A PARENT-IMPLEMENTED SOCIAL-COMMUNICATION INTERVENTION FOR INFANTS AND TODDLERS AT RISK FOR A DIAGNOSIS OF AUTISM LIVING IN POVERTY

By

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Submitted to the graduate degree program in Special education, and the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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Date Defended: June 9, 2014

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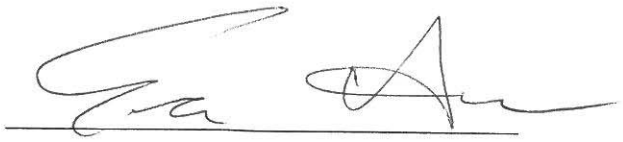

Chairperson Dr. Eva Horn

Date approved: 6/9/2014

ABSTRACT

This dissertation evaluates the effects of a parent-implemented social-communication intervention designed to support families affected by poverty with infants and toddlers at risk for or diagnosed with autism. The efficacy of the intervention package was assessed across four parent-child dyads utilizing a concurrent multiple probe design. The results indicate that the parents who have low-income and represent diverse cultural and educational backgrounds were able to learn the social-communication intervention in a brief 10 week study and implement the strategies within their own homes. Additionally, positive changes were observed in the parents' behavior in areas not directly targeted within the intervention package, such as an increase in appropriate proximity and positive language while playing with their children. All infant and toddler participants within this study showed an increased use of functional verbal communication. This study found similar positive outcomes for parents and their children as previous parent-implement intervention studies for children with autism; therefore, this study provides empirical evidence that parents living in poverty with multiple risk factors are capable of implementing social-communication intervention within their homes in order to positively influence their child's social communication development.

This document includes five chapters: (a) introductory overview which includes a statement of purpose and research questions (i.e., chapter 1), (b) a literature synthesis of the current parent-implemented home-based infant/toddler autism research (i.e., Chapter 2),(c) the research study (i.e., chapter 3), followed by (d) the results (i.e., chapter 4) and (e)the discussion which includes limitations and implications for research (i.e., chapter 5).

ACKNOWLEDGEMENTS

It is with genuinely warm appreciation that I thank the faculty members at the University of Kansas. My Jayhawk family not only provided guidance but continuous support and encouragement on this journey.

Dr. Eva Horn, thank you for sharing your immense knowledge about early childhood and higher education. Through your positive and patient mentoring style, I was able to grow and learn as a writer, researcher, and educator. Dr. Richard Simpson, thank you for your mentorship and your encouragement to explore applied settings and the implementation of evidence-based practices. Dr. Claudia Dozier, thank you for challenging me to advance my understanding of applied behavioral analysis and for providing me with instrumental feedback. Dr. Steven Warren, Dr. Barbra Thompson, and Dr. Greg Cheatham, thank you for your positive influence on my doctoral experience and your support as members of my doctoral committee.

I also would like to acknowledge the families who welcomed me into their homes and willingly shared their neighborhoods, lifestyles, friends, and family with the goal of improving their child's development. I learned many lessons during my time spent within their homes and communities, and I am very grateful for their participation in this study. Their participation in this study will increase the understanding of how early interventionists can effectively support low-income, high-risk parents implementing interventions within their own homes.

I am also grateful for the foundational education and research experience provided at The University of California, Santa Barbara, at the Koegel Autism Research and Training Center, where the mentorship from Lynn and Bob Koegel along with their doctoral students was energizing. In particular, Nicolette Nefdt-Gonzalez and Suzanne Robinson taught me how to evaluate research studies, code for reliability, implement interventions with fidelity across multiple applied settings, and, most of all, how to love research.

My sincere appreciation and thanks to Vera Lynn Stroup-Reinter, Cathie Huckins, Kelly Frantz-Langford, and Karen Buhler. Their endless hours of encouragement along with their friendship supported me through the long winters and hot summers away from my friends and family while completing my doctoral program.

Lastly, thank you to my family, whose encouragement, loving support, and, most of all, patience allowed me to pursue my passion and dream to become a behavioral scientist. To Linda Smith, for your hours and hours of proof reading and being my constant sounding board. To my parents, and brother my deepest thanks and gratitude for always encouraging me. Finally, to my husband, my closest and dearest companion on this journey. I do not have the words to thank you enough for your positive attitude, your relentless encouragement, and to the sacrifices you made that allowed this project to be possible.

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Chapter 1: Introduction

Once considered a rare disorder, autism is now one of the most common developmental disabilities in the United States, affecting one in 88 children (Center for Disease Control, 2011). Children included in the category of Autism Spectrum Disorder, also known as Pervasive Developmental Disorder (American Psychiatric Association, 2000), share three common characteristics: (1) impaired social skills, (2) delayed language development or impaired use of language, and (3) repetitive behavior and restricted interests. The manifestation of autism is unique for each individual but is believed to impact these core areas of life starting at a young age and "has life-long effects" (National Research Council, 2001, P.11).

Background

Although autism is not typically diagnosed in infants and toddlers, research suggests that early indicators may well be present before a significant delay in language can be reliably detected (Osterling & Dawson, 1994; Werner, Dawson, Munson, & Osterling, 2005). Some of these early indicators focus on atypical social-emotional development, including absence of a social smile and limited gestures and vocalizations (Boyd, Odom, Humphreys, & Sam, 2010). Awareness of earlier indicators of autism may allow for earlier identification and thus the provision of potentially preventative social communication interventions for young children at risk for a diagnosis of autism through early intervention.

Early Intervention under Part C of IDEA. Infants and toddlers with multiple red flags for autism or with delays in social communication often qualify for early intervention services under Part C of the Individuals with Disabilities Education Act (IDEA, 2004). Part C of IDEA is not an autism specific early intervention program but a federally funded program that serves families with infants and toddlers birth through three years of age who have developmental

delays or established risk conditions and disabilities. Part C of IDEA, or the Infant Toddler program, requires that research-based interventions be individualized for the child and family and be provided within the "natural environment, including the home and community settings in which children without delays of disabilities participate" (20 U.S.C. Sec. 632(4)). The intent of early intervention covered under Part C of IDEA is not only "to enhance the development of infants and toddlers with disabilities" but also "to enhance the capacity of families to meet the special needs of their infants and toddlers" (20 U.S.C. Sec. 631 (a)).

The Role of the Family in Part C Services. Part C of IDEA also states that services should be provided not only to improve the infants' and toddlers' development but also to improve the family's ability to support their child within their home and community (20 U.S.C. Sec. 631 (a)). The law mandates that the Individualized Family Service Plan (IFSP), which is the written document describing early intervention services to be provided, identifies the family's priorities and concerns and requires that parents are active participants in the planning of their child's intervention (20 U.S.C. Sec. 636(4)). Schertz, Baker, Hurtwiz and Benner (2011), however, in their review of 27 intervention studies for infants and toddlers at high risk for autism noted that more than one third of the studies reviewed (37%) did not involve parents during any aspect of the intervention, and two thirds (66%) of the interventions were not provided within the family's home or everyday community settings. Thus, a real need exists for interventions that not only support infants and toddlers at high risk for autism but that also strengthen parents in supporting their child within the context of the home and everyday community environment.

Parent-Implemented Interventions. One mechanism for supporting parents, while targeting specific developmental domains for the child, is to provide a parent education program that enables parents to implement specific strategies with their children throughout their daily

routines. Some parent education programs, referred to as parent-implemented intervention programs, focus on directly educating the parent to be the primary implementer of the intervention which can provide an opportunity for parents to collaborate with professionals and participate actively in the design and implementation of the child's intervention such that their identified concerns, priorities, and resources are included. Having the parents directly participate, and implement in the interventions allows the child to receive a significantly enhanced amount of the intervention within his or her natural environment, increasing the likelihood of generalization of positive outcomes.

Families receiving Part C services. The families receiving Part C early intervention services are linguistically, culturally, and economically diverse. Although low-income families and minorities are overrepresented in early intervention, they are less likely to be satisfied with the services they receive (Hebbeler et al., 2007). Additionally young children living in economically impoverished environments are more likely to be exposed to other risk factors associated with poor developmental outcomes, such as high levels of parental stress and potentially mental health difficulties, limited access to nutritious food, and violence (Harden, Monahan, & Yoches, 2012); therefore, it is critical that families affected by poverty with infants and toddlers with autistic characteristics receive individualized, effective, and efficient early intervention services.

Need for Research

All families, regardless of their education, income level, and ethnicity, with children who qualify for Part C Early Intervention services should have the opportunity to participate in programs providing evidence-based interventions designed to assist them in supporting the growth and development of their infants and toddlers within their own homes. Few of the

currently established evidence–based interventions for young children with autism also meet the guidelines of Part C of IDEA for infants and toddler as they lack parent involvement, and are not implemented within the families' natural environment (Schertz, Baker, Hurtwiz, & Benner, 2010, & Wong et al., 2014). Additionally minorities and low income families have been less frequently included as participants in efficacy studies focusing on children with autism (Wong et al., 2013) but are over represented in Part C of IDEA(Hebbeler et al., 2007). In conclusion, there is a great need for research and evaluation of interventions that are specifically designed for families receiving services covered under Part C of IDEA that: (a) focus on infants and toddlers at risk for a diagnosis of autism, (b) are provided within the family's home and typical community settings, (c) educate and support parents to implement the intervention, and (e), address the needs of families living in poverty.

Statement of Purpose and Research Questions

The purpose of this study is to evaluate the effectiveness of a parent-implemented social-communication intervention that systematically blends multiple strategies in order to support families' affected by poverty with infants and toddlers at risk for or diagnosed with autism. The following five research questions will be addressed within the study:

1. Will parents with low-income learn to implement the intervention with fidelity in their home and everyday community environment?
2. Will the parent's implementation of the blended-intervention package positively influence the child's social-communication skills?
3. Will the implementation of the strategies positively affect how the parent and his or her child interact?

4. Will the child's change in social-communication skills maintain overtime once the intervention is removed?
5. Will the parents indicate their satisfaction with the program by indicating that they would be willing to recommend the intervention to other parents in their community?

Organization of Dissertation

This study is organized into five chapters, followed by references and appendices. Chapter one presents the background, need for research, statement of problem and research questions. Chapter two is a research synthesis that describes the current empirical evidence of parent-implemented home-based interventions for children under the age of three with autistic characteristics. In chapter three, the methodology of research is described, including the setting and participants for the single case design. Chapter four presents the results of the study and chapter five includes the summary, discussion, limitations, implications for early interventionists, and recommendations for future research.

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Chapter 2: Synthesis of Research

This chapter includes a synthesis of research that reviews the currently available evidence on the effectiveness of home-based, parent-implemented interventions for infants and toddlers at risk for a later diagnosis of autism under the context of Part C of the Individuals with Disabilities Education Act (IDEA, 2004). The chapter is organized in four major sections: (a) parent-implemented interventions for children with autism (b) search procedures, (c) a synthesis of results, and (d) a discussion of findings. The synthesis of results is further divided into five subsections: (a) methodological quality, (b) degree to which study participants reflect the diversity of those receiving Part C of IDEA services, (c) the strategies and approaches used to teach the parent(s), (d) change in parent behavior as an outcome of participation in the training, and (e) change in child behavior as an outcome of parent-implemented intervention.

Parent-Implemented Interventions for Children with Autism

Part C of IDEA requires that early intervention services be individualized and improve the parents' ability to support their child within the context of the home and everyday community environment (20 U.S.C. Sec. 631 (a)). One way to empower parents to provide individualized strategies to their children across environments is to educate parents to be the primary implementer of the intervention.

Parent-implemented interventions have shown positive outcomes for both parents and their children with autism (Brookman-Frazee, Stahmer, Baker-Ericzén, & Tsai, 2006; Koegel, Koegel, Harrower, & Carter,1999; McConachie & Diggle, 2007; Vismara, Colombi, & Rogers, 2009). McConachie and Diggle (2007) evaluated 12 published and unpublished intervention studies in which parents were the main implementers of the intervention for their young children with autism and found that parent-implemented interventions positively influenced the children's

social-communication skills and interactions with their parents. However, while Part C of IDEA only provides services to infants and toddlers from birth to age three, the children included in the studies McConachie and Diggle reviewed were from twelve months to nine years old and most of the parent training was not provided in the family's natural environment.

Similarly, Meadan, Ostrosky, Zaghlawan, and Yu (2009) evaluated 12 intervention studies in which the parent was the main implementer of the intervention and some portion of the data collection was conducted in the home environment. The review reported that parents were able to implement the specific strategies within their homes and their children had improved developmental outcomes. However, children 20 months to nine years old were included within this review and Meadan et al. (2009) used a limited definition of home-based interventions and only required some portion of the intervention to be within the home rather than focusing on interventions designed to be delivered to families within their homes and typical community settings, thus falling short of meeting the recommended practice as defined within the regulations of Part C of IDEA.

In 2014, Wong and his colleagues in the Autism Evidence-based Practice Review Group at the Frank Porter Graham Child Development Institute completed a systematic review of the literature and concluded that parent-implemented interventions are an evidence-based practice for children birth-11 years of age with autism. They defined parent-implemented interventions as structured programs in which "parents learn to deliver interventions in their home and/or community, " which included clinic settings, laboratory settings, research rooms within large universities, and preschool specifically for children with autism (p.20), However, Part C of IDEA recommends that interventions be provided within the family's natural environment, which is defined as "the home and community settings in which children without delays of disabilities

participate" (20 U.S.C. Sec. 632(4)). Additional information is still needed about the effectiveness of parent–implemented interventions within the family's home, and neighborhoods, rather than clinical settings, and special education classrooms. Therefore reviews of parent-implemented intervention programs for supporting infants and toddlers should embrace the guidelines of Part C of IDEA and train, educate, and support parents to implement interventions within the family's home and everyday natural environment.

In summary, the reviews of the literature focusing on parent-implemented interventions for older children with autism (i.e., McConachie & Diggle, 2007; Meadan et al., 2009) have found positive outcomes for parents and children, and Wong and colleagues (2014) concluded parent-implement interventions is an evidence-based practice for children with autism ranging from birth to 11. However, few reviews of the literature have focused specifically on parents implementing interventions with infants and toddlers within their homes and everyday community environments, as defined by Part C of IDEA. The purpose of this research synthesis is to review the currently available evidence on the effectiveness of home-based, parent-implemented interventions for infants and toddlers with autism or exhibiting early indicators of autism putting them at risk for later diagnosis.

The following specific questions will be targeted for further analysis in the identified studies:

1. Do the identified studies meet the standard of high-quality from a methodological perspective?
2. Do study participants represent the full range of cultural, linguistic, and economic backgrounds of families receiving part C of IDEA services?
3. What strategies are used to teach parents to implement the intervention, and which, if any, have been found to be the most effective?

4. What strategies/procedures are used to measure change in the parent's behavior?
5. Did measured change in parent behavior result in positive changes in child behavior?

