

The Efficacy of Joint Attention Interventions on Play Skills
in Children with Autism Spectrum Disorder:
A Systematic Review

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Abstract

Purpose: The aim of this study is to determine if joint attention interventions have an effect on general play skills in individuals with Autism Spectrum Disorder (ASD) aged birth to five years.

Method: The reviewers examined various databases and selected research based on predetermined inclusion/exclusion criteria. This included peer-reviewed research articles that assessed children with a formal diagnosis of ASD between the ages of birth to five years, examined joint attention interventions, included outcome measures related to play, and were published after the year 2000. The articles reviewed consisted of 581 participants. Research designs included primarily pre-post randomized clinical trials, one single subject multiple baseline design, and one case study design.

Results: The collective results suggest that joint attention interventions may be effective in increasing play skills in children with ASD. While some studies report no change to either functional or symbolic play skills, other studies report improvements in only one type. No study reports a decrease in play skills.

Conclusion: While there is evidence that joint attention interventions may improve play skills in children with ASD, overall, the results of this systematic review are inconclusive. Future research will help to clarify if joint attention interventions have a measurable impact on either symbolic or functional play skill development.

Introduction

Children with Autism Spectrum Disorder (ASD) often present with significant social communication deficits. Many of these deficits may be due to their difficulty learning early social communicative acts, such as joint attention and symbolic play, at typical ages. These early acts form the foundation of future social communication development and are key to the understanding of others as separate entities. Additionally, these early skills are thought to help form the foundation of representational thought (Sigman et al., 1999; Ungerer, Zelazo, Kearsley, & O'Leary, 1981; Van Berckelaer-Onnes, 2003).

While prevalence of ASD varies across sources, the Center for Disease Control and Prevention (CDC) (2015) currently estimates that 1 in 68 children across the United States are diagnosed with Autism Spectrum Disorder (ASD). The World Health Organization (WHO) (2017) estimates that globally 1 in 160 children are diagnosed with ASD, although they state well-controlled studies imply the prevalence is higher than reported in some parts of the world. The CDC (2015) and the WHO (2017) state that there is no conclusive evidence regarding the cause of ASD, although it is thought that a mix of genetic, neurobiological, and environmental factors can all cause ASD (ASHA, n.d.).

Diagnosis of ASD can reliably occur as young as 2 (ASHA, n.d.; CDC, 2015). Early signs of ASD include limited eye gaze or contact, lack of response to own name, and lack of pointing or showing objects of interest. These are all prerequisites to a child's development of social communication. In recent years, research has focused on two social communicative deficits in children with ASD, joint attention and play (Kasari, Gulsrud, Freeman, Paparella, & Helleman, 2012; Toth, Munson, Meltzoff, & Dawson, 2006; Warreyn, Van der Paelt, & Roeyers, 2014).

Joint attention can be defined as the coordination of attention between a person and a communication partner. The ability of joint attention can often be divided into two acts: (1) passive or supported joint attention and (2) active or coordinated joint attention (Warreyn et al., 2014; White et al., 2011). Passive or supported joint attention appears to develop as the child follows the gaze of their communication partner. Active or coordinated joint attention involves the child initiating the act of joint attention with their communication partner towards an object. This usually involves pointing, gesturing or even vocalizations (Warreyn et al., 2014; White et al., 2011). Children with ASD demonstrate a marked impairment in both forms of joint attention. However, research has suggested that “the presence of joint attention in children with ASD is associated with a less severe symptomatology, better language abilities, and better social competence in interaction with their peers” (Warreyn et al., 2014, p. 713). Warreyn et al. (2014) suggest that improving joint attention skills in children with ASD may have subsequent positive outcomes on language and social interactions.

Play, another early social skill generally impaired in children with ASD, is often discussed as having different forms or types. Functional play involves repetitive actions such as pressing buttons, opening doors, and placing things in or out of containers. Functional play is an integral part of world-exploration and facilitates means-ends understanding. Another form of play, symbolic play, is the type of play that involves either pretending an object, such as a banana, represents another object, such as a phone, or play in which a child attributes feelings and motives to other toys or persons, such as feeding a hungry baby doll. Piaget lists symbolic play as one of the final developmental characteristics of the sensorimotor stage of cognitive development.

Piaget notes that functional play types, such as realizing objects can cause actions, develops prior to symbolic play. Sigman et al. (1999) state that functional and symbolic play development in typically developing children is correlated with more complex language development. Their study found, “[t]he number of functional and symbolic play acts used by the children with autism when they were between 3 and 5 years old predicted social engagement in the mid-school years,” (p. 95). This implies that symbolic and functional play skills at an early age have positive improvements on social development and engagement, especially in regards to peer-to-peer interactions.

