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Citation for published version:
Rumney, H & Macmahon, K 2017, 'Do social skills interventions positively influence mood in children and young people with autism? A systematic review', *Mental Health & Prevention*, vol. 5, pp. 12-20. https://doi.org/10.1016/j.mhp.2016.12.001

Digital Object Identifier (DOI):
10.1016/j.mhp.2016.12.001

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Peer reviewed version

Published In:
Mental Health & Prevention

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Download date: 12. Oct. 2024

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PII: S2212-6570(16)30039-3
DOI: http://dx.doi.org/10.1016/j.mhp.2016.12.001
Reference: MHP66

To appear in: *Mental Health & Prevention*

Received date: 12 August 2016
Revised date: 8 December 2016
Accepted date: 15 December 2016

Cite this article as: Heather Lorna Rumney and Ken MacMahon, Do Social Skill Interventions Positively Influence Mood in Children and Young People witl Autism? A Systematic Review, *Mental Health & Prevention* http://dx.doi.org/10.1016/j.mhp.2016.12.001

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Do Social Skills Interventions Positively Influence Mood in Children and Young People with Autism? A Systematic Review

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Abstract

Depression and anxiety in children and young people with autism spectrum disorders (CYP with ASD) are relatively prevalent. Social skills deficits may be risk factors for the development of mood difficulties. This systematic review examined existing literature to establish whether social skills interventions positively influence mood in CYP with ASD. The majority of studies found that interventions improved mood, although there was heterogeneity in interventions and outcome reporting. As there is evidence that social skills interventions positively influence mood, future research should investigate the preventative effect of these interventions in moderating progression to clinical depression and anxiety in this population.

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Keywords:
autism spectrum disorders, anxiety, depression, social skills, emotion, young children

1. Introduction

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Recent research suggests that 25% of children and young people will have experienced a mood disorder such as anxiety or depression by the time they reach adulthood (Copeland *et al*, 2011). There are a multitude of factors that may lead to the development of mood disorders in children and young people. Although these include genetic, environmental and temperamental factors, difficulties surrounding social interactions may also play a pivotal role. This is the core reason why individuals with an autism spectrum disorder may be increasingly vulnerable to developing mood disorders. Autism spectrum disorder (ASD) is a pervasive developmental disorder defined in the DSM-5 (APA, 2013) as persistent deficits in social communication across multiple contexts. These deficits are manifested by abnormalities in social-emotional reciprocity, nonverbal communication, and the development and maintenance of relationships.

A recent meta-analysis found that 39.6% of 2,121 children and adolescents had a comorbid anxiety disorder with autism (Van Steensel & Bogels, 2011). Similar statistics were found with comorbid depression; Strang *et al*. (2012) reported that 44% of children with autism were either borderline or clinically depressed. Vickerstaff *et al.* (2007) found it is likely that depression levels increase with age and IQ based on a sample of 7-13 year-old children with autism (IQ 82-141). Previous research aligns with these findings and states that higher cognitive ability is associated with increased levels of depression in children with autism and with prevalence levels increasing over time (Ghaziuddin *et al*. 2002*)*. Research consistently shows that mental health disorders peak during adolescence (Merikangas, Nakamura & Kessler, 2009). Although depression and anxiety are amongst the most common disorders, they are also considered to be treatable, and even preventable (Mrazek & Haggerty, 1994). For people with autism, the inherent features of the condition may increase an individual's vulnerability to developing anxiety or depression in later life. As described by Vasey and Dadds transactional developmental pathways model (2001), repeated exposure to social

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difficulties can lead to the development of maladaptive coping strategies and heighten the risk of anxiety, with difficulties interpreting or predicting the behaviour of others maintaining this anxiety (Brent *et al.* 2004).

Social skills interventions are a common intervention for children and young people with autism. Usually delivered through manualised treatment, social skills interventions aim to teach social skills through active participation in small groups with examples of social etiquette, practical activities and role-play. Miller *et al*. (2014) conducted a systematic review that analysed 44 studies and concluded that social skills interventions are useful for adolescents with autism, with improvements observed in social responsiveness and social engagement. Another review conducted by Camargo *et al.* (2014) investigated the quality of behaviourally based interventions to improve social interaction in children with autism in inclusive school settings and found similar conclusions. These existing reviews consider the primary outcomes of the interventions, namely development of increased competence in social skills (usually measured using the Social Responsiveness Scale - Constantino & Gruber, 2005). However, secondary outcomes of exposure to social skills interventions, such as change in mood, have not thus far been reviewed across studies. This gap is arguably surprising considering the plethora of research that does suggest children and young people with autism are at an increased risk of developing mood disorders. If the goal of these interventions is to improve the quality of life for individuals, then it is important to understand additional implications of social skills interventions. In particular, whether they are an effective and valuable treatment for children and young people with autism, and may subsequently prevent this population from developing clinical levels of depression and/or anxiety in later life.