Search Procedures

The research studies included within this synthesis were identified through an extensive search of electronic databases including Psych Info, ERIC, Psych Article, and PubMed for the years 2000 through 2013. Search terms included "autism," "infants," "toddlers," "early intervention," "early indicators," and "parents." The initial search resulted in 240 studies. The abstract and methods section of each of the 240 studies were reviewed for fit with the following initial inclusion criteria: (a) at least one child under the age of three with autism or identified at risk for autism participated (b) the intervention included an explicit parent-participation component, and (c) the document appeared to be a report of an intervention study rather than a review, position, or descriptive paper. Of the 240 studies initially identified, 32 studies met the initial inclusion criteria. Further, a hand search of reference lists of related studies and reviews was conducted using the same criteria (i.e., Boyd, Odom, Humphreys, & Sam, 2010; McConachie & Diggle, 2007; Meadan et al., 2009; Odom, Boyd, Hall, & Hume, 2010; Rogers & Vismara, 2008; Schertz, Baker, Hurwitz, & Benner, 2011; Schultz, Schmidt, & Stichter, 2011), resulting in eleven additional studies for inclusion. Thus, a total of 43 studies were included.

The resulting 43 studies were reviewed by the first author to verify that they met the following inclusion criteria: (a) published in a peer-reviewed publication, (b) used an experimental or quasi-experimental design including single case designs, (c) included at least one child with autism or clearly defined risk factors for autism under the age of 36 months, (d) a parent served as the primary interventionist and implementer of the intervention, (e) parent's

implementation of the intervention was a major component of the model being studied, (f) parent training and intervention for the child was delivered within the family's home or routine community settings, and (g) the study was conducted within the United States. The last criterion was included because the focus of this review is on services provided in fulfilling the expectations of Part C of IDEA, a U.S. law.

Of the initial group of 43 studies, 32 of the studies were omitted because the parent was not trained within the family's home or within typical community settings but within a clinical setting including university research centers, hospitals, and clinic rooms. As noted earlier, the focus of this review is to fully understand the effectiveness of parent training programs provided within the family's home or typical community setting as defined by Part C of IDEA. An additional two studies were eliminated because parent implementation of the intervention was not a major component of the model being studied. Another study was eliminated because it was not conducted within the United States. Thus, a total of eight of the studies met the inclusion criteria and are included in the review. Table 1 provides a list of the studies and participant demographics, Table 2 provides information about the parent training features, and Table 3 describes the parent and child outcomes.

Synthesis Results

A descriptive summary is provided of the eight studies identified as meeting the inclusion criteria including a primary focus on parent-implemented interventions for infants and toddlers (birth to three years old) at risk for autism. The summary is organized into the following five sections: (a) methodological quality, (b) degree to which study participants reflect the diversity of those receiving Part C of IDEA services, (c) the strategies and approaches used to teach the

parent(s), (d) change in parent behavior as an outcome of participation in the training, and (e) change in child behavior as an outcome of parent-implemented interventions.

Methodological Quality

The purpose of this research synthesis is to review the currently available evidence on the effectiveness of home-based, parent-implemented intervention for infants and toddlers with autism or who are exhibiting early indicators of autism, putting them at risk for later diagnosis. Given the focus on "available evidence," evaluating the methodological quality of the studies included within this synthesis is imperative. Across the eight studies, two types of research designs were used: group design and single case design. For the experimental and quasi-experimental group design studies, the guidelines suggested by Gersten, Fuchs, Compton, Coyne, Greenwood, & Innocenti (2005) were used to evaluate the methodological quality. Similarly, for the single case design, guidelines suggested by Horner, Carr, Halle, McGee, Odom & Wolery (2005) were used to evaluate the methodological quality.

Group design. Gersten and colleagues (2005) use five key areas with clearly described quality indicators to evaluate if experimental and quasi-experimental group designs met the level of methodological rigor to be considered high quality. The five areas are: 1) conceptualization underlying the study, 2) participants/sampling, 3) implementation of the intervention and the nature of comparison conditions, 4) outcome measures, and 5) data analysis. There are eight additional desirable quality indicators (i.e., outcomes for capturing the intervention's effect are measured beyond an immediate posttest, and the research team assesses more than surface features of fidelity implementation). In order for a group design research study to be considered high quality, the study needs to meet all indicators encompassed in the five areas above and have at least four of the desirable indicators.

Of the eight studies included within this research synthesis, five studies used a form of group design (i.e., Mahoney & Perales, 2005; Nefdt, Koegel, Singer, & Gerber, 2010; Smith, Groen, & Wynn, 2000; Solomon, Necheles, Ferch, & Bruckman, 2007; Wetherby & Woods, 2006). The five studies were evaluated by the quality standards defined by Gersten and colleagues (2005), and only two studies met the standards: Nefdt et al., (2010) and Smith et al., (2000). These two studies randomly assigned children to groups and showed the two groups were comparable across conditions before intervention. The other three studies had several methodological weaknesses. Specifically, Solomon et al. (2007) used weak outcome measures and reported no measures for fidelity of implementation. Wetherby and Woods (2006) had no parent measures for the parent-implemented intervention. Also, Mahoney & Perales (2005) did not include a description of how parents were trained or how the intervention was delivered to the child; consequently, the independent variables were not clearly defined (i.e., Mahoney et al., 2005). Thus only Nefdt et al., (2010) and Smith et al., (2000) met the standards to be considered methodologically high quality.

Single-case design. For single-case design, Horner and colleagues (2005) use seven key areas with clearly described quality indicators. These indicators are used to evaluate if single-case design research studies published in peer-reviewed journals are considered high quality and are methodologically sound. These seven areas are: 1) description of participants and settings, 2) dependent variable, 3) independent variable, 4) baseline, 5) experimental control/internal validity, 6) external validity, and 7) social validity. In order for a single-case design study to be considered high quality, the study must meet the requirements of five of the seven areas listed above. These are the criteria used to evaluate the three single-case design studies (i.e., Brookman-Frazee, 2004; Park, Alber-Morgan, & Cannella-Malone, 2011; Schertz &

Odom, 2007) included in this synthesis.

All three studies provided clear descriptions of the participants and settings. All three studies clearly identified parent and child dependent variables that were measured over time to evaluate the change caused by the families' participation in parent training programs. The independent variables related to parent training, however, were not clearly described nor measured for the fidelity of implementation (i.e., Brookman-Frazee, 2004; Schertz & Odom, 2007). Two of the three studies indicated experimental control by demonstrating a pattern of change across three different points in time (Brookman-Frazee, 2004; Park et al., 2011). However, one study did not show similar experimental effects across three participants, with one child having minimal change between baseline and intervention sessions (i.e., Schertz & Odom, 2007). Within the quality indicators of social validity, all three studies implemented their interventions within typical social contexts, targeting socially important variables. However, none of the studies implemented the interventions using typical early intervention professionals or discussed the feasibility of applying the intervention within the existing Part C system. Given this information, two out of the three studies (i.e., Brookman-Frazee, 2004; Park et al., 2011) met the quality standards with at least five of the seven areas defined by Horner and colleagues (2005) and, therefore, met the minimum requirements to be considered high quality.

Summary of methodological quality. The current available evidence across both group and single case designs is not methodically strong, with only four of the eight studies exploring home-based, parent-implemented interventions for infants and toddlers with autism meeting the minimum requirements to be considered high quality. The lack of strong methodological studies impedes the conclusion that the intervention is effective. Therefore, at best, home-based, parent-

implemented interventions for infants and toddlers with autism could be considered a promising practice.

Participants

The families receiving early intervention across the United States are a heterogeneous population that is linguistically, culturally, and economically diverse. Table 1 summarizes the family demographic information provided by each of the studies for its participating families, with each reporting somewhat different types of information. The demographic information about the parents is summarized first, and then information about their children is provided.

Parent participants. Six of the eight studies provide information about the families' ethnicities or cultures (Brookman-Frazee, 2004; Mahoney & Perales, 2005; Nefdt et al., 2010; Park et al., 2011; Smith et al., 2000; Wetherby & Woods, 2006). Caucasian/White parents were the most common group to participate in the parent training programs, only three studies included Hispanic/Latin American parents (Brookman-Frazee, 2004; Smith et al., 2000; Wetherby & Woods, 2006), and only one study included black parents (Smith et al., 2000). Additionally, no studies reported the inclusion of multilingual or non-native English-speaking parents.

Six of the eight studies reported that the majority of parents who participated in the studies were highly educated and had completed some college (i.e Mahoney & Perales, 2005; Nefdt et al., 2010; Park et al., 2011; Schertz & Odom, 2007; Solomon et al., 2007; Wetherby & Woods, 2006). Additionally, four studies noted that the majority of their participating parents were stay-at-home mothers (Mahoney & Perales, 2005; Nefdt et al., 2010; Park et al., 2011; Solomon et al., 2007). Family income information was provided in only two of the eight studies. Nefdt et al. (2010) reported family participant income ranging from a low of $15,000 to a high of

$75,000, and Smith, Groen, and Wynn (2004) noted a similar range, with an average of $40,000-$50,000 annual income. Only one article, Schertz and Odom (2007), clearly reported having parents with mental health concerns or other learning disabilities as participants.

Four of the studies reported inclusion criteria for parents that would limit the study's population. Specifically, Smith et al (2000), Wetherby and Woods (2006), and Solomon et al., (2007) required that the families be located in a close proximity to the university, while the Brookman-Frazee (2004) study required that parents be high school graduates in order to participate. Therefore, families who did not live near the research centers or had not completed high school were not eligible to participate in these parent education studies. These inclusion criteria for parents limit the population of parents who can participate and are not reflective of the inclusive nature of Part C of IDEA, which is designed to support diverse families and their children.

This limited and incomplete demographic information across studies prevents clear conclusions about parents who participated in home-based parent educations. Although Part C of IDEA supports linguistically, culturally, and economically diverse parents, the limited demographic information within this synthesis suggests that minorities, non-native English speakers, and parents with less than a high school education were less likely to be included within parent-implemented intervention studies that teach parents specific strategies to support their infants or toddler at risk for or diagnosed with autism.

Child participants. Across all eight of the studies, the child participants were either diagnosed with autism or were considered at risk for autism. Three of the eight studies included children with autistic behaviors who were not diagnosed with autism spectrum disorder (i.e., Brookman-Frazee, 2004; Schertz & Odom, 2007; Wetherby & Woods, 2006), three included

children with a diagnosis of autism spectrum disorder and other pervasive development disorders (Mahoney & Perales, 2005; Park et al., 2011; Solomon et al., 2007), and the final study required the children to be diagnosed with autism spectrum disorder (Nefdt et al., 2010). Children under the age of three with autistic characteristics do not need a diagnosis to receive early intervention services; therefore it is critical that children at risk for a diagnosis of autism are included within intervention studies.

Although all studies included at least one child under the age of 36 months, the child participants represented a wide range of ages from 12 months to 72 months. The focus of this synthesis is on infants and toddlers eligible to receive part C services and who are thus under the age of three. However, even with this intentional focus, only four of the eight studies exclusively addressed this age range (Brookman-Frazee, 2004; Park et al., 2011; Schertz & Odom, 2007; Wetherby & Woods, 2006). Previous synthesis suggests parent-implemented interventions in the home environment are effective for older children; however, few studies specifically focus on children within the Part C system aged birth through three (Wong et al., 2014).

Strategies and Approaches Used to Teach Parents

Exploring the elements of parent training can assist in a better understanding of which if any of the particular elements are most effective at teaching parents to implement interventions with their children. Table 2 provides information about the parent-trainers and the strategies used to train parents to implement interventions. A discussion of the parent implemented strategies is presented first, followed by a description the training procedures.

Parent implemented interventions. A variety of parent-implemented interventions were used in the identified studies. Depending upon the studies, parents were educated to

implement one of the following interventions: Pivotal Response Treatments (Brookman-Frazee, 2004; Nefdt et al., 2010), Picture Exchange Communication System (Park et al., 2011), The Joint Attention Mediated Learning Intervention (Schertz & Odom, 2007), Developmental Individualized and Relationship–Orientation Model (Solomon et al., 2007), Early Social Interaction Project (Wetherby & Woods, 2006), and The Lovass Model (Smith et al., 2000). Seven of the studies provide a description of the strategies used to train the parents. Mahoney and Perales (2005) did not provide a description but rather reported the use of the responsive teaching curriculum.

Strategies for training parents. Across the studies, the parent-trainer used written materials and additional instructional strategies. The additional instructional strategies can be grouped into the following four approaches: 1) direct instruction, 2) live feedback/coaching, 3) modeling or demonstrations of strategies, and 4) video clips or video assessments to enhance parent learning. For example, when parents participated in the Play and Language for Autistic Youngsters Project, "modeling, coaching, video assessment and written objectives" were used during each home visit to help parents learn (Solomon et al., 2007, p. 211). Parents participating in the Early Social Interaction Project (ESI) could choose from "easy-to-read handouts, videos, or demonstrations of specific strategies" during home visits (Wetherby & Woods, 2006, p. 74).

Parent training procedures. The intensity and duration of training provided to the parents varied across the studies. Some studies provided parent education programs for just a few months (Brookman-Frazee, 2004; Schertz & Odom, 2007; Smith et al., 2000), while others provided ongoing parent training and education for 12 months or longer (Mahoney & Perales, 2005 & Wetherby & Woods, 2006). Some intervention sessions were two to three hours long (Solomon et al., 2007), while others were only 40 minutes (Park et al., 2011). Also, the

frequency of parent training varied widely; it was offered to families from several times a week (Wetherby & Woods, 2006) to once a month (Solomon et al., 2007). Further, Nefdt et al., used a self-directed interactive parent training program which was designed specifically to address the preferences and learning styles of each individual parent, allowing parents to select how many times they viewed the training DVD. Hence, there is little consistency across studies on how parent training programs were provided to families within their homes.

Summary of strategies and approaches to teach parents. A wide variety of strategies were utilized to educate parents; however, given the limited information provided, it is difficult to identify which characteristics and strategies make parent training most effective. The most common strategy for educating parents was written instruction, but other strategies were also used. The incongruence between studies impedes evaluating which components of a parent education program are most effective and efficient at training parents to implement interventions within their homes.

Parent Measures and Outcomes

The two main categories of parent measures used across the eight studies are the parents' fidelity of implementation and other parent outcomes. Parents' fidelity of implementation measures if the parents were able to learn and implement the intervention strategies correctly with fidelity with their child. The other parent outcomes are measures evaluating behaviors and interaction styles, including parent confidence and parent responsiveness. Table 3 summarizes the parents' fidelity of implementation and other parent outcomes.

Parent implementation of intervention. Parents were trained to implement specific interventions; therefore, their behavior should change, and the fidelity with which the parents implement the intervention with their child should be observable. Only three studies directly

measured the parents' ability to implement the intervention with their child during intervention sessions. Nefdt et al. (2010) reported that parents who viewed the interactive DVD correctly implemented the intervention 75% of the time, and Park et al. (2011) used a checklist to insure the parents were implementing the intervention with high fidelity. Additionally, one study did not directly measure the parents' behavior but used the parents' reports and notes as a systematic way to measure how the intervention was implemented within the home (Schertz & Odom, 2007). In conclusion, the majority of the studies did not measure how the parents implemented the intervention strategies with their children or how it changed the parental behavior thought to be critical for the specific intervention.

