: parent-assisted PEERS) with concurrent parent training 12 week duration (one 90 min session per week) Control condition: wait list ('delayed treatment')
Outcomes	Primary outcome: social competence (Social Skills Rating System - parent) Secondary outcomes: quality of life - friendship quality
Notes	Participants needed VIQ > 70 to be included (Mean FSIQ = 84.8)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of randomization not specified
Allocation concealment (selection bias)	Unclear risk	Method of allocation concealment not specified
Incomplete outcome data (attrition bias) All outcomes	Low risk	3 of 36 participants who began intervention did not complete
Selective reporting (reporting bias)	Low risk	All collected data appear to be reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to nature of intervention, participants and key personnel likely not blind to treatment status
Blinding of outcome assessment (detection bias) All outcomes	High risk	Parents were not blind to treatment status and were respondents for primary outcome measure
Baseline measurements	Low risk	No significant differences between groups at baseline

Frankel 2010

Methods	Randomized wait list control trial
Participants	68 children with autism spectrum disorders in 2nd through 5th school grade (58 M, 10 F; mean age = 8.6 years)
Interventions	Social skills group (curriculum: Children's Friendship Training) with concurrent parent training

Frankel 2010   (*Continued*)

12 week duration (one 60 min session per week)
Control condition: wait list ('delayed treatment')

Outcomes	Primary outcome: social competence (Social Skills Rating System) Secondary outcomes: quality of life - popularity and loneliness
Notes	Participants needed verbal IQ > 60 (Mean FSIQ = 106.9)

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Used random sequence generator
Allocation concealment (selection bias)	Unclear risk	Method of allocation concealment not specified
Incomplete outcome data (attrition bias) All outcomes	High risk	11 of 68 (9 treatment, 2 control) participants had missing data on primary outcome
Selective reporting (reporting bias)	Low risk	All collected data appear to be reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to nature of intervention, participants and key personnel likely not blind to treatment status
Blinding of outcome assessment (detection bias) All outcomes	High risk	Parents were not blind to treatment status and were respondents for primary outcome measure
Baseline measurements	Low risk	No significant differences between groups at baseline

Koenig 2010

Methods	Randomized wait list control trial
Participants	44 children with autism spectrum disorders aged 8-11 years old (34 M; 10 F; mean age = 9.2 years)
Interventions	Social skills groups with peer tutors (curriculum not specified) 16 week duration (one 75 min session per week) Control condition: wait list
Outcomes	Primary outcome: social competence (Social Competence Inventory) Secondary outcomes: none relevant to review
Notes	Participants needed FSIQ > 70 to be included (Mean FSIQ = 96.2)

Koenig 2010 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	Used randomization table
Allocation concealment (selection bias)	Low risk	Assignment completed by research assistant without prior participant or researcher knowledge of assignment
Incomplete outcome data (attrition bias) All outcomes	Low risk	3 of 44 participants had missing data on primary outcome measure
Selective reporting (reporting bias)	Low risk	All collected data appear to be reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to nature of intervention, participants and key personnel likely not blind to treatment status
Blinding of outcome assessment (detection bias) All outcomes	High risk	Parents were not blind to treatment status and were respondents for primary outcome measure
Baseline measurements	Low risk	No significant differences between groups at baseline

Lopata 2010

Methods	Randomized wait list control trial
Participants	36 children with autism spectrum disorders aged 7-12 years (34 M; 2 F; Mean age = 9.5 years)
Interventions	Social Skills Groups (curriculum: modified from *Skillstreaming*) with concurrent parent training 5 week duration (twenty-five 70 min sessions per week) Control condition: wait list
Outcomes	Primary outcome: social competence (Social Responsiveness Scale) Secondary outcomes: emotion recognition (Diagnostic Analysis of Nonverbal Accuracy 2 - child faces); social communication (Comprehensive Assessment of Spoken Language 4 - idioms)
Notes	Participants needed FSIQ > 70 to be included (Mean FSIQ = 103)

Risk of bias

Lopata 2010   (*Continued*)

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Method of randomization not specified
Allocation concealment (selection bias)	Unclear risk	Participants were randomized prior to allocation
Incomplete outcome data (attrition bias) All outcomes	Low risk	0% attrition reported
Selective reporting (reporting bias)	Low risk	All collected data appear to be reported
Blinding of participants and personnel (performance bias) All outcomes	High risk	Due to nature of intervention, participants and key personnel likely not blind to treatment status
Blinding of outcome assessment (detection bias) All outcomes	High risk	Parents were not blind to treatment status and were respondents for primary outcome measure
Baseline measurements	Low risk	No significant differences between groups at baseline

FSIQ: full scale IQ
VIQ: verbal IQ

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Baghdadli 2010	Did not have a no treatment or wait list control group
Barry 2003	Not randomized
Beaumont 2008	Did not evaluate a social skills group intervention (included individual computerized component)
Domitrovich 2007	Participants did not have ASD
Godfrey 2005	Participants did not have ASD
Golan 2006	Did not evaluate a social skills group intervention
Kroeger 2007	Did not have a no treatment or wait list control group

(Continued)

Mesibov 1984	Not randomized
Ozonoff 1995	Not randomized

DATA AND ANALYSES

Comparison 1. Social Competence

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Social Competence	4	178	Std. Mean Difference (IV, Random, 95% CI)	0.47 [0.16, 0.78]

Comparison 2. Social Communication

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Social Communication	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected

Comparison 3. Emotion Recognition

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Emotion Recognition	2	54	Std. Mean Difference (IV, Random, 95% CI)	0.34 [-0.20, 0.88]

Comparison 4. Quality of Life

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Loneliness	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
2 Friendship	2	101	Std. Mean Difference (IV, Random, 95% CI)	0.41 [0.02, 0.81]
3 Child Depression	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected
4 Maternal Depression	1		Std. Mean Difference (IV, Random, 95% CI)	Totals not selected

Analysis 1.1.   Comparison 1 Social Competence, Outcome 1 Social Competence.