2. Method

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2.1. Identification of Studies

Studies were identified through the following electronic databases: Embase, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R), and PsycINFO databases. An independent search of Education Resources Information Center (ERIC) and ProQuest was also carried out. A hand search was conducted in the Journal of Autism and Developmental Disorders for studies published between December 1980 and July 2015 to identify any studies that were not identified within the defined search terms. Similarly, a search was conducted within the "Online First" database of the Journal of Autism and Developmental Disorders for studies that are published online but yet to be printed. Publication year for all searches was restricted to between 1980 and current (3rd July 2015). For all databases, the following search terms were used: social skill*; child* or adolesc* OR young; intervention* or program* OR training*; autis* OR Asperger*; anxiety OR depression. All searches were combined with the 'AND' function. Additional searching of reference lists was also carried out with reference to the inclusion/exclusion criteria.

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2.2. Inclusion and Exclusion Criteria

Studies were included if they met the following criteria: (i) study design that incorporated pre- and post-intervention validated measures of anxiety and/or depression for the child/young person (either self- or other-rated); (ii) participants between the ages of 4 and 25 and a diagnosis of an autism spectrum disorder, without intellectual disability (i.e., Asperger's syndrome, High Functioning Autism); (iii) studies that used a recognised social skills intervention - defined as any intervention that sought to increase the social skills of participants. Examples of specific skills taught include: introducing oneself; starting, maintaining and ending a conversation; appropriate use of eye contact; taking turns; understanding perspective; listening to others; and appropriate use of humour. Studies that

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incorporated a treatment element other than social skills, such as CBT, were excluded due to the potential confounding influence on mood.

2.3. Quality Criteria Assessment Tool

The quality rating tool used to assess studies was based on the standardised Scottish Intercollegiate Guidance Network methodology checklist for randomized controlled trials. However, to fully represent the subject area and variety of designs utilised, amendments were made, including the addition of several further criteria, taken from previous systematic reviews (Miller *et al*. 2014; Camargo *et al*. 2014; White *et al*. 2007; Rao *et al*., 2008). See Table 1 for details.

3. Results

3.1. Search Results

Searches from OVID (Embase, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R), and PsycINFO), ProQuest and ERIC retrieved 180 potential studies with an additional study (Tse et al., 2007) identified through hand searching the Journal of Autism and Developmental Disorders. Following review of abstracts, 163 articles were excluded. Full texts of 17 studies were retrieved for review, with seven subsequently excluded. See Figure 1 for search and retrieval process and Table 2 for excluded studies.

3.2. Rating of Study Quality

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The quality ratings for each study are summarised in Table 3 (see below). An independent evaluator reviewed 30% of the included studies to determine reliability of assessment of study quality. This produced a Cohen's kappa of k=0.95, with only one study revealing a disagreement between quality of participant characteristics (Tse, 2007). This study was reassessed and evaluated to reach 100% agreement following discussion.

3.3. Demographics Across Studies

Findings are largely more generalizable to boys with autism, with girls represented as 13% of the total 399 participants across all ten studies. Overall, 60% of the studies reported significant reduction in either depression or anxiety levels, suggesting a marginal majority for the effectiveness of the interventions. Details of studies are provided in Table 4 (below).

3.4. Depression

3.4.1. Randomised Controlled Trials

Although Solomon (2004) did not find an overall significant reduction in CDI scores (Kovacs, 1992) across all participants, there was a significant difference between the two age groups (8-10 years and 10-12 years) with the older, less cognitively able group showing significantly larger decreases in scores on this measure than the younger, more able group. Although speculative, it appears that the less able children might have benefited more from the intervention. The moderate to large effect size of d=0.6 also demonstrates the size of the difference between the two age groups. Total treatment time consisted of 30 hours over the course of 20 weeks, making this the longest intervention utilised in the studies. Parent psychoeducation was also utilised within this study. However, due to poor response rate, no

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data for the control condition exists for depression levels, thus significantly reducing the weight of the results.

The study conducted by Yoo (2014) also found a significant reduction in scores on the CDI (Kovacs, 1985) with a moderate effect size of d=0.5 which was maintained at a follow-up assessment three months later. Participants' ages ranged between 12-18 years therefore it is difficult to differentiate between the effects on age within this study. The study was rated as high quality due to the RCT design and use of a control group with homogeneity between the groups at baseline. The social skills treatment also incorporated parent psychoeducation. The treatment time was slightly shorter, with a total of 21 hours over 14 weeks.

