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Parent-Mediated Support of Social Communication

Parent-Mediated Support of Social Communication among Toddlers with Autism: A
Systematic Review and Direct Observation of Parent-Child Interaction

by

Danielle Michael Moore, Bachelor of Arts in Journalism

A Thesis Submitted to the School of Public Health Graduate Faculty
at Georgia State University in Partial Fulfillment
of the
Requirements for the Degree
MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA
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APPROVAL PAGE

Parent-Mediated Support of Social Communication among Toddlers with Autism: A
Systematic Review and Direct Observation of Parent-Child Interaction

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Author's Statement Page

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Danielle Michael Moore

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ABSTRACT

INTRODUCTION: Autism spectrum disorder (ASD) is a neurodevelopmental disorder affecting 1 in 59 children in the United States (Centers for Disease Control and Prevention [CDC], 2018). Parent-mediated early interventions, which aim to support parent facilitation of toddler social communication, are a major focus of research (Green et al., 2017). Systematic review of the literature revealed that, out of 27 studies of parent-mediated interventions to improve toddler social communication outcomes, only seven (25.9%) used a measure designed to assess both parent and child behavior during observed parent-child interaction. Measures reported in this literature are of limited relevance for community early childhood practitioners due to high level of training and burden required for administration and scoring. To address this limitation, secondary coding and analysis of parent-child interaction video data from a recently published study (Schertz, Odom, Baggett, & Sideris, 2017) was conducted. Using a practical and psychometrically sound indicator of parent-child interaction, the aim was to provide an empirical example of how results of an indicator of parent-child interaction could be applied by practitioners via a data-based approach for monitoring progress of parent support of toddler social behavior among dyads participating in community parent-mediated intervention services. Analyses were conducted to examine parent support behaviors in relation to the general outcome of child social behavior toward their parents and address the following research questions: What is the mean, median, range, and standard deviation of parent positive support behavior and child social behavior in a sample of toddlers with ASD? Is parent positive support behavior significantly and positively related to child social behavior? Do children whose parents engage in high levels of support behavior demonstrate more positive social behavior in contrast to children whose parents engage in low levels of support behavior?

METHOD Direct observation of parent-child interaction was conducted using the Indicator of Parent Child Interaction-2 (IPCI-2), within a sample of parents and toddlers from a randomized controlled trial of a parent-mediated early behavioral intervention focused on improving outcomes for toddlers with ASD (Schertz et al., 2017). Videos were coded from 10-minute parent-child free-play sessions recorded in the family homes. Two independent coders established interobserver agreement at 92.5%. Descriptive statistics were provided of caregiver support behavior (facilitator) and child engagement with parents. To quantify the strength of the relationship between parent and child behavior, correlation, and bivariate regression analyses were conducted between caregiver facilitators and child engagement.

RESULTS: Caregivers overall obtained a mean facilitator score of 217.9 (SD= 59.8, range=285) and mean child engagement score of 126.37 (SD= 40.0, range= 190). Overall caregiver facilitator and overall child engagement variables showed highly significant strong correlations, $r=.747$, $p<.0001$. Overall engagement behavior of children differed significantly depending upon whether their caregivers engaged in low, medium, or high levels facilitator behaviors, $F(2, 128) = 47.72$, $p < .0001$.

DISCUSSION: This study highlights the relevance of practical application of a practitioner measure to assess parent-child interaction. Results demonstrate that an applied observation measure, with high interobserver agreement, can be used to capture targeted parent behaviors key to promoting social communication in toddlers with ASD.

Key Words: autism, parent-mediated, intervention, social communication, toddlers, infants

CHAPTER 1: INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects an estimated 1 in 59 children in the United States (Centers for Disease Control and Prevention [CDC], 2018). The disorder manifests across diverse ethnic and socioeconomic backgrounds and is diagnosed 4 times more often in boys than in girls (Centers for Disease Control and Prevention [CDC], 2018). Social communication deficits, including impairments in reciprocal social interaction, and repetitive interests are core to the disorder. Symptoms of ASD appear during the first 3 years and can be reliably diagnosed by 18-24 months of age through a comprehensive evaluation that includes neurologic examinations, clinical observation, developmental assessments, and caregiver report (American Psychiatric Association, 2013). However, social developmental risk indicators for later ASD diagnosis can be reliably identified as early as 6-14 months of age (Estes, Zwaigenbaum, et al., 2015; Landa et al., 2013; Ozonoff et al., 2010). Prominent examples of social indicators include deficits in shared positive affect, directed vocalizations, gaze, social engagement, and joint attention (Bolton, Golding, Emond, & Steer, 2012; Rogers & Talbott, 2016).

Public Health Burden

As children age, developmental difficulties become more pronounced and the need for specialized care, treatment, and therapeutic service increase in number and cost. With a total estimate of approximately 850,000 children under the age of 17 living with ASD (Buescher et al., 2014) and ongoing evidence of rising incidence, the associated economic cost to society and families is substantial. Estimated annual economic cost of caring for an individual child with ASD, including healthcare, therapy, family-coordinated services, special education, and caregiver time, totaled \$60,000 in 2011 (Buescher et al., 2014). If rates continue to rise, the

collective economic cost estimates for direct medical, non-medical, and productivity loss involved with caring for a person with ASD are forecasted to reach \$461 billion by 2025 in the United States (Leigh & Du, 2015). Burden continues to increase as children with ASD face life challenges specific to social communication difficulties and the lack of ability to infer mental states of others. By adolescence people with ASD are at higher risk for comorbid psychiatric disorders. A meta-analysis found 40 percent of children and adolescents with ASD had elevated levels of at least one social phobia or anxiety disorder, significantly higher than rates observed in typically developing children (Van Steensel, Bögels, & Perrin, 2011). Human learning is embedded in social experiences (Vygotsky, 1934/1986) and therefore measuring the progress of children with ASD in their interactions with others is important to early intervention. Yet, the challenges children with ASD face are grounded in difficulties responding to and initiating social interactions.

Social communication Deficits of ASD

Children with ASD display deficits that fall under specific social communication constructs, such as shared positive affect and joint attention. Shared positive affect is defined as shared social smiling, laughing, and the exchange of positive emotional expressions. During the first year of life, children typically display the earliest forms of these communicative acts toward their caregivers during face-to-face interactions (Bakeman & Adamson, 1984). However, children with ASD show deficits in shared positive affective behaviors such as social smiling and gaze after 6 months (Ozonoff et al. 2010). In addition, children exhibit deficits in more advanced triadic forms of communication such as joint attention. Joint attention is defined as the ability to share focus and coordinate gaze or interest between another person and an object for the purpose of social sharing and is typically established by 11 months of age (Jones & Klin, 2013). Joint

attention is an important early precursor to social communication development with cascading effects on later cognitive and social development (Mundy, 2017; Siller & Sigman, 2008).

Outcomes in 20 year longitudinal examinations of adults with ASD show that responding to joint-attention at 3.5 years predicted adult social functioning and independence (Gillespie-Lynch et al., 2012) emphasizing the importance of targeting support of joint attention in early childhood. Moreover, without early intervention, absence of joint attention and shared positive affective behaviors continue to be a problem and communication deficits compound over time to include repetitive behavior patterns, verbal language delays, lack of social smiling and shared enjoyment, poor eye-contact, delayed symbolic and functional play skills, and limited response to one's name (Boyd et al., 2010; Murza, 2016).

Conceptual Underpinnings of ASD

Theory of Mind (ToM) is a prominent framework for conceptualizing social communication deficits observed in ASD (Baron-Cohen, Leslie & Frith, 1985; Premack and Woodruff, 1978). ToM describes the cognitive ability to infer the mental states, intentions, and emotions of others. These aspects of ToM are commonly referred to in social cognitive research as referential processes which are critical to advancing along the continuum toward a more mature social cognition known as *mentalizing*. Mentalizing integrates information that a child has gathered based on memories of where another person has directed their attention in the past and allows them to apply this information to common experiences (Mundy, 2016). This capacity for perspective-taking emerges by 5 years of age in typically developing children and continues to mature as children become more skilled in learning to predict the thoughts and feelings of others through more complex social interactions (Astington & Dack, 2008). The capacity to share reference is an important developmental function because it facilitates the connection

between joint attention skills and mentalizing (Mundy, 2016). However, young children with ASD lack the ability to interpret the speech, actions, and intentions of others during early development.

Further research indicates that specific forms of joint attention, responding and initiating, may involve activation of different areas of the brain. fMRI research has shown that typical infants following someone's gaze toward an object (responding to joint attention) resulted in activation of the left dorsal prefrontal cortex (Grossman & Johnson, 2010). Joint attention initiation, such as attempting to direct someone else's attention toward an object, is found to activate the overlapping regions within the ventral striatum and involves the cohesion of the frontal-central lobe. Physiological research indicates that children with ASD may experience low connectivity within the default cortices (Kuhn-Popp, Kristen, Paulus, Meinhardt, & Sodian, et al., 2016; Mundy, 2017; Schilbach et al., 2010). Further evidence suggests that the default network of the brain is active when individuals imagine the perspective of others and involve skills that enable the individual to retrieve information from past experiences in order to construct mental simulations (Mundy, 2016). Several studies have linked the default region of the brain to the function of spontaneous social behavior and use of imagination indicating that poor communication development may be associated with weak connectivity among the nodes within the default network cortices (Kennedy & Courchesne, 2008; Weng et al., 2010).

These developmental delays in ToM and referential mental processing are core characteristics of ASD with differences observable through measures of language-learning and social communication, including reduced frequency of joint attention and symbolic play – abilities which are foundational to social communication development (Charman et al., 2000). As research develops, experts point toward the use of early interventions that use natural, self-

relevant, and meaningful experiences that build capacities for joint attention and shared engagement in order to take advantage of early brain plasticity as cortical connections become established (Bauman, 2000; Mundy, 2017; Pierce et al., 2016). During this early period, the brain undergoes immense structural change as neural activity is refined making early intervention of fundamental importance to improving life-long outcomes (Pierce, Courchesne, & Bacon, 2016).

Parent-Mediated Early Interventions

Parent-mediated early interventions for toddlers with autism focus on engaging parents in intervention to support their child's social communication development. In the past five years, a growing body of evidence has demonstrated that parent-mediated interventions can substantially improve social communication of toddlers with autism (Green et al., 2017; Siller et al., 2013; Schertz et al., 2017). Mediated learning theories postulate that development is modifiable from within the context of the parent-child relationship (Feuerstein, 1980). Responsive and sensitive parent support behaviors are an example of parent-mediation of child directed learning (Feuerstein, Klein, & Tannenbaum, 1991; Schreibman et al., 2015). Responsive behaviors support joint attention skills by engaging the child's intrinsic interests. Responsive parent-mediated behaviors include following the child's lead, imitating, expanding on the child's interest, commenting, and recognizing communicative symbols such as eye gaze and emotions (Kasari et al., 2010; Shire, Gulsrud, Kasari, 2016). Parent-mediation of pre-verbal social communication also involves support of shared positive affective behaviors such as social smiling, laughing, using a warm tone, affirming comments, and affectionate touch (Baggett et al., 2011; Steiner, 2011; Vernon, Koegel, Dauterman, & Stolen, 2012). However, effective mediation of pre-verbal social communication of toddlers with autism is particularly challenging

for the most under-resourced parents (Hoffman, Sweeney, Hodge, Lopez-Wagner, & Looney, 2009; Stuart & McGrew, 2009).