Review: Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD)

Comparison: 1 Social Competence

Outcome: 1 Social Competence

Study or subgroup	Experimental		Control		Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
	N	Mean(SD)	N	Mean(SD)			
Koenig 2010	23	2.91 (0.62)	18	2.89 (0.51)		23.9 %	0.03 [-0.58, 0.65]
Frankel 2010	35	12 (3.1)	33	10.4 (3.5)		37.8 %	0.48 [0.00, 0.96]
Lopata 2010	18	82.5 (13.8)	18	73.7 (11.4)		20.2 %	0.68 [0.01, 1.35]
Laugeson 2009	17	89.7 (12.1)	16	79.8 (11.7)		18.1 %	0.81 [0.10, 1.52]
Total (95% CI)	**93**		**85**			**100.0 %**	**0.47 [0.16, 0.78]**

Heterogeneity: Tau^2 = 0.01; Chi^2 = 3.17, df = 3 (P = 0.37); I^2 =5%

Test for overall effect: Z = 2.99 (P = 0.0028)

Test for subgroup differences: Not applicable

```
        -2      -1       0       1       2
           Favors Control    Favors Treatment
```

Analysis 2.1.   Comparison 2 Social Communication, Outcome 1 Social Communication.

Review: Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD)

Comparison: 2 Social Communication

Outcome: 1 Social Communication

Study or subgroup	Experimental		Control		Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
	N	Mean(SD)	N	Mean(SD)		
Lopata 2010	18	12.9 (7.3)	16	12.5 (9.3)		0.05 [-0.63, 0.72]

```
      -100    -50       0      50     100
        Favours experimental    Favours control
```

Analysis 3.1. Comparison 3 Emotion Recognition, Outcome 1 Emotion Recognition.

Review: Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD)

Comparison: 3 Emotion Recognition

Outcome: 1 Emotion Recognition
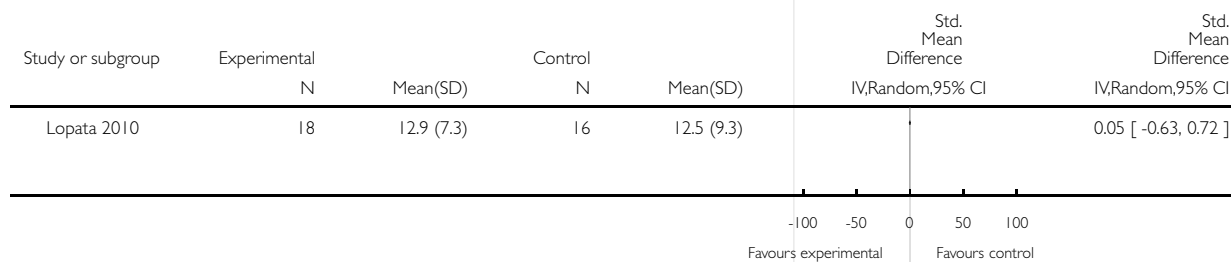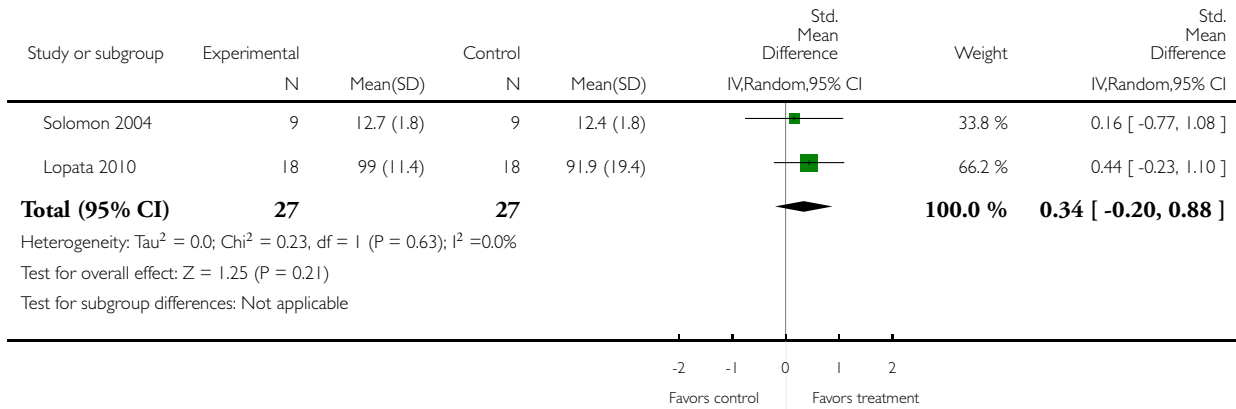
Study or subgroup	Experimental		Control		Std. Mean Difference	Weight	Std. Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
Solomon 2004	9	12.7 (1.8)	9	12.4 (1.8)		33.8 %	0.16 [-0.77, 1.08]
Lopata 2010	18	99 (11.4)	18	91.9 (19.4)		66.2 %	0.44 [-0.23, 1.10]
Total (95% CI)	**27**		**27**			**100.0 %**	**0.34 [-0.20, 0.88]**