In the final RCT included in this review, Kuehnel (2013) reported no significant reduction in scores of depression levels after the intervention, although regression analysis did reveal an association between increased social skills and increased scores of anxiety. This study was rated high quality for implementation of a RCT design and a large sample size not biased to participants from clinics. However, it is possible that the online delivery of social treatment could have limited the effectiveness of the intervention, as no practical opportunity for face-to-face interaction was given. In addition, a total treatment time of three hours over eight weeks may not be adequate for skills to develop and have an effect on mood. Participants' ages ranged from 9-12 years, thus allowing for the results to be generalised to early adolescence. However, the results should be interpreted with caution for two reasons: firstly, this study is an unpublished dissertation thesis. Secondly, descriptive statistics were uninterpretable thus making it impossible to calculate effect size to investigate the association between increased social skills and increased scores on anxiety levels.

3.4.2. Non-Randomised Controlled Trials

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The study conducted by Lerner (2011) reported no significant reductions in scores on depression measures after the intervention. It incorporated an intensive social skills intervention with a total of 145 hours in 6 weeks. There was a broad age range in this study, with 11-17 year-olds assessed accumulatively, limiting the conclusions that can be drawn regarding age as an influence on the effectiveness of the intervention. Due to the lack of randomisation, it is not possible to tell whether specific aspects of the individual participants influenced the results. Similarly, descriptive statistics were not calculable for further inspection of the data. Details on the control group were unclear as to whether an active or inactive treatment was used. Therefore it is difficult to place significant confidence in the conclusions drawn within this study.

3.4.3. Non-comparative Study

The study that received among the lowest quality rating out of the ten studies was a single-case design (Plienis, 1987). Although not employing a manualised treatment, the skills taught are akin to the other studies, including conversation skills and role-play, with two confederate peers to form the group setting. The total treatment time was the second highest observed in the studies, with 33 hours of training in 11 weeks. The 19-year-old female participant in this study was diagnosed with clinical depression. Depression levels significantly reduced over the course of the intervention and in measures taken at a six-week follow up. Although the lack of a control group partially limits the conclusions, this study was the only study to include a participant with clinical levels of depression at baseline and report a reduction in levels to within the normal range following the intervention. No descriptive statistics were available to calculate the size of this significance. Plienis (1987) was also the only study not

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to include detail on the quality of the program facilitator, therefore affecting the strength in the conclusions of this study.

3.5. Anxiety

3.5.1. Randomised Controlled Trials

Focusing on anxiety, Schohl (2014) utilised participants drawn from the wider community, rather than specifically from a clinical setting. Age of participants ranged from 11-16 years, thus not allowing for closer dissemination of age effects of the social skills training. The finding that a significant decrease in anxiety was observed can be interpreted with adequate confidence, based on the strength of the design and larger sample size. The small effect size of d=0.2 suggests that the improvements were small, but reached significance. Total treatment time was 21 hours over 14 weeks.

In contrast to the significant findings for reduction in depression scores, Yoo (2014) did not find any significant decrease in measures of anxiety levels after the intervention. As previously stated, this study was evaluated as high quality and therefore the results are to be valued with greater confidence than lower quality designs. Both Schohl (2014) and Yoo (2014) utilised versions of the PEERS® social skills intervention. As well as parent psychoeducation, this intervention has a strong focus on the quality of the training for the program facilitators and incorporates weekly supervision to assess any issues within the delivery. It is possible that treatment effects are attributable to these strengths within the intervention delivery.

3.5.2. Non-Randomised Controlled Trials

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As one of the only studies to report existing clinical levels of anxiety at baseline (18% of 46 children had a comorbid anxiety disorder) Beaumont (2015) found significant reductions in levels of anxiety were found after the structured social skills intervention whereas the unstructured intervention revealed no reductions in anxiety levels. However, although significant reductions were found, the levels of anxiety remained clinically significant for a clinical diagnosis of anxiety disorder. The structured intervention involved a multi-level computer game encouraging emotion recognition and strategies to cope with bullying as well as utilising a trained program facilitator, who was not involved in the unstructured intervention. A small effect size of d=0.3 was calculated and this was maintained at a six-week follow up. A large sample size of 69 participants strengthens the results of the study. Results are generalizable to children aged 7-12 years. Within the two treatment groups, IQ was significantly higher in the unstructured intervention. The finding that anxiety did not reduce in this group is congruent with previous research that suggests individuals with autism (but without intellectual impairment) are more vulnerable to heightened anxiety levels. It also suggests the importance of an adequately trained intervention facilitator. Total treatment time consisted of 15 hours over 10 weeks, shorter than the majority of the other studies.