When parents attempt to engage their children with autism are repeatedly ignored, parents may develop patterns of problematic interaction in which they either disengage or become excessively directive with their children neither of which lead to positive parent-child interaction (Siller & Sigman, 2002). Extensive research has shown the effects of autism diagnosis on early parenting. Studies have shown parents of children with ASD experience high rates of parental grief after the diagnosis, stress, depression, and marital challenges due to caregiving demands and lack of skills to facilitate social communication competencies in preverbal children with autism. (Hartley, Barker, Seltzer, Floyd, Greenberg, et al. 2010; Ingersoll & Hambrick, 2011; Stuart & McGrew, 2009). These challenges can be especially difficult for parents with low-social support systems and those who lack access to specialized training and resources that can meet the needs of a child with ASD (Boyd, 2002; Ingersoll & Hambrick, 2011; Siller & Sigman, 2002). Parents who are poor and experience associated stressors are particularly vulnerable to higher risk interactions with their children in general (Stuart & McGrew, 2009; Vig & Kaminer, 2002) and have been demonstrated to be less responsive to their children. Because parent-child relationships can suffer and compound social communication challenges these stressors are important to consider at the start of intervention. Limited parent-mediation and low responsivity can lead to delays across all developmental domains for young children (Landa.

Because strong parent-mediation and responsiveness are crucial for supporting child social communication competencies of children with autism, (Brown & Woods, 2016; Morales et al., 2000; Siller & Sigman, 2008) these are the focus of early parent-mediated interventions. The

parent-child relationship serves as a vehicle for creating embedded learning opportunities for children to internalize positive affective interactions that are associated with facilitating joint attention (Kasari et al., 2012; Kasari, Sigman, Mundy, & Yiriya, 1990). Parent-mediated interventions teach parents responsive and affective mediation skills for interacting with their children in routine activities at home that support self-efficacious, socially valid, and sustainable learning for both parents and children and have proven effects (Schreibman et al., 2015). For example, results from a 2013 review of parent-mediated early interventions for children with ASDs summarized proximal indicators of improved parent-child interaction such as shared attention as well as distal indicators of decreased autism severity and increased language comprehension (Oono et al., 2013). Outcomes of subsequent studies of parent-mediated interventions demonstrate significant increases in toddler joint attention, (Schertz et al., 2013; Schertz et al., 2017) interactive play, gaze shift, shared positive affect, as well as gains in verbal communication (Green et al., 2015; Kasari et al., 2008; Kasari et al., 2014; Wetherby et al., 2014).

In addition to predicting long-term gains in child social outcomes (Estes et al., 2015; Kasari et al. 2012), early intervention can help reduce the financial strain families face years following a diagnosis. Early intervention targeting social communication prior to age 2 is associated with reduced financial burden to families seeking services (MacDonald, Parry-Cruwys, Dupere & Ahearn, 2014; Zwaigenbaum et al., 2015) and the most recent findings show that families who begin very early intervention use fewer cumulative intervention services overall (e.g. physical therapy, speech therapy) resulting in savings of about \$19,000 per child per year (Cidav et al., 2017). Children who receive early parent-mediated social communication focused intervention before age 3, in contrast to older children, show greater improvements in

social communication outcomes and less severe autism symptoms two years after treatment (Estes et al., 2015; Green et al., 2017; Johnson & Meyers, 2007; Kasari et al., 2008; Wetherby & Woods, 2006; Zwaigenbaum et al., 2015). Accordingly, the American Academy of Pediatrics recommends that families begin intensive intervention as early as possible following a positive risk assessment or ASD diagnosis between the ages of 2 to 3 years of age (Anderson, Liang, & Lord, 2014; Pierce et al., 2016; Rogers & Talbott, 2016).

Research-to-Practice Gaps and Needs

While there is strong and growing evidence of the effectiveness of parent-mediated interventions for improving social communication of toddlers with autism, there are still substantial challenges to moving these researcher-implemented interventions into community practice. Community implementers need data-based indicators to show whether their interventions are having the intended effects of increasing parent supports that facilitate preverbal social communication of very young children (Baggett & Carta, 2010).

It is not clear to what extent the existing experimental literature on parent-mediated interventions include examples of parent-child interaction measures that practitioners could use to monitor the progress of interventions focused on promoting the key parent support behaviors demonstrated to strengthen child social communication competencies. There are no systematic reviews of the use of parent-child interaction measures within parent-mediated intervention studies for children younger than 3. Furthermore, best practices for applied interventionists recommend using parent-child interaction progress-monitoring measures to determine whether or not interventions are effective at improving toddler social communication outcomes through parent-child relationships (Greenwood, et al., 2011; Baggett et al., 2011). To address this need, a systematic review of the experimental literature on the effects of parent-mediated intervention

was conducted. In particular, measures of parent-child interaction were examined within this literature. The purpose of this review was to address whether the literature provides community early interventionists with examples of progress-monitoring measures that can be used to monitor whether parent-mediated interventions are increasing parent support behavior as intended to promote toddler social communication. Specifically, parent-child interaction measures within this literature are described and summarized in the following chapter.

CHAPTER 2: SYSTEMATIC LITERATURE REVIEW

The objectives of this systematic review were to: (1) Identify and describe methodology of published experimental and quasi-experimental studies of parent-mediated intervention focused on social communication promotion among children with ASD younger than 36 months of age; (2) Quantify and describe approaches to measuring progress of parent support of their children's social communication behavioral within studies of parent-mediated intervention; (3) Evaluate the current status of this literature to inform community level early childhood personnel, who are primarily comprised of bachelor's level and lay personnel, to monitor the progress of parent support of social communication among dyads participating in parent-mediated intervention.

In order to systematically identify studies that focused on parent-mediated interventions for promoting social communication among children under 36 months with ASD, several procedural steps were taken. First, search terms were identified using relevant key words in order to conduct the electronic database and subsequent ancestral searches of relevant studies published since year 2000. Second, methodological criteria for final study inclusion was

determined. Finally, a systematic review of the included literature was conducted to address the above study objectives. These steps are detailed in the following sections.

Search Procedures for Study Identification

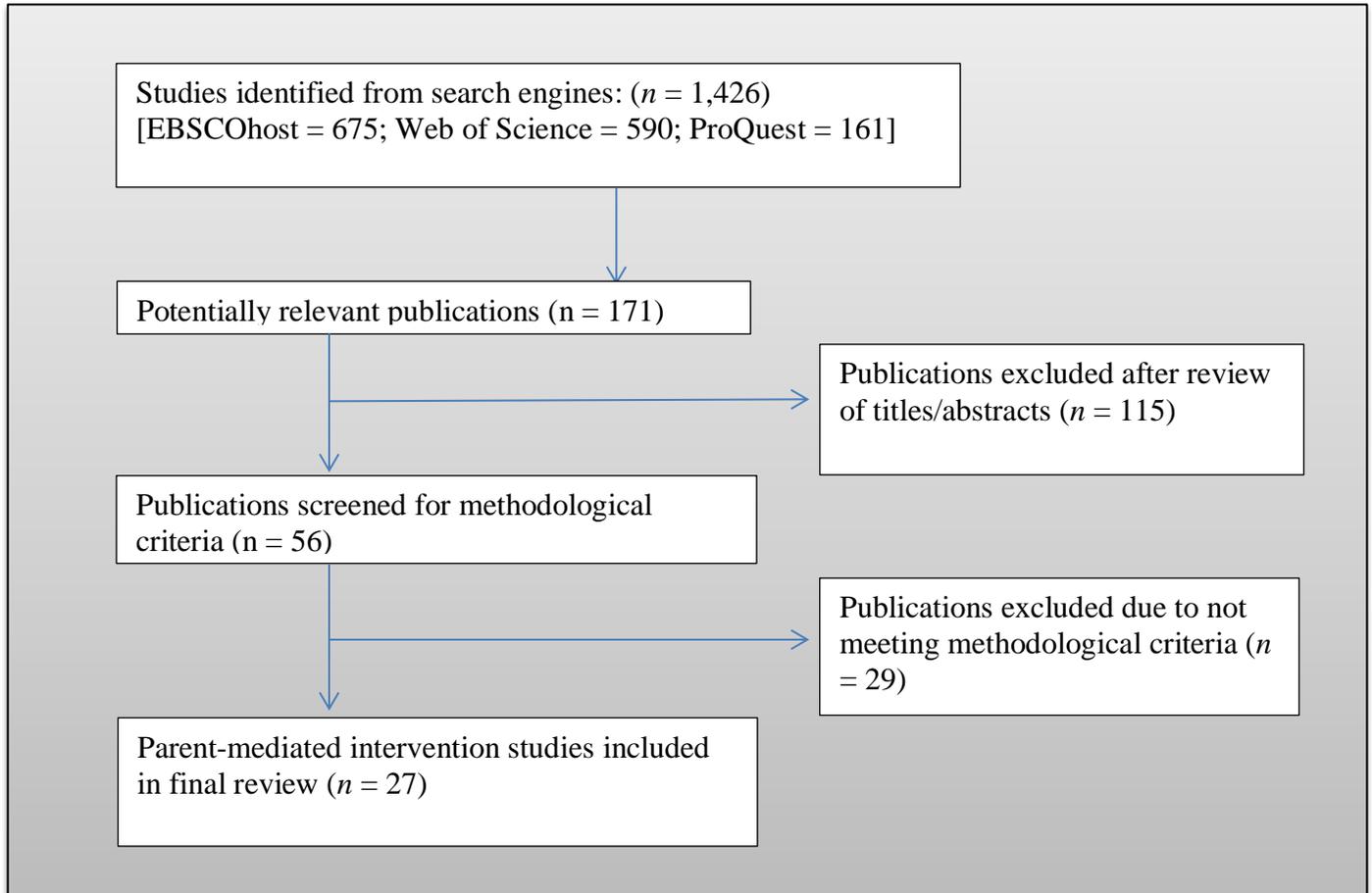
Search Terms. Key words were extracted from prominent published studies and reviews to generate preliminary terms for searching major electronic databases, including the following: Elton B. Stephens Company (EBSCO), Web of Science, and ProQuest, a multi-disciplinary, full-text database that includes dissertations, theses, primary source material, and scholarly content. Search terms included the following: AB (autis* OR "pervasive developmental" OR asperger*) AND AB (toddler OR infant) AND AB intervention AND AB (parent OR early). Upon completion of searches, references of identified studies were examined for the purpose of identifying relevant studies that were not captured in the original electronic search.

Inclusion and Exclusion Criteria. For inclusion, studies met each of the following criteria: (1) an experimental or quasi-experimental design was employed to examine effects of parent-mediated interventions to promote social communication among toddlers; (2) The majority of study participants were younger than 36 months of age and met diagnostic criteria for ASD. Mode age was used if available. Mean age was used if mode age could not be determined. Studies that were not available in English, not published in a peer-reviewed journal, or published before year 2000 were excluded.

Review Procedures for Study Inclusion. 1,426 titles generated from combined electronic searches of EBSCOhost, Proquest, and Web of Science were coded by two independent reviewers as “relevant” or “irrelevant” relative to inclusion criteria. 171 titles coded as “relevant” via consensus progressed to the next level of review. This process was repeated with abstracts of studies with relevant titles, resulting in the identification of 56 abstracts that met

inclusion criteria. Finally, published reports of manuscripts were reviewed relative to each of the inclusion criteria and those studies. After methodology review of the remaining 56 studies, 29 studies (51.8%) were excluded due to failure to meet all inclusion criteria. Of these, five studies (8.9%) failed to meet design criteria, nine studies (16.4%) contained subjects with average age > 36 months, six studies (10.9%) were not peer-reviewed, and six studies (10.9%) failed to use or mention a reliable or valid ASD screening or diagnostic tool, three studies (5.4%) were excluded for lacking a parent-mediated intervention focus. Twenty-seven studies, which met all inclusion criteria, comprised the final set of studies for systematic review. See Appendix D PRISMA checklist. Twenty percent of these studies were randomly selected for independent review of inclusion criteria. Inter-coder agreement of inclusion status as “met” or “unmet” was calculated using the formula: $[\textit{number of agreements} \div (\textit{number of agreements} + \textit{number of disagreements}) \times 100]$. Inter-coder agreement that studies met criteria for inclusion for systematic review was 100%.