Heterogeneity: Tau² = 0.0; Chi² = 0.23, df = 1 (P = 0.63); I² =0.0%

Test for overall effect: Z = 1.25 (P = 0.21)

Test for subgroup differences: Not applicable

```
       -2      -1      0      1      2
       Favors control      Favors treatment
```
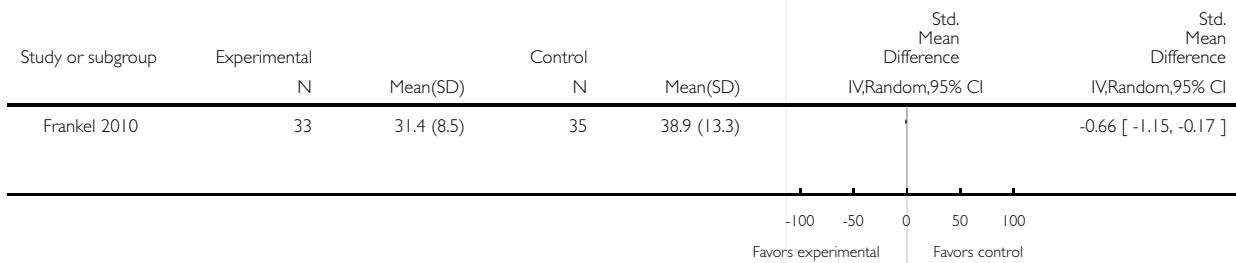
Analysis 4.1. Comparison 4 Quality of Life, Outcome 1 Loneliness.

Review: Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD)

Comparison: 4 Quality of Life

Outcome: 1 Loneliness

Study or subgroup	Experimental		Control		Std. Mean Difference	Std. Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Random,95% CI	IV,Random,95% CI
Frankel 2010	33	31.4 (8.5)	35	38.9 (13.3)		-0.66 [-1.15, -0.17]

```
     -100    -50     0     50    100
     Favors experimental      Favors control
```
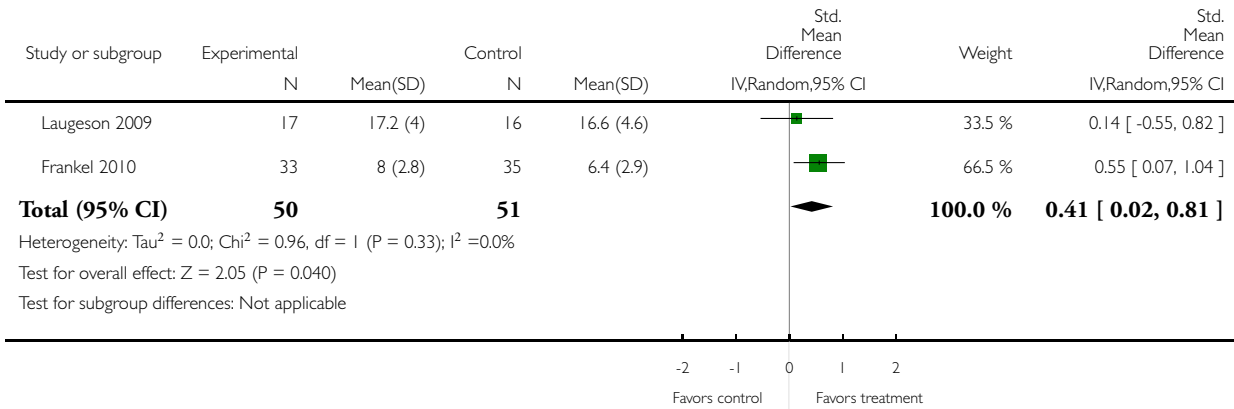
Analysis 4.2.   Comparison 4 Quality of Life, Outcome 2 Friendship.

Review: Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD)

Comparison: 4 Quality of Life

Outcome: 2 Friendship

Study or subgroup	Experimental		Control		Std. Mean Difference	Weight	Std. Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Random,95% CI		IV,Random,95% CI
Laugeson 2009	17	17.2 (4)	16	16.6 (4.6)		33.5 %	0.14 [-0.55, 0.82]
Frankel 2010	33	8 (2.8)	35	6.4 (2.9)		66.5 %	0.55 [0.07, 1.04]
Total (95% CI)	**50**		**51**			**100.0 %**	**0.41 [0.02, 0.81]**

Heterogeneity: Tau² = 0.0; Chi² = 0.96, df = 1 (P = 0.33); I² =0.0%

Test for overall effect: Z = 2.05 (P = 0.040)

Test for subgroup differences: Not applicable

```
-2      -1       0       1       2
   Favors control       Favors treatment
```
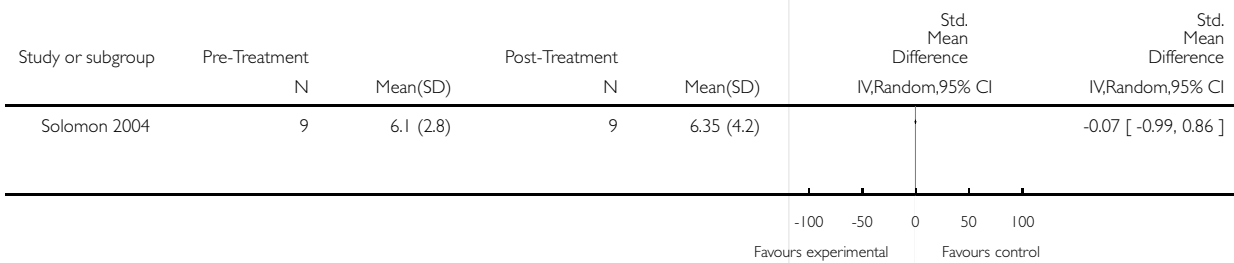
Analysis 4.3.   Comparison 4 Quality of Life, Outcome 3 Child Depression.