Other parent outcomes. Other outcomes were measured in order to evaluate how educating parents to implement an intervention would affect the parents' behavior. Two studies measured parent confidence and concluded that parents participating in the self-directed parent education program or collaborative family-focused sessions showed an increase in confidence (Nefdt et al., 2010, & Brookman-Frazee, 2004). Three studies asked parents to practice the intervention at home (Mahoney & Perales, 2005; Schertz & Odom, 2007; Smith et al., 2004), but only two studies provided data about the parents' self-reported use of the intervention throughout the day (Mahoney & Perales, 2005; Schertz & Odom, 2007). Mahoney and Perales (2005) suggest that parents showed an increase in responsiveness and affect after participating in intervention for approximately one year, while Solomon et al. (2007) reported no measurable change in parenting styles.

In summary, five studies did not include measures of fidelity for parents implementing the intervention; therefore additional information is needed to make conclusive statements about how the parents delivered the intervention to their children. Additionally, other parent measures

were inconsistent; however, the two studies measuring parent confidence and one measuring parent responsiveness reported positive results. Lastly, Solomon et al. (2007) reported no change in the parent measures from the parents participating in the intervention. Based on the limited data and detail provided, it is unclear how the parents' behavior was changed from learning specific intervention strategies; however, in all studies, the parent was the primary implementer of the designated intervention.

Child Outcomes

In order to assess the impact of the parent implementing the intervention, specific target behaviors or standardized measures were used to measure outcomes often associated with core deficits of autism, with all studies having some measure on social-communication skills. Table 3 details child outcomes for each study.

All eight studies reported positive social-communication outcomes for children diagnosed with or at risk for autism. Two studies concluded that young children with autism were able to learn nonverbal social communication skills considered to be pivotal for language development through their parents' implementation of designated interventions (i.e., Odom, Boyd, Hall, & Hume, 2010; Wetherby & Woods, 2006). Nefdt et al. (2010) found that children's language increased after parents completed an interactive DVD parent education program. Solomon et al., (2007) reported that nearly 50% of the children showed good or very good developmental progress although there measures showed no change in parenting behaviors. Park et al. (2011) found that after parents implemented the first three phases of the Picture Exchange Communication System (PECS), their children were able to learn to communicate with PECS, and two of the three children showed an increase in verbal communication. Smith and colleagues (2000) found positive results in everyday skills, adaptive skills, and problem

behaviors for children whose families participated in short parent-training programs; however, children in a two-year intensive therapist-delivered behavioral intervention program showed more improvement in language skills, overall cognition, and school placement. Overall, positive developmental outcomes were reported for children whose parents participated in parent education programs.

Discussion

Although several previously published literature reviews (e.g., McConachie & Diggle, 2007; Meadan et al., 2009) suggest parent-implement interventions are effective for older children with autism, few have solely evaluated studies of parent-implemented interventions within the homes of infants and toddlers. The primary purpose of this synthesis of research is to evaluate the effectiveness of home-based, parent-implemented intervention studies focusing on infants and toddlers at risk for or diagnosed with autism. In order for studies to be included within this synthesis, they had to meet the inclusion criteria previously discussed in this paper. Some of the key inclusion criteria are that at least one child is identified as at risk for or diagnosed with autism, that the child was under 36 months when the study started, and that the parent was the primary implementer of the intervention within their home. A total of eight studies met the inclusion criteria, with five studies utilizing group-designs and three single case designs. Overall, all eight studies reported positive gains in social development for children at risk for or diagnosed with autism whose parents participated in the parent-implemented intervention; however, several limitations of the studies have been identified.

Although eight studies met the inclusion criteria for this synthesis, only two single case designs and two group designs met the minimum criteria to be considered high quality. Therefore, only four out of the eight studies were considered high quality, with several of the

other studies having significant methodological concerns revealing a clear need for more high quality, methodologically sound studies conducted within the natural environment that focus on empowering parents to implement interventions. Although only a few of the high quality studies reviewed evaluated if parent-implemented interventions for infants and toddlers at risk for autism was effective, this synthesis found similar positive outcomes as previous reviews for older children with autism, suggesting it may be effective for younger children within their homes as well.

This synthesis also evaluated if the participants within the study represented the full range of linguistically, culturally, and economically diverse backgrounds of families receiving Part C of IDEA services. However, the very limited amount of demographic information provided about the families who participated in the study indicated that the majority of parents were white, highly educated, stay-at-home mothers, which is not reflective of the diverse families who participate in Part C, early intervention services. Hence, this synthesis, similar to other reviews of parent-implemented interventions for children with autism, found that the participants were not representative of the early intervention population, lacking cultural, educational, linguistic, and economic diversity.

This synthesis also investigated if the children participating in the studies represented a wide range of children who may be considered at risk for autism while receiving Part C services. Infants and toddlers are often not diagnosed with autism but are considered at risk when they demonstrate early indicators or show autistic characteristics at a very young age. Additionally, infants and toddlers with autistic characteristics often qualify for Part C early intervention services without a diagnosis; thus, it is important that children with autistic characteristics are

also included as participants in efficacy interventions studies. Only three of the eight studies include infants or toddlers who had autistic characteristics but who did not have a diagnosis. Furthermore, this synthesis explored which strategies are used to teach parents to implement interventions; however little information was provided in the studies on how parents were actually educated or trained to implement the information. All studies paired written materials with other strategies such as modeling or video instruction in order to educate parents; however, the actual training procedures varied widely across studies, with some providing a short, frequent burst of education while other programs lasted longer than a year with intensive education programs. Therefore it is unclear what elements are critical for effective parent training programs.

In parent implemented interventions, parents are the primary implementer of the intervention; therefore, it is critical to measure how their behavior changes in direct response to learning new intervention strategies and how the parent implements those strategies. Only three out of eight studies measured the parents' implementation of the intervention with their child, so firm conclusions about how the parents' behavior changed and how the actual intervention was being delivered to the child cannot be made. Without this information it is unclear what mechanism, or which element of the intervention is actually responsible for the positive outcome reported for the children participating in parent implemented interventions. However, the positive results suggest that parents who participated in the parent education programs did change their behavior and are capable of learning intervention strategies and implementing them within their home.

Although all studies had positive outcomes for the children, the methodological limitations and limited number of studies that met the inclusion criteria prevent conclusive

statements about the effectiveness of parent-implemented, home-based interventions for infants and toddlers at risk for or diagnosed with autism. Additionally, the limited demographic information and understanding of how parents were trained makes it uncertain how the positive findings could be generalized to the large and diverse population of children and families receiving Part C early intervention services. Also, additional information is needed to better understand how the parent education programs directly impact the parent behavior and in turn positively affect their children's development.

Implications for the Field

This synthesis adds to the literature base evaluating parent-implemented interventions for young children with autism. Although only eight studies were included with this research synthesis, all of them showed positive social-communication outcomes for infants and toddlers at risk for autism. This limited evidence suggests that parent-implemented interventions within the parents' homes may be an effective delivery system for infants and toddlers with behavioral characteristics of autism. Therefore, early interventionists supporting families with infants and toddlers with autistic characteristics and delays in social-communication should embrace the requirements of Part C IDEA and educate or train parents to implement intervention strategies within the family's home and typical community settings.

Implications for Future Research

This synthesis identified numerous areas in need of further research in order to better understand the effectiveness and process of parent-implemented interventions in the home. Three critical areas will be discussed below: 1) including children without an autism diagnosis in efficacy studies, 2) including more families with diverse cultural backgrounds and discussing

how culture may influence parent-implemented intervention programs, and 3) individualizing and blending interventions to support families affected by poverty.

Children with repetitive behaviors and delays in social communication being served by community Part C early intervention agencies do not need a diagnosis of autism in order to receive services. For this synthesis, some studies used a screening tool to identify children at risk for autism but most required a diagnosis of autism or other pervasive developmental disorders. Although "infants and toddlers considered at risk for autism" is a poorly-defined diverse group of children with a range of abilities, the results may still not generalize to infants and toddlers who are unable to access a diagnosis or to children who show significant risk factors at a very young age and do not have a diagnosis. Additionally early interventionists may be less likely to use or select interventions that have only been validated with children diagnosed with autism when they are serving and providing services to families with children at-risk for autism. Future research needs to explore how early interventionists identify children at risk for autism within community settings and understand how infants and toddlers with different risk factors respond to different types of intervention when services are implemented by their parents in the home.

Though Part C of IDEA serves diverse families across the United States who have young children at risk for autism, the majority of the studies provided incomplete demographic; therefore, understanding who participated in the parent education programs and how the results can be generalized is difficult. Also, most of the studies had parents who were highly educated and Caucasian, which is not reflective of the Part C system (Hebbeler, Spiker, & Mallik, 2004). The lack of diversity within the infant/toddler autism research literature limits the generalizability of the interventions to diverse communities throughout the United States. Some

research suggests that possible differences in parenting styles across cultural groups, or environmental risk factors may affect how parents implement interventions. Future infant/toddler autism research should evaluate how different parent characteristics, including cultural beliefs toward parenting, shape parent engagement and the implementation of interventions within the home. Given the overrepresentation of minorities and low income families participating in Part C early intervention services, additional research that includes culturally, linguistically, and economically diverse families who support infants and toddlers with autistic behaviors is needed in order to generate positive outcomes for all families.

This synthesis identified several different styles and types of intervention that had positive child outcomes (i.e., Pivotal Response Therapy, Picture Exchange Communication System, The Joint Attention Mediated Learning, Lovass Model). Little is known about which interventions are implemented within community-based models or how early interventionists use an evidence-based decision-making process to identify and select different interventions for children at risk for autism (Buysse, Wesley, Snyder, & Winton, 2006). Stahmer and colleagues (2010) suggest that a systematic eclectic approach, which blends multiple evidence-based practices and theoretical approaches, may be a superior way of addressing the individual needs of families with young children with autism; however, there is limited research about the effectiveness of such a systematic eclectic approach to developing a blended intervention packages (Wong et al., 2013). Also in using a technical eclectic approach for blending different elements of various evidence-based practices in order to develop an individualized treatment package (Odom, Hume, Boyd, & Stabel, 2012) may allow early interventions to develop and implement more practical and family-friendly strategies specifically designed to match the family's needs, including families impacted by poverty.

One promising technical eclectic intervention package that already blends multiple evidence-based practices and theoretical approaches and which focus on children under the age of three with autistic characteristics is the Early Start Denver Model (ESDM) (Rogers & Dawson, 2010). Initial studies suggest that ESDM can increase cognitive, communication, and adaptive skills in infants and toddlers with autistic characteristics (Dawson et al., 2010) and may normalize brain activity when children are processing social information (Dawson et al., 2012). However, the ESDM was specifically designed to be delivered by experts across multiple hours in a clinic setting; therefore it did not meet the inclusion criteria for this research synthesis, nor does it meet the recommendations of Part C of IDEA (Dawson et al., 2010; Rogers & Dawson, 2010). Additionally, in a review of the ESDM research literature, minimal demographic information was provided about the participants, however the majority of the participants were white, and living near or around the research center, which was located in a high-income area.

Thus, while the ESDM provides preliminary support for blending multiple intervention models into a single intervention package, there is a need for additional research studies about blended packages that embrace Part C of IDEA and support families impacted by poverty. Future research should evaluate how a systematic eclectic approach to blending of multiple research-based intervention strategies can be used to develop intervention packages in order to support specific populations or address particular communities. More specifically, future studies should focus on designing and evaluating eclectic research-based parent-implemented intervention packages specifically for families living in poverty who are often not included within parent-implemented intervention programs.

Conclusion

The current literature synthesis evaluates parent-implemented home based interventions for infants and toddler with autistic characteristics. All studies reported increases in targeted social-communications goals for the children whose parents participated in the intervention programs. However the current quality and quantity of the empirical evidence prevents a conclusive statement about the effectiveness of home-based parent-implemented interventions for infants and toddlers at risk for autism. Several specific areas have been identified for future research. In conclusion, this synthesis found similar positive outcomes for children and parents as previous reviews for older children with autism; therefore, home-based parent-implemented interventions may be a promising practice with limited but positive empirical evidence for infants and toddlers at risk for or diagnosed with autism.

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Table 1

Participant Demographics

Article	Parent Education /Income	Ethnicity/ Culture of Parent	Other Parent Characteristics	Age of Children in Months	Inclusion Criteria for Children
Brookman-Frazee & Koegel (2004)	At least high school education	1 Asian-American 1 Latino-American 1 White	NA	29 - 34	• Autistic Behaviors Consistent with a diagnosis of ASD
Mahoney, & Perales (2005)	Average education 14-15 years across participants	89% white	• 92% married • Majority stay-at-home moms.	12 to 54	• PDD- some diagnosis on the spectrum
Nefdt, Koegel, Singer, & Gerber (2010)	15% completed college 29% some college 4% completed high school Income range 15,000-75,000.		• 52% stay-at-home parents.	Mean 38	• Diagnosis of autism • Under 60 months • Less than 20 functional words • Access to video recorder and DVD player
Park, Alber-Morgan, & Cannella-Malone (2011)	1 college educated, Part - Time Job 1 stay-at-home mom and attending university 1 stay-at-home mom with masters degree	2 White, 1 Indian – American mothers	• Mothers age range 33-35 years old	29-31	• Between 24-36 months, diagnosed with ASD • No language • Recommend for ACC • Had not used PECS
Schertz & Odom (2007)	1 Graduate training in SPED 2 High school graduates		• Two mothers out of three had self-reported LD's • One mother had self-reported mental health issues • Mother age 23-32 years old	23-33	• Younger than 36 months • Strong indicators of autism
Smith, Groen, & Wynn (2000)	Average 13-14 years of school across participants. Household income average 40-50000 across participants Range less than 10,000 to 100,000	50%white 21% Hispanic 14% Asian 14%Black	• 71 % married • Must be less than a one hour drive from UCLA	18-42	• IQ between 35-75 • Diagnosis of autism • No major medical problems
Solomon, Necheles, Ferch, & Bruckman (2007)	70 % had college degrees or above		• 91% married • Middle- to upper-income parent population • Must live 60 miles or less from the university	18-72, Mean 42	• Diagnosis of autism or PDD-NOS or Asperger's • No other medical complications • Children 18-144 months age of diagnosis
Wetherby & Woods (2006)	Average education between 15-16 years across participants	64.5 % Caucasian 11.8% African American 23.7% Hispanic	• Family agreed to at least 12 months of intervention • Mothers age at birth was 31 years old	12-24	• Significant red flags for autism • Child started between 12-24 months • Family agreed to diagnostic evaluation at 36 months

Table 2

Parent Training Features

Article	Intervention	Teaching Strategies Used to Teach Parents	Intensity and Duration
Brookman-Frazee & Koegel (2004)	Collaborative Partnership PRT vs. Clinician directed PRT	• Direct Education • Written Materials • In-vivo Feedback	Each child had 12 probes
Mahoney & Perales (2005)	Responsive Teaching(RT)	• No Description Provided	1 hour per week, for about 1 year
Nefdt, Koegel, Singer, & Gerber (2010)	Pivotal Response Therapy (PRT)	• Modeling • Written Materials • Video	Self-selected by parent with DVD
Park, Alber-Morgan, & Cannella-Malone (2011)	Picture Exchange Commination System (PECS)	• Modeling • Direct Education • Written Materials • Video • In-vivo Feedback • Role Playing	40-60 min sessions. Parent had to reach 90% before moving on across 3 consecutive trials. Duration different for every parent.
Schertz & Odom (2007)	The Joint Attention Mediated Learning (JAML)	• Direct Education • Written Materials • In-vivo Feedback	1 to 2 times per week for 9-26 weeks based on the child's progress
Smith, Groen, & Wynn (2000)	Lovass Model	• Direct Education • Written Materials	IV group Average 24.5 hours per week, for average of 33 months. Parent-training group 5 hours of training per week, for 3-9 months with 1 group meeting every 3 months.
Solomon, Necheles, Ferch, & Bruckman (2007)	Play and Language for Autistic Youngsters (PLAY) Project Home Consulting model	• Modeling • Direct Education • Written Materials • Video • In-vivo Feedback • 1-day Workshop	Initial 1 day workshop, 1 visit per month, 2-3 hours long. For 10-12 months
Wetherby & Woods (2006)	Early Social Interaction Project (ESI)	• Modeling • Direct Education • Written Materials • In-vivo Feedback	2 visits per week in home plus 1 hour of play group for first 9 weeks.