Fig. 1 Flow diagram displaying decision-making criteria across the literature search and study selection.



Systematic Review Categories

The 27 studies, which met criteria for inclusion in the systematic review, were coded according to the following methodological characteristics: study design, ASD inclusion method, sample characteristics, and observation measures of parent support of toddler social communication. Categories of study design included randomized controlled trials, single-subject, and quasi-experimental designs. Sample characteristics included child gender, caregiver

education, maternal age, employment, household income, race or ethnicity, and native-language if reported. Categories of ASD inclusion method included the use of a gold-standard diagnostic measure, the Autism Diagnostic Observation Schedule (ADOS) or Autism Diagnostic Observation Schedule-2 (ADOS-2) (Falkmer, Anderson, Falkmer, & Horlin, 2013; Lord, Rutter, DeLavore, & Risi, 2008), a screener tool, another standardized measure, referral through regional intervention programs that required positive diagnostic screens for ASD such as Part C regional intervention programs, or a combination of any of these items. Observation measures of parent support were coded according to whether the study reported observed child behavior only and did not measure parent behavior, used separate observational measures of parent support and toddler behavior, or used a single observational parent-child interaction measure for both parent and child behavior. See Appendix A for definitions of review categories.

Reliability Coding. After initial systematic review and coding of studies according to the above criteria, an independent reviewer randomly selected 20% of studies and coded them according to four review criteria (intervention design, participant age, category of ASD identification, and social communication outcomes). Inter-rater agreement was calculated using the formula: $[number\ of\ agreements \div (number\ of\ agreements + number\ of\ disagreements) \times 100]$. Inter-coder agreement was 100%.

Categories of study design. Systematic review revealed that among the 27 studies, 55.6% (n=15) employed a randomized controlled trial design, 40.7% (n=11) used a single subject experimental design, and 3.7% (n=1) used a quasi-experimental design. See Appendix B for a table of individual study characteristics.

Sample characteristics. Sample characteristics of study participants were as follows. Female children were the minority in all but one study (3.7%) (Brown & Woods, 2015). Male

children made up the entire sample in 29.6% (n=8) studies. Caregiver education level was reported in 77.8% (n=21) of studies. Only 18.5% of studies (n=5) reported a majority with at most a high school education but no college degree. A sample majority with at least some college or a college degree was reported in 29.6% of studies (n=8). A majority sample with a college degree or post-graduate degree was reported in 29.6% of studies (n=8). A few studies 22.2% (n=6) did not report education level. Maternal age was reported in only (37.0%) studies (n=10). One study reported a majority of mothers who were younger than 30 years (Schertz & Odom, 2007). There were six studies (22.2%) that listed information regarding current employment of which 3.7% (n=1) included a majority unemployed sample. Household income was reported in only 14.8% of studies (n=4). An entire sample majority with income levels greater than \$60,000 was reported in 7.4% (n=2) studies. One study reported a split majority between \$41,000-\$60,000 and greater than \$60,000 (Schertz et al., 2017). Only 3.7% of the studies (n=1) reported a plurality below \$40,000 (Kasari et al., 2014). Finally, a majority white demographic sample was reported in 55.6% studies (n=15) and 25.9% (n=7) reported a non-white majority. There were five studies (18.5%) that did not report race or ethnicity. Surprisingly, 14.8% studies (n=4) reported information on native-spoken language and 3.7% (n=1) reported a split majority of both English and Spanish native-speakers. See Appendix B for table of individual study characteristics.

ASD Inclusion Method. Of the studies in this review, 70.3% (n=19) used a gold-standard measure, the Autism Diagnostic Observation Schedule, to determine study inclusion (ADOS; Lord et al., 1999). In 10.7% of studies (n=3) another standardized measure was used as the primary measure for study inclusion. In 10.7% studies (n=3) referrals from regional

intervention programs that required positive diagnostic screens for ASD was used. Finally, 7.4% of studies (n=2) screeners in addition to standardized measures for study inclusion.

Observation measures of parent support behavior of toddler social communication.

Ten studies (37.0%) reported data on observed child behavior only and did not measure parent behavior. Ten studies (37.0%) reported on parent support of toddler social communication using separate observation measures of parent support and toddler behavior. Only, seven studies (25.9%) used an instrument designed to measure both parent and child behavior during observed parent-child interaction. For more detail on measures used, see Appendix B for table of individual study characteristics.

Implications for use of progress monitoring measures for community EI service providers. This review found very few practical observation measures of parent support behavior used in the current literature that could be used by community practitioners to assess social communication within parent-mediated interventions of young children with ASD. Of the 17 total studies that reported on some quality of parent support behavior in addition to toddler behavior, 10 used separate observational methods to do so. This finding is troublesome because requiring community practitioners to train and learn to code using two separate observational measures can be highly burdensome and expensive. Many measures incorporate complicated coding schemes that may be laborious and require specialized training beyond what many early intervention practitioners possess. Furthermore, the majority of the measures used to code parent support behavior and child behavior, either in tandem or separately, were adapted from previous studies or coding schemes and not readily accessible or realistic for use within community practice. Many measures include extensive observation periods that are not practical for repeated measurements especially when used in addition to other standardized measures. This is

especially important for single-subject study designs where continuous assessment is necessary in order to monitor small changes. Finally, few observational measures that assess parent-child interaction account for more than one construct and do not capture the universal qualities necessary for interventions to adequately inform practitioners as to the quality and progress of parent-child interaction throughout intervention.

The findings of this review underscore the scarcity and need for practical measures for use in parent-mediated intervention studies that focus on the sensitive and responsive parent behaviors that promote social communication and joint attention development in toddlers under 36 months with ASD. If interventions that focus on promoting crucial social communication skills through parent-mediation do not measure the positive parent support behaviors that promote these child outcomes, then it is impossible for practitioners to understand how well interventions are working and whether or not to modify the intervention or increase intensity to enhance parent learning (Walker, Carta, Greenwood & Buzhardt, 2008). Furthermore, at the community level, measures must be feasible for frequent use by applied professionals in the field of child development.

While brief practitioner tools relevant for monitoring parent support behavior based on direct observation of parent-child interaction were not found in the studies of parent-mediated interventions examined in the literature review, examples of such measures exist. An example of one measure that captures both parent and child interaction behaviors is the Indicator of Parent Child Interaction (IPCI-2; Baggett et al., 2011). The IPCI-2 (1) focuses on parent behaviors identified in the literature to promote social communication outcomes of infants and toddlers, (2) is designed to focus on everyday activities in the home or child-care setting, (3) can be administered frequently and within 10 minutes (4) and can be administered by a variety of

practitioners including para-professionals, nurses, Part C Early Intervention staff, Early Head Start staff, and social workers (Baggett & Carta, 2006; Carta et al., 2010, Oono et al., 2013; Zwaigenbaum et al., 2015). It has been used in studies of high risk infants and in population-based studies of universal interventions to promote early parent support behavior (Barr et al., 2014; Davis, Baggett, & Feil et al., 2018, Hackworth et al., 2017) in accordance with recommendations that address the need for interventions designed for the natural environment (American Academy of Pediatrics, 2016; Division for Early Childhood, 2014; National Research Council, 2001; Gould et al., 2011; Reichow, Boyd, Barton, & Odom, 2016; Siller et al., 2014; Wetherby & Woods, 2006). The Indicator of Parent Child Interaction is an evidence-based measure created to monitor the growth and risk behaviors indicative of varying levels of responsive support in order to provide a practical and quality assessment of parent-child interaction in order to inform and guide intervention (Carta et al., 2010). Most importantly the IPCI-2 was created so that measures of intervention progress can be easily transferred to community settings. Considering the strength of parent-mediated interventions and lack of progress monitoring measures across parent-mediated studies, the IPCI-2 may serve as a practical measure for capturing important parent support behaviors known to promote child social behaviors.

Study Purpose and Research Questions

To examine parent-child interaction within a sample of toddlers who met criteria for inclusion in a parent-mediated study of autism, a secondary analysis and descriptive study was conducted using the Indicator of Parent Child Interaction-2 (IPCI-2), within a sample of parents and toddlers who met eligibility for inclusion in a randomized controlled trial of a parent-

mediated early behavioral intervention focused on improving outcomes for toddlers with ASD (Schertz et al., 2017).

The IPCI-2 was used to examine parent-child interaction videos for degrees of parent positive support behaviors as well as toddler social behaviors in order to assess the relationship between these domains and the relationship between varying degrees of positive parent support and child social communication behavior. Research questions include the following: (1) What is the mean, median, range, and standard deviation of parent positive support behavior and child social behavior in a sample of toddlers with ASD? (2) Is parent positive support behavior significantly and positively related to child social behavior? (3) Do children whose parents engage in high levels of support behavior demonstrate more positive social behavior in contrast to children whose parents engage in low levels of support behavior?

It was hypothesized that parent positive support behaviors (overall caregiver facilitators and individual variables acceptance/warmth, descriptive language, follows lead, and maintains/extends) will be significantly and positively correlated with overall child engagement as well as individual variables positive social feedback, follow through, and sustained engagement. It was also hypothesized that mean levels of child engagement behavior will differ significantly among levels of positive parent support behaviors (overall low, medium, and high caregiver facilitators) as has been demonstrated for other high-risk samples of parents and toddlers (Landry, Smith, Swank, & Guttentag, 2008).

CHAPTER 3: METHOD

Participants

Toddlers aged 16-30 months and their parents were recruited for the JAML study from both rural and urban areas in North Carolina, Kansas/Missouri, and Indiana. Researchers recruited participants from diagnostic centers, speech clinics, Part C providers, and university research databases. In order to be eligible for this study, children met the following criteria 1) age below 30 months at evaluation, 2) scores above the cut-off for ASD as measured by the Toddler Module of the Autism Diagnostic Observation Scale-II (ADOS-T; Lord et al, 2012), 3) and no greater than three instances of initiating or responding to joint-attention during a 10-minute free play activity with parents at home (Schertz et al., 2017). Toddlers born premature, failure to thrive, or who possessed other developmental disabilities were excluded. There were 144 participants that met inclusion criteria for the JAML study. Of these participants, videos of parent-child interaction were obtained for 131 dyads for whom complete video data was available. Demographic data, including child gender and caregiver role, were also obtained for secondary analysis. Sample characteristics for this analysis are displayed in Table 1. For detailed information about the full sample, see Schertz et al., 2017.