Review: Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD)

Comparison: 4 Quality of Life

Outcome: 3 Child Depression

Study or subgroup	Pre-Treatment		Post-Treatment		Std. Mean Difference	Std. Mean Difference
	N	Mean(SD)	N	Mean(SD)	IV,Random,95% CI	IV,Random,95% CI
Solomon 2004	9	6.1 (2.8)	9	6.35 (4.2)		-0.07 [-0.99, 0.86]

```
-100    -50      0      50     100
 Favours experimental    Favours control
```

Analysis 4.4. Comparison 4 Quality of Life, Outcome 4 Maternal Depression.

Review: Social skills groups for people aged 6 to 21 with autism spectrum disorders (ASD)

Comparison: 4 Quality of Life

Outcome: 4 Maternal Depression

Study or subgroup	Pre-Treatment		Post-Treatment		Std. Mean Difference IV,Random,95% CI	Std. Mean Difference IV,Random,95% CI
	N	Mean(SD)	N	Mean(SD)		
Solomon 2004	9	5.9 (7.2)	9	3.9 (3.3)		0.34 [-0.59, 1.27]

-100 -50 0 50 100

Favours experimental   Favours control

ADDITIONAL TABLES

Table 1. Additional methods that were not used

Protocol	Reason not used
Reporting of multiple outcome time points	Studies included in review only included one time point, which was immediately after treatment
Assessment of measurement psychometrics not included in risk of bias	This item was removed from the risk of bias assessment to be more consistent with current Cochrane tool
Did not have to adjust for unit of analyses issues	All trials were run as wait list control trials, in which data were analyzed after first wave of research (i.e., after the initial treatment group completed treatment)
Did not have to adjust for missing data	Included studies had few instances of missing data.
Did not conduct subgroup analyses	Small number of studies with little heterogeneity.
Did not conduct sensitivity analyses	Small number of studies.

APPENDICES

Appendix 1. Search strategies

CENTRAL, part of *The Cochrane Library*
Searched 2 March 2011 and 19 December 2011
#1MeSH descriptor Social Behavior, this term only
#2MeSH descriptor Interpersonal Relations, this term only
#3MeSH descriptor Socialization, this term only
#4MeSH descriptor Social Adjustment, this term only
#5(interpersonal NEAR/3 (behav* or communication* or competenc* or relation* or skill*))
#6(social NEAR/3 (behav* or communication* or competenc* or relation* or skill*))
#7sociali?ation
#8(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7)
#9MeSH descriptor Behavior Therapy, this term only
#10(educat* or train* or program* or therap* or intervention*)
#11(#9 OR #10)
#12(#8 AND #11)
#13MeSH descriptor Child Development Disorders, Pervasive explode all trees
#14pervasive development* disorders* or PDD or PDDs
#15autis* or Asperger* or Kanner* or Rett*
#16childhood schizophrenia
#17MeSH descriptor Communication Disorders, this term only
#18MeSH descriptor Speech Disorders, this term only
#19language developmental disorders
#20MeSH descriptor Language Development Disorders, this term only
#21(language or speech) NEAR/3 (delay* or disorder*)
#22Social Behavior Disorders/
#23((behav* or communicat*) NEXT (disorder* or impair*))
#24(#13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23)
#25(#24 AND #12)
#26(#25)

MEDLINE (OVID)
Searched 28 February 2011 and 19 December 2011
1 Social Behavior/
2 Interpersonal Relations/
3 (interpersonal adj3 (behav$ or communication$ or competenc$ or relation$ or skill$)).tw.
4 (social adj3 (behav$ or communication$ or competenc$ or relation$ or skill$)).tw.
5 socialization/ or sociali#ation.tw.
6 social adjustment/
7 or/1-6
8 (educat$ or train$ or program$ or therap$ or intervention$).tw.
9 Behavior Therapy/
10 8 or 9
11 7 and 10
12 exp Child Development Disorders, Pervasive/
13 (pervasive development$ disorder$ or PDD or PDDs).tw.
14 Rett$.tw.
15 Asperger$.tw.
16 autis$.tw.
17 Kanner$.tw.
18 childhood schizophrenia.tw.
19 communication disorders/