No significant reduction in anxiety levels after the intervention were found in Laugeson (2014), although a trend towards significance was found with a large effect size of d=0.95. Despite the lack of randomisation, the study included a control group, adding strength to the conclusion that levels of anxiety were not reduced by the interventions. Similarly, the largest sample size of 73 participants strengthens these results. Participants' age ranged from 12-14 years, allowing for the results to be attributable to early adolescence. Laugeson (2014) was the only study to incorporate parent psychoeducation within the treatment and find no significant effect on mood for the participants. In addition, Laugeson incorporated daily

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treatment with a total of 35 hours over 14 weeks which is the second highest intensity of intervention.

3.5.3. Uncontrolled Studies

Significant decreases in anxiety and a moderate effect size of d=0.4 for 46 participants in Tse (2007). The study incorporated an extensive age range (13-18 years), although this wide range was taken into account, with t-tests differentiating between 14 years and younger versus 15 years and older. No significant age effects were reported for the insecure/anxious subscale of the Nisonger Child Behaviour Rating Form (Aman, 1996). It is possible that the lack of a control group could make the results artificially biased towards significance. Therefore, the conclusions of this study are limited due to absence of a control group and no evidence of blinding. In addition, a non-manualised intervention was implemented thus limiting future replication to confirm the conclusions of this study. Loudon (2008) was rated with the lowest quality score out of the ten studies, therefore the insignificant finding should not be interpreted with as much weight as the superior quality studies mentioned above. Video self-modelling was utilised within this intervention, with the inclusion of typically developing peers to initiate conversation. As only three 11-12 year-olds were assessed in the results, it is with caution that conclusions are drawn. It should also be noted that Loudon (2008) is a dissertation thesis and therefore cannot be assumed to be of equal quality to the peer-reviewed studies.

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4. Discussion

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This review aimed to evaluate whether social skills interventions could have a positive influence on mood in children and young people with autism. The conclusions drawn from the analysis are that there is some evidence that mood can be positively influenced. A total of six out of the ten studies reported significant reductions in depression and anxiety levels when measured before and after a social skills intervention. Thus, a social skills intervention, in some contexts, may support reductions in mood difficulties but will not be sufficient for all. This, intuitively, would make sense. Social skills deficits will be only part of the jigsaw of causative factors for mood difficulties, but for some it will be a significance piece.

Interestingly, there is some suggestion that the intensity of the intervention had little effect on measures of depression. The intensive treatment of 145 hours utilised in Lerner (2011) over a period of 6 weeks did not have any significant effect on depression levels. However, significant reductions in levels of depression were observed for interventions that lasted between 14 and 20 weeks with a far lower treatment time of 21 and 30 hours respectively.

Nonetheless, it is important to note that due to the confounding factors of pre-existing depression and anxiety levels, range of delivery style and varying levels of training for program facilitators, it is difficult to be definitive about whether intensity really does have little effect. It is possible that longer and less intense interventions allow participants more time to develop and generalise their skills and thus exert an effect on mood. This finding is in accordance with Bellini (2004) who states that learning and practicing social skills over time could create a heightened sense of confidence and security within social situations for individuals with autism. However, for anxiety levels, no apparent link was observed between intervention intensity and outcome. Increasing the length of an intervention, but not necessarily increasing the number of hours, is a consideration future research could investigate.

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The majority of the studies incorporated participants in middle adolescence, with Plienis (1987) including the only participant above 18 years. Beaumont (2015) and Solomon (2004) included participants under the age of 10 years. Due to the heterogeneity in age and the varying results with regards to the effectiveness of the different interventions, it is not possible at this stage to infer at what age interventions are most beneficial. It is also in question whether observed changes in mood are the direct result of the exposure to social skills interventions or whether they are the actual result of improved social skills. By understanding the underlying mechanisms of change, therapists could further enhance the way they treat mood disorders in the future.

It seems that parent psychoeducation may play an important role in determining the effectiveness of social skills interventions, and, with the exception of Laugeson (2014), all studies that utilised parent psychoeducation found significant reductions in depression or anxiety levels. It is possible that the presence of 'homework' also aids the generalisation of skills. Where follow-up data is available, improvements were maintained. This suggests the potential efficacy for social skills interventions to continue influencing mood by providing children and young people with autism enduring skills to assist them in anxiety-provoking situations.

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Reducing levels of either anxiety or depression was not the focus of any of the interventions utilised in the studies. Therefore the outcome that these interventions can have an indirect positive influence on depression and anxiety levels is of interest. This positive by-product highlights the potential for developing social skills interventions and adapting the skills to include specific traits that are associated with factors known to protect against the vulnerability of developing depression and anxiety in later life. Skills that specifically teach

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children and young people with ASD how to cope with social anxiety could be an important addition to these interventions in future research.