Measures

The IPCI-2 is a general outcome measure that assesses both parent and child behavior based on direct observation of parent-child free play (IPCI-2; Baggett et al., 2011). For the purpose of this study, parent positive support behaviors (caregiver facilitator behaviors) were examined. These include acceptance/warmth, descriptive language, follows lead, and maintains extends. Acceptance/warmth involves sensitive responding behaviors such as use of gentle touch, smiling, and affirming praise. Descriptive language involves comments that both label and

connect objects and actions or nouns and adjectives. Follows lead involves noticing and commenting on a child's interest or joining in the activity. Maintains and Extends is categorized as following a child's lead in addition to introducing a theme or activity that extends the interest of the child. A summary variable was also created by adding all four caregiver facilitator variables to create an overall caregiver facilitator variable. Child engagement behaviors include positive feedback, sustained engagement, and follow through. Positive feedback involves affectionate touch, words, smiling, and social signals directed at the caregiver. Sustained engagement is categorized as social or non-social engagement for at least more than half of the interval. Follows through involves responsive gestures or vocalizations toward the caregiver as a result of attempts from the caregiver to engage the child. A composite child variable, follow through and positive social feedback, was created to isolate the two primarily social-oriented child variables, while excluding the sustained engagement variable. The composite was created because sustained engagement can be exhibited through both through non-social and social behavior. A summary variable (overall child engagement) was created to represent all three child variables. See definitions of caregiver and child items in Appendix C. Psychometrics of the IPCI-2 are reported in multiple studies, demonstrating adequate inter-rater agreement, test-retest reliability, concurrent validity, and predictive validity for children 2-42 months of age and their caregivers (Baggett et al., 2006; Baggett et al., 2011; Barr et al., 2014; Hackworth et al. 2017). Specifically, one recent study showed the measure is sensitive to differences in at-risk populations of parents and children with 0.5 SD increase in caregiver facilitator support and child engagement (n=287 observations) pre-post across seven intervention sessions (Barr et al., 2014). The most recent randomized controlled trial (n=900 observations) showed inter-rater agreement on 20% of observations independently coded was 87.4%. Additionally, parents in the

treatment group for this study showed greater improvement in use of descriptive language (ES = 0.77; 95% CI 0.35, 1.20) and maintaining their child's interest (ES = 0.52; 95% CI 0.05, 0.98) compared to standard. (Hackworth et al. 2017).

The IPCI-2 is scored as follows. For each 10-minute recorded parent-child interaction free play video, IPCI-2 items are coded within 30 second intervals as present or absent (1 or 0 respectively). A summary score is calculated for each behavior as the sum total across all intervals.

Coding. Prior to the secondary analysis study, two coders were trained and certified as IPCI-2 coders by an expert coder. Training processes consisted of reviewing the IPCI-2 operational definitions and procedures, observing video examples and non-examples of parent and child behavior items, and coding practice. Certification required that coders met interobserver agreement criterion of 80%, calculated by dividing the total number of agreements by the total number of agreements + disagreements. After initial coding, 25% (n=33) videos were randomly selected for review by an independent coder to document interobserver agreement. Inter-observer agreement was calculated by dividing agreement on a behavior occurring in an interval by agreement plus disagreement and multiplying by 100. Mean inter-observer agreement was high at 92.51%.

Procedure

For this descriptive study, secondary data coding and analysis was conducted using parent-child interaction videos obtained from a study of toddlers with autism and their parents who were recruited to participate in a parent-mediated intervention, the Joint Attention Mediated Learning (JAML) program aimed at improving toddler social communication (Schertz, Odom, Baggett, Sideris, 2016; Schertz, Odom, Baggett, Sideris, 2017).

Video recording procedures were conducted in three visits during pre-assessment for later coding. Each video administration was 10 minutes in length. All assessment activities were recorded in the family home by trained research assistants. Institutional Review Board approval was obtained to view parent-child interaction videos from the JAML study (Schertz et al., 2017).

Analysis

The data analysis for this study was generated using SAS University Edition software. Copyright © 2017 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA. Descriptive statistics including mean, standard deviation, median, and range of seven behavior variables and two summary variables were generated for behaviors within each domain of interest: caregiver facilitators and child engagement. Descriptive statistics were also included to summarize distributions of study variables among caregiver role and child gender.

To determine if caregiver facilitator behaviors were significantly and positively related to child engagement behaviors, correlation coefficients were included to describe positive and negative linear relationships between each variable (e.g. overall caregiver facilitator and domain outcomes and overall child engagement and domain outcomes).

To investigate whether children whose parents engage in high levels of support behavior demonstrate more positive social behavior in contrast to children whose parents engage in low levels of support behavior, a tertile split was conducted using PROC RANK to divide overall caregiver support into three groups. The one-way analysis of variance (ANOVA) was used to examine differences in mean, standard deviation, and generate p-values among levels of overall caregiver facilitator levels and overall child engagement. Due to heterogeneity of variances, the nonparametric Welch's one-way analysis of variance tests were used to analyze differences in

mean, standard deviation, and generate p-values among levels of overall caregiver facilitator and the composite child follow through and child positive social feedback outcome variable.

CHAPTER 4: RESULTS

Demographics

The study sample included 133 total caregiver-child dyads. The child sample was majority male (n = 108) comprising 82.44% of the sample. There were 23 female children (17.56%). The majority of caregivers, n=124 (94.66%), were mothers. There were seven father caregivers in the sample (5.34%). For detailed information about the full sample, see Schertz et al., 2017.

Table 1

Demographic Profile of Sample

Participant Characteristics	N	Percent
Caregiver Role		
Mother	124	94.66
Father	7	5.34
Child Gender		
Male	108	82.44
Female	23	17.56

Research Question 1: What is the mean, median, range, and standard deviation of parent support behavior and child social behavior? Descriptive statistics for IPCI domain and item scores are reported separately for all caregivers, mothers, and fathers. See Table 2.

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Table 2

Univariate Analysis of IPCI-2 Scores by Overall Caregivers, Mothers, and Fathers

Variable	Caregiver Outcomes								
	Caregivers Overall			Mother (n=124)			Father (n=7)		
	M(SD)	MDN	Range	M(SD)	MDN	Range	M(SD)	MDN	Range
Caregiver Facilitators									
Overall Caregiver Facilitator ¹	217.90 (59.8)	215	(80-365)	218.55 (61.12)	217	(80-365)	206.43(27.90)	195	(175-245)
Caregiver Acceptance/Warmth	44.31 (19.66)	40.0	(5-100)	45.12 (19.56)	45.0	(5-100)	30.0 (16.58)	25.0	(10-50)
Caregiver Descriptive Language	76.95 (20.71)	80.0	(10-100)	76.61 (21.05)	80.0	(10-100)	82.86 (13.18)	85.0	(65-100)
Caregiver Follows Lead	78.89 (21.5)	85.0	(5-100)	78.59 (21.91)	85.0	(5-100)	84.29 (12.05)	85.0	(65-100)
Caregiver Maintains/Extends	17.75 (21.84)	10.0	(0-95)	18.23 (33.24)	10.0	(0-95)	9.29 (10.18)	5.0	(0-30)
Child Engagement									
Overall Child Engagement ¹	126.37 (40.0)	120	(50-240)	126.69 (40.61)	125	(50-240)	120.71 (29.22)	110	(90-175)
Child Positive Social Feedback	17.71 (19.12)	10.0	(0-95)	18.35 (19.39)	15.0	(0-95)	6.43 (7.48)	5.0	(0-20)
Child Sustained Engagement	73.05 (21.04)	75.0	(20-100)	72.46 (21.43)	75.0	(20-100)	83.57 (6.90)	80.0	(75-95)
Child Follow Through	35.61 (21.16)	30.0	(0-95)	35.89 (21.09)	30.0	(0-95)	30.71 (23.70)	25.0	(10-75)

Note. ¹Sum, variable percent

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IPCI item and domain scores for mothers and fathers are nearly indistinguishable with the exception of higher scores for mothers on Maintaining and Extending and Acceptance and Warmth. See Discussion section regarding cautions for difference interpretation. On average, caregivers overall obtained an IPCI Facilitator score of 217.9 (SD= 59.8, range=285). Mean IPCI scores within the facilitator domain are as follows: acceptance and warmth was 44.31 (SD= 19.66, range=95); descriptive language was 76.95 (SD= 20.71, range= 90); follows lead was 78.89 (SD= 21.5, range= 95); maintains and extends was 17.75 (SD= 21.84, range= 95).

For caregivers overall, the average IPCI Child Engagement domain score was 126.37 (SD= 40.0, range= 190). Mean IPCI scores within the child engagement domain are as follows: child positive social feedback was 17.71 (SD= 19.12, range= 95); child sustained engagement was 73.05 (SD= 21.04, range= 80); child follow through was 35.61 (SD= 21.16, range= 95).

Correlational Analyses

Research Question 2 Is parent positive support behavior significantly and positively related to child social behavior? Spearman correlation coefficients showing associations between all caregiver and child domain variables and Pearson correlation coefficients showing associations between overall caregiver facilitators and overall child engagement variables are presented in Tables 5.

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Table 3

Correlation Coefficients Among Caregiver Facilitator and Child Engagement Variables (n=131)

Variable	1	2	3	4	5	6	7	8	9
1. Caregiver Acceptance/Warmth	1	0.342**	0.397**	0.423**	0.723**	0.356**	0.367**	0.319**	0.581**
2. Caregiver Descriptive Language		1	0.385**	0.345**	0.716**	0.097	0.237**	0.230**	0.306**
3. Caregiver Follows Lead			1	0.329**	0.729**	0.161	0.757**	0.247**	0.644**
4. Caregiver Maintains/Extends				1	0.669**	0.336**	0.283**	0.454**	0.555**
5. Overall Caregiver Facilitators					1	0.326**	0.571**	0.441**	0.747** ¹
6. Child Positive Social Feedback						1	-0.032	-0.028	0.401**
7. Child Sustained Engagement							1	0.343**	0.723**
8. Child Follow Through								1	0.684**
9. Overall Child Engagement									1

Note: ¹Pearson Correlation Coefficient, *p-value < 0.05. **p-value < 0.01

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Correlation between overall caregiver facilitators and overall child engagement was strong and highly significant, $r = .747$, $p < .0001$. Significant strong, moderate, and weak correlations between item level IPCI caregiver facilitator and child engagement domain variables in order of strength of association were as follows: caregiver follows lead and child sustained engagement showed the strongest significant correlation, $r_s = 0.757$, $p < .0001$.

Significant moderate correlations between caregiver facilitator and child engagement variables were as follows: caregiver maintains/extends and child follow through, $r_s = 0.454$, $p < .0001$, caregiver acceptance and warmth and child sustained engagement, $r_s = 0.367$, $p < .0001$, caregiver acceptance/warmth and child positive social feedback, $r_s = 0.356$, $p < .0001$, caregiver maintains and extends and child positive feedback, $r_s = 0.336$, $p < .0001$, caregiver acceptance and warmth and child follow through, $r_s = 0.319$, $p = .0002$.

Significant weak correlations between caregiver facilitator and child engagement variables were as follows: caregiver maintains extends and child sustained engagement, $r_s = 0.283$, $p = .001$, caregiver follows lead and child follow through, $r_s = 0.247$, $p = .005$, caregiver descriptive language and child sustained engagement, $r_s = 0.237$, $p = .007$, caregiver descriptive language and child follow through, $r_s = 0.230$, $p < .008$.

Non-significant associations were as follows: caregiver follows lead and child positive social feedback, $r_s = 0.161$, $p = .066$, caregiver descriptive language and child positive social feedback $r_s = 0.097$, $p = .270$.

Analyses of Variance

Research Question 3: Do children whose parents engage in high levels of support behavior (e.g. total caregiver facilitators who show acceptance and warmth, follow their child’s lead, use descriptive language, and maintain and extend their child’s attention) demonstrate more positive social behavior (e.g. positive social feedback, follow through, and sustained engagement or total child engagement) in contrast to children whose parents engage in low levels of support behaviors? Results from the one-way analysis of variance test indicated there were significant differences between overall child engagement at Bonferroni adjusted alpha levels of $< .02$ ($.05/3$) for low, medium, and high levels of overall caregiver facilitators, $F(2, 128) = 47.72, p < .0001$. Results from the analysis of relative low, medium, and high parent support and overall child engagement are displayed in Table 7.