20 Speech Disorders/
21 (speech adj3 (delay$ or disorder$)).tw.
22 language development disorders/
23 child behavior disorders/
24 (language adj3 (delay$ or disorder$)).tw.
25 Social Behavior Disorders/
26 ((behav$ or communicat$) adj (disorder$ or impair$)).tw.
27 or/12-26
28 11 and 27
29 randomized controlled trial.pt.
30 controlled clinical trial.pt.
31 randomi#ed.ab.
32 placebo$.ab.
33 drug therapy.fs.
34 randomly.ab.
35 trial.ab.
36 groups.ab.
37 or/29-36
38 exp animals/ not humans.sh.
39 37 not 38
40 28 and 39
EMBASE (OVID)
Searched 28 February 2011 and 19 December 2011
1 social behavior/
2 interpersonal communication/
3 social competence/
4 social interaction/
5 (interpersonal adj3 (behav$ or communication$ or competenc$ or relation$ or skill$)).tw.
6 (social adj3 (behav$ or communication$ or competenc$ or relation$ or skill$)).tw.
7 or/1-6
8 behavior therapy/
9 social adaptation/
10 (educat$ or train$ or program$ or therap$ or intervention$).tw.
11 8 or 9 or 10
12 exp autism/
13 (pervasive development$ disorder$ or PDD or PDDs).tw.
14 Rett$.tw.
15 Asperger$.tw.
16 autis$.tw.
17 Kanner$.tw.
18 childhood schizophrenia.tw.
19 communication disorder/
20 speech disorder/
21 (speech adj3 (delay$ or disorder$)).tw.
22 language disability/
23 behavior disorder/
24 ((behav$ or communicat$) adj (disorder$ or impair$)).tw.
25 or/12-24
26 Clinical trial/
27 Randomized controlled trial/
28 Randomization/
29 Single blind procedure/
30 Double blind procedure/

31 Crossover procedure/

32 Placebo/

33 Randomi#ed.tw.

34 RCT.tw.

35 (random$ adj3 (allocat$ or assign$)).tw.

36 randomly.ab.

37 groups.ab.

38 trial.ab.

39 ((singl$ or doubl$ or trebl$ or tripl$) adj3 (blind$ or mask$)).tw.

40 Placebo$.tw.

41 Prospective study/

42 (crossover or cross-over).tw.

43 prospective.tw.

44 or/26-43

45 7 and 11 and 25 and 44

PsycINFO (OVID)

Searched 19 December 2011

1 Social Behavior/

2 Social Adjustment/

3 Interpersonal Relationships/

4 Social Interaction/

5 (interpersonal adj3 (behav$ or communication$ or competenc$ or relation$ or skill$)).tw.

6 (social adj3 (behav$ or communication$ or competenc$ or relation$ or skill$)).tw.

7 Social Skills/

8 socialization/ or sociali#ation.tw.

9 or/1-8

10 Behavior Therapy/

11 (educat$ or train$ or program$ or therap$ or intervention$).tw.

12 10 or 11

13 9 and 12

14 Communication Skills Training/ or Human Relations Training/ or Social Skills Training/ or Sensitivity Training/

15 13 or 14

16 exp pervasive developmental disorders/

17 (pervasive development$ disorder$ or PDD).tw.

18 Rett$.tw.

19 Asperger$.tw.

20 autis$.tw.

21 Kanner$.tw.

22 childhood schizophrenia.tw.

23 communication disorders/

24 Speech Disorders/

25 Language Disorders/

26 Language Delay/

27 Behavior Disorders/

28 (speech adj3 (delay$ or disorder$)).tw.

29 (language adj3 (delay$ or disorder$)).tw.

30 ((behav$ or communicat$) adj (disorder$ or impair$)).tw.

31 or/16-30 (53694)

32 15 and 31

33 clinical trials/

34 (randomis$ or randomiz$).tw.

35 (random$ adj3 (allocat$ or assign$)).tw.

36 ((clinic$ or control$) adj trial$).tw.

37 ((singl$ or doubl$ or trebl$ or tripl$) adj3 (blind$ or mask$)).tw.
38 (crossover$ or "cross over$").tw.
39 random sampling/
40 Experiment Controls/
41 Placebo/
42 placebo$.tw.
43 exp program evaluation/
44 treatment effectiveness evaluation/
45 ((effectiveness or evaluat$) adj3 (stud$ or research$)).tw.
46 or/33-45
47 32 and 46
48 limit 47 to up="20110301-20111219"
PsycINFO (EBSCOhost)
Searched 1 March 2011
S50 S10 and S14 and S35 and S49
S49 S36 or S37 or S38 or S39 or S40 or S41 or S42 or S43 or S44 or S45 or
S46 or S47 or S48
S48 (evaluation N3 stud* or evaluation N3 research*)
S47 (effectiveness N3 stud* or effectiveness N3 research*)
S46 DE "Placebo" or DE "Evaluation" or DE "Program Evaluation" OR DE
"Educational Program Evaluation" OR DE "Mental Health Program Evaluation"
S45 (DE "Random Sampling" or DE "Clinical Trials") or (DE "Experiment
Controls")
S44 "cross over*"
S43 crossover*
S42 (tripl* N3 mask*) or (tripl* N3 blind*)
S41 (trebl* N3 mask*) or (trebl* N3 blind*)
S40 (doubl* N3 mask*) or (doubl* N3 blind*)
S39 (singl* N3 mask*) or (singl* N3 blind*)
S38 (clinic* N3 trial*) or (control* N3 trial*)
S37 (random* N3 allocat*) or (random* N3 assign*)
S36 randomis* or randomiz*
S35 S15 or S16 or S17 or S18 or S19 or S20 or S21 or S22 or S23 or S24 or
S25 or S26 or S27 or S28 or S29 or S30 or S31 or S32 or S33 or S34
S34 TI (speech disorder*) Or TI (speech delay*)
S33 AB (speech disorder*) Or AB (speech delay*)
S32 AB (language disorder*) Or AB (language delay*)
S31 TI (language disorder*) Or TI (language delay*)
S30 TI(communicat* disorder*) or TI (communicat* impair*)
S29 AB (communicat* disorder*) or AB (communicat* impair*)
S28 AB (behav* disorder*) or AB (behav* impair*)
S27 TI (behav* disorder*) or TI (behav* impair*)
S26 DE "Behavior Disorders"
S25 DE "Language Disorders" OR DE "Language Delay"
S24 DE "Speech Disorders"
S23 DE "Communication Disorders"
S22 TI(childhood schizophrenia) or AB(childhood schizophrenia)
S21 TI(Kanner*) or AB (Kanner*)
S20 TI (Rett*) or AB (Rett*)
S19 TI (Asperger*) or AB (Asperger*)
S18 TI (autis*) or AB (autis*)
S17 TI (pervasive development* disorder* or PDD or PDDs)
S16 AB(pervasive development* disorder* or PDD or PDDs)