Current literature demonstrates that there is a connection between the early social-communicative abilities of joint attention and play and other developmental domains, such as language and social interaction. As discussed by Toth et al. (2006), “early abilities involved in social exchange and communication, namely, joint attention and immediate imitation, appear to be important for setting the stage for early language learning in autism, while representational skills, demonstrated through toy play and deferred imitation, contribute to the continued expansion of language and communication skills over the preschool and early school age years” (p. 1002). This suggests that targeting these “pivotal skills” during early intervention may support future social communication and language (Warreyn et al., 2014).

Early intervention, as demonstrated in current literature, improves long-term outcomes for children with ASD (ASHA, n.d.; CDC, 2015; WHO, 2017). Warreyn et al. (2014) also discuss the benefits of early intervention stating, “It is important that intervention starts as early as possible after diagnosis is made as there is growing evidence that early intervention leads to a better prognosis” (p. 712). One of the common early intervention strategies used with young children with ASD is joint attention intervention. There are multiple intervention strategies that

fall under this heading including Joint Attention, Symbolic Play, Engagement and Regulation (JASPER) as well as other interventions that combine components of discrete trial training (DTT) and pivotal response training (PRT). A systematic review conducted by Murza, Schwartz, Hahs-Vaughn & Nye (2017) indicates that there “were positive and significant yielding moderate effects” in the development of joint attention skills in children with ASD after receiving joint attention interventions. While joint attention interventions have been shown to improve joint attention skills in young children with ASD, no current systematic review has assessed if joint attention interventions have a secondary effect on the non-targeted skill area of play. Thus, it is the objective of this systematic review to determine if early joint attention interventions have any positive effect on play skills in children with ASD aged birth to five years.

Methods

Search Strategy

The researchers conducted searches within CINAHL, ERIC, PSYCinfo, LLBA, ComDisDom, and OVID Medline databases from January to March 2018. Each researcher examined two of these databases. Search phrases were developed with the assistance of a university librarian skilled in conducting database research. These included terms joint attention training, joint attention intervention, “Joint Attention, Symbolic Play, Engagement and Regulation” (JASPER), autism*, ASD, and play. A complete summary of our search strategy can be seen in Table 1. Articles were initially limited to those published in English within the last 10 years. When less than 10 articles were found with the agreed upon inclusion and exclusion criteria, the date range was increased from January 2000 to December 2017.

Each researcher reviewed the abstracts in their databases to determine if they warranted further review. Those articles selected for full text review were assessed by two researchers for

eligibility, based on the inclusion and exclusion criteria defined below. If consent could not be reached between the two primary reviewers, the third researcher would also critically assess an article. The PRISMA 2009 Flow Diagram, Figure 1, shows the number of abstracts screened, the number of duplicates identified, the number of full text articles assessed for eligibility, and the number of articles excluded.

Study Selection – Inclusion and Exclusion Criteria

A study was determined eligible for inclusion in this review if it was comprised of children between the ages of birth to five years with a formal diagnosis of Autism Spectrum Disorder. Studies were included regardless of if the children had received previous therapy, were currently receiving additional therapy, or had comorbid diagnoses. The inclusion and exclusion criteria of this study can be seen in Table 2.

Validity Assessment and Critical Appraisal

After full text review, studies were critically appraised by the original researcher. The critical appraisal for all studies assessed the quality level of evidence and research design. This included examination of the following: design type, blinding, reported randomization, intensity and duration of interventions, comparison of group characteristics, definitions of play, outcome measurements, reliability, validity, fidelity, biases and limitations, statistical significance, and general study conclusions. Table 3 shows the criteria of quality of evidence that each article received based on the critical appraisal process. The criteria for this can be seen in Appendix A.

Results

A total of 465 studies were identified through six databases and manual searches as potential sources to be included in this systematic review. One hundred and sixty-nine of these studies were duplicates for which 296 studies remained to be briefly screened for their title and

abstract. As seen in Figure 1, 269 studies were excluded for not meeting the criteria of assessing the effectiveness of joint attention interventions or not assessing play skills. After considering the remaining 27 studies, 11 met the inclusionary criteria. Of those that did not meet the inclusionary criteria, ten were excluded because they did not report on play skills, three did not report on play skills in regard to joint attention intervention, two examined children over the age of 5-years old, and one examined populations other than those with ASD.