Table 4

Relative Low, Medium, and High Overall Caregiver Facilitators and Child Engagement Outcomes

Variable	Overall Child Engagement (%)			
	N=131	Mean	SD	P Value
Overall Caregiver Facilitator				<.0001** ^a
High	43	159.65	33.95	
Middle	45	124.11	27.37	
Low	43	95.47	30.04	

Note. ^a One-way Analysis of Variance test, Bonferroni adjusted alpha levels of $< .02$, *p-value $<.05$ **p-value $<.01$

Post hoc pairwise comparisons using the Tukey HSD test indicated that mean child engagement for low overall caregiver facilitators ($M = 95.47, SD = 30.04$), medium overall caregiver facilitators ($M = 124.11, SD = 27.37$), and high ($M = 159.65, SD = 33.95$) significantly differed between all groups. Independent t-tests revealed that mean overall child engagement for low overall caregiver facilitators was significantly lower than for medium overall caregiver facilitators $t(86) = 4.68; p = .0001$ with a large effect size ($d = 0.997$). Mean overall child engagement was also significantly lower for low overall caregiver facilitators than for high overall caregiver facilitators $t(84) = (-9.28); p = .0001$ with a very large effect size ($d = 2.003$). Similarly, the mean overall child engagement for medium overall caregiver facilitators was significantly lower than high overall caregiver facilitators $t(86) = (-5.42), p = .0001$. Cohen’s D effect size between groups was 1.15.

A second bivariate analysis was used to evaluate differences in a composite score of child positive feedback and child follow through among low, medium, and high parent support behavior classes. Results from this analysis can be found in Table 8.

Table 5

Relative Low, Medium, and High Overall Caregiver Facilitators and Composite Child Positive Social Feedback and Child Follow Through

Composite Child Positive Social Feedback and Child Follow Through (%)				
Variable	N=131	Mean	SD	P Value
Overall Caregiver Facilitator				<.0001**a
High	43	74.42	29.73	
Middle	45	49.22	22.31	
Low	43	36.51	17.85	

Note. ^aWelch’s One-way Analysis of Variance test for unequal variances and normal distributions, Bonferroni adjusted alpha levels of < .02, *p-value<.05 **p-value<.01

The Welch's one-way analysis of variance test for normal distributions and heterogeneity of variance was conducted with Bonferroni adjusted alpha levels of $< .02$. Results of Welch's ANOVA indicated that the three groups significantly differed significantly, $F(2, 82.19) = 25.71$, $p = < .0001$. Post hoc pairwise comparisons using the Tukey HSD test indicated that the mean child composite scores for low overall caregiver facilitator ($M = 36.51$, $SD = 17.85$) medium overall caregiver facilitators ($M = 49.22$, $SD = 22.31$) and overall high caregiver facilitators ($M = 74.42$, $SD = 29.73$) all differed significantly between groups. Results from independent samples t-tests using Satterthwaite approximation indicated that mean child composite scores for low overall caregiver facilitators were significantly lower compared to medium overall caregiver facilitators, $t(86) = (-2.94)$, $p = .004$ with a medium effect size between groups ($d = 0.629$). Mean child composite scores for low overall caregiver facilitators were significantly lower compared to high overall caregiver facilitators, $t(68.79) = (-7.17)$, $p = .0001$ with a very large effect size between groups ($d = 1.546$). Finally, there was a significantly lower mean child composite score for medium overall caregiver facilitators compared to high overall caregiver facilitators, $t(77.85) = (-4.48)$, $p = .0001$ with a large effect size ($d = 0.959$).

CHAPTER 5: DISCUSSION

Parent-mediated interventions in young children with autism are well established as an evidence-based guideline. Proper measurement tools of parent support behaviors are critical to assessing effectiveness of interventions of parent-mediated support of child social outcomes. It was initially suspected that progress-monitoring measures of both parent support and child social/behavioral outcomes would be infrequently used in the published literature, which systematic review confirmed. Furthermore, direct observation of parent-child interactions using the IPCI-2 tool confirmed that this particular measure is efficient, validated, easily learned, and potentially invaluable in quantifying parent support behaviors and child social behaviors in children with ASD.

As exhibited in our systematic review, there is no current standard practice regarding parent and child monitoring in the field of ASD. Although parent-mediation was theorized as the mechanism for promoting child social outcomes in all of the studies included in the systematic review, only 25.9% (n=7) used a measure of both parent and child behavior to assess directly observed behavior during parent-child interaction. Of concern, measures that were used to assess both parent and child behavior based on direct observation of parent-child interaction tended to fall into one of two categories. Some were very narrow in focus. For example, two studies focused primarily on shared parent-child positive affect such as smiling, laughing, and elevated playful tone (Brian et al, 2017; Vernon et al., 2012) which warranted reliance on supplementary, separate parent measures to account for additional support behaviors (as cited in Brian et al, 2017). The others involved complex coding schemes, and high levels of training, which are not consistent with recommendations for routine measurement in early intervention (Greenwood, Carta, & McConnell, 2011).

Direct observation of a sample of toddlers with ASD and their caregivers using the IPCI-2 progress-monitoring measure yielded easily quantifiable and interpretable parent support behavior and child social behavior outcomes with high reliability between two independent coders (92.5%) and significant associations between observed parent behavior and child social communication (Baggett et al., 2011; Schertz et al., 2017). Descriptive analysis of IPCI caregiver and child behaviors were similar for mothers and fathers. Although mothers engaged in higher levels of Maintaining and Extending and Acceptance and Warmth behavior as compared to fathers, this should be interpreted with caution given that this difference was due to five dyads that were univariate outliers.

Correlational analysis supported the study hypothesis that IPCI caregiver facilitator variables would positively correlate with child engagement behavior. Interestingly, caregiver maintains and extends, a behavior built upon following a child's lead, was significantly associated with positive social feedback. This finding suggests that children, whose caregivers provide high level support in maintaining their children's interest, have patterns of higher affective engagement with their parents. Analysis of variance and post-hoc comparison tests provided support for the second hypothesis that mean levels of child engagement behavior would differ significantly among levels of overall caregiver facilitator behaviors. Children whose caregivers engaged in higher levels of support (low versus medium versus high), engaged in significantly higher levels of overall engagement behaviors, as well as composite child follow through and positive social feedback behaviors, with large effects. This particular difference was interesting given that child follow through and child positive social feedback require social engagement, whereas sustained engagement – the child variable excluded from this composite – does not require social engagement behavior to be exhibited.

Contributions to Current Research

This study provided the first systematic review of the early parent-mediated intervention literature. The results from this review supported recommendations from several other studies addressing the need for measures of parent-child interaction that are sensitive to the key proximal indicators of positive parent support behavior and child outcomes to further the understanding of how various intervention components effect change (Brown & Woods, 2016; Oono & McConachie, 2013). It also highlighted the lack of practical, general progress monitors in use in the current early intervention literature. However, this study fills this gap by showing how the IPCI-2 can be used by lay practitioners working to measure progress in toddler social communication through parent-mediated intervention. This measure may be used by community interventionists to examine several areas of inquiry including information about whether coaching strategies are working as intended to increase levels of parent-responsivity as well as general mediating effects of parent behavior on child outcomes. This study showed that variations in levels of parent support (low, medium, high) predict levels of total child engagement behaviors as well as composite child follow through and positive social feedback. Parent-child interaction progress measures like the IPCI can be used to inform coaches about behaviors that parents are using more or less actively. This data-based information can be used to help coaches make decisions about when to modify coaching to provide more targeted support to parents.

Study Limitations and Implications for Future Research

This study was limited to descriptive analysis of video data of caregiver-child interaction. Future efforts should focus on evaluating the effects of intervention on change in caregiver-child interactions. Future research may also benefit from further investigation that expounds on the

results of this study. One example would be to include variables in analysis that may impact parent facilitator scores such as child autism diagnostic scores, parent stress indices, income-levels, and native-language in order to explore how these variables may describe variations in parent support, as indicated by the IPCI, before the start of the intervention. This may be used to guide decisions about coaching strategies and intensity of intervention in response to specific associations with low facilitator scores before intervention begins. Another, example, would be to consider outliers as a focus of inquiry as they may provide valuable information in regard to causes of variation within specific caregiver-child dyads. These cases may warrant follow-up work to explore as a phenomenon of interest. Furthermore, research should also investigate the use of the IPCI to measure specific changes in caregiver-child interaction at several times points pre- and post-intervention within randomized samples of toddlers with ASD. Future community interventions should ensure parent responsive behaviors are appropriately measured as recommended by using a parent-child interaction measure, such as the IPCI-2, that can be administered in short routine assessments to evaluate the progress of interventions and make quick decisions regarding treatment (Division for Early Childhood, 2014; Greenwood, Carta, & McConnell, 2011; Odom et al., 2016). Finally, if early ASD intervention studies exhibited more uniformity through use of a validated and reliable parent-child interaction measures, research would benefit from the ability to more accurately synthesize results from parent support within parent-mediated interventions.

Conclusion

Evaluating parent support behavior within the parent-child relationship in early intervention is critical because evidence shows responsive and sensitive caregiving leads to improved joint attention and social communication outcomes in toddlers with ASD. Evidence is

increasing that delivering parent-mediated early intervention through the meaningful and embedded parent-child relationship in natural environments gives children with ASD context to learn joint attention skills and improve other key social communication skills (Siller & Sigman, 2008; Green et al., 2017). Moreover, it is important that these outcomes are measured frequently in early intervention in order to maximize treatment efficiency. Through systematic review of the literature, this study highlighted the lack of practical examples of observation measures that can be used in the community setting. Results from a direct observation of parent-child interaction using the IPCI-2 monitoring tool demonstrated the feasibility of an observation measure with high reliability and utility to capture targeted constructs key to promoting social communication in toddlers with ASD.

References

- American Academy of Pediatrics (2016) Committee on Practice and Ambulatory Medicine. Bright Futures Periodicity Schedule Workgroup. Recommendations for preventive pediatric health care. *Pediatrics*, 137 (1):1-3
- American Psychiatric Association (2013) Diagnostic and statistical manual of mental disorders. (5th ed.). American Psychiatric Association: Arlington, VA
- Anderson DK, Liang JW, Lord C (2014) Predicting young adult outcome among more and less cognitively able individuals with autism spectrum disorders. *Journal of Child Psychology and Psychiatry*, 55(5):485-94
- Astington, J.W. & Dack, L.A. (2008) Theory of mind. Encyclopedia of infant and early childhood development. In: Haith MM, Benson JB, eds. San Diego, CA: Academic Press. Vol 3, 343-356.
- Bakeman, R., & Adamson, L. (1984). Coordinating Attention to People and Objects in Mother-Infant and Peer-Infant Interaction. *Child Development*, 55(4), 1278-1289.
doi:10.2307/1129997
- Baron-Cohen, S., Leslie, A.M. & Frith, U. (1985). Does the autistic child have a 'theory of mind'? *Cognition*. 21, 37-46.
- Baggett, K.M., Carta, J.J., Horn, E.M. (2011) Indicator of Parent-Child Interaction Manual. Juniper Gardens Children's Project, Kanas City, Kansas.
- Barr, R., Morin, M., Brito, N., Richeda, B., Rodriguez, J., & Shauffer, C. (2014). Delivering services to incarcerated teen fathers: A pilot intervention to increase the quality of father-infant interactions during visitation. *Psychological Services*, 11(1), 10-21.
<http://dx.doi.org/10.1037/a0034877>