S15 DE "Pervasive Developmental Disorders" OR DE "Pervasive Developmental
Disorders" OR DE "Aspergers Syndrome" OR DE "Autism" OR DE "Rett Syndrome"
S14 S11 or S12 or S13 S
S13 AB(educat* or train* or program* or therap* or intervention*)
S12 TI(educat* or train* or program* or therap* or intervention*)
S11 DE "Behavior Therapy" OR DE "Communication Skills Training" OR DE
"Human Relations Training" OR DE "Social Skills Training" OR DE
"Sensitivity Training"
S10 S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9
S9 DE "Social Skills" or DE"Socialization"
S8 AB (social N3 behav*) or AB(social N3 communicat*) or AB(social N3
competenc*) or AB(social N3 relation*) or AB(social N3 skill*)
S7 TI(social N3 behav*) or TI(social N3 communicat*) or TI(social N3
competenc*) or TI(social N3 relation*) or TI(social N3 skill*)
S6 AB(interpersonal N3 behav*) or AB(interpersonal N3 communicat*) or
AB(interpersonal N3 competenc*) or AB(interpersonal N3 relation*) or
AB(interpersonal N3 skill*)
S5 TI(interpersonal N3 behav*) or TI(interpersonal N3 communicat*) or
TI(interpersonal N3 competenc*) or TI(interpersonal N3 relation*) or
TI(interpersonal N3 skill*)
S4 DE "Social Interaction" S
S3 DE "Interpersonal Relationships"
S2 DE "Social Adjustment"
S1 DE "Social Behavior"
CINAHL (EBSCOhost)
Searched 1 March 2011 and 19 December 2011
S52 S17 and S35 and S51
S51 S37 or S38 or S39 or S40 or S41 or S42 or S43 or S44 or S45 or
S46 or S47 or S48 or S49 or S50
S50 TI (evaluat* study or evaluat* research) or AB (evaluate* study
or evaluat* research) or TI (effectiv* study or effectiv* research)
or AB (effectiv* study or effectiv* research) OR TI (prospectiv*
study or prospectiv* research) or AB(prospectiv* study or
prospectiv* research) or TI (follow-up study or follow-up research)
or AB (prospectiv* study or prospectiv* research)
S49 "cross over*"
S48 crossover*
S47 (MH "Crossover Design")
S46 (tripl* N3 mask*) or (tripl* N3 blind*)
S45 (trebl* N3 mask*) or (trebl* N3 blind*)
S44 (doubl* N3 mask*) or (doubl* N3 blind*)
S43 (singl* N3 mask*) or (singl* N3 blind*)
S42 (clinic* N3 trial*) or (control* N3 trial*)
S41 (random* N3 allocat*) or (random* N3 assign*)
S40 randomis* or randomiz*
S39 (MH "Meta Analysis")
S38 (MH "Clinical Trials+")
S37 MH random assignment
S36 S17 and S35
S35 (S18 or S19 or S20 or S21 or S22 or S23 or S24 or S25 or S26 or
S27 or S28 or S29 or S30 or S31 or S32 or S33 or S34)
S34 TI (speech delay*) or TI (speech disorder*) or AB (speech
delay*) or AB (speech disorder*)

S33 TI (language delay*) or TI (language disorder*) or AB (language delay*) or AB (language disorder*)

S32 TI (communicat* disorder*) or TI (communicat* impair*)

S31 AB (communicat* disorder*) or AB (communicat* impair*)

S30 AB (behav* disorder*) or AB (behav* impair*)

S29 TI (behav* disorder*) or TI (behav* impair*)

S28 (MH "Speech Disorders")

S27 (MH "Language Disorders")

S26 (MH "Communicative Disorders")

S25 TI(childhood schizophrenia) or AB(childhood schizophrenia)

S24 TI(Kanner*) or AB (Kanner*)

S23 TI (Rett*) or AB (Rett*)

S22 TI (Asperger*) or AB (Asperger*)

S21 TI (autis*) or AB (autis*)

S20 AB (pervasive development* disorder* or PDD)

S19 TI (pervasive development* disorder* or PDD)

S18 (MH "Child Development Disorders, Pervasive+")

S17 S15 or S16

S16 (MH "Social Skills Training") OR (MH "Communication Skills Training")

S15 S10 and S14

S14 S11 or S12 or S13

S13 AB(educat* or train* or program* or therap* or intervention*)

S12 TI(educat* or train* or program* or therap* or intervention*)