Although studies were conducted across several countries, participants involved in the studies were from diverse cultures, ranging from Australia to South Korea and the USA. Results of the review are also limited to individuals with autism without intellectual disability. Research consistently states that these individuals are at a greater risk of depression and anxiety (Mayes *et al*. 2010), although it is important to recognise that the presentation of depression and anxiety may be different depending on level of intellectual functioning.

Due to the sparsity of research in this area, studies with different designs, of varying quality, a range of intervention delivery formats and participant ages were included in an attempt to capture the entirety of available literature. However, this brings with it methodological concerns regarding the wide variety of measures utilised within the studies for assessing depression and anxiety levels. Also there is the implication of whether depression and anxiety scales are as reliable for use in individuals with autism as they are for typically developing individuals (Magnuson & Constantino, 2011). As research in this area progresses, future reviews should be able to incorporate studies that use similar interventions and consistent measures of assessment that take into account traits of ASD. Furthermore, this study focused upon individuals without intellectual disabilities. Consideration of the effects of social skills training on mood for those with ASD and intellectual disabilities would be worthwhile examining.

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5. Conclusion

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The conclusions that can be drawn from the review are limited due to the lack of available research. However, this review gives some weight to the suggestion that social skills interventions are an effective method of improving mood in children and young people with autism, both for individuals with and without clinical levels of depression and anxiety. Although speculative, it might be possible to mitigate the future development of clinical depression and anxiety by offering social skills interventions to children and young people with autism.

Acknowledgements

Ms Yuqing Yang provided the independent ratings of study quality used in this review.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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Vickerstaff, S., Heriot, S., Wong, M., Lopes, A. & Dossetor, D. (2007). Intellectual ability, self-perceived social competence, and depressive symptomatology in children with high-functioning autistic spectrum disorders. *Journal of Autism Developmental Disorders, 37*(9), 1647–1664.

White, S. W., Keonig, K. & Scahill, L. (2007). Social skills development in children with autism spectrum disorders: a review of the intervention research. *Journal of Autism and Developmental Disorders, 37* (1858-1868).

* Yoo, H., Bahn, G., Chi, I., Kim, E., Kim, J., Min, J. et al. (2014). A randomized controlled trial of the Korean version of the PEERS® parent-assisted social skills training program for teens with ASD. *Autism Research, 7*, 145-161.