Table 3
Parent and Child Outcomes

Article	Design	Parent Outcomes	Child Outcomes
Brookman-Frazee & Koegel (2004)	Repeated Reversal Design	All parents showed a decrease in stress and increase in confidence during the partnerships condition	All children showed increase in positive affect, increase in engagement, and appropriate responding during the partnership condition.
Mahoney, & Perales (2005)	Quasi Experiment, Pre-test/Post-Test, comparative group	Results indicated that RT procedures were effective at encouraging two thirds of the parents to engage in more responsive interactions with their children during intervention.	Three fourths of the children increased their pivotal developmental behaviors.
Nefdt, Koegel, Singer, & Gerber (2010)	Randomized Clinical Control Trial	Parents in the intervention group showed an increase in language opportunities provided to child, and increase in confidence. Parents were able to learn how to implement PRT from the video.	Children showed an increase in functional utterances.
Park, Alber-Morgan, & Cannella- Malone (2011)	Changing Criterion	Parents were able to implement PECS with their children with fidelity. Parents were satisfied with goals, procedures, and outcomes of the study	All children communicated using pictures, and the behavior maintained over 4 weeks after intervention stopped. Two of the three children showed increases in vocal vocabulary.
Schertz & Odom (2007)	Mixed Methods, Multiple baseline + qualitative analysis	Qualitative Fidelity: Parents wrote journals about applying the intervention	All three children showed increase in focusing on parents face and turn taking. Only two of three children showed a substantial increase in responding to their parents joint attention overtures and initiating joint attention bids.
Smith, Groen & Wynn (2000)	Randomized Clinical Trial	Both groups were satisfied, found the intervention helpful, and would recommend to other parents	No difference between groups for problem behaviors and adaptive skills. Intensive group less restrictive school placement, increase in IQ and language skills.
Solomon, Necheles, Ferch & Bruckman (2007)	Quasi-experimental, one group, Pretest/Posttest No Control Group	No change in The Functional Emotional Assessment Scale (FEAS) ratings	45.5% of children made good to very good functional developmental and social commenting progress over the study period.
Wetherby & Woods (2006)	Quasi-experimental, one-group, pretest–posttest design	No parent measures	Children showed a significant improvement in social communication skills; 76% of the children had verbal language skills at the end of the study.

Chapter 3: Research Study

The efficacy of the intervention package described below was assessed across parent-child dyads utilizing a concurrent multiple probe design (Horner & Baer, 1978). This study measured whether the parents who participated in the parent education program were able to implement the intervention with fidelity and change their behavior as they interacted with their children in their homes. Additionally, the study examined if the change in parent behavior directly affected the children's social-communication skills.

This chapter includes: (a) information about the participants, including the inclusion criteria, recruitment procedures, and family information; (b) details about the settings in which the research was conducted; (c) experimental design and procedures; and (d) description of the measurements collected.

Participants

This section includes information about: (a) the inclusion criteria for parents/child dyads, (b) recruitment of infant/toddler networks and providers, (c) recruitment of participants, and (d) family information and participant characteristics.

Inclusion criteria for parents/child dyads. Parents with low-income who were receiving early intervention services in Part C Infant/Toddler programs (i.e., Tiny-K networks) with children who also meet the inclusion criteria described below were eligible to participate in the study. Medicaid eligibility was used as a measure of low-income; therefore, only parents who had an income that qualified their child for Medicaid were included in this study. There were no exclusion criteria for parents aside from income; therefore, parents with any education level or with disabilities themselves were eligible to participate.

Children who were considered at risk for autism were eligible to participate in this study.

"Children at risk for a diagnosis of autism" is a poorly defined heterogeneous group; therefore, for the purposes of the this study, infants/toddlers (birth to 3 years at the start of study) who had at least three of the following risk factors were included: (a) demonstrated significant delays in verbal communication, (b) had sibling with autism, (c) were referred to infant/toddler services by a medical professional for concerns of autistic or severe challenging behaviors, (d) demonstrated significant delays in social-emotional development, (e) engage in repetitive and stereotypic behaviors, (f) regularly engaged in severely challenging behaviors, and (g) display limited play skills or restricted play interests.

Children with a known history of drug exposure or known genetic disorder were not included in this study. Children exposed to drugs in utero and children with genetic disorders may present behaviors similar to children at risk for autism early in development; however, it is unclear if these behaviors are because they are at risk for a diagnosis of autism or due to other developmental factors. Therefore, because there are known overlaps of behavioral profiles among these groups, they were not included within this study. Additionally, children who spent 30 hours or more per week with an adult other than the primary parent implementer were not included because the focus of this study is for the parent to implement the intervention strategies throughout the day with his or her child.

Thus taking the two inclusion criteria together, child and parent, families who received early intervention services under Part C of IDEA with low income who had a child at risk for autism were eligible to participate in this study.

Recruitment of infant/toddler networks and providers. As noted in the description of parent/child participant inclusion criteria, the parent/child dyad must have already been participating in early intervention services covered under Part C of IDEA provided by a local

community agency. Therefore, directors of community Infant/Toddler Part C agencies serving urban populations within 60 miles of a large Midwestern university were recruited through their publically posted email regarding the opportunity to participate in the study. A large community early intervention agency responded to the email and expressed interest in participating in the research study. The agency employed 55 early intervention professionals who served over 600 families. Of those families, 60% of them qualified for Medicaid and therefore were considered having low-income.

During the initial meeting, the director of the community agency and lead researcher reviewed the research study, including risks to the participants and the initial inclusion criteria. A handout with a brief overview of the study was provided to the director, who posted it in the office and emailed it to the early interventionists employed by the agency (see appendix A). The director then asked the early interventionists to contact the lead researcher directly if they had a family they believed could benefit from participating in the study and they thought might meet the inclusion criteria.

Recruitment of participants. There were four phases in the recruitment process for families with children at risk for autism. The first phase was an email to the early interventionists with the overview document attached (see appendix A), which lists the behaviors that may indicate a child is at risk for autism and a short description of the study. Early interventionists were instructed through email by their director to contact the lead researcher if they thought that they served a family who would benefit from the study and a child who demonstrated some of the behaviors on the handout.

The second phase involved the early interventionists meeting the lead researcher and confirming that the family the early interventionists would like to approach met the parent

inclusion criteria and that the child had multiple risk factors for autism. The lead researcher held office hours at the community agency where early interventionists could drop in and ask questions about the research opportunity and clarify if the family met the inclusion criteria. During these 20 minute meetings, the lead researcher gathered more information about the child's development, confirmed that the child had multiple risk factors for autism documented, and confirmed that the family meets the inclusion criteria. At no time during this initial recruitment effort, however, did the lead researcher ask for the early interventionists to share any parent or child identification information.

In phase two, an early interventionists had a family she thought was a good fit for the study but the parents were medical professionals and did not meet the definition of low-income required to participate in this study, and the child was in preschool 40 hours a week. Therefore, that family was not included within this study but all materials about the intervention strategies, and the structure of the home visits were shared with the early interventionist. The first four early interventionists who had families who met the inclusion criteria were provided with the consent forms and given the opportunity to contact the family. (Again, the early interventionists provided no identifying information regarding the family/families at that time.)

In phase three, early interventionists approached their selected families and summarized the study for them. If the family was interested in participating, the early interventionist reviewed the consent forms with the family. Families also had the option of contacting the researcher directly if they had questions. Signed consent forms were then submitted to the program director, who kept the forms in a locked file cabinet until the lead researcher was back on site in order to protect the identity of the families who chose to participate.

In phase four, the lead researcher and early interventionist scheduled a visit in order for

the lead researcher to meet the families who had signed consent form, reviewed the consent form, verified the family's desire to participate with a verbal consent, and gathered basic information (i.e., the child's age, what times the parents are typically available). Also, the researcher answered any additional questions the family had about the study, which included questions about scheduling, video recording, and the participation of other relatives. Lastly, the primary parent who would participate and attend all visits was identified at this time, and the lead researcher explained that his or her behavior would be measured. The first four families who were originally identified in this four step process chose to participate in the study.

Family information and participant characteristics. Through the process described above, four families chose to participate in the research study. Table 4 provides information about the families who participated. Although limited inclusion criteria was used for selecting families from the urban community, many of the families shared common characteristics. All four families who participated in the study had a family income less than $24,000.00 per year and indicated that they were utilizing an assistance program to get their daily needs met. Additionally, all four families reported a family history of mental health disorders and had some involvement with child protective services or were reported to child protective services during the past three years because of concerns for their children's wellbeing. Additional information for each mother-child dyad is provided below, and additional information about each child is provided in Table 5.

Dana and Sam. Dana has four children (ages 13 months, 3 years, 8 years, and 12 years) and is a stay-at-home mother. Two of her older children were diagnosed with autism and are in full-day special education classes. Her husband worked long hours and night shifts that change regularly. Dana was working on her associate's degree. Dana shared that mental health

disorders, including schizophrenia, bipolar disorder, and major depressive disorder, run on both sides of their family and that she struggles with depression. She also shared that her family had been involved with child protective services in the past for reports of child abuse in the home. She wanted to participate in the study to learn strategies that could help support Sam's development because his older siblings have autism. Sam was 13 months old and has not yet started babbling consistently, playing peak-a-boo, or responding to his name. Sam liked to watch his siblings play, mouth toys, and shake toys close to his eyes.

Dana and Sam were unable to complete all intervention session. Dana had a family crisis and expressed she was no longer able to focus on Sam's development and the family abruptly moved out of the area halfway through the intervention portion of the study during week 5.

Kris and Natesha. Kris is a single mother of two young girls (ages 25 months and 3 years). Her older daughter was diagnosed with autism and was in a half-day special education classroom. Kris is a stay-at-home mother and lives with her two daughters and her own mother. Kris shared she has been twice previously married and that her first husband was verbally and physically abusive. She also shared that she and her family members have been reported multiple times for suspicion of child abuse and that mental health disorders run in her family, including depression. Kris wanted to participate in the study because she was worried that Natesha, who was 25 months old at the beginning of the study, was different and not like other children. Kris stated, "I am not seeing any improvement with Natesha's words." Natesha had just a few word approximations, like "nahh" for *no* but mostly grunted. She liked to watch TV and dance with her sister, but had multiple lengthy tantrums a day.

Landa and George. Landa is the mother of four children and is currently living with her long-term partner and her three youngest children (ages 29 months, 6 years, and 13 years). She

was previously married and shared that it was a verbally and physically abusive marriage for her and her children. She and her partner work part-time for a big box store, and they both hope to pick up more hours soon. Landa shared that she struggled with school and received special education services until she dropped out in junior high. She explained that she still has a hard time remembering things she is told and remembering what she is reading. She and her partner struggle with anxiety, and they both have a family history of mental health disorders and drug addiction. She wanted to participate in the study to learn strategies to calm George and to play with George. At the beginning of the study, George was 29 months old and only used a few words repetitively mixed with long strings of unclear sounds. He liked to run, climb, jump, and spin but displayed very few play skills. He also had hour-long tantrums during which he could become very aggressive.

Jackie and Kevin. Jackie lived with her husband and four of her five children (ages 12 months, 31 months, 31 months, and 4 years old) at the beginning of the study. Her school-aged child was in a half-day special education preschool, and she stayed home with the other three children. She has her associate's degree and was unemployed looking for work and child care options in her neighborhood. Her husband worked long days and was sometimes gone for multiple days at a time for his job. He has a criminal record of child abuse from incidents prior to their marriage and has a history of drug abuse. Jackie shared that there is a history of child abuse, drug abuse, and mental health disorders on both sides of the family. Jackie wanted to participate in the study to learn how to get Kevin to play with his siblings and be a part of the family. She shared that Kevin seemed to be "in his own world." Kevin was 31 months old at the start of the study and had several words and phrases but often chose to hide or play alone, away from the family. Kevin was referred to early intervention for concerns of autism. He liked to

line up his trains and trucks during playtime and watch movies about trains.

The researcher was unable to collect follow-up data on Jackie and Kevin. Jackie moved once the intervention portion of the study was over. Jackie shared she left her home with her children and moved to a larger city in order to find a safer neighborhood for her children to play in and to find employment.

Setting

This study was conducted in a large urban area and visits were conducted primarily within the family's home. One of the purposes of this study was to support the parents' implementation of the strategies within their typical routines and activities, which include activities in the community; therefore, each family identified the area in the community where they wanted support (i.e., community centers, grocery store, driving in the car, play group) and sessions were also held out in the community. All families were renting their homes and had multiple siblings sharing rooms. The living room was often used as the indoor play area, and toys and other play items (e.g. books, pots and pans, basketballs, backpacks) that the families already had were used to illicit communication and play during intervention. Food was rarely used for teaching purposes or as reinforcement during intervention because of the limited amounts readily available for all families. All sessions required the primary parent implementer and the child to be present in order for the session to occur; however, all families had siblings present during intervention sessions as well. All individuals who were in the child's home environment were welcome to be present during intervention sessions, including siblings, family friends, and relatives, allowing the parent to practice implementing the intervention in the social environment in which they live. Additionally, all families had other adult members who knew the child well and wanted to participate in the intervention or watch interventions sessions.