Four of the 11 studies examined a joint attention intervention to a control group (either waitlist or treatment as usual). One study examined joint attention intervention over time in one group of children. Five studies assessed either joint attention to a comparison education group or a combination of comparisons such as joint attention versus symbolic play versus control group. Lastly, one study was a case report comparing each child to himself pre- and post- treatment. An in-depth description of each study reviewed can be found in Table 4.

Joint Attention Intervention

A case report, structured as a pretest-posttest design, was used to assess the effectiveness of a joint attention intervention and symbolic play intervention on joint attention, play and language skill areas (Kasari, Freeman, & Paparella, 2001). In this study there were no statistics reported, but visual analysis indicated gains in language and the skill areas targeted by treatment but not in the non-targeted skill areas of play or joint attention (Kasari et al., 2001). This study has a moderate level of quality evidence. It also has many limitations such as a small sample size, minimal characteristics of the children before treatment, a short intervention period, and no statistical analysis (Kasari et al., 2001). These limitations negatively impact the ability to generalize these results to a larger population and indicates that is the potential for bias to be present in the results.

Joint Attention Intervention to Baseline

A single-subject, multiple baseline design was used to assess the effectiveness of a joint attention intervention on play skills which incorporated elements of discrete trial training (DTT) and pivotal response training (PRT) (Whalen, Schreibman & Ingersoll, 2006). Although this study demonstrated a moderate level of quality evidence, positive changes in both symbolic and functional play acts were observed with two of the four children demonstrating a similar percentage of play acts to typically developing peers. No change in rate of symbolic or functional play acts were found (Whalen et al., 2006).

Compared to the other studies included in this review, this study presents many limitations. The design of the study, single-subject design, identifies this article has having a moderate level of quality evidence. In addition, multiple biases may impact the overall reliability and validity of the results. These biases include selection bias due to the small number of participants who were all recruited from UCSD Autism Research Lab or from a referral from previous research, and observer bias due to a lack of blinding throughout the study.

Joint Attention Intervention Versus Control Group

Many of the studies involved a comparison of a joint attention intervention to a control group. The authors of this systematic review defined a control group as children who either received no additional intervention (i.e. treatment as usual), who received intervention after a designated amount of time (i.e. waitlist), or who received both. These studies varied with regards to how the effect of joint attention intervention on play skills was examined. Some of the studies assessed the time spent exhibiting certain types of play acts ($n = 1$) while others examined the number of play acts observed ($n = 3$). All four studies showed greater improvement in play skills for children in the treatment group as compared to those in the control group (Chang, Shire,

Shih, Gelfand, & Kasari, 2016; Goods, Ishijima, Chang, & Kasari, 2013; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; and Shire et al., 2017). Of these four studies, three found an increase in types of functional play acts with limited to no change in symbolic play acts (Chang et al., 2016; Kasari et al., 2010; and Shire et al., 2017). Furthermore, Chang et al. (2016) and Shire et al. (2017) observed that an increase in higher level, functional play acts, created a decrease in simple play skills. The study conducted by Goods et al. (2013) did not examine the effect of joint attention intervention on specific types of play acts, but rather, measured the difference in diversity of play (i.e. combination of unique spontaneous and functional play acts). The results were consistent with the findings of the other studies in which the treatment group demonstrated a greater increase in play types compared to the control group.

All of the studies (Chang et al., 2016; Goods et al., 2013; Kasari et al., 2010; Shire et al., 2017) were considered randomized clinical trials suggesting a high level of evidence for all sources. Furthermore, Kasari et al. (2010) and Shire et al. (2017) both demonstrated a moderate to high level of fidelity as well as high reliabilities on all outcome measures. In regard to the limitations of these studies, Chang et al. (2016) and Goods et al. (2013) both demonstrated to have small sample sizes, which could cause sample biases. A limitation found in all of the studies (Chang et al., 2016; Goods et al., 2013; Kasari et al., 2010; Shire et al., 2017) was the short duration of the interventions which generally lasted no longer than three to four months. Chang et al. (2016) reported another limitation of their study was the need for more supports to assist teachers with continuing implementation of the joint attention intervention (JASPER). Shire et al. (2017) reported a lack of fidelity checks of the on-site JASPER supervisor to ensure proper implementation, which may be another drawback of their study. Furthermore, it should be noted that 85% of the participants in the study conducted by Shire et al. (2017) had either a

formal diagnosis of PDD-NOS or Autism. The results of this study may have been impacted by 15% of the population being formally diagnosed with a condition other than ASD.