*** Included studies**

Figure 1. Article Identification Process

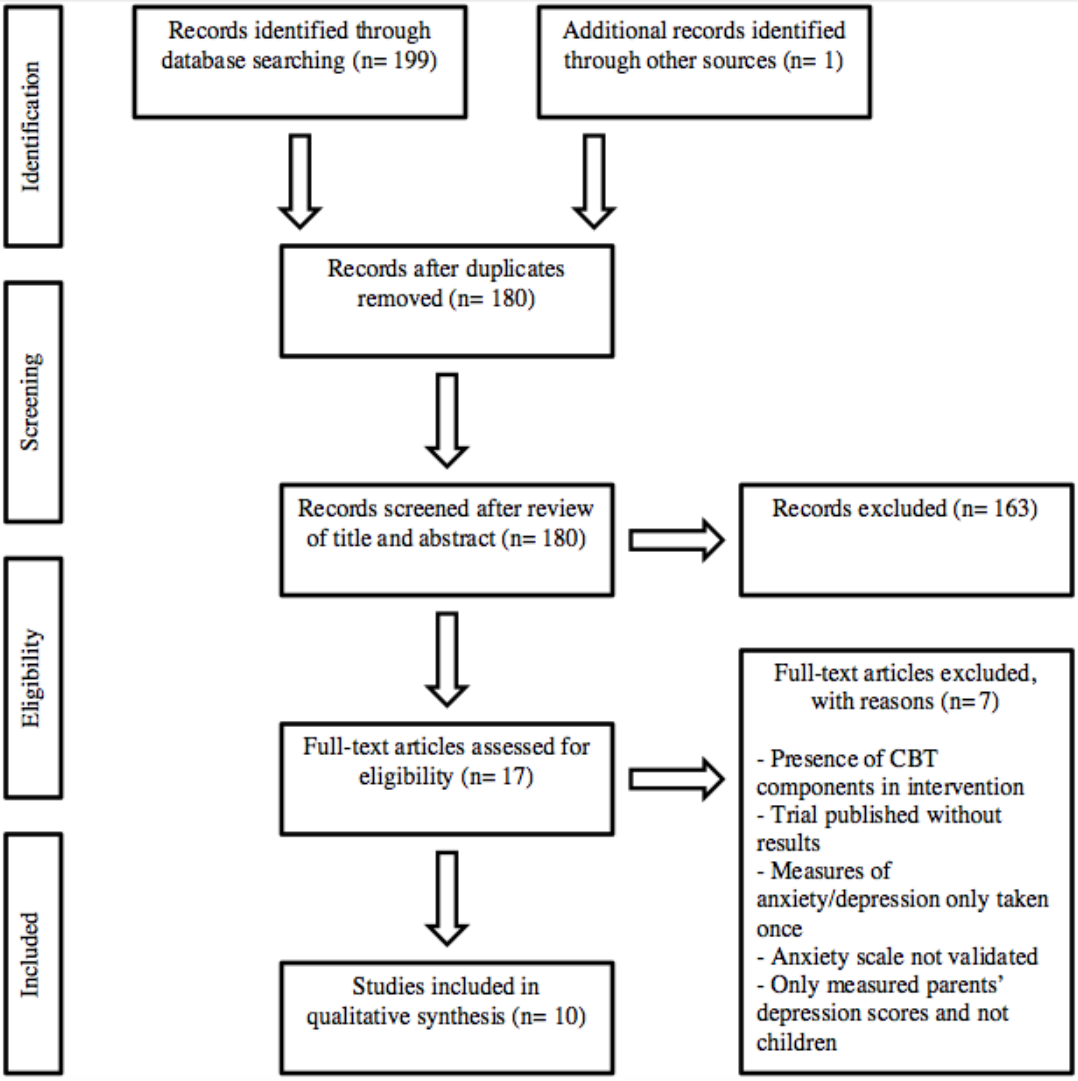

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Table 1. Quality Assessment Tool

Factor	Weighting		
	2	**1**	**0**
Research Question	Clearly defined with depression or anxiety addressed	Clearly defined but no depression or anxiety addressed	No clear question and no clear aims
Inclusion/Exclusion criteria	Inclusion/Exclusion criteria are fully stated	Inclusion/Exclusion are partially stated	Unclear or not stated
Sampling methods	Sampling not limited to clinics	Convenience sampling from clinics or volunteer sample	Unclear or not stated
Randomisation	Clear evidence of randomisation	No randomisation but explanation for this	No randomisation
Control group	Control group present and no differences between groups at baseline	Control group present with differences between groups accounted for	No control group
Participant characteristics	Full details on age, gender and IQ, ASD diagnosis, no. of participants in group	Partial details on age, gender, IQ	Unclear participant characteristics
Validated outcomes measures	Validated depression or anxiety measures for appropriate age group and with ASD	Validated depression or anxiety measures for age group but not ASD	N/A – All studies must include validated measures
Definition of social skills	Clear definition stated with examples	Definition stated but lacking detail	No specific definitions mentioned
Blind treatment assessment	Double blind – participant and assessor	Single blind – participant or assessor	No blinding
Missing data	Frequency stated and method of accommodating for missing data clearly explained	Missing data acknowledged but unclear if this was accounted for	Unclear or not stated
Quality of program facilitator	Details of who the facilitators were, and whether training had been provided	Details on facilitators but no mention of prior training	Unclear or not stated
Follow up	Presence of follow up > 6 months after intervention has ended	Follow up <6 month after intervention has ended	No follow up

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Table 2. Excluded Studies

Reference	Reason for Exclusion
Freitag *et al*. (2013) - The group-based social skills training SOSTA-FRA in children and adolescents with high functioning autism spectrum disorder – study protocol of the randomised, multi-centre controlled SOSTA – net trial.	Study protocol only hence no results. A request to the lead author for information regarding outcome has been made, but no response has been received.
White *et al*. (2013) - Randomized controlled trial: Multimodal anxiety and social skill intervention for adolescents with autism spectrum disorders.	Elements of CBT were used within the intervention.
Ichikawa et al (2013) - TEACCH-based group social skills training for children with high-functioning autism: a pilot randomized controlled trial.	Depression measure used related to parents' mood, rather than child's.
D'Elia *et al*. (2013) - A longitudinal study of the TEACCH Program in different settings: the benefits of low intensity intervention in preschool children with autism spectrum disorder.	Not a focused social skills intervention.
Cotugno (2009) - Social competence and social skills training and intervention for children with autism spectrum disorders.	Anxiety scale used was not a validated measure.
Provencal (2003) – The efficacy of a social skills training program for adolescents with autism spectrum disorders.	Elements of CBT were used within the intervention.
Hillier *et al*. (2011) - Social and vocational skills training reduces self-reported anxiety and depression among young adults on the autism spectrum.	Included participants above 25 years of age.