- Bolton, P., Golding, J., Emond, A. & Steer, C., (2012). Autism spectrum disorder and autistic traits in the Avon Longitudinal Study of Parents and Children: precursors and early signs. *Journal of Academy of Child and Adolescent Psychiatry*. 51(3), 249-260. doi: 10.1016/j.jaac.2011.12.009
- Boyd, B.A., Odom, S.L., Humphreys, B.P., Sam, A.M. (2010) Infants and Toddlers With Autism Spectrum Disorder: Early Identification and Early Intervention. *Journal of Early Intervention*. 22 (2), 75-98. DOI: 10.1177/1053815110362690
- Boyd, B. A. (2002). Examining the relationship between stress and lack of social support in mothers of children with autism. *Focus on Autism and Other Developmental Disabilities*, 17, 208 –215.
- Buescher, A., Cidav, Z., Martin, K., Mandell, D.S. (2014) Costs of Autism Spectrum Disorders in the United Kingdom and the United States. *JAMA Pediatrics*.168(8), 721-728. doi:10.1001/jamapediatrics.2014.210
- Bradshaw, J., Koegel, L., Koegel, R, (2017) Improving Functional Language and Social Motivation with a Parent-Mediated Intervention for Toddlers with Autism Spectrum Disorder. *Journal of Autism Developmental Disorders*. 47, 2443-2458. DOI: 10.1007/s10803-017-3155.
- Brian, J. A., Smith, I. M., Zwaigenbaum, L., Roberts, W., & Bryson, S. E. (2016). The Social ABCs caregiver-mediated intervention for toddlers with autism spectrum disorder: Feasibility, acceptability, and evidence of promise from a multisite study. *Autism Research*, 9(8), 899–912. <http://doi.org/10.1002/aur.1582>
- Brown, J., Woods, J., (2016) Parent-Implemented Communication Intervention

- Sequential Analysis of Triadic Relationships. *Topics in Early Childhood Education*. (36) 2, 115-124. <https://doi.org/10.1177/0271121416628200>
- Campbell, S. B., Leezenbaum, N. B., Mahoney, A. S., Day, T. N., & Schmidt, E. N. (2015). Social Engagement with Parents in 11-Month-Old Siblings at High and Low Genetic Risk for Autism Spectrum Disorder. *Autism: The International Journal of Research And Practice*, 19(8), 915-924.
- Carta, J., Greenwood, C., Walker, D., Buzhardt, J. (2010). Using IGDIs: Monitoring Progress and Improving Intervention for Infants and Young Children. Juniper Garden's Children's Project. Baltimore, Maryland: Brookes Publishing.
- Carter, A., Messinger, D., Stone, W., Celimi, S., Nahmias, A., Yoder, P., (2011) A randomized controlled trial of Hanen's More Than Words' in toddlers with early autism symptoms. *Journal of Child Psychiatry*. 52 (7), 741-52. doi: 10.1111/j.1469-7610.2011.02395
- Centers for Disease Control and Prevention (2018) Community Report from the Autism and Developmental Disabilities Monitoring (ADDM) Network. Centers for Disease Control and Prevention. Retrieved from <https://www.cdc.gov/ncbddd/autism/addm-community-report/documents/addm-community-report-2018-h.pdf>
- Charman, T., Baron-Cohen, S., Swettenham, J., Baird, G., Cox, A. Drew, A., (2000) Testing joint attention, imitation, and play as infancy precursors to language and theory of mind. *Cognitive Development*. 15 (4), 481-498. [https://doi.org/10.1016/S08852014\(01\)00037-5](https://doi.org/10.1016/S08852014(01)00037-5)
- Cidav, Z., Munson, J., Estes, A., Dawson G., Rogers S., Mandell D. (2017) Cost Offset Associated With Early Start Denver Model for Children With Autism. *Journal of the American Academy of Child and Adolescent Psychiatry*. 56 (9), pp. 777-783.

Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., et al., (2010).

Randomized Controlled Trial of an Intervention for Toddlers With Autism: The Early Start Denver Model. *Pediatrics*. 125 (1). doi:10.1542/peds.2009-0958

Division for Early Childhood. (2014). DEC recommended practices in early intervention/early childhood special education 2014. Retrieved from <http://www.dec-sped.org/recommendedpractices>.

Drew, A., Baird, G., Baron-Cohen, S., Cox, A., Slonims, V., Wheelwright S., (2002). A pilot randomized control trial of a parent training intervention for pre-school children with autism. *European Child & Adolescent Psychiatry*. 11, 266-272. DOI: 10.1007/s00787-002-0299-6

Estes, A., Zwaigenbaum, L., Gu, H., St. John, T., Paterson, S., Elison, J. T., et al. (2015). Behavioral, cognitive, and adaptive development in infants with autism spectrum disorder in the first 2 years of life. *Journal of Neurodevelopmental Disorders*, 7(1), 24. <http://doi.org/10.1186/s11689-015-9117-6>

Estes, A., Munson, J., Rogers, S. J., Greenson, J., Winter, J., & Dawson, G. (2015). Long-Term Outcomes of Early Intervention in 6-Year-Old Children With Autism Spectrum Disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 54(7), 580–587. <http://doi.org/10.1016/j.jaac.2015.04.005>

Falkmer, T., Anderson, K., Falkmer, M., Horlin, C. (2013) Diagnostic procedures in autism spectrum disorders: a systematic literature review. *European Child & Adolescent Psychiatry*. 22, 329. Retrieved from <https://doi.org/10.1007/s00787-013-0375-0>

Feuerstein, R. (1980). *Instrumental enrichment: An intervention program for cognitive modifiability*. Baltimore: University Park Press.

- Foxx, R. M. (2008). Applied behavior analysis treatment of autism: The state of the art. *Child and Adolescent Psychiatric Clinics of North America*, 17(4), 821-834.
doi:<http://dx.doi.org/10.1016/j.chc.2008.06.007>
- Gillespie-Lynch, K., Sepeta, L., Wang, Y., Marshall, S., Gomez, L., Sigman, M., et al. (2012). Early Childhood Predictors of the Social Competence of Adults with Autism. *Journal of Autism and Developmental Disorders*, 42(2), 161–174. <http://doi.org/10.1007/s10803-011-1222-0>
- Greenwood, C.R., Carta, J., McConnell, S., (2011). Advances in Measurement for Universal Screening and Individual Progress Monitoring of Young Children. *Journal of Early Intervention*. (33) 4, 254-267. <https://doi.org/10.1177/1053815111428467>
- Green, J., Pickles, A., Pasco, G., Bedford, R., Wai Wan, M., Elsabbagh, M., et al. (2017). Randomized trial of a parent-mediated intervention for infants at high risk for autism: longitudinal outcomes to age 3 years. *The Journal of Child Psychology and Psychiatry*. 58, 1330–1340. <https://doi.org/10.1111/jcpp.12728>
- Gulsrud, A., Helleman, G., Shire, S., Kasari, C., (2016). Isolating active ingredients in a parent-mediated social communication intervention for toddlers with autism spectrum disorder. *Journal of Child Psychology and Psychiatry*. 57 (5), 606-13. doi: 10.1111/jcpp.12481
- Hartley, S. L., Barker, E. T., Seltzer, M. M., Floyd, F., Greenberg, J., Orsmond, G., et al. (2010). The Relative Risk and Timing of Divorce in Families of Children with an Autism Spectrum Disorder. *Journal of Family Psychology*. 24(4), 449–457.
<http://doi.org/10.1037/a0019847>
- Hackworth, N. J., Berthelsen, D., Matthews, J., Westrupp, E. M., Cann, W., Ukoumunne, O. C., Nicholson, J. M. (2017). Impact of a Brief Group Intervention to Enhance Parenting and

- the Home Learning Environment for Children Aged 6–36 Months: a Cluster Randomised Controlled Trial. *Prevention Science*, 18(3), 337–349. <http://doi.org/10.1007/s11121-017-0753-9>
- Harrop, C., Gulsrud, A., Shih, W., Hovsepyan, L., Kasari, C. (2017) The Impact of Caregiver-Mediated JASPER on Child Restricted and Repetitive Behaviors and Caregiver Responses. *Autism Research*. 10, 983-992. DOI: 10.1002/aur.1732
- Harrop, C., Gulsrud, A., Shih, W., Hovsepyan, L., Kasari, C. (2016) Characterizing caregiver responses to restricted and repetitive behaviors in toddlers with autism spectrum disorder. *Autism*. Sage Publications. 20(3) 330–342. DOI: 10.1177/1362361315580443
- Hill, A.P., Zuckerman, K., Fombonne, E., (2014) Epidemiology of Autism Spectrum Disorders. *Translational Approaches to Autism Spectrum Disorder*. Wiley & Sons. Eds: Fred Volkmar. DOI: 10.1007/978-3-319-16321-5_2
- Hoffman, C. D., Sweeney, D. P., Hodge, D., Lopez-Wagner, M. C., & Looney, L. (2009). Parenting stress and closeness: mothers of typically developing children and mothers of children with autism. *Focus on Autism and Other Developmental Disabilities*, 24(3), 178–187.
- Ingersoll, B., Hambrick, D.Z., (2011) The relationship between the broader autism phenotype, child severity, and stress and depression in parents of children with autism spectrum disorders, *Research in Autism Spectrum Disorders*, 5 (1), 337-344. <https://doi.org/10.1016/j.rasd.2010.04.017>.
- Johnson, C.P., Meyers, S.M. (2007). Identification and Evaluation of Children with Autism Spectrum Disorders. *Pediatrics*, 120, 1183-215. DOI: 10.1542/peds.2007-2361

- Jones, W., & Klin, A. (2013). Attention to Eyes is Present but in Decline in 2–6-Month-Olds Later Diagnosed with Autism. *Nature*, 504(7480), 427–431.
<http://doi.org/10.1038/nature12715>.
- Kasari C, Gulsrud A, Freeman S, Paparella T, Hellemann G., Berry, K., (2015). Randomized comparative efficacy study of parent-mediated interventions for toddlers with autism. *Journal of Consulting and Clinical Psychology*. 83 (3), 554-563.
<http://dx.doi.org/10.1037/a0039080>.
- Kasari, C, Gulsrud, A, Freeman, S., Paparella T, Hellemann, G. (2012). Longitudinal follow-up of children with autism receiving targeted interventions on joint attention and play. *Journal of the American Academy of Child Adolescent Psychiatry*. 51:487–495.
- Kasari, C., Gulsrud, A., Wong, C., Kwon, S., Locke, J., (2010). Randomized Controlled Caregiver Mediated Joint Engagement Intervention for Toddlers with Autism. *Journal of Autism and Developmental Disorders*. 40, 1045-1056. DOI 10.1007/s10803-010-0955-5.
- Kasari , C., Paparella, T., Freeman, S., Jahromi, L. (2008). Language outcome in autism: Randomized comparison of joint attention and play interventions. *Journal of Consulting and Clinical Psychology*, 76(1), 125-37. DOI: 10.1037/0022-006X.76.1.125
- Kasari, C., Siller, M., Huynh, L., Shih, W., Swanson, M., Hellemann, G., et al, (2014). Randomized controlled trial of parental responsiveness intervention for toddlers at high risk for autism. *Infant Behavior and Development*. 37, 711-721.
<http://dx.doi.org/10.1016/j.infbeh.2014.08.007>
- Kennedy, D. P., & Courchesne, E. (2008). Functional abnormalities of the default network during self- and other-reflection in autism. *Social Cognitive and Affective Neuroscience*, 3(2), 177–190. <http://doi.org/10.1093/scan/nsn011>