Joint Attention Intervention Versus Symbolic Play Versus Control Group

Three studies compared joint attention intervention versus symbolic play versus control group. Two of the studies compared joint attention intervention, symbolic play intervention and a waitlist group to determine their effects on play skills (Kasari, Freeman, & Paparella, 2006; Kasari, Paparella, Freeman, & Jahromi, 2008). Although increases in symbolic and functional play were observed, the joint attention intervention had no significant improvement compared to the other intervention in increasing play skills or types (Kasari et al., 2006). Kasari et al. (2008) demonstrate a significant increase in symbolic play skills as compared to the control group during the mother-child interaction.

Both studies were randomized clinical trials (RCT) with relatively small sample sizes. Although the sample sizes were smaller than desired, the design of the study (RCT) suggests a high level of quality evidence. A limitation of both studies involves the selection of participants from the same early intervention program or the same geographical area increasing the likelihood of selection bias. Kasari et al. (2008) also reported 5 drop-outs during the course of the study suggesting possible attrition bias.

The third study by Wong (2013) combined symbolic play and joint attention interventions, in which groups received one intervention followed by another. The three groups in this study included symbolic play then joint attention (SP-JA), joint attention then symbolic play (JA-SP), and a waitlist group. Results showed no significant differences between the three intervention conditions for play skills with research staff. However, there was a significant increase in symbolic play skills in the classroom for each group.

A major strength of this study was the study design (RCT) and a multilevel analysis. In addition, this study showed positive findings for the use of an intervention in the classroom setting compared to the other interventions conducted in the home or clinical environment (Kasari et al., 2006; 2008) which may be due to the high level of fidelity. A notable downfall of this study was the small sample size ($n = 33$) and the short-term nature of the joint attention intervention. Additionally, as no statistically significant change to play skills was seen at the mid-intervention assessment, it is unclear if play skills were impacted solely by the joint attention intervention administered.

Joint Attention Intervention Versus Parent or Caregiver Education

Two additional studies included in this systematic review compared joint attention intervention to caregiver or parent education (Kasari et al., 2014; Kasari, Gulsrud, Paparella, Helleman, & Berry, 2015). One of the studies examined the effect of similar joint attention interventions when administered directly by caregiver with researcher support as opposed to researchers providing education about intervention to caregivers (Kasari et al., 2014). The joint attention intervention use in this study was based on the JASPER protocol. Results from Kasari et al. (2014) indicated the caregiver-mediated, joint attention intervention had significant improvements in symbolic play with no improvements in functional play when compared to the caregiver education intervention model (Kasari et al., 2014).

In contrast, the other study compared parent-mediated JASPER intervention and a manualized psychoeducational intervention (PEI) (Kasari et al., 2015). This study found significant improvements in types of functional play acts as well as increases in the highest level of play achieved for the treatment (i.e. JASPER condition) compared to the PEI condition (Kasari et al., 2015). No change in symbolic play for either group was observed.

In assessing the strengths and limitations of these studies, both represent high levels of evidence due to their large sample sizes (i.e. 80-100+) and the nature of randomized clinical trials. A setback for Kasari et al. (2014) was the high percentage of attrition present (35%). In the study by Kasari et al. (2015), significant differences between the two treatment groups in age were noted which can impact the study's overall generalizability due to sample bias. A limitation for both studies involves the short-term nature of the joint attention interventions ranging from two to three months in length. It may be argued that providing the intervention for a longer period of time can result in more desirable outcomes. Also, both parent-mediated models involved JASPER, which has symbolic play as a targeted skill for the intervention. This results in the inability to assess if the joint attention tasks alone have an impact on play skills.

Discussion

The results of the studies analyzed imply mixed results regarding the efficacy of joint attention interventions on both symbolic and functional play skills. The studies that compared joint attention interventions to control groups suggested an overall increase in functional play skills, with limited to no changes noted in symbolic play skills. Those studies that compared joint attention interventions to interventions targeting symbolic play skills specifically indicated that joint attention intervention is less effective at improving symbolic play skills in children with ASD.

The most variable results were found in those studies that compared joint attention interventions to caregiver mediated or caregiver education approaches. The two studies that included caregiver-mediated JASPER demonstrates contradictory results. One article noted an increase in just symbolic play (Kasari et al., 2014) which the other noted an increase in just functional play (Kasari et al., 2015).

Of the seven studies that resulted in a significant improvement in either functional or symbolic play skills, five used the JASPER intervention in one or more conditions. These results should be interpreted with caution as JASPER does target symbolic play separately from joint attention. Additionally, all of these studies varied in whether JASPER improved functional play, symbolic play, or both.