S11 (MH "Behavior Therapy")

S10 S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9

S9 AB (social N3 behav*) or AB(social N3 communicat*) or AB (social N3 competenc*) or AB(social N3 relation*) or AB (social N3 skill*)

S8 TI(social N3 behav*) or TI(social N3 communicat*) or TI(social N3 competenc*) or TI(social N3 relation*) or TI (social N3 skill*)

S7 AB(interpersonal N3 behav*) or AB(interpersonal N3 communicat*) or AB(interpersonal N3 competenc*) or AB(interpersonal N3 relation*) or AB(interpersonal N3 skill*)

S6 TI(interpersonal N3 behav*) or TI(interpersonal N3 communicat*) or TI(interpersonal N3 behav*) or TI(interpersonal N3 communicat*) or TI(interpersonal N3 competenc*) or TI(interpersonal N3 relation*) or TI(interpersonal N3 skill*)

S5 (MH "Social Skills")

S4 (MH "Communication Skills")

S3 (MH "Interpersonal Relations")

S2 (MH "Social Adjustment")

S1 (MH "Social Behavior")

ERIC (Dialog Datastar)

Searched 1 March 2011 and 20 December 2011

"(((INTERPERSONAL-COMPETENCE.DE. OR SOCIAL-DEVELOPMENT.DE. OR SOCIAL-BEHAVIOR.DE. OR COM-MUNICATION-SKILLS.DE. OR INTERPERSONAL-COMMUNICATION.DE.) OR ((SOCIAL ADJ (BEHAVIO$4 OR COMMUNICATION$1 OR COMPETENC$3 OR RELATION$5 OR SKILL$1)) .TI,AB.) OR ((INTERPERSONAL ADJ (BEHAVIO$4 OR COMMUNICATION$1 OR COMPETENC$3 OR RELATION$5 OR SKILL$1)) .TI,AB.) OR (SOCIAL-IZATION.W..DE.) OR ((SOCIALIZATION OR SOCIALISATION) .TI,AB.)) AND ((BEHAVIOR-MODIFICATION.DE. OR INTERVENTION.W..DE.) OR (SKILL-DEVELOPMENT.DE.) OR (Teaching-Methods.DE.) OR ((EDUCATION OR TRAINING OR PROGRAM$1 OR PROGRAMME$1 OR THERAPY OR THERAPIES OR INTERVENTION$1) .TI,AB.)) AND ((AUTISM.W..DE. OR PERVASIVE-DEVELOPMENTAL-DISORDERS.DE. OR ASPERGER-SYNDROME.DE.) OR ((

CHILDHOOD ADJ SCHIZOPHRENIA) .TI,AB.) OR ((AUTIS$3 OR ASPERGER$1 OR RETT$1 OR KANNER$1) .TI,AB.)
OR (COMMUNICATION-DISORDERS.DE.) OR (LANGUAGE-IMPAIRMENTS.DE.) OR (DELAYED-SPEECH.DE.) OR
(BEHAVIOR-PROBLEMS.DE.) OR (((BEHAVIO$4 OR COMMUNICATION) ADJ (DISORDER$1 OR IMPAIR$4))
.TI,AB.))) AND ((CONTROL-GROUPS.DE.) OR (EXPERIMENTAL-GROUPS.DE.) OR (LONGITUDINAL-STUDIES.DE.)
OR (FOLLOW-UP-STUDIES.DE.) OR (PROGRAM-EFFECTIVENESS.DE.) OR (((PROSPECTIVE OR FOLLOW ADJ UP
OR EVALUAT$4 OR COMPAR$4 OR BLIND$2) NEAR (STUDY OR STUDIES)) .TI,AB.) OR ((EVALUAT$4 NEAR
RESEARCH) .TI,AB.) OR (((COMPAR$4 OR CONTROL$1) NEAR GROUP$1) .TI,AB.) OR (RANDOM$.TI,AB.) OR
(INTERVENTION$1.TI,AB.) OR (EXPERIMENT$2.TI,AB.) OR (TRIAL$1.TI,AB.))"

Sociological Abstracts (Proquest)

Searched 20 December 2011

(((((SU.EXACT("Social Behavior") OR SU.EXACT("Social Competence") OR SU.EXACT("Interpersonal Communication") OR
SU.EXACT("Socialization") OR SU.EXACT("Social Interaction")) OR ALL(social NEAR/3 (behav* OR communication* OR com-
petence* OR relation* OR skill*)) OR ALL(interpersonal NEAR/3 (behav* OR communication* OR competenc* OR relation*
OR skill*))) OR ALL(sociali*ation)) AND (SU.EXACT("Behavior Modification") OR SU.EXACT("Training") OR ALL(educat*
OR train* OR program* OR therap* OR intervention*))) AND ((SU.EXACT("Behavior Problems") OR SU.EXACT("Autism")
OR SU.EXACT("Language Disorders")) OR ALL(autis* OR asperger* OR kanner* OR rett* OR "childhood schizophrenia") OR
ALL(language NEAR/3 (delay* OR disorder*)) OR ALL(speech NEAR/3 (delay* OR disorder*)) OR ALL("behav* disorder*" OR
"behav* impair*" OR "communicat* disorder*" OR "communicat* impair*")))) AND (su("treatment outcomes" OR "evaluation re-
search" OR "program evaluation" OR "random samples") OR (ab(randomi*ed OR randomly OR control* OR trial* OR groups* OR
effectiveness OR evaluation OR placebo*)))