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Table 3. Study Quality Rating

		Quality Criteria												
Design	**Study**	**Research Question**	**Inclusion /Exclusion Criteria**	**Sampling Methods**	**Randomisation**	**Control Group**	**Participant Characteristics**	**Validated Outcome Measures**	**Definition Of Social Skills**	**Blind Treatment Assessment**	**Missing Data**	**Quality of Program Facilitator**	**Follow Up**	**Total out of 24**
RCT	Solomon (2004)	2	2	1	2	0	2	1	2	0	1	2	0	15
	Schohl (2014)	2	2	2	2	2	2	1	2	1	2	2	0	20
	Yoo (2014)	2	2	1	2	2	2	1	2	1	1	2	1	19
	Kuehnel (2013)	2	2	2	2	0	2	1	2	0	1	N/A	0	14/22
	Lerner (2011)	2	2	1	1	1	2	2	2	1	2	2	1	19
Non-RCT	Laugeson (2014)	1	2	1	1	2	2	1	2	0	1	2	0	15
	Beaumont (2015)	1	2	2	0	1	2	1	1	1	2	2	1	16
	Tse (2007)	1	1	1	0	0	1	2	2	1	2	2	1	16
Non-comparative Study	Pliennis (1987)	1	0	1	0	0	2	1	2	0	N/A	1	1	9/22
	Loudon (2008)	2	0	1	0	0	2	1	2	0	N/A	0	0	8/22

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Table 4. Study Details

Study	Country	Setting	Measures	Intervention Detail	Intervention Frequency and Duration	Design	Participant Demographics	Control Condition	Results	Follow Up
[1] Solomon et al (2004)	USA	Clinic based	The Children's Depression Inventory (Kovacs, 1992).	The Social Adjustment Enhancement Curriculum: Skills targeted: emotion recognition, conversation skills, perspective taking. Games and discussions to practice skills, homework. Psychoeducation for parents	20 group based weekly sessions lasting 90 minutes each 30 hours over 20 weeks	RCT	18 participants with autism. 1st group aged 8-10 years, 2nd group 10-12 years No clinical levels of depression IQ > 75	Wait list control group N/A for depression as data was not complete	Significant reduction in depression scores for the older, less cognitively able participants compared to the younger more able group ($p<0.05$, $d=0.6$).	No
[2] Lerner et al (2011)	USA	Clinic based	Beck Depression Inventory – Youth; (Beck *et al*. 2001)	Socio-Dramatic Affective-Relational Intervention – Skills targeted: working together, body language, tone of voice, perspective taking, improvisation, non-verbal interaction	29 group-based sessions of 5 hours per day over six weeks 145 total hours	Non-Randomised Controlled Trial	17 participants with autism and no intellectual disability 11-17 years, mean age 14±1.5 Comorbid disorders assessed but prevalence rates within groups not stated.	8 matched control participants Unclear explanation of active/inactive treatment.	No significant changes in depression scores were found after the intervention or at follow up measures.	6 weeks post treatment

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Study	Country	Setting	Measures	Intervention Detail	Intervention Frequency and Duration	Design	Participant Demographics	Control Condition	Results	Follow Up
[3] Schohl et al (2014)	USA	Clinic based	Social Interaction Anxiety Scale (Mattick & Clarke, 1998)	The PEERS® Curriculum for School-Based Professionals Skills taught: Conversation, humour, handling disagreements, choosing appropriate friends. Homework, Parent psychoeducation.	14 weekly sessions lasting 90 minutes 21 total hours	RCT	58 participants with autism aged 11–16 – mean age 13.65 ± 1.50. IQ>70. No suggestion that any participants had clinical levels of social anxiety.	Wait-list control group - 29 participants	Social anxiety significantly reduced between intervention and control group (p=0.01 d=0.2).	No
[4] Laugeson et al (2014)	USA	Classroom based	Social Anxiety Scale (La Greca & Lopez, 1998)	The PEERS® Curriculum for School-Based Professionals – see description in Schohl above Super Skills (Coucouvanis, 2005) similar to peers – but no parent psycho-education.	Daily 30-minute lessons, delivered 5 days a week over the course of 14 weeks 35 hours over 14 weeks	Non-Randomised Controlled Trial	73 participants with autism, 12-14 mean age 13 ± 0.7 and without intellectual disability. Comorbid diagnosis of anxiety/depression not stated.	33 active treatment control participants in Super Skills intervention.	Trend towards significant anxiety reduction for PEERS intervention group compared to active treatment control (p<0.06, d=0.95).	No