One key limitation of this review, and the research conducted on this topic, is the relatively small sample sizes found within seven of the nine randomized clinical trials. This makes the generalizability of the results questionable and leads to an increase in potential sample biases. Another limitation is the lack of attrition analysis reported and its potential impact on the results of these studies. Additionally, selection bias was present in most studies as subjects were often identified through the same facility for each research group. This review was also limited by the inability to assess a single joint attention intervention as there is not a sufficient evidence base regarding the efficacy of any one of these approaches.

Future research may aim to improve the current limitations of this systematic review. Using larger sample sizes as well as including children from other facilities or geographical locations will assist in increasing the generalizability of each intervention. Furthermore, future research could benefit by analyzing the benefits of one intervention approach over another (e.g., JA intervention vs. symbolic play intervention).

Conclusion

While there is evidence that joint attention interventions may improve play skills in children with ASD, overall, the results of this systematic review are inconclusive. Future research will clarify if joint attention interventions have a measurable impact on either symbolic

or functional play skill development. Future research will also demonstrate which types of joint attention intervention are most effective at secondarily improving play skills.

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TABLES/FIGURES

Table 1: List of Search Terms

Databases	Search Phrase
CINAHL	("joint attention" AND (training OR intervention)AND play AND (autis* OR ASD)) OR ((JASPER OR "joint attention symbolic play engagement and regulation") AND play AND (autis* OR ASD))
ComDisDom	("joint attention" AND (training OR intervention)AND play AND (autis* OR ASD)) OR ((JASPER OR "joint attention symbolic play engagement and regulation") AND play AND (autis* OR ASD))
LLBA	(((("joint attention" OR MAINSUBJECT("Joint Attention")) AND (training OR intervention)) AND (("Autism Spectrum Disorder" OR Autis* OR ASD OR Asperger*) OR (MAINSUBJECT("Autism") OR MAINSUBJECT("Asperger Syndrome")) AND (MAINSUBJECT("Playing") OR play)) OR (((("Autism Sprecum Disorder" OR Austis* OR ASD OR Asperger*) OR (MAINSUBJECT("AUTISM") OR MAINSUBJECT("Asperger Syndrome")))) AND (JASPER OR "joint attention symbolic play engagement and regulation"))
Ovid MedLine	(((joint attention.mp. and training.mp.) or (joint attention.mp. and intervention.mp.)) and (exp Autism Spectrum Disorder/ or autis*.mp. or ASD.mp.) and ("Play and Playthings"/ or play.mp.)) or ((JASPER.mp. or joint attention symbolic play engagement.mp.) and (exp Austism Spectrum Disorder/ or autis*.mp. or ASD.mp.) and ("Play and Playthings"/ or play.mp.))
ERIC	(((("joint attention" AND (training OR intervention)) AND play AND (MAINSUBJECT("Autism") OR ASD OR autis*)) OR ("joint attention symbolic play engagement and regulation" OR JASPER) AND (MAINSUBJECT("Autism") OR ASD OR autis*))
PsycINFO	(((("joint attention" AND (training OR intervention)) AND play AND (MAINSUBJECT("Autism") OR ASD OR autis*)) OR ("joint attention symbolic play engagement and regulation" OR JASPER) AND (MAINSUBJECT("Autism") OR ASD OR autis*))

Table 2: Inclusion/Exclusion Criteria

Inclusion Criteria			
Population	Intervention and Comparison	Outcome	Study Type
Preschool age (ages 0-5)	Joint attention interventions (all types)	Varied play skills (increase or decrease)	Quantitative
Formal diagnosis of ASD			Written In English
Individuals with and without previous therapy			Published since January 1, 2000 (Original criteria: Published within last 11 years)
Individuals with or without additional diagnoses			Peer-reviewed
Exclusion Criteria			
Population	Intervention and Comparison	Outcome	Study Type
Ages over 5			Qualitative
Individuals without a formal diagnosis of ASD			In languages that are not English
			Published prior to January 1, 2000 (Original Criteria: Published prior to January 1, 2006)
			Not-peer reviewed