The visits were scheduled to occur twice each week for 60 minutes for approximately 10 weeks. The parent and the child were required to be at each visit or the visit was cancelled. Also, the family was able to contact the lead researcher or the primary early interventionist to cancel a planned visit. All cancelled visits were rescheduled at the family's convenience.

Experimental Design and Procedures

The efficacy of the intervention package was assessed across parent-child dyads utilizing a concurrent multiple probe design (Horner & Baer, 1978). This design allows for the functional relationships between the intervention and change in target behaviors to be observed and measured across each phase and across parent child dyads. The multiple probe design was selected for this study because (a) the families had individualized and varying schedules during baseline (i.e., skip one week for a trip for spring break, increase intensity before a sibling had surgery), (b) a small number of participants met the inclusion criteria, (c) some of the target skills are not easily reversed (i.e., increasing verbal communication), (d) other target skills could be considered unethical to reverse (i.e., the parent's proximity to the child), and (e) other target skills take time to master (i.e., reinforcing and responding to communicative attempts).

The continuous observational measures were graphed and baseline probes were compared with the intervention and follow-up. Follow-up probes were conducted on each of the observational measure in order to observe if the changes in the target behaviors maintained over time and generalized to new routines. A brief description of the three phases (i.e., baseline, intervention, follow-up) is provided below.

Baseline. Baseline visits/sessions consisted of the parent/child dyad participating in: (a) business as usual conditions, which consists of the primary early interventionist leading the early intervention sessions for approximately 45 minutes, (b) a 10-minute parent-child play session,

and (c) and interviews. Each baseline visit was video recorded by the lead researcher. The length of time each family was in baseline varied because of the research design implemented.

Business as usual. The business as usual condition is based on the typical early intervention services that the family was receiving. Table 5 provides information about which services were being provided. Often within this condition the early interventionist and parent talked about the child's development, life events, accessing resources, and possible strategies that support the child's development. Within this condition, the early interventionist and possibly other consulting professionals such as a speech therapists or social workers visit the home and support the parent in goals that they have developed together on the Individualized Family Service Plan (IFSP). Part C of IDEA requires that the early interventionist and parent write a plan, called the Individualized Family Service Plan (IFSP), that identifies the family's' priorities for their child and desired outcomes for the child and family. Therefore, the home visits within this condition were focused on the IFSP and addressing the outcomes or other new concerns and priorities that the family may have identified. Table 5 provides information about the IFSP outcomes and the services that were provided to each family at the start of baseline.

A home visit within the business as usual condition at times focused on specific goals, such as increasing word approximations during play, or it may have focused on supporting the family, such as helping the family locate safe housing options. How the information was shared with families differed based on the early interventionist's style; for example, some modeled and provided coaching for the parent to try a new strategy while other early interventionists described the strategy or provided a handout with an example. However, at the end of every visit, a joint plan between the early interventionist and the family was written that identifies what the family would work on until the next home visit.

Play session. The only change within the business as usual condition during baseline was that the parent was asked to play and interact with his or her child for 10 minutes. These "play sessions" were video recorded and later coded for baseline data. The parent was asked, "Can you show me how you play with your child or try to have him or her communicate with you?" or if the parent shared an example of how he or she was playing with his or her child, he or she was asked, "Can you show me what that looks like? I would like to see how you play with your child." If neither of these prompts was successful in getting the parent engaged with his or her child in play, additional prompts were used. Examples of additional prompts used include: "I see your child likes to play with (insert name of toy or object). Would you like to join him so I can understand how he/she plays with you?" "What would you and your child be doing if we (lead researcher and early interventionists) weren't here? Can you show me?," and " I understand you have concerns with (insert name of routine) routine. It would be helpful if I could see what happens during that routine. Would you please show me?" If none of these statements resulted in the parent interacting with his or her child, the visit was scored as having no parent child interaction.

Following each visit, the lead researcher created a 10-minute continuous video clip of the parent and child interacting and playing. If the parent did not respond to any of the statements listed above , then the first 10 minutes of the visit was used. The 10-minute video clip was used to score the observational measures for both the parent and the child for every baseline session.

Pre-assessment interview. Baseline visits were also important as they allowed the lead researcher to begin to form a relationship with the family and to understand the family's concerns and priorities for the child. During the first few visits, the lead researcher conducted an interview with the parent in order to identify concerns and priorities for the child and better

understand the parent's experience with disabilities within his or her own life. Additionally, the parents were asked to complete a demographic form and an initial survey to gather information in order to have a comprehensive description and better understanding of the families participating in the study (See Appendix B and Appendix C).

Intervention. The intervention phase was approximately ten weeks long with five phases, each of which was approximately two to three weeks in duration. This study uses a social-communication intervention that blends two different intervention models in order to meet the needs of low-income families affected by poverty while also embracing the early intervention legislation.

Social-communication intervention. This study systematic blends multiple research based models, which is referred to as a "technical eclectic approach" for designing a comprehensive social-communication intervention(Odom, Hume, Boyd, & Stabel, 2012). This approach allows for the development of an intervention package to meet the needs of specific communities and families (Stahmer, Schreibman, & Cunningham, 2011) while utilizing evidence focused intervention practices to address core areas of development often affected by autism (Odom et. al.,, 2012; Stahmer, Schreibman, & Cunningham, 2011). This study was specifically designed to meet the needs of low-income families with young children with autistic characteristics receiving early intervention services covered under Part C of IDEA. Therefore, this study blends Responsive Interaction Intervention strategies (Aldred, Green, &Adams, 2004; Mahoney & Perales, 2003, Kong & Carta 2001, Yoder & Warren, 2002) to support parental responsiveness and the growth of a positive language environment for low-income families and Naturalistic Teaching Procedures (Hart & Risley, 1975; Koegel, O'Dell, & Koegel, 1987; Hancock & Kaiser, 2002) in order to

teach and embed fundamental applied behavioral analysis techniques to address core areas of autism within the home environment.

Responsive Interaction Interventions (RII). RII, also called relationship-focused intervention, are interventions that encourage parents to become more responsive to their child with the goal of improving their child's overall development (Kong & Carta, 2011; Mahoney & Perales, 2003; Pearce, Girolametto, & Weitzman, 1996). In particular, maternal responsiveness is associated with positive school outcomes, reduced behavioral problems, and healthy peer relationships later in life (World Health Organization, 2006). Trivette (2007) reviewed 13 studies focused on young children at risk for or diagnosed with developmental disabilities and concluded that responsive caregiving behaviors positively influenced the children's cognitive development. Kong and Carta (2011) synthesized 26 Responsive Interaction Interventions (RII) studies and concluded that the adults who implemented the intervention strategies showed an increase in responsiveness to their child and that their children showed increases in social communication, cognition, and emotional development. Thus, parental responsiveness is associated with better developmental outcomes for children at risk for developmental delays or with identified developmental delays. Furthermore, research has demonstrated that parental responsiveness can be increased by having parents implement responsive interaction interventions.

Research suggests that families with low-income or families affected by poverty are less likely to verbally respond to their young children and use positive commenting and encouragement (Harris & Marmer, 1996; Hart & Risley, 1995; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). Therefore, it is crucial that the intervention package within this study include RII strategies to enhance the parent's responsiveness to the infant or toddler across daily routines and community activities. However, due to the limited amount of research specifically

examining RIIs and young children with autistic characteristics, RII strategies need to be blended with empirically-supported practices that address core areas often affected by autism, including challenging behaviors and social communication.

Naturalistic teaching procedures. Naturalistic teaching procedures are empirically-supported strategies often based on applied behavior analysis that enable parents to provide learning opportunities targeting social communication and problem behavior throughout the day within their naturally occurring routines (Alpert & Kaiser, 1992; Brookman-Frazee, 2004; Hart & Risley, 1975; Hemmeter & Kaiser, 1994; Kaiser & Trent, 2007; Laski, Charlop, & Schreibman, 1988; LeBlanc, Esch, Sidener, & Firth, 2006; Yoder & Warren, 2002). Naturalistic language teaching procedures focus on providing language opportunities based on the child's interests during play or typical daily interactions and having the parents respond to the child's communicative attempts. Naturalistic language interventions have been shown to be effective for children within low-income families and children with a wide range of developmental disabilities, including autism (Goldstein, 2002). Additionally, parents have successfully implemented naturalistic teaching procedures within their own homes, which in turn positively affected their child's communication and social skills (Alpert & Kaiser, 1992; Hemmeter & Kaiser, 1994; Laski, Charlop, & Schreibman, 1988; Symon, 2005).

Young children at risk for autism often have delays in communication and social-emotional development; therefore, it is critical that this intervention package target social-communication skills. Additionally, young children with autism often struggle with generalizing new skills (Lovaas, Koegel, & Schreibman, 1979; Koegel et al., 1987), including social-communication skills; therefore it is critical that the intervention package support parents in providing multiple learning opportunities to the child within routines and activities in which they

typically participate. Including naturalistic teaching procedures as part of a blended package allows for more learning opportunities for children diagnosed with or at risk for a diagnosis of autism. Additionally, families in low-income urban areas are more likely than other families to have young children with challenging behaviors and are less likely to have access to behavioral and social supports for their children (Fox, Dunlap, & Powell, 2002). Furthermore, young children with autistic characteristics are more likely to engage in problem behavior and less likely to engage in social interactions (Koegel, Koegel, & McNerney, 2001; Taylor & Harris, 1995). Therefore, it is critical that this intervention support parents, especially those in poverty, in understanding problem behavior and implementing strategies in order to decrease and prevent their child's problem behavior within the home and community.

The intervention package. There are five phases of intervention that blend Responsive Interaction Interventions and Naturalistic teaching procedures. Table 6 provides a brief description of each phase. In addition, a description of each phase is provided in the following sections, including the supporting evidence base for the selection of the specific strategies, the purpose of the phase, the expected outcomes, and the specific skills to be learned by the parent.

Intervention phase one. The purpose of phase one, "Supporting the Parent-Child Relationship," was to increase the parent's responsiveness to the child and to enhance the positive interactions between the parent and child. This phase was based on Responsive Teaching (Mahoney & Perales, 2003), and the expected outcomes were an increase in the parent's use of positive praise and an increase in physical proximity to the child. This phase lasted approximately two weeks with each family. During these two weeks, the researcher provided the parent with instruction and practice on the following strategies: (a) increasing positive praise, (b) providing positive attention for good behavior, (c) interacting at the child's level, (d) responding

to the child when he or she makes noise or physical contact, and (e) following the child's lead in play and exploration.

Intervention phase two. The purpose of phase two, "Prelinguistic Communication," was to increase the parent's awareness of the child's communicative behaviors and to encourage the parent to provide clear communication opportunities that build on the child's pre-linguistic skills and interests. This phase was based on naturalistic teaching strategies of the Prelinguistic Milieu Teaching (Yoder & Warren, 2002), and the expected outcomes were increases in the parent's ability to use a variety of strategies for recruiting and maintaining the child's attention. This phase also lasted approximately two weeks with each family. Thus, in weeks three and four, the researcher worked with the parent on learning the following strategies: (a) playing turn-taking games or playing within routines, (b) identifying motivating objects/routines, (c) holding preferred objects close to eyes, (d) providing clear models, (e) recasting the child's vocalizations with functional words, (f) reinforcing the child's attempts and correct responses, thereby decreasing directives, and (g) using motivating objects to start interactions.

Intervention phase three. The purpose of phase three, "Preventing Problem Behavior," was to help the parent to understand why challenging behavior was occurring and how to address the challenging behavior in order to prevent future challenging behaviors. This phase introduced the concept that problem behavior serves a function for the child and explored strategies to address problem behavior for young children in the home environment (Durrand & Carr, 1991; Neilsen & McEvoy, 2004). The expected outcome was the parent's increased use of positive praise directed toward the child and consistent response to problem behavior. This phase required approximately three weeks for each family. Thus, weeks five, six, and seven included instruction and practice opportunities for the parent to learn the following strategies: (a)

withholding preferred items when a child is having a tantrum, (b) providing non-contingent attention, (c) responding less to non-preferred behaviors and more to preferred behaviors, (d) embedding non-preferred task within daily routines, (e) following non- preferred activities or tasks with something preferred, (e) setting clear rules and boundaries and following through (consistency with safety issues), and (f) providing immediate reinforcement for compliance.

Intervention phase four. The purpose of the fourth phase, "Verbal Communication," was to increase the parent's use of clear language opportunities and provide appropriate and natural reinforcement based on the child's response. This phase draws heavily on naturalistic language teaching procedures, particularly Pivotal Response Therapy (Koegel & Koegel, 2006). The expected outcome was the parent's increase in providing clear language opportunities and immediate reinforcement for communication. It was expected that the consistent use of these strategies by the parent will lead to increases in the child's functional verbal communication. This phase required approximately two weeks (i.e., weeks eight and nine) for each family. During this phase, the researcher provided the parent with instruction and learning opportunities in the use of the following strategies: (a) manipulating the environment based on the child's interest, (b) providing immediate reinforcement, (c) providing clear language opportunities, and (d) using time delays and leading statements.

Intervention phase five. The purpose of the last phase, phase five, "Implementing Strategies within the Families Routines," was to support the parent as he or she implements the strategies learned as a regular part of daily routines and activities. This phase was based on a naturalistic language intervention model, the Teaching Social Communication approach (Ingersoll & Dvortcsak, 2010). The expected outcome was increased use of all of the strategies learned by the parent with a high level of fidelity as appropriate throughout the child and family's

day. This phase lasted approximately one week (i.e., week 10 of 10). The focus of the parent learning during this final phase included: (a) understanding how to put all the strategies learned in the previous phases together and (b) learning how to implement all of the strategies across multiple daily routines.

Session plan across intervention phases. Each intervention session began with the researcher reviewing the previous session and checking in with the parent about problem behaviors or situations that may have occurred since the previous visit. Following the review, the parent was asked to interact and play with the child, and a 10-minute video probe was collected. From there, the lead researcher provided feedback and problem solved together with the parent regarding anything related to the previous session's strategies. Then the researcher introduced the new strategy, provided a model of implementing the new strategy with the child, and had the parent practice implementation of the strategies with the child, providing scaffolding for accurate implementation as needed.

The session concluded with the lead researcher encouraging the parent to make written notes to support his or her independent, accurate implementation of the strategies and how he or she thinks the strategies could be useful during specific daily routines. The lead research would ask questions like "What would you like to work on until our next session?" and "What strategies would you like to try, or continue to use before our next meeting?" Although the lead researcher encouraged the parents to write down their own notes, the parents would ask the researcher to write down their response and the lead researcher would write down their response verbatim in their own words (i.e., "work on him using his eyes: look at mama when you want something", "joining in what he is doing", or "working on encourage positive things instead of don't don't don't"). Using this information, the researcher and parent together selected one daily

routine the parent could practice the strategy they selected. The researcher asked "During what time of the day do you think this could be helpful?" or "When are you planning on using the strategy?" The note was written on carbon copy paper so the parent had a copy and the lead researcher had a copy. No other written materials were provided to parents. Between sessions, the lead researcher sent text messages to the parents providing encouragement and a reminder of the strategy and routine they selected for practice opportunities. Research suggests that providing families with information through cellular phone communication increases engagement and implementation of specific strategies within the home of high-risk families (Carta, Lefever, Bigelow, Borkowski, &Warren, 2013). Appendix D provides a visual presentation of the sequence and flow of the sessions. A checklist was completed during each session by the lead researcher in order to document whether all of the steps were followed during each home visit. The Intervention Check-List for the Parent Educator is attached in Appendix D.