- Koegel, L.K., Koegel, R.L., Fredeen, R.M., Gengoux, G.W. (2008) *Naturalistic Behavioral Approaches to Treatment. Autism Spectrum Disorders in Infants and Toddlers: diagnosis, assessment, and treatment*. Ed. Chawarska, Katarzyna, Klin, Ami, Volkmar, Fred. New York, New York: The Guilford Press.
- Kuhn-Popp, N., Kristen, S., Paulus, M., Meinhardt, J., Sodian, B., (2016). Left hemisphere EEG coherence in infancy predicts infant declarative pointing and preschool epistemic language. *Social Neuroscience*. 11(1), 49-59. doi: 10.1080/17470919.2015.1024887
- Landa, R. J., Stuart, E. A., Gross, A. L., & Faherty, A. (2013). Developmental Trajectories in Children With and Without Autism Spectrum Disorders: The First 3 Years. *Child Development*, 84(2), 429–442. <http://doi.org/10.1111/j.1467-8624.2012.01870.x>
- Landry, S.H. (2014) The role of parents in early childhood learning. *Encyclopedia on Early Childhood Development* [online]. Retrieved from <http://www.child-encyclopedia.com/parenting-skills/according-experts/role-parents-early-childhood-learning>.
- Lavelle, T.A., Weinstein, M.C., Newhouse, J.P., Munir, K., Kuhlthau, K.A., Prosser, L.A. (2014) Economic Burden of Childhood Autism Spectrum Disorders. *Pediatrics*. 133 (3), 1347-1360. Retrieved from <http://pediatrics.aappublications.org/content/133/3/e520>.
- Leigh, J.P., Du, J. (2015) Brief Report: Forecasting the Economic Burden of Autism in 2015 and 2025 in the United States. *Journal of Autism and Developmental Disorders*. 45(12): 4135-9 DOI: 10.1007/s10803-015-2521-7.
- Lord C, Rutter M, DeLavore PC, Risi, S (1999, 2001, 2002, 2008). *Autism Diagnostic Observation Schedule*. Los Angeles: Western Psychological Services

- MacDonald, R., Parry-Cruwys, D., Dupere, S., Ahearn, W. (2014) Assessing progress and outcome of early intensive behavioral intervention for toddlers with autism. *Research in Developmental Disabilities*. 35 (12), 3632-3644. Retrieved from <https://doi.org/10.1016/j.ridd.2014.08.036>
- McCrimmon, A., & Rostad, K. (2014). Test Review: Lord, C., Luyster, R. J., Gotham, K., & Guthrie, W. (2012). "Autism Diagnostic Observation Schedule, Second Edition (ADOS-2) Manual (Part II): Toddler Module." Torrance, CA: Western Psychological Services, 2012. Lord, C., Rutter, M., DiLavore, P. C., Risi, S., Gotham, K., & Bishop, S. "Autism Diagnostic Observation Schedule, Second Edition." Torrance, CA: Western Psychological Services, 2012. *Journal Of Psychoeducational Assessment*, 32(1), 88-92.
- Mundy, P. (2017). A review of joint attention and social-cognitive brain systems in typical development and autism. *European Journal of Neuroscience*. doi 10.1111/ejn.13720.
- Mundy, P. (2016). *Autism and Joint Attention: Development, Neuroscience, and Clinical Fundamentals*. (1st ed.) The Guilford Press.
- Murza, K.A., Schwartz, J.B., Hahs-Vaughn, D.L., Nye, C. (2016) Joint attention interventions for children with autism spectrum disorder: a systematic review and meta-analysis. *International Journal of Language and Communication Disorders*. 51 (3), 236-251. doi: 10.1111/1460-6984.12212
- Muzammal, M., & Jones, E., (2017). Social communication Intervention for Toddlers with Autism Spectrum Disorder: Effects of Initiating Joint Attention and Interactions with Mother. *Journal of Developmental and Physical Disabilities*. 29, 203-221. doi:10.1007/s10882-016-9519-8

- National Autism Center. (2009). National standards report: The national standards project — addressing the need for evidence-based practice guidelines for autism spectrum disorders. Randolph, MA: National Autism Center
- National Research Council. (2001). *Educating Children with Autism*. Washington, D.C.: National Academy Press.
- Neimy, H., Pelaez, M., Carrow, J., Monlux, K., & Tarbox, J. (2017). Infants at risk of autism and developmental disorders: Establishing early social skills. *Behavioral Development Bulletin*, 22 (1), 6-22. doi:10.1037/bdb0000046
- Oono, I.P., Honey, E.J. , McConachie, H. (2013) Parent-mediated early intervention for young children with autism spectrum disorders (ASD). The Cochrane Database of Systematic Reviews. Issue 4. doi: 10.1002/14651858.CD009774.pub2.
- Oosterling, I., Visser, J., Swinkels, N., Donders, R., Woudenberg, T., Roos, S., et al., (2010). Randomized Controlled Trial of the Focus Parent Training for Toddlers with Autism: 1-Year Outcome. *Journal of Autism and Developmental Disorders*. 40, 1447-1458. doi: 10.1007/s10803-010-1004-0
- Ozonoff, S., Iosif, A.-M., Baguio, F., Cook, I. C., Hill, M. M., Hutman, T., Young, G. S. (2010). A Prospective Study of the Emergence of Early Behavioral Signs of Autism. *Journal of the American Academy of Child and Adolescent Psychiatry*, 49(3), 256–66.e1–2.
- Pierce, K., Courchesne, E., & Bacon, E. (2016). To screen or not to screen universally for autism is not the question: Why the task force got it wrong. *The Journal of Pediatrics*, 176, 182–194.
- Reichow, B., Boyd, B. A., Barton, E. E., & Odom, S. L. (2016). *Handbook of early childhood special education*. Springer International Publishing. DOI: 10.1007/978-3-319-28492-7

- Robins DL, Fein D, Barton M. (1999). The Modified Checklist for Autism in Toddlers (M-CHAT). Self-published.
- Rollins, P., Campbell, M., Hoffman, R., Self, K., (2016). A community-based early intervention program, for toddlers with autism spectrum disorders. *Autism*. 20(2), 219-232. doi: 10.1177/1362361315577217
- Rogers, S.J., Estes, A., Lord, C., Vismara, L., Winter, J., Fitzpatrick, A., et al., (2012). Effects of a Brief Early Start Denver Model (ESDM)- Based Parent Intervention on Toddlers at Risk for Autism Spectrum Disorders: A Randomized Controlled Trial. *Journal of the American Academy of Child & Adolescent Psychiatry*.(51)10. Retrieved from www.jaacap.org
- Rogers, S.J., Talbott, M.R. (2016) Early Identification and Early Treatment of Autism Spectrum Disorder. *International Review of Research in Developmental Disabilities*. Vol. 50, 233-274. Retrieved from <http://dx.doi.org/10.1016/bs.irrdd.2016.05.004>
- Rutter, M, Le Couteur, A, Lord, C (2003). *Autism Diagnostic Interview Revised (ADI-R)*. Los Angeles, CA: Western Psychological Services.
- Schertz, H. H., Odom, S. L., (2007). Promoting Joint Attention in Toddlers with Autism: A Parent-Mediated Developmental Model. *Journal of Autism and Developmental Disorders*. 37, 1562-1575. doi: 10.1007/s10803-006-0290-z.
- Schertz, H. H., Odom, S. L., Baggett, K.M., Sideris, J.H., (2013). Effects of Joint Attentions Mediated Learning for toddlers with autism spectrum disorders: An initial randomized controlled study. *Early Childhood Research Quarterly*. 28, 249-258. <http://dx.doi.org/10.1016/j.ecresq.2012.06.006>

- Schertz, H. H., Odom, S. L., Baggett, K. M., & Sideris, J. H. (2017). Mediating parent learning to promote social communication for toddlers with autism: Effects from a randomized controlled trial. *Journal of Autism and Developmental Disorders*. Advance online publication. doi:10.1007/s10803-017-3386-8.
- Schilbach, L. Wilms, M., Eickhoff, S., Romanzetti, S., Tepest, R. et al. (2010). Minds made for sharing: initiating joint attention recruits reward-related neurocircuitry. *Journal of Cognitive Neuroscience*. 22(12), 2707-15. doi: 10.1162/jocn.2009.21401.
- Schopler E. C., Reichler R., Renner B., (1988). The Childhood Autism Rating Scale (CARS). Western Psychological Services, Los Angeles, CA
- Schreibman, L., Dawson, G., Stahmer, A.C., Landa, R., Rogers, S.J., McGee, G.G., Halladay, A. (2015). Naturalistic Developmental Behavioral Interventions: Empirically Validated Treatments for Autism Spectrum Disorder. *Journal of Autism and Developmental Disorders*, 45(8), 2411-2428. <http://doi.org/10.1007/s10803-015-2407-8>.
- Shattuck, P.T. (2006) The contribution of diagnostic substitution to the growing administrative prevalence of autism in U.S. special education. *Pediatrics*. 117(4):1028–1037.
- Shire, S., Gulsrud, A., & Kasari, C., (2016). Increasing Responsive Parent-Child Interactions and Joint Engagement: Comparing the Influence of Parent-Mediated Intervention and Parent Psychoeducation. *Journal of Autism and Developmental Disorders*. 46, 1737-1747. doi: 10.1007/s10803-016-2702-z
- Siller, M., Morgan, L., Turner-Brown, L., Baggett, K. M., Baranek, G. T., Brian, J. & Zwaigenbaum, L. (2013). Designing studies to evaluate parent-mediated interventions for toddlers with autism spectrum disorder. *Journal of Early Intervention*, 35, 355–377. doi:10.1177/1053815114542507

- Siller, M., & Sigman, M. (2008). Modeling longitudinal change in the language abilities of children with autism: Parent behaviors and child characteristics as predictors of change. *Developmental Psychology*, 44(6), 1691-1704.
- Siller, M., Sigman, M. (2002) The behaviors of parents of children with autism predict the subsequent development of their children's communication. *Journal of Autism and Developmental Disorders*. 32, 77–89.
- Steiner, A. M. (2011). A strength-based approach to parent education for children with autism. *Journal of Positive Behavior Interventions*, 13, 178–190.
- Steiner, A.M., Gengoux, G., Klin, A., Chawarska, K., (2013). Pivotal Response Treatment for Infants At-Risk for Autism Spectrum Disorders: A Pilot Study. *Journal of Autism and Developmental Disorders*. 43, 91-102. doi: 0.1007/s10803-012-1542-8
- Stuart, M., & McGrew, J. H. (2009). Caregiver burden after receiving a diagnosis of an autism spectrum disorder. *Research in Autism Spectrum Disorders*, 3, 86–97.
- Van Steensel, F. J. A., Bögels, S. M., & Perrin, S. (2011). Anxiety Disorders in Children and Adolescents with Autistic Spectrum Disorders: A Meta-Analysis. *Clinical Child and Family Psychology Review*, 14(3), 302–317. <http://doi.org/10.1007/s10567-011-0097-0>
- Vig, S., Kaminer, R. (2002) Maltreatment and Developmental Disabilities. *Journal of Developmental and Physical Disabilities*. (14) 4. Retrieved from <https://link.springer.com/content/pdf/10.1023%2FA%3A1020334903216.pdf>
- Vernon, T., Koegel, H., Stolen, K., (2012). An Early Social Engagement Intervention for Young Children with Autism and their Parents. *Journal of Autism and Developmental Disorders*. 42, 2707-2717. doi: 10.1007/s10803-012-1535-7.