Table 3: Criteria of Quality

Study	Type of design	1	2	3	4	5	6	7	8	9	10	Quality Level	Evidence Level
Chang et al. (2016)	3 (RCT n<100)	0	0	1	1	1	1	0	1	1	1	7/10 High	I
Goods et al. (2013)	3 (RCT n<100)	1	0	1	1	1	1	0	0	1	0	6/10, Moderate	I
Kasari et al. (2001)	7 (Single subject, pretest-posttest)	N/A	1	0	1	0	1	0	1	N/A	N/A	4/7 Moderate	V
Kasari et al. (2006)	3 (RCT n<100)	0	0	1	1	1	1	1	0	1	1	7/10 High	I
Kasari et al. (2008)	3 (RCT n<100)	1	0	1	1	1	1	1	0	1	1	8/10 High	I
Kasari et al. (2010)	3 (RCT n<100)	1	0	1	1	1	1	0	1	1	1	8/10 High	I
Kasari et al. (2014)	2 (RCT n>100)	0	1	1	1	1	1	0	0	1	1	7/10 High	I
Kasari et al. (2015)	3 (RCT n<100)	1	1	0	1	1	1	0	1	1	1	8/10 High	I
Shire et al. (2017)	2 (RCT n>100)	1	1	1	1	1	1	1	0	1	1	9/10 High	I

Whalen et al. (2006)	7 (Single subject, multiple baseline)	1	1	0	1	0	0	0	1	N/A	N/A	4/8 Moderate	IV
Wong (2013)	3 (RCT n<100)	1	1	1	1	1	0	1	1	1	1	9/10 High	I

Table 4: Study Descriptions

Author (Date)	Tx n	Control n	Comparison n	Mean age (months)	Type of Tx	Tx Administrator	Outcome Measure Type	Dosage/Intensity	Statistically significant changes on play skills
Chang et al. (2016)	38	N/A	28	Treatment: 48.87 Waitlist: 51.64	JASPER	Generally special education teacher and teaching assistants	Joint engagement, IJA and initiation behavioral regulation, play (teacher-child interaction/E SCS); play (teacher-child interaction and SPA)	15-minutes daily for 8-weeks	Significant treatment effect in functional play skills
Goods et al. (2013)	7	8	N/A	Treatment: 48.73 Control: 54.68	JASPER	Graduate students in educational psychology	Reynell Developmental Language Scales; SPA;	Control group: 30-hours of ABA-based	Significant difference for diversity of

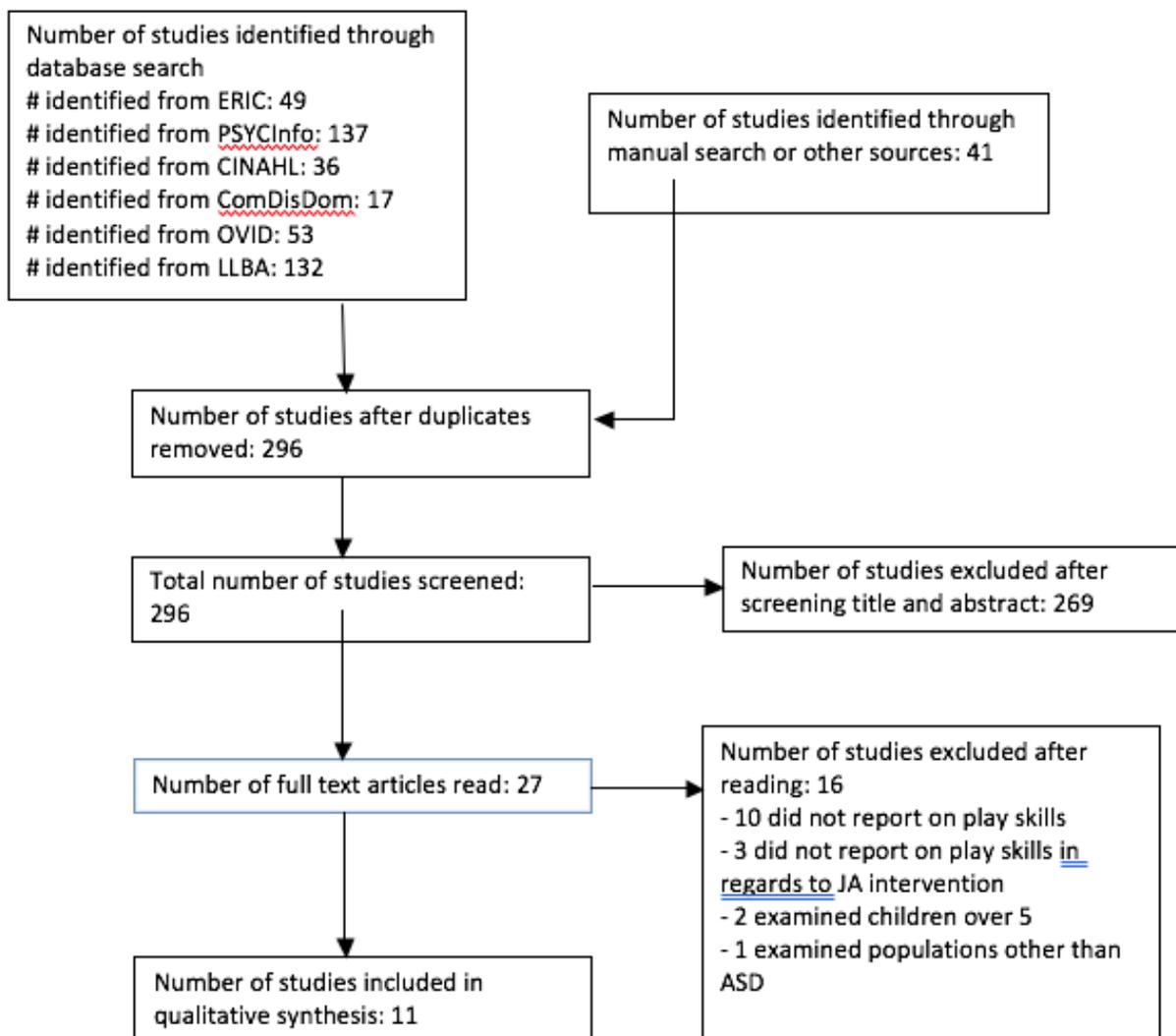
							ESCS; classroom observation measure	therapy per week JASPER group: 30 hours of ABA- based therapy per week with 30 minutes of JASPER treatment twice weekly during regular program	spontaneous play. Treatment group had significant increase in play type from entry to exit
Kasari et al. (2001)	1	1	1	JA Treatme nt: 44 SP Treatme nt: 39 Control: 42	Joint Attention Treatment, Symbolic Play Treatment	Not defined	Reynell Development al Language Scales; Structured Play Scale; ESCS	Control: 30- hours of ABA style Early Intervention Program JA & SP Treatment: Same EI Program along with 30-minute daily treatment targeting either JA or SP	No Statistics Reported. Visual analysis indicate gains made in targeted skill are and language but not in non- targeted skill area
Kasari et al. (2006)	20	17	21	JA: 43.2 SP: 42.67 Control: 41.94	Joint attention and symbolic play	Experimente r	ESCS; Joint attention and types of play (parent/child	30 minutes per day, 5-6 weeks	No statistically significant improvement s noted