The lead researcher also was in frequent contact with each family's primary early interventionist, who provided service coordination and resources to the family during the study. Table 7 provides additional information about the information and resources provided to each family during the course of the study. When the families would ask the lead researcher for support beyond the scope of the study, the lead researcher would contact the family's primary early interventionists and schedule a joint visit as soon as possible. On the joint visit, it was made clear to families that the primary early interventionist was there to provide service coordination and the lead researcher would observe. Each family had at least one IFSP update, and requested support related to service coordination twice during the intervention phase.

This study was designed for the families to continue to have a close connection with their primary early interventionist in order to ensure families continued to receive service

coordination, which included support for locating safe housing, food banks, or resources for mental health concerns or problem solving financial barriers. Also, the early interventionists were made aware of all intervention session and were welcome to observe any of the intervention session in order to learn the strategies within the intervention package or to continue to be supportive of the family. The primary early interventionists for the families observed the majority of the intervention session, and attended at least one intervention visit per week.

Follow-up visit. In order to evaluate the effectiveness of the intervention in positively influencing the parent's skills in supporting his or her child's social-emotional and communicative behaviors, a maintenance probe was collected three weeks after the intervention was completed. The maintenance probes was collected during a routine or activity not targeted during the intervention period. The probes were scored for all observational measures in order to evaluate if the positive changes were sustainable once the interventionist was no longer present. Sam and Kevin's families moved out of the area therefore they do not have any follow-up data.

Measures

Both parent and child behaviors were measured in order to assess the effects of the intervention. The continuous measures were used to track individual growth and behavioral changes across baseline, intervention, and follow-up phases, and parent interviews were used as a measure of social validity. All visits were video recorded and 10-minute clips of the parent and child playing together were used for all continuous measures. The following sections discuss: (a) continuous measures, which include three parent measures and one child measures,(b) social validity measures, including parent exit surveys and systematic anecdotal notes, and (c) data analysis procedures.

Continuous measures. The continuous measures include both parent and child-focused

measures. The parent measures include a measure of the parent's correct implementation of the intervention package and the parent use of proximity and positive language in the home. The child measure is of the child's use of functional verbal communication while interacting with their parents. Parent and child measures are described in detail in the following section.

Parent continuous measures. Also as noted earlier, the parent's fidelity of implementation of the learned strategies was measured in order to understand how the parents were implementing the intervention with their children. Additionally, two parent behaviors were selected for continuous observational measurement: parent's use of appropriate proximity and parent's use of language. These two behaviors were not specifically targeted within the intervention package but are measures to detect collateral changes in the parents' interaction style with their children as a consequence of participating in the study.

Parent implementation fidelity measure. The parent fidelity measurement tool measured six critical behaviors. Each behavior was scored in one minute intervals across the 10-minute clip. The six parent behaviors are(a) showing interest in the child's play or behavior, (b) recasting vocalizations with simple words, (c) providing direct statements of positive praise, (d) following the child's lead and interests and/or attempting to get the child's attention if the child is unengaged, (e) providing a clear learning opportunity, and (f) providing direct reinforcement of communicative attempts. For details, see Appendix E.

A partial interval system was used to score implementation fidelity with 1-minute intervals. Specifically, a plus was scored for each behavior if it occurred anytime during the 1-minute interval or a minus if it did not occur within the 1- minute interval. A total percentage for fidelity was calculated by totaling the number of intervals that the parent used each of the 6 strategies and dividing by 60, which is the numbers of behaviors (6) multiplied by the number of

intervals (10). Then that number was multiplied by 100 in order to calculate a percentage of the parent's total fidelity of implementation.

Additionally, a percent of intervals for each behavior was calculated by totaling the "plus" intervals and dividing by the total number of intervals (i.e., 10) multiplied by 100. This allowed the lead researcher to see if particular strategies were more challenging for an individual parent to implement. It also provided a description of which elements of the packaged intervention were consistently or inconsistently provided to the child.

Measure of parent use of appropriate proximity. Proximity is the initial step in becoming involved in the child's world. It is critical that parents are in close proximity to their infants and toddlers in order to engage them in play, keep them safe, provide comfort, and respond to their needs. Without appropriate proximity, the majority of suggested strategies within this intervention will be ineffective. *Proximity* for this study and for purposes of measuring changes in the parents' use of appropriate proximity was defined as a parent being within two arm's lengths of the child or the toys/activities in which the child was engaged. The full definition and coding instructions are provided in Appendix F. The researcher did not tell parents where to stand, where to sit, or to move closer to their child in their own homes, but it was hypothesized that parents would increase their use of appropriate proximity during the intervention phase of this study.

Proximity was measured using whole interval scoring in 20 second intervals across the 10-minute video clip**.** Interval recording involves observing whether a behavior occurs or does not occur during specified time periods. In whole interval recording, the observer marks down whether a behavior occurs for the entire length of the interval by placing an "X" for occurrence and an "O" for nonoccurrence. That is, the parent must have engaged in appropriate proximity the

entire interval for an "X" to be documented; otherwise, an “O” was recorded for that 20 second interval. Once the recording was complete, the observer counted the number of intervals in which the behavior was observed and a percentage of intervals with the behavior were calculated.

Parent use of language. It is well documented that low-income parents are more likely to use directive language rather than positive comments with young children, and high levels of positive commenting has been shown to reduce problem behaviors in young children. The intervention teaches parents to provide direct and specific positive praise for appropriate behavior, for example “Good job picking up your toys” or “I like when you help pick-up” and is measured within the fidelity implementation measure; however, this measure is focused on the overall language environment. It was hypothesized that the intervention package would positively affect the parents’ overall tone and increases the use of positive or neutral language directed at the child while decreasing harsh statements (i.e., “Child, you better do it or else”) and directive statements (i.e., “Pick it up now!”). Therefore, this is a measure of the language environment with the parent interacting with the child.

In order to understand the language environment in which the child and parent are interacting, the parent’s use of language during play was scored in one of the three following categories: (a) positive language directed toward the child, including neutral language such as comments about play or asking if the child wants a snack, (b) negative language, yelling, harsh or threating statements or directive statements, or (c) not talking. The full definition and coding instructions are provided in Appendix F. For this measure, a partial interval coding system was used with the 10-minute video clip divided into 20-second intervals. In partial interval recording, the observer marks down whether a behavior occurs any time during the interval by placing an “X” for occurrence and an “O” for nonoccurrence. Thus, the occurrence of parent language

behaviors resulted in an "X", while no parent language behavior at any point in the intervals resulted in a score of "O."

Child continuous measure. One child behavior was selected for continuous observational measurement: functional verbal communication.

Functional verbal communication. To assess if the parent's implementation of the strategies influenced the child's ability to socially interact and communicate, the child's functional utterances and spontaneous words were coded. A time anchored transcript of child verbal behaviors was used to code the child's functional verbal utterances and spontaneous words during the 10-minute video clips. Then, at the end of the clip, the number of intervals with either a functional utterance or spontaneous word was totaled and divided by the total number of intervals and multiplied by 100 to produce a percentage of intervals in which the child used functional verbal communication to communicate with his parent. The two components of functional verbal communication are described in detail below.

Functional utterances are defined as any sound or word approximation the child generates that is directly related to the task or context or serves a purpose that is meaningful to the context. For example, if a child points to the door and says "ohhhh" for *outside*, this is a functional utterance, or if the mother is preparing his bottle, and she says "milk" and her child says "mmmm," this would also be a functional utterance. Utterances include imitated echolalia or repetitive sounds directed to a person or item.

Spontaneous words are defined as any word the child generates that is directly related to the task or context or serves a purpose (i.e., requesting a drink, pointing to the door while saying "outside"). Unlike functional utterances, imitated echolalia, or word approximations were not be counted. Additionally, repetitive non-functional words (ex: child saying "me me me" while hand

flapping) or scripting (ex: the child says “Help me, Percy, the snow is coming” while petting the dog) were not be included. Additionally, a frequency count of spontaneous words as well as a transcription of the words was collected across the 10-minute interval.

Measures of Social Validity

The parents completed an exit survey as seen in Appendix G, which asks several questions related to their perceptions of the intervention. Given the lack of research focusing on low-income families with children under three years of age, evaluating how the parents’ perceived the program and whether they believed it was developmentally appropriate, addressed their concerns, was respectful of their values, and positively affected their relationship with their young child was critical in further enhancing and evaluating the intervention within this study.

Data Analysis

Continuous measures. The data collected through continuous measures was analyzed utilizing three methods: visual analysis of graphs, descriptive statistics, and Tau-U method for calculating effect size (Parker, Vannest, Davis, & Sauber, 2011). Each measure was graphed across three phases: baseline, intervention, and follow-up. The change produced by the intervention had to be visually observable on the graphs. Thus, baseline data must have been visually stable, with little fluctuation, and once the intervention was implemented, a direct change in behavior must have been observable on the graph. Additionally, to control for maturation or history effects, this pattern must have been repeated three times (in this study, across three parent-child dyads) in order to show experimental control. In order to support and strengthen the conclusions made from the visual analysis of graphs, descriptive statistic are provided, and a change in the average level between phases is discussed.

The Tau-U method was used to calculate effect sizes (Parker, Vannest, Davis, & Sauber,

2011). The Tau-U is a nonparametric statistical analysis of non-overlapping points and the change in trend lines between phases and follows an "s" sampling distribution. The Tau-U uses pairwise data comparisons where each individual value in baseline is compared to all points in intervention and the number of intervention points that are positive or negative relative to the baseline point is calculated. This is continued for every point in baseline, and then the total number of positive values is subtracted from the negative values and divided by the number of pairs. This calculation provides a ratio of non-overlapping pairs between phases that is sensitive to the change in trends and therefore provides a score of magnitude of improvement between phases. The Tau-U can be calculated at the website http://www.singlecaseresearch.org/. If the generated "d" value is above a .65, the intervention is considered to be effective (Parker, Vannest, Davis, & Sauber, 2011). The closer the number is to 1, the more effective the intervention. The Tau-U will be reported for a measure of overall improvement between baseline and intervention across all participants for the following two measures; parent's fidelity of implementation and the child's use of functional verbal communication.

Interobserver agreement for observation measures. Interobserver agreement was collected across 25% of each phase (i.e., baseline, intervention, and follow-up) for each parent-child dyad for all observational measures. The lead researcher was the primary coder of all clips, and the research assistant scored a third of the clips for reliability. For the observational measure, interobserver agreement was calculated comparing point to point within each interval.

Training the research assistants. The research assistants were trained to score results based on the operationally-defined target behaviors for both the parent and child measures. Together, the lead researcher and research assistants reviewed the operational definitions and watched short example video clips and practiced coding. Then they scored new example clips

individually and compared scores in order to check that scores were reliable. When the scores were not reliable with the lead researcher, they closely reviewed the operation definitions together, watched the portions of the clip where there was a disagreement, and discussed why their scoring was different. This process continued until the research assistants and lead researcher were able to score example clips independently and have reliable scores. Once reliability was met on three example clips at 90%, the research assistants started coding clips for this study.

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Table 4

Parent Demographic Information

Mother (child)	Household Income	Education level	Marital Status	Children	Self-Identified Mental Health Concerns or Disabilities
Dana (Sam)	15,000-23,999.00	Some college	Married	4	• Family history of autism, depression, and schizophrenia
Kris (Natesha)	Less than 15,000.00	Master's Degree	Divorced	2	• Child abuse survivor • Previously in abusive marriage • Family history of depression and child abuse
Landa (George)	Less than 15,000.00	Some Junior High	Life Partner	4	• Learning Disability/IEP in school • Previously in abusive marriage • Family history of child abuse, anxiety, depression
Jackie (Kevin)	Less than 15,000.00	Associate's Degree	Married	5	• Family history of depression, anxiety, child abuse and drug use.

Table 5

Child Information

Child (Mother)	Age Sex	Ethnicity	Autism Risk Factors	IFSP Outcomes	Services per Month on IFSP at Start of Baseline
Sam (Dana)	13 mths Male	White	• Two older siblings have autism • Delays in cognition including limited play skills • Does not respond to name • Delays in receptive and expressive communication. • Does not babble or point	• Resources about development	4 hours of service coordination < 1 hour of Speech Therapy
Natesha (Kris)	25 mths Female	White	• Older sibling has autism • Pediatrician referred child to autism specialist • Limited play skills • Delays in receptive and expressive communication • Has a few word approximations	• Improve communication and behavior during reading time • Improve following directions	2 hours of special instruction & service coordination < 1 hour of Speech & Occupational Therapy
George (Landa)	29 mths Male	Latino / Native-American/ White	• Referred to EI for concerns of autism by pediatrician at 24 months • Extreme challenging behaviors including tantrums that last longer than 30 minutes • Delays in expressive communication • Has fewer than 10 clear words	• Increase safe behaviors in the home and out in the community • Resources about transitioning to school	3.5 hours of special Instruction & service coordination < 1hour of Occupational Therapy, Speech Therapy, &Social work
Kevin (Jackie)	31 mths Male	Latino/ White	• Referred to EI for concerns of autism by pediatrician at 22 months • Restrictive play interests and prefers to play alone • Delays in expressive communication • Has several words but doesn't use them consistently	• Improve behavior during bedtime • Improve playing with other children • Increase communication skills during play	1 hour per month of service coordination & special instruction < 1 hour of Speech Therapy and Occupational Therapy

Table 6

Intervention Components

Phase 1: Supporting the Parent--- Child Relationship

Week 1

Visit 1 (a) increasing positive praise
Visit 2 (b) providing positive attention for good behavior

Week 2

Visit 3 (e) responding to the child when he or she makes noise or physical contact
Visit 4 (f) following the child's lead in play and exploration

Phase 2: Prelinguistic Communication

Week 3

Visit 5 (a) playing turn-taking games or playing within routines
Visit 6 (b) identifying motivating objects/routines
(c) holding preferred objects close to eyes

Week 4

Visit 7 (d) providing clear models
(e) recasting the child's vocalizations with functional words--- what would he/she say
Visit 8 (f) reinforcing the child's attempts and correct responses, decreasing correctives

Phase 3: Preventing Problem Behavior

Week 5

Visit 9 (a) withholding preferred items when a child is having a tantrum
Visit 10 (b) providing non-contingent attention

Week 6

Visit 11 (c) responding less to non-preferred behaviors and more to preferred behaviors
Visit 12 (d) embedding non-preferred tasks within daily routines

Week 7

Visit 13 (e) following non-preferred activities or tasks with something preferred, using motivating items for less preferred tasks
Visit 14 (f) setting clear rules and boundaries and following through and providing immediate reinforcement for compliance

Phase 4 : Supporting Verbal Communication

Week 8

Visit 15 (a) manipulating the environment based on the child's interest
Visit 16 (b) providing immediate reinforcement

Week 9

Visit 17 (c) providing clear language opportunities
Visit 18 (d) using time delays and leading statements (songs)

Phase 5 : Implementing Strategies within the Families Routines

Week 10

Visit 19 (a) using all the strategies together, problem solving reoccurring challenges
Visit 20 (b) implementing strategies across multiple routines

Table 7

Service Coordination

Parent & Child	**Support provided by the service coordinator during the study**
Dana & Sam	• Explanation of IEP and school placement for older sibling • Coordination with services the family was receiving for older sibling • Resources for additional financial support for multiple children with disabilities • IFSP Update
Kris & Natesha	• Support for doctor visit/comprehension of medical report • Resources for additional financial support for multiple children with disabilities • IFSP Update • One visit provided by a psychologist about mental health concerns
Landa & George	• Enrollment paperwork for school • Questions about medical coverage/comprehension of medical report • Access to diapers • IFSP Update • One visit provided by a psychologist about previous traumatic incidents and older children in the home
Jackie & Kevin	• Enrollment paperwork for local preschool/child care options • Transportation support • IFSP Update • One visits provided by social worker to provide information about alternative and safe housing options

Appendix A

Example Handout for Infant/Toddler Networks

Parent Education Program for Infants and Toddlers with Social-Communcation Delays

This is an opportunity to have your families participate in an intervention study. The purpose of this study is to provide a parent education program to families who reside in an urban area with infants and toddlers with delays in social-communication and/or problem behaviors. The 10 week intervention program is design to empower low-income parents to implement evidence-based practices with their young children.