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Study	Country	Setting	Measures	Intervention Detail	Intervention Frequency and Duration	Design	Participant Demographics	Control Condition	Results	Follow Up
[5] Yoo et al (2014)	South Korea	Clinic based	Child Depression Inventory (Kovacs, 1985) AND State and Trait Anxiety Inventory for Children (Spielberger, 1972)	Korean Version of PEERS® Treatment Manual. Skills taught: conversation, electronic communication appropriate use of humour, good sportsmanship, embarrassing conflict management Homework and parent psychoeducation	90 minute weekly sessions for 14 weeks 21 hours over 14 weeks	RCT	47 participants with autism - 12-18 years mean age 14.04 ± 1.64 IQ ≥ 65. No clinical levels of depression or anxiety reported	Wait list control group – 27 matched participants	Depression scores significantly reduced: (p=0.01, d=0.5) and maintained at follow up Anxiety did not significantly reduce.	3 month post treatment
[6] Beaumont et al (2015)	Australia	Classroom based	The Spence Children's Anxiety Scale—Parent Version, (Spence, 1998)	Secret Agent Society - Skills taught: Condition 1: structured multi-level computer game teaching recognition of emotions, conversation, bullying. Condition 2: unstructured- use game "as see fit" and no training for facilitators	90-minute (or twenty 45-minute) group sessions for 10 weeks 15 hours over 10 weeks	Non-Randomised Controlled Trial	69 children with autism aged 7-12 years and IQ ≥79 46% of participants had comorbid diagnosis: 18% anxiety and 5% depression. Other comorbid conditions included ADHD, ODD and sensory processing disorder	No inactive control group – two conditions of the same intervention; structured and unstructured	Anxiety significantly reduced in structured intervention (p<0.001, d=0.3) and were maintained at follow up. No significant reduction in anxiety for unstructured condition.	6 week post treatment

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Study	Country	Setting	Measures	Intervention Detail	Intervention Frequency and Duration	Design	Participant Demographics	Control Condition	Results	Follow Up
[7] Pliens (1987)	USA	Classroom based	Child Depression Inventory – self report (Kovacs, 1983)	Non-manualised small group training - skills taught: conversational skills, problems solving, role play, performance feedback, group discussions	22 group treatment sessions, lasting 45 minutes each twice weekly 33 hours over 11 weeks	Non-comparative Study	19-year-old female, clinically depressed (2 additional participants not analysed as no ASD diagnosis).	No control group	Depression scores declined to within normal range. Effects maintained at follow up. Descriptive statistics not available.	6 week post treatment
[8] Tse (2007)	Canada	Clinic based	Nisonger Child Behavior Rating Form (Aman *et al*. 1996)	Non-manualised intervention –Skills taught: expression of feelings, non-verbal communication, Conversation skills , Negotiating, Teasing, bullying hygiene, dining, dating etiquette	12 weekly sessions lasting 90 minutes each 18 hours over 12 weeks	Non-comparative Study	46 participants, with autism 13-18 mean age 14.6 ± 1.7 IQ not formally measured – if participants could verbalise their desired gains then they took part. 37% of participants taking psychotropic medicine.	No control group	Anxious and insecure behaviour decreased significantly over intervention (p=0.04, d=0.42).	No

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Study	Country	Setting	Measures	Intervention Detail	Intervention Frequency and Duration	Design	Participant Demographics	Control Condition	Results	Follow Up
[9] Kuehnel (2013)	USA	Online	Reynolds Adolescent Depression Scale, Second Edition; (Reynolds, 2002) Revised Children's Manifest Anxiety Scale, Second Edition (Reynolds & Richmond, 2008)	Video modelling program developed from PEERS® Skills taught: Conversation, skills, arranging get-togethers, handling disagreements, teasing and embarrassing feedback asking for help	30-180 second videos modeling each skill, 15-30 minute weekly sessions. Running for 8 weeks 3 hours over 8 weeks	RCT	50 participants with autism aged 9-12 years. No formal IQ taken but participants had no intellectual disability "Additional diagnosis" was noted for 42 participants but no further information was given.	Wait-list control group	No significant reductions for measures of anxiety or depression after intervention.	No
[10] Loudon (2008)	USA	Classroom based	Multidimensional Anxiety Scale for Children (March, 1999)	Non-manualised – skills taught: 1. social skills groups – conversation skills 2.video-self modelling (role play) 3.social narratives (social stories)	20 minutes sessions every day for 11 weeks	Non-compara-tive Study	3 participants, mean age 11.5 with Asperger's, 2 participants had comorbid diagnoses of ADHD and Tourette's syndrome. IQ within normal range	No control group	Results not interpretable in current state	1 month follow up but data not available for anxiety

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