							interaction); SPA		
Kasari et al. (2008)	20-JA	17	19	JA: 43.2 SP: 42.67 Control: 41.94	Joint attention and symbolic play	ABA therapists	MSEL; Reynell Development Language Scales; ESCS; Structured play assessment; functional and SP acts and JA skills (mother-child interactions)	30 minutes per day, 5-6 weeks	Significant difference in terms of SP types. SP more improvement than JA and control. JA group significant improvement over control group
Kasari et al. (2010)	19	16	N/A	JA: 30.35 Control: 31.31	Unnamed joint attention intervention	Interventionist and caregiver	Engagement states and play acts (caregiver/child interaction); Mullens Scale of Early Learning (MSEL)	45 minutes 3 times a week for 8 weeks	Statistically positive improvement on the types of functional play
Kasari et al. (2014)	60	N/A	52	CEM: 42.8,	Caregiver-mediated intervention	Caregivers/parents	Joint engagement (child-	CEM: 2-hour group sessions	Improvement of symbolic

				CMM: 41.9	n (CMM), caregiver education (CEM)		caregiver interaction); initiation joint attention (ESCS); functional and symbolic play (SPA); caregiver involvement and adherence	each week for 12 weeks CMM: 2, 1- hour weekly sessions for 12 weeks	play rates for CMM group over CEM group
Kasari et al. (2015)	43	N/A	43	JASPER : 30.7 PEI: 32.2	JASPER, Psychoeduc ational Interventio n (PEI)	Parents	Joint engagement, child play skills, play level, joint attention (via parent-child interaction); cognitive and language assessments, parenting stress and joint attention (in classroom)	JASPER: 1- hour weekly for 10 weeks PEI: 1-hour weekly sessions for 10 weeks	Significant increases in functional play acts for JASPER group compared to PEI group

Shire et al. (2017)	55	58	N/A	JASPER : 55, Control: 58	JASPER, control (treatment as usual)	Teaching assistants/interventionists	Joint engagement, child IJA and initiation behavioral regulation, child play, clinical global severity/improvement (teacher-child interaction and short play and communication evaluation (SPACE))	JASPER: 30 min daily sessions for 10 weeks Control: 30 min daily sessions for 10 weeks	Significant effect for functional play for JASPER group compared to control group where children spent more time in functional play
Whalen et al. (2006)	4, 1 in each analysis	N/A	N/A	JA: 50 Control: 32	Joint attention intervention	Experimenter	Unstructured joint attention assessment; Structured joint attention assessment; Empathetic response; SPA	3, 25 minute sessions with 5 minute breaks (total 1.5 hours) 3 days a week, approximately 5 weeks per child	Intervention had minimal to no effect on spontaneous play skills