Intervention Summary

- Supporting the Parent-Child Relationship
- Prelinguistic Communication
- Addressing Challenging Behaviors and Understanding Behavioral Principles
- Verbal Communication
- Putting It All Together and Applying Strategies Across Multiple Routines

FIND SARA
And ask her your questions

Wed Dec 5th 8:00pm-4:00pm
Thurs Dec 6th 1:00pm- 4:00pm

Contact Information:
Lead Researcher
Phone Number and
Email

Which children are a good fit for this intervention?

Any child you currently serve who is eligible for Medicaid and fits one or more of the descriptions bellow:

- ✓ Has delays in social-emotional development
- ✓ Has challenging behaviors
- ✓ Was referred to infant/toddler services for challenging behaviors
- ✓ Was referred to infant/toddlers services for concerns of autism
- ✓ Has significant delays in communication
- ✓ Has repetitive and stereotypic play or behaviors
- ✓ Has a sibling diagnosed with autism
- ✓ Did not pass the M-Chat

Eligible children do not need to fit all of the elements listed; however, children who fit multiple descriptions would be a good fit too.
Kiddos with a known history of drug exposure or identified genetic disorders are not a good fit at this time.

Additionally, children who spend 30 hours or more with an adult other than their primary caregiver are also not a good fit at this time (ex: Early-Head start, in-home child care for more than 30 hours a week).

Appendix B

Demographic Survey for Primary Parent

<table>
<tr>
<td>Gender:
____Male
____Female

Marital Status
___Single, never married
___Married
___Divorced
___Widowed
___ Life Partner</td>
<td>Parents' Ethnicity:
___Hispanic or Latino
___American Indian/Alaskan Native
____Native Hawaiian or other Pacific Islander
___Asian
___Black/African American
___White, not Hispanic
___More than One Race
___Unknown/Do not wish to say
____Other:_____</td>
<td>Age Range:
_____21-25 _____46-50
_____26-30 _____51-55
_____31-35 _____56-60
_____36-45 _____61+

How many children do you have?_____

How many of them live with you? _____</td>
</tr>
<tr>
<td>Education Level:
____Some Junior High
____Some High School
_____GED
_____High school Diploma
_____Some College
_____Associate's Degree
_____Bachelor's Degree
_____Master's Degree
_____Doctorate Degree</td>
<td>Household Income:
_____Less than 15,000
_____15,000-23,999
_____24,000 -49,999
_____50,000-74,999
_____75,000-99,999
_____100,000+</td>
<td colspan="2">Have you ever received the following:
____WIC
____Food stamps
____Cash Assistance
____Child Care Assistance
____Housing Assistance
____Cell phone Assistance
____Other Financial Assistance

Do you currently have a case worker assisting you with subsidies? Yes/ No</td>
</tr>
</table>

Appendix C

Initial Interview to Gather Information

1. How do you think your child learns best?
2. How does your child currently communicate with you?
3. How did you learn about your local infant/toddler network (name of agency)?
4. Tell me about any concerns or questions you have about your child's development.
5. Why do you want to participate in this study?
6. There are some specific strategies used to for increasing communication in young children. How do you feel about learning some new strategies?
7. Does your child have any siblings? With whom does he/she like to play?
8. What are some of your child's favorite things to do? Favorite things to eat?

Appendix D

Intervention Check List for Parent Educator

Home Visit Check List	**Completed**
1. Review last week's strategies/Check in	
2. Ask the parent to demonstrate what s/he has been practicing, and to play with his/her child (take 10-min play clip)	
3. Identify one thing the parent did really well	
4. Provide a verbal description of the new strategies	
5. Discuss with the parent how the strategy can be used in daily routines and activity, or how it may be helpful for their family	
6. Model the strategies	
7. Have the parent try the strategy with their child	
8. Have the parent identify what time of day or what routine s/he would like to focus on practicing the strategies	
9. Encourage the parent to write down what's important to him/her (if capable) and identify what routine or time of day they want to use the strategy.	
**Send text reminder to parent about next meeting time and strategies s/he is practicing	
Total:	

Code: _____ Date:_____ Topic:_____

Appendix E

Parent Implementation Fidelity Checklist

Minute	1	2	3	4	5	6	7	8	9	10	%
1. Shows interest in the child's play or behavior											
2. Recasts single words or recast vocalizations with simple words											
3. Provides direct positive praise or positive comments											
4. Follows the child's lead and child's interests--if unengaged, attempts to get the child's attention (including holding object up to eyes or asking the child to play)											
5. Provides clear learning opportunity (gesture model or vocal Lang Model)											
6. Reinforce communicative attempts											

Total Fidelity Percentage:

Score + if it happened once during the interval
Score – if it did not occur

Definition of Strategies

1. **Show interest in the child's play or behavior**: The parent is focused on the child's behavior, they are looking at the child

2. **Recast vocalization**: If the child says "babababab," parent says "yes bottle"; if the child says "myyyyy", the parent says "mine"; if the child says "ball" the parent repeats the word, "ball."

3. **Provides direct positive praise or comments**: Clapping , thumbs up, kisses, and hugs NOT included
Examples to count: "You're such a big boy," "You're so strong and smart, "I like when you pick up your toys," "Yay, you did it!," "you're so handsome in that outfit," "I like how calm you are." Statement must be directed at target child.

4. **Follows the child lead and child's interests:** If unengaged, attempts to get the child's interest and attention. Learning opportunity must be focused on the child's interests or getting the child's attention; attempts to start turn-taking activities count, as does holding preferred toys and objects up to eyes while expecting eye contact.

5. **Provides clear learning opportunity:** Parent provides a clear and concise opportunity for the child to respond: gesture model or vocal Lang model Also count. Simple questions count: "What do you want?" and "What's that?" if the parent pauses for response.

6. **Reinforce communicative attempts:** In response to the learning opportunity, any attempt the child makes is positively reinforced, including approximations. During leading statements like "Row Row Row…," if the parent continues the favorite song once the child attempts, count it!

Appendix F

Data Collection Form

Language Environment (Partial Interval)

	Positive language directed at any child, laughing	Directive statements toward children	Talking to other adults	Proximity
0:00---0:20				
0:20---0:40				
0:40---1:00				
1:00---1:20				
1:20---1:40				
1:40---2:00				
2:00---2:20				
2:20---2:40				
2:40---3:00				
3:00---3:20				
3:20---3:40				
3:40---4:00				
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6:00---6:20				
6:20---6:40				
6:40---7:00				
7:00---7:20				
7:20---7:40				
7:40---8:00				
8:00---8:20				
8:20---8:40				
8:40---9:00				
9:00---9:20				
9:20---9:40				
9:40---10:00				

Total				

Child Language Measure (Time Anchored)

	Functional Verbal Utterance	Spontaneous Words
0:00---0:20		
0:20---0:40		
0:40---1:00		
1:00---1:20		
1:20---1:40		
1:40---2:00		
2:00---2:20		
2:20---2:40		
2:40---3:00		
3:00---3:20		
3:20---3:40		
3:40---4:00		
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7:20---7:40		
7:40---8:00		
8:00---8:20		
8:20---8:40		
8:40---9:00		
9:00---9:20		
9:20---9:40		
9:40---10:00		

Total	Utterance	Spon

Partial Interval--Coding Definitions

Positive language--positive language directed at the child or children in the home, include statements commenting on play or asking the child to join an activity. Also include direct statements of positive praise. Also include neutral statements like "Do you like that ball?" or "Let's go get snack."

Directive statements-- this includes yelling, harsh statements, threats of punishment, as well as telling the child what to do with a firm voice ("clean up those toys now" or "put that down").

Talking to other adults--- score this if the parent talks to the researcher, early interventionist, or other adults in the environment. Also score this category if the adult talks on phone.

Score + if the behavior occurs within the 20 sec interval
Score – if the behavior does not occur within the 20 sec interval

Whole interval—Proximity

The parent must be within 2 arm's length (or approximately three feet) of the child and be able to reach the child to keep him/her safe or assist if help is needed. The parent must meet this definition of appropriate proximity for the entire interval to receive a plus. Also, if the parent is not within the video clip, score it as a minus.

Coding Definitions

Functional Verbal Utterance-- the child makes an unclear vocalization in attempt to request an item, imitates a verbal model or sound, or protests and the vocalization is part of a social interaction. Include purposeful grunting or grunting with an appropriate tone (example: harsh and short when mad, high pitched when excited and reaching for toy). Also score this when it is unclear which words the child said on the video. If it is hard to hear the child on the video but the parent repeats back the word or phrase, score it in this

Score + if the behavior occurs within the 20 sec interval
Score – if the behavior does not occur within the 20 sec interval

Spontaneous words--write each word the child says next to the appropriate time code. If the child says "that's my ball" that counts as 3 words. Each word counts as one. Echoing and non-social vocalizations do not count, like signings songs repetitively.

Appendix G

Exit Interview

Open-Ended Interview Questions:

1. Would you recommend this intervention to other families? Why or why not?
2. Do you have any questions about the study?
3. What areas would you still like help with?
4. Have the strategies provided helped your family? Which strategies would you like to continue to use?
5. Is there anything that you found confusing or that you did not like?
6. Have you noticed a change in your child's challenging behaviors?
7. What was the most challenging part of participating in this study?
8. How does your child currently communicate with you?

Chapter 4: Results

The purpose of this study is to evaluate the effectiveness of a home-based, parent-implemented early-intervention package that systematically blends multiple strategies in order to support families affected by poverty with infants and toddlers at risk for or diagnosed with autism. This chapter will provide results of the multiple baseline study for answering the following research questions: 1) Are low-income parents of infants and toddlers at risk for or diagnosed with autism able to implement the intervention with fidelity in their home and everyday community environment? 2) Does parent implementation of the blended-intervention package positively influence the child's social-communication skills (i.e., functional verbal communication)? 3) Does implementation of the strategies by the parent positively affect how the parent and his or her child interact? 4) Will the child's change in social-communication skills maintain over time once the intervention is removed? and 5) Do parents indicate their satisfaction with the program by stating that they are willing to recommend the intervention to other parents in their community?

The section below is organized to answer each of the five questions, followed by reporting of interobserver agreement for all measures. Under each section, results are reported about each parent/child dyad, starting with Landa and George, followed by Dana and Sam who were unable to complete the intervention study, Kris and Natesha, and Jackie and Kevin. The results were analyzed using descriptive statistics (i.e., median, range, and percent change) and visual analysis, which included evaluation of difference in median, variability, and trend between phases. Additionally, a Tau-U coefficient was calculated as a statistical estimate of effect size in order to evaluate the overall impact and magnitude of change of the intervention across all participants (Parker, Vannest, Davis, & Sauber, 2011).

Parent Fidelity of Implementation

In order to assess if parents were able to implement the intervention package with fidelity (at or above 70%), six parent behaviors were measured across each phase. The six behaviors are: (a) showing interest in the child's play or behavior, (b) recasting vocalizations with simple words, (c) providing direct statements of positive praise, (d) following the child's lead and interests and/or attempting to get the child's attention if the child is unengaged, (e) providing a clear learning opportunity, and (f) providing direct reinforcement of communicative attempts.

Results show that parents were able to learn new strategies and change their behavior in order to implement the intervention package within their own homes. Table 8 shows the percent of 1-minute observational intervals in which the parents were correctly implementing each of the strategies during the ten minute play session for each of the four parent/child dyads and the overall fidelity score. The median percent correct of implementation as well as the range are shown for both baseline and intervention for each parent/child dyad. Additionally, the change in percent correct of implementation between baseline and intervention is presented. The median was used as an estimate of the central tendency within each phase because it is less likely to be skewed by outliers than the mean and represents the most common response within a condition (Cooper, Heron & Heward, 2007, p. 150). Figure 1 includes graphs of the parent's fidelity of implementation with median and trend lines (i.e., total percent fidelity of implementation score). The following sections provide a brief summary of each parent's fidelity of implementation.

Landa and George. Using information from Table 8 and visual analysis of Figure 1, Landa was observed implementing the intervention across the six behaviors in baseline at a median level of 23% with low variability (i.e., 8%-30%) and a slight downward trend. During intervention, Landa was implementing the six intervention strategies with at a median level of

67% with moderate variability (i.e., 42%-87%) and a moderate upward trend. Thus Landa showed a 43% change (i.e., 23%-67%) between the median level of implementation from baseline to intervention. Also, during the third session of intervention, Landa implemented the intervention package correctly 76% of the play sessions meeting the stated fidelity criteria. The high level of correct use of strategies maintained in the follow-up probe, where she implemented the intervention correctly 70% of the time.

Landa consistently implemented three strategies: (1) showing interest in the child's play or behavior (i.e., median in intervention 100%), (2) following the child's lead and interests during play (i.e., median in intervention 100%), and (3) providing clear communication learning opportunities (i.e., median in intervention 70%). Landa showed most change from baseline to intervention using the strategy of following the child's lead and interests with a change from 15% in baseline to 100% in intervention (i.e., 85% change in median level between phases). Landa showed at least 30% change between baseline and intervention for five out of the six strategies targeted in the intervention package; however, Landa showed a 25% change between baseline and intervention and inconsistently implemented the strategy of providing reinforcement for the child's communicative attempts. Also, Landa struggled with providing positive praise to George consistently within the intervention phase, with a range of 0% to 80% and a median level of 40%. However, in baseline, she was only providing positive praise during play 10% of the time; therefore there is still a notable increase in use of directive positive statements toward George during intervention.