- Vismara, L. & Lyons, G., (2007). Using Perseverative Interests to Elicit Joint Attention Behaviors in Young Children With Autism. *Journal of Positive Behavior Interventions*.9(4), 214-228.
- Vismara, L., McCormick, C., Young, G., Nadhan, A., Monlux, K. (2013). Preliminary Findings of a Telehealth Approach to Parent Training in Autism. *Journal of Autism and Developmental Disorders*. 43, 2953-2969. doi: 10.1007/s10803-013-1841-8
- Vygotsky, L. S. (1934/1986). In A. Kozulin (Transl.). *Thought and language*. Cambridge, MA: MIT Press.
- Walker, D., Carta, J.J., Greenwood, C.R., & Buzhardt, J.F (2008) The Use of Individual Growth and Developmental Indicators for Progress Monitoring and Intervention Decision Making in Early Education, *Exceptionality*, (16)1, 33-47, DOI: [10.1080/09362830701796784](https://doi.org/10.1080/09362830701796784)
- Weitlauf, A.S., McPheeters, M.L., Peters, B., Sathe, N., Travis, R., Aiello, R. et al. (2014) Therapies for Children With Autism Spectrum Disorder: Behavioral Interventions Update. Agency for Healthcare Research and Quality. Comparative Effectiveness Review, 137. Retrieved from <https://www.ncbi.nlm.nih.gov/books/NBK241444/>
- Welterlin, A., Turner-Brown, L., Harris, S., Mesibov, G., Delmolino, L. (2012). The Home TEACCHing Program for Toddlers with Autism. *Journal of Autism and Developmental Disorders*. 42, 1827-1835. doi:10.1007/s10803-011-1419-2
- Weng, S., Wiggins, J., Peltier, S., Carrasco, M., Risi, S., Lord, C., et al. (2010). Alterations of resting state functional connectivity in the default network in adolescents with autism spectrum disorders. *Brain Research*. 1313, 202-14. doi: 10.1016/j.brainres

Wetherby, A., Guthrie, W., Woods, J., Schatschneider, C., Holland, R., Morgan, L. et al. (2014).

Parent-Implemented Social Intervention for Toddlers With Autism: An RCT. *Pediatrics*.

1234(6). Retrieved from <http://pediatrics.aappublications.org/>.

Wetherby, A. & Prizant, B (2002) CSBS DP Manual: Communication and Symbolic Behavior

Scales : Developmental Profile. Baltimore, MD: Brookes Publishing

Wetherby, A. & Woods, J., (2006). Early Social Interaction Project for Children With Autism

Spectrum Disorders Beginning in the Second Year of Life. *Topics in Early Childhood*

Special Education. 26(2), 67-82.

Yoder, P. J., & Warren, S. F. (1999). Maternal responsivity mediates the relationship between

prelinguistic intentional communication and later language. *Journal of Early Intervention*,

22, 126–136.

Zenko, C. B., & Hite, M. P. (2014). Here's How to Provide Intervention for Children with

Autism Spectrum Disorder : A Balanced Approach. San Diego, CA: Plural Publishing,

Inc.

Zwaigenbaum, L., Bauman, M. L., Choueiri, R., Kasari, C., Carter, A., Granpeesheh, D. et al.,

(2015). Early Intervention for Children With Autism Spectrum Disorder Under 3 Years

of Age: Recommendations for Practice and Research. *Pediatrics*. Retrieved from

<http://pediatrics.aappublications.org/>.

Appendix A

Variable Definitions for Systematic Review

Variable	Definition
Study Design	Study design was defined as Randomized Controlled Trial, Quasi-experimental, Single-subject design.
ASD Inclusion Method	Gold-standard = ADOS, ADOS-2 Standardized Measure = e.g. ADI-R, CSBS, VABS, CARS Screener = e.g. M-CHAT Referral = e.g. Referral from Part C or other regional services with fixed diagnostic protocol
Sample Characteristics	
Child Gender	Majority ¹ male or female
Caregiver Education	Majority ¹ education level represented in the sample: less than high school, high school, some college/trade, college graduate, post-graduate school, unreported
Maternal Age	Mode or mean age of mothers < 30 years or > 30 years
Employment	Majority ¹ unemployed, majority unemployed, unreported
Household Income	Sample majority ¹ : < \$15,000 \$15,000 - \$40,000 > 41,000 - \$60,000 > \$60,000 unreported
Race or ethnicity	Percentage Majority ¹ white, non-white or non-western origin, race/ethnicity unreported
Native-Language	Majority ¹ native-language reported as English, Spanish, other, or unreported
Observation Measure	Child only = Study reported observed child behavior only and did not measure parent behavior. Separate = Study reported on observed parent support of child social communication using separate observational measures of parent support and toddler behaviors. Single = Study reported single direct observational parent-child interaction measure for both parent and child behaviors.

¹Majority = mode or largest proportion was used to report majority if study only reported mode or percentage of sample. Mean used if mode or proportion were not reported. Two codes for one variable indicates the majority was split between groups.

APPENDIX B

Systematic Review Study Categories

	Bradshaw et al. (2017)	Brian et al. (2017)	Brown & Woods (2015)	Carter et al. (2011)	Dawson et al. (2010)	Drew et al. (2002)	Gulsrud et al. (2016)	Harrop et al. (2017)	Ingersoll et al. (2005)	Kasari et al. (2015)	Kasari et al. (2014)	Kasari et al. (2010)	Muzammal & Jones (2017)	Oosterling et al. (2010)	Rogers et al. (2012)	Rollins et al. (2016)	Schertz & Odom et al. (2007)	Schertz et al. (2013)	Schertz et al. (2017)	Shire et al. (2016)	Steiner et al. (2013)	Vernon et al. (2012)	Vismara & Lyons (2007)	Vismara et al. (2013)	Welterlin et al. (2012)	Wetherby & Woods et al. (2006)	Wetherby et al. (2014)	
Study Design																												
RCT		x		x	x	x	x	x		x	x	x		x	x			x	x	x								x
Quasi-experimental																										x		
Single-subject	x		x						x				x			x	x				x	x	x	x	x			
Categories of ASD																												
Gold-standard ADOS	x	x	x	x	x		x	x		x				x	x	x		x	x	x	x	x		x		x	x	
Standardized					x	x	x	x	x	x	x	x		x		x	x			x		x						
Screeners											x						x											
Referral													x										x		x			
Sample Characteristics																												
Child Gender																												
Male	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	
Females			x																									
Unreported																		x										
Caregiver Education Level																												
Less than high school																												
High School														x			x									x	x	
Some College/Trade				x			x	x		x				x		x		x	x	x					x	x	x	
College Graduate	x	x	x	x			x	x		x	x	x			x	x			x	x			x	x	x			
Post-graduate School	x	x													x										x			
Unreported					x	x			x				x									x	x					

APPENDIX B

Systematic Review Study Categories cont'd

	Bradshaw et al. (2017)	Brian et al. (2017)	Brown & Woods (2015)	Carter et al. (2011)	Dawson et al. (2010)	Drew et al. (2002)	Gulkrud et al. (2016)	Harrop et al. (2017)	Ingersoll et al. (2005)	Kasari et al. (2015)	Kasari et al. (2014)	Kasari et al. (2010)	Muzammal & Jones (2017)	Oosterling et al. (2010)	Rogers et al. (2012)	Rollins et al. (2016)	Schertz & Odom (2007)	Schertz et al. (2013)	Schertz et al. (2017)	Shire et al. (2016)	Steiner et al. (2013)	Vernon et al. (2012)	Vismara & Lyons (2007)	Vismara et al. (2013)	Welterlin et al. (2012)	Wetherby & Woods et al. (2006)	Wetherby et al. (2014)	
Maternal Age																												
< 30 years																		x										
> 30 years							x	x		x		x							x	x		x					x	x
Unreported	x	x	x	x	x	x			x		x		x	x	x	x		x			x		x	x	x			
Employment																												
Majority employed	x		x						x										x						x			
Majority unemployed												x																
Unreported		x		x	x	x					x		x	x	x	x	x		x	x	x	x	x		x	x	x	x
Household Income																												
≤ \$15,000																												
\$15,000 - \$40,000											x																	
\$41,000 - \$60,000																												
> \$60,000											x				x										x			
Unreported	x	x	x	x	x	x	x	x	x	x		x	x	x		x	x	x		x	x	x	x		x	x	x	x
Race/Ethnicity																												
Majority White	x	x			x		x	x		x		x			x				x	x				x	x	x	x	x
Majority Nonwhite			x	x							x				x		x				x		x					
Unreported						x			x				x					x				x						

APPENDIX B

Systematic Review Study Categories cont'd

	Bradshaw et al. (2017)	Brian et al. (2017)	Brown & Woods (2015)	Carter et al. (2011)	Dawson et al. (2010)	Drew et al. (2002)	Gulsrud et al. (2016)	Harrop et al. (2017)	Ingersoll et al. (2005)	Kasari et al. (2015)	Kasari et al. (2014)	Kasari et al. (2010)	Muzammal & Jones (2017)	Oosterling et al. (2010)	Rogers et al. (2012)	Rollins et al. (2016)	Schertz & Odom et al. (2007)	Schertz et al. (2013)	Schertz et al. (2017)	Shire et al. (2016)	Steiner et al. (2013)	Vernon et al. (2012)	Vismara & Lyons (2007)	Vismara et al. (2013)	Welterlin et al. (2012)	Wetherby & Woods et al. (2006)	Wetherby et al. (2014)	
Language																												
English	x		x													x								x				
Spanish																x												
Other																												
Unreported		x		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x	x	x	x	x
Observation Measure																												
Child only					x	x				x			x			x	x	x	x								x	x
Separate	x		x						x			x			x					x	x		x	x	x			
Single		x		x			x	x			x			x								x						

*If only mean education years were reported, then education level was categorized by closest range around the average (e.g. 15.7 years of education would be coded to include categories for high school graduate and some college/trade school, since it is above 13 and below 17 years).

Appendix C

IPCI-2 Variable Definitions

Variable	Definition
Caregiver Facilitators	
Acceptance and Warmth	Smiling at the child, making positive comments to or about the child, providing affectionate touch, agreeing with something the child has said, indicating that the child's behavior is correct, confirming what the child has just said, thanking the child for something, stating that the child made a good effort, even if the task was not performed correctly.
Descriptive Language	Comment both labels and connects objects, persons, and actions. The comment labels and connects objects and adjectives in a complete sentence. Use of pronouns is acceptable as long as the statement meets previous criteria. Do not count negative descriptive statements about the child.
Follows Lead	Noticing what the child is interested in and specifically commenting on the child's interest or joining in the activity with some kind of action without interrupting the child. Caregiver does not interrupt or redirect the child's behavior. Examples include: attending, imitating, joining, turn-taking, or commenting appropriately on the child's interest.
Maintains and Extends	Caregiver must already be following child's lead to for this behavior to be scored. Caregiver adds on to what the child is already doing by introducing a theme, materials, or activity in a novel way to build on the child's interest and extend their focus. Maintains and extends involves a back and forth pattern of engagement between caregiver and child.
Overall Caregiver Facilitator	Total percent summary variable for all caregiver facilitator item level variables
Child Engagement	
Positive Social Feedback	Eye contact, words, vocalizing, smiling, laughing, or gentle touch clearly directed at the caregiver. Positive

commenting and gentle affectionate touch is an example of social feedback regardless of whether it is paired with looking at the caregiver. While the signal and look do not need to happen at exactly the same time, they should occur within at least 10 seconds.

Follow Through

When the caregiver attempts to engage the child or requests action, the child follows through by vocalizing, gesturing, or attempting the task. Requesting can be gestural or verbal but must involve a specific prompt. Watch for child to follow a caregiver's instruction, follow through with a verbal request or clear non-verbal cue that may or may not be paired with a verbal request or instruction. Follow through is the first chain of response in turn-taking behavior – watch for the caregiver to start a turn and for the child to respond.

Sustained Engagement

Child engages in a social or nonsocial activity for a sustained length of time. Consider both social and non-social engagement with materials or toys. The child should be engaged in an activity for the majority of the interval with only brief intermittent breaks such as looking away and then refocusing. If a child shifts focus between more than two activities during the interval or is not actively engaged such as looking around the room, then this is not an example of sustained engagement.

Composite

Composite created to isolate primarily social-oriented child variables: positive social feedback and follow through total percent summary variable

Overall Child Engagement

Total percent summary variable for all child engagement item level variables

APPENDIX D



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	17
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	16
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	17
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	20
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	17
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	18-19
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	18-19
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	18
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	20-21
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	

APPENDIX D



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	20
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	20
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	23-25
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	24-25
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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