Sociological Abstracts (CSA)

Searched 1 March 2011

(DE=("treatment outcomes" or "evaluation research" or "program evaluation" or "random samples")or(KW=(randomi*ed or randomly
or control* or trial* or groups* or effectiveness or evaluation or placebo*)))and((((((DE="social competence") or(DE="social behavior")
or(DE="interpersonal communication")) or(KW= (interpersonal within 3 (behav* or communication* or competenc* or relation* or
skill*))) or(KW= (social within 3 (behav* or communication* or competenc* or relation* or skill*))) or(DE="socialization") or(KW=
sociali?ation)) or(DE="social interaction")) and((DE="behavior modification") or(DE="training") or(KW=(educat* or train* or pro-
gram* or therap* or intervention*)))) and((DE="autism") or(KW=(pervasive development* disorder* or PDD)) or(KW=(autis* or
asperger* or kanner* or rett* or childhood schizophrenia)) or(KW=(childhood schizophrenia)) or(DE="language disorders") or(DE=
"behavior problems") or(KW=(language within 3 (delay* or disorder*))) or(KW=(speech within 3 (delay* or disorder*))) or(KW=
(behav* disorder* or behav* impair* or communicat* disorder* or communicat* impair*))))

Social Science Citation Index (Web of Science)

Searched 20 December 2011 and 1 March 2011

11 #10 AND #9

DocType=All document types; Language=All languages;

#10 TS=(random* or control* or trial* or groups* or effectiveness or evaluation or placebo*)

DocType=All document types; Language=All languages;

#9 #8 AND #3

DocType=All document types; Language=All languages;

#8 #7 AND #6

DocType=All document types; Language=All languages;

#7 TS=(educat* or train* or program* or therap* or intervention*)

DocType=All document types; Language=All languages;

#6 #5 OR #4

DocType=All document types; Language=All languages;

#5 TS=(interpersonal behav* or interpersonal communicat* or interpersonal competenc* or interpersonal relation* or interpersonal
skill*)

DocType=All document types; Language=All languages;

#4 TS=(social behav* or social communicat* or social competenc* or social relation* or social skill*)

DocType=All document types; Language=All languages;

#3 #2 OR #1

DocType=All document types; Language=All languages;

#2 TS=(pervasive development* disorder* or PDD)

DocType=All document types; Language=All languages;
#1 TS=(autis* or asperger* or kanner* or rett* or childhood schizoprenia)
DocType=All document types; Language=All languages;
WorldCat (www.worldcat.org)
Searched 20 December 2011 and 2 March 2011
kw:(autis* | asperg* | rett* | kanner* | "pervasive development* disorder*" | PDD) AND (("social comptenc*") | ("social skill*")| (
"social behav*") | ("social communicat*") | ("social relation*"))
Search limited to theses and dissertations

metaRegister of Clinical Trials (mRCT)
Searched 20 December 2011 and 2 March 2011
(social skills or social competenc*) and (autis* or asperg* or pervasive)

HISTORY

Protocol first published: Issue 5, 2010

Review first published: Issue 7, 2012

Date	Event	Description
28 April 2010	Amended	Note on Campbell Collaboration co-registration added

CONTRIBUTIONS OF AUTHORS

BR and FV contributed to the development of this protocol. BR and FV drafted the introduction. BR drafted the objectives and methods, which were reviewed by FV. BR and AS screened the abstracts and titles, retrieved potentially eligible papers, and made decisions about eligibility. BR and AS extracted data. BR drafted the full review with regular input and final review from FV and AS.

DECLARATIONS OF INTEREST

Brian Reichow - receives royalties from book publication, honoraria from lectures on autism spectrum disorders, and has received funding from the US Department of Education, none of which supported or influenced my work on this review.

Amanda M Steiner - receives honoraria from lectures on autism spectrum disorders, and has received funding from the US National Institutes of Health, none of which supported or influenced my work on this review.

Fred Volkmar - receives royalties from book publication, honoraria from lectures on autism spectrum disorders, and has received funding from the US National Institutes of Health, none of which supported or influenced my work on this review.

SOURCES OF SUPPORT

Internal sources

- Associates of the Yale Child Study Center, USA.
- Yale University School of Medicine, USA.

External sources

- No sources of support supplied

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

- Amanda Mossman Steiner was added as an author and completed study selection and data extraction with BR and reviewed final report with BR and FV.

- Minor edits were made to the Background to improve clarity.

- Addition of outcomes 'Adverse events' and 'Emotion recognition'.

- After initial search returned nearly 12,000 studies, we decided to limit the review to randomized trials and reran the search using the randomized study filter.

- 'Risk of bias' amended to be more consistent with current Cochrane recommendations. Blinding was divided into two categories (blinding of participants and personnel and blinding of outcome data), selection bias was changed to baseline measurements, and treatment fidelity was removed.

- A table detailing protocol decisions that were not needed or used in the final review has been added (see Table 1).

NOTES

This review is co-registered within the Campbell Collaboration and also published on the Campbell Library.

INDEX TERMS

Medical Subject Headings (MeSH)

*Emotional Intelligence; Child Development Disorders, Pervasive [*rehabilitation]; Psychotherapy, Group [*methods]; Randomized Controlled Trials as Topic; Reinforcement, Social; Social Facilitation

MeSH check words

Adolescent; Child; Humans; Young Adult