Wong (2013)	14	9	10	JA-SP: 56.21 SP-JA: 54.50 Control: 59.67	Joint attention and symbolic play	Classroom teachers	Engagement states, supported joint, joint attention, child RJA, child IJA, play, child functional play & symbolic play (classroom observation); ESCS; frequency and level of symbolic play (SPA)	SP-JA/JA-SP: 1-hour weekly sessions for 8 weeks (switching interventions at week 4) Control: No intervention until week 4 (then randomized to 1 of 2 groups)	Significant increases in symbolic play skills
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Figure 1: Flowchart of Articles

APPENDIX A

Criteria of Quality Assessment, Quality Level and Level of Evidence Used

Type of design

- 1 = Meta-analysis (aka quantitative systematic review)
- 2 = Large (n>100) randomized clinical trial (RCT; aka Pretest-Posttest Control Group Design)
- 3 = Small (n<100) RCT (Pretest-Posttest Control Group Design)
- 4 = Qualitative systematic review
- 5 = Nonequivalent pretest-posttest control group design (p.228) OR Nonequivalent Posttest-only control group design (p.231) (i.e., RCT with inadequate approach to key elements)
- 6 = One-Group pretest-posttest design (p. 223) OR Time Series Design (p. 225)
- 7 = Single-case design; specify type: _____
- 8 = cohort study
- 9 = Case-control study

Criteria of Quality: Criteria Description by Type of Design

2 and 3 = RCTs

1. Was the assignment to the treatment groups really random?
 - Computer-generated random numbers
 - Random numbers tables
2. Was the treatment allocation concealed?
 - Adequate approaches to concealment of randomization
 - Centralized or pharmacy-controlled randomization
 - Serially-numbered identical containers
 - On-site computer based system with a randomization sequence that is not readable until allocation
 - Other approaches with robust methods to prevent foreknowledge of the allocation sequence to clinicians and patients
 - Inadequate approaches to concealment of randomization
 - Use of alternation, case record numbers, birth dates or week days
 - Open random numbers lists
 - Serially numbered envelopes (even sealed opaque envelopes can be subject to manipulation)
3. Were the groups similar at baseline on key characteristics? (Selection/confounding bias)
4. Were the eligibility criteria specified and were they logical in terms of the intervention under study?
5. Were outcome assessors blinded to the treatment allocation? (Detection bias)
6. Was (were) the outcome measure(s) valid and reliable?
7. Was the care provider blinded to the study purpose?
8. Were drop-outs and loss to follow-up reported? If so was it less than 20% and balanced between groups? (Attrition bias)
9. Was the intervention based on reasonable, physiological plausibility?
10. Was fidelity of intervention explicitly addressed in the study?

7 = Single-case design

1. Did the type of design allow us to attribute change to the intervention (e.g., stable baseline, withdrawal/extinction phase, alternate treatment, follow-up)?
2. Were the subject eligibility criteria logical in relation to the population and the intervention under study?
3. Were the children's characteristics well described permitting determination who the results might apply to?
4. Was the intervention sufficiently described that it could be replicated?
5. Was fidelity of intervention addressed?
6. Was (were) the outcome measure(s) valid and reliable?
7. Was the assessor blinded to phases of the study (baseline vs. intervention)?
8. Was the intervention based on reasonable, physiological plausibility?

Quality Levels

High: A study that meets 70% or more of design-specific criteria well.

Moderate: A study that meets at least 40% but than 70% of design-specific criteria and has no known "fatal flaw".

Low: A study that meets less than 40% of design-specific criteria OR has at least one design-specific "fatal flaw". These studies' results should be interpreted with great caution as these studies are deemed to have limited ability to inform practice recommendations.

Level of Evidence

Levels of Evidence (adapted from Sackett, D.L., Rosenberg, W.M., Muir Gray, J.A., Haynes, R.B. & Richardson, W.S. (1996). Evidence-based medicine: What it is and what it isn't. British Medical Journal, 312, 71- 72).

Level I - Systematic reviews, meta-analyses, randomized controlled trials

Level II - Two groups, nonrandomized studies

Level III - One group, nonrandomized

Level IV - Descriptive studies that include analysis of outcomes (e.g., single subject design)

Level V - Case reports and expert opinion that include narrative literature reviews and consensus statements