Dana and Sam. Using information from Table 8 and visual analysis of Figure 1, Dana was observed implementing the intervention across the six behaviors in baseline at a median level of 32% with low variability (i.e., 15%-40%) and a slight downward trend. In baseline, Dana

showed a moderate level of correct implementation of the intervention techniques. In the intervention phase, Dana only completed half of the sessions and was implementing the intervention with at a median level of 57% with low variability (i.e., 38%-72%) and a clear upward trend. There was a 25% change between the median level of implementation in baseline and intervention within the first few sessions of Dana's participation in intervention. Also, during the fourth session of intervention, Dana implemented the intervention package correctly 72% of the play sessions meeting fidelity criteria.

Dana, like Landa, consistently implemented three strategies: (1) showing interest in the child's play or behavior (i.e., median in intervention 100%), (2) following the child's lead and interests during play (i.e., median in intervention 100%), and (3) providing clear communication learning opportunities (i.e., median in intervention 70%). Dana showed the most change from baseline to intervention using the strategy of providing clear communication learning opportunities. For five out of six strategies, Dana showed greater than a 30% change between baseline and intervention or was already utilizing the strategies at a high rate during baseline. Dana showed little change in the use of recasting vocalizations to words; however, Sam was a very quiet baby, making minimal noise.

Kris and Natesha. Using information from Table 8 and visual analysis of Figure 1, Kris was observed implementing the intervention across the six behaviors in baseline at a median level of 3% with medium variability (i.e., 0%-30%) and a flat trend. Kris rarely engaged in the intervention behaviors during baseline while interacting with her daughter. In the intervention phase, Kris implemented the intervention across the six behaviors with a median level of 40% with low variability (i.e., 30%-58%) and a flat trend. There was a 37% change between the median level of implementation in baseline and intervention (i.e., 3%-40%). Kris maintained her

positive change in correct use of intervention strategies in the follow-up phase and was implementing the strategies 68% of the time while playing with her daughter, which was her highest use of intervention strategies, just below the criteria needed to meet fidelity.

Kris implemented two strategies consistently within this intervention phase, similar to Landa and Dana. She correctly showed interest in the child's play or behavior(i.e., 90%) and followed the child's lead and interests during play (i.e., 90%). Kris started with very low baseline scores, with a median level of 0% in all strategies but showing interest in her child (i.e., 20%). However, she showed at least a 30% improvement in four out of the six strategies within the intervention package. Kris did not consistently provide positive praise or reinforce communicative attempts while interacting with Natesha during the intervention phase; however, the median response for these measures did increase from baseline.

Jackie and Kevin. Again in reviewing the information in Table 8 and through visual analysis of Figure 1, it can be seen that Jackie implemented the intervention across the six behaviors with in baseline at a median level of 10% with medium level of variability (i.e., 2%-30%) and a flat trend. In the intervention phase, Jackie implemented the intervention with fidelity at a median level of 52% with large variability (i.e., 23%-75%) and a clear upward trend. Therefore, there was 42% change noted between the median level of implementation in baseline and intervention (i.e., 10%-52%). Also, during the seventh session of intervention, Jackie implemented the intervention package correctly 70% of the play sessions, meeting fidelity criteria.

Like Kris, Jackie implemented two strategies consistently which included showing interest in the child (i.e., 100%), and following the child's lead (i.e., 100%). Jackie showed the greatest improvement in following the child's lead during play. In baseline, she had a median of

0% with a range of 0 to 70%; during intervention, she had a median of 100%. Therefore, this intervention package helped Jackie learn how to be more responsive to her child and follow his interest during their interactions during play consistently. Additionally, Jackie showed an increase of at least 30% from baseline to intervention for four of the six strategies. However, just like Kris, she struggled to provide consistent positive praise and reinforcement for child communicative attempts during the intervention phase.

Summary of parent fidelity of implementation. All four parents showed improvement in their use of the six intervention strategies once the intervention was started. All four parents used the same two strategies consistently within the intervention phase at or above 90%(i.e., showing interest in the child's play or behavior, and following the child's lead and interest in play). Also three of the four parents (i.e., Landa, Kris, and Jackie) showed the most change between the baseline and intervention phases for correctly following their child's lead and interest during play. Although all four parents improved their use of direct positive praise when playing with their children, three of the four parents (Landa, Kris, and Jackie) struggled with providing consistent positive praise and statements to their children in the intervention phases with median rates between 20% and 40% of correct implementation.

Each of the parents showed increased use of all six strategies between baseline and intervention and three out of the four parents(i.e., Landa, Dana, and Jackie) implemented the intervention with fidelity using all six strategies correctly for at least 70% of the play clip. Therefore the low-income parents of the infants and toddlers at risk for or diagnosed with autism were able to implement the intervention with fidelity in their home.

Table 9 provides information about the Tau-U effect size and relevant confidence intervals (Parker, Vannest, Davis, & Sauber, 2010). Tau-U is a nonparametric statistics based on

the ratio of non-overlapping pairs between phases and change in trend between phases. Therefore Tau-U provides an effect size that represents the magnitude of improvement between the baseline and intervention phase. Tau-U effect size is interpreted as .5-.69 having moderate effect and .70-1 having a large effect. The Tau-U effect size for the parents' fidelity of implementation of the intervention strategies when comparing baseline and intervention is 0.96, (p=0.00) with a confidence interval of CI95 = 0.64 to 1.00, indicating that the large change in the parents correct use of the intervention package can be attributed to the parents participating in the intervention.

Child's Functional Verbal Communication

In order to assess if the parents' implementation of the social-communication intervention positively influenced the child's social-communication skills, the child's use of functional verbal communication was measured. Results indicate that all four children showed an increase in use of functional verbal communication, and the three children (i.e., George, Natesha, and Kevin) whose parents completed the intervention program also showed an increased use in spontaneous words during play sessions with their mothers.

Table 10 provides a summary of the children's functional verbal communication. The table includes the median percent and range in percent of functional verbal communication for the ten second intervals with occurrences of functional communication in each phase. Figure 2 is a graph of the percent of 10 second intervals in which the children used a form of functional verbal communication while playing with their mothers for 10 minutes. The functional verbal communication measure includes the child's use of functional verbal utterances, word approximations, and spontaneous whole words. Figure 3 provides additional information about the child's use of whole words. The bar graph depicts the average number of spontaneous words

used in each phase. Sam was not included in Figure 3 because he did not complete the entire intervention and was not yet using whole words. Natesha had 0 spontaneous words in baseline which is represented by the absence of a bar in the baseline column. Below is a brief summary of each child's functional verbal communication.

George and Landa. In baseline, George's median percentage of functional communication was 38% with a wide range of variability (i.e., 20%-50%) and descending trend. During intervention, George's median percentage of functional communication increased to 83% with a large rate of variability (i.e., 37%-100%); however, most points are near the trend line. Figure 3 depicts George's median use of words in baseline as 6, intervention as 16, and follow-up of 23 words. These results indicate that George increased his use of function verbal communication skills, particularly the use of spontaneous whole words, once his mother started learning new skills and strategies during intervention.

Sam and Dana. In baseline, Sam was not engaging in functional communication as defined and measured within this study; therefore, in baseline his median percentage was 0, and his functional communication on Figure 2 is graphed at 0. Although Sam and his mother participated in only half of the intervention sessions, Sam's median percentage of functional communication increased to 3% with a range of 0%-3% with a small upward trend. Although this is a very small change, Sam did start to produce functional utterances in response to his mother once intervention had started.

Kris and Natesha. In baseline, Natesha's median percentage of functional communication was 13% with a high range of variability (i.e., 0%-27%) and flat trend. During intervention, Natesha's median percentage of functional communication increased to 33% with a high rate of variability (i.e., 20%-53%) around the stable trend line. The results indicate,

similar to George's, that during intervention her use of functional communication increased and maintained once the intervention program was removed. Figure 3 depicts Natesha's median use of spontaneous whole words in baseline as 0, intervention as 3 and follow-up a value of 8, suggesting that Natesha's use of spontaneous whole words is emerging in response to her mother's participation in the intervention program.

Jackie and Kevin. In baseline, Kevin's median percent of functional communication was 18% with a high range of variability (i.e., 3%-37%) and flat trend. During intervention, Kevin's median percent of functional communication increased to 50% with a high rate of variability (i.e., 7%-83%) with an increasing trend line. Table 10 indicates that Kevin's use of functional verbal communication changed 32% between phases; however, Figure 2 shows that within intervention there is a wide range of variability and inconsistent use of functional verbal communication until the last four weeks of intervention, when his use of functional verbal communication remained high. Also Figure 3 depicts Kevin's median use of whole words in baseline as 5 and intervention as 33; therefore, Kevin greatly increased his use of whole words in response to his mother's participation in the intervention program.

Summary of functional verbal communication. All four children showed an increase in functional social-communication skills. Figure 2 shows that all children increased their use of functional verbal communication during intervention. Figure 3 shows that the three children whose parents completed the intervention(i.e., George, Natesha, Kevin) showed a dramatic change in their use of spontaneous words as a form of functional communication during play. The parents' use of the intervention positively influenced their children's social communication development. Figure 4 provides additional support for this conclusion by showing that the child's use of functional communication while playing with their parents is closely related to the

parent's use of the intervention strategies. In Figure 4 the shape in the parent's fidelity of implementation graph is reciprocated in the children's measure of functional verbal communication therefore suggesting that the parent's use of the intervention strategies directly impacts the children's use of functional verbal communication during the play session.

Additionally Tau-U was again used as an estimation of effect size and additional information can be found in Table 9. Tau-U effect size is interpreted as .5-.69 having moderate effect and .70-1 having a large effect. The Tau-U effect size for the children's use of functional verbal communication when comparing baseline and intervention is 0.72, (p=0.00) with a 95% confidence interval of 0.37 to 1.00, indicating that the moderate to large change in the children's use of functional verbal communication can be attributed to their parents participating in the intervention.

Parent and Child Interactions

In order to assess if the intervention package positively affected how parents interacted with their child, two measures were collected. Although the quality of interaction between mother and child was not specifically targeted within the intervention, it is hypothesized that the implementation of the intervention package by parents would have collateral effects on how parents interact with their children. The two measures are: appropriate use of proximity and the parents' use of positive language. The results of these measures are summarized in Table 11 and the parent's use of positive language is depicted in Figure 4.

George and Landa. Table 11 shows that in baseline, Landa was inconsistently using positive language when playing with George with a range of 7% to 57% of intervals observed and a median of 38%. Once intervention started, Landa used positive language with George and his siblings with a range of 57%-100% of intervals observed and a median of 73%. Figure 5

depicts the stable trend line close to the median level in the baseline condition for Landa's use of positive language directed at George and his sibling during play and the large jump in median level with a positive trend line in the intervention phase. Additionally, the positive change in the use of language maintained in the follow-up phase with a value of 87% of intervals observed.

Table 11 also shows that Landa's use of directives or harsh language directed at George were very low in baseline (i.e., 3% with a range of 0%-13%); however, she sometimes was not within an appropriate proximity, with a median of 58% and a range of 0-83%, to engage George, provide comfort, or keep him safe while playing. Landa's use of directive statements dropped to a median of 0% during the intervention phase with a range of 0-10%, and the use of appropriate proximity increased to a median of 97% with a range of 63-100%. Therefore, Landa increased her use of positive language within her home, decreased her use of directive and harsh statements and was within an appropriate proximity of George while playing during the intervention phase. Landa displayed more positive social behaviors while interacting with George after she learned to implement the specific strategies within the intervention package.

Sam and Dana. Table 11 shows that in baseline Dana often used positive language when playing with Sam and his siblings, with a median of 57%. Once intervention started, Dana used positive language with Sam and his siblings with a range of 57%-97% of intervals observed and a median of 73%. Figure 5 depicts the slightly positive trend line close to the median level in the baseline condition for Dana's use of positive language directed at Sam and his sibling during play and shows a positive trend line in the intervention phases. Table 11 also shows that Dana was always within an appropriate proximity of Sam while playing and rarely used harsh or direct words during baseline (i.e., median=0% and a range of 0-3%), and the high rate of appropriate proximity and low rate of harsh language continued in the intervention phases as

well. Therefore, Dana displayed more positive language when interacting with Sam and maintained appropriate rates of other positive behaviors with Sam after she learned to implement the specific strategies within the intervention package.

Kris and Natesha. Table 11 shows that in baseline Kris was occasionally and inconsistently using positive language when playing with Natesha, with a median of 10% (i.e., range 7%-43%). During the intervention phase, Kris immediately increased her use of positive language during play and continued to use positive language through intervention with a median of 80% (i.e., range 53%-93%). Figure 5 depicts the slightly positive trend line close to the median level in the baseline condition for Kris's use of positive language during play and the positive trend line in the intervention phases. Figure 5 also shows that Kris's use of positive language maintained in the follow-up probe with a value of 87%. Again, as is the case for the previous parents, Kris demonstrated improvements in the use of positive language during play during intervention.

Table 11 also shows that Kris was occasionally using harsh or directive language toward Natesha during play with a median value of 13% and range of 0%-17%, and was not always within an appropriate proximity of Natesha to play or keep her safe during play time within baseline with a median value of 33% and a range of 0-73%. During the intervention phase, Kris's use of negative or harsh language dropped to a median level of 0, and her use of appropriate proximity increased to a median value of 80%. Therefore, Kris increased her use of positive language within her home and decreased her use of directive and harsh statements during the intervention phase. Kris dramatically changed her behavior and displayed more positive social behaviors while interacting with Natesha after she learned to implement the specific strategies within the intervention package.

Jackie and Kevin. Table 11 shows that in baseline, Jackie was already using positive language with Kevin and his siblings during play time, with a median level of 73% positive language. Within intervention phases, Jackie increased her use of positive language and neutral language to a median level of 87% and a range of 77-100%. Table 11 also shows that Jackie rarely used negative or harsh language within baseline or intervention with her children, and she was often in appropriate proximity to Kevin across both phases. Jackie maintained her positive interaction style with her children during intervention.

Summary of parent and child interactions. Collateral positive outcomes were observed by all four parents who participated in the intervention by showing increases in positive social behaviors directed towards their children that were not specifically targeted within the intervention package. All parents were observed using an increase of positive language and maintained their low use of directive statements or decreased their use of directive statements and harsh language in their home while playing with their children.

Maintenance of Social-communication Skills

In order to assess if the child's change in social-communication skills will maintain over time once the intervention is removed, follow-up probes were collected for two of the four families(i.e.Landa and George, Kris and Natesha). It was not possible to collect a follow-up probe for Kevin because his family moved immediately following the conclusion of the intervention, and Sam and his mother moved during intervention and did not complete all of the intervention sessions. Figure 2 shows that three weeks after the intervention was removed, George's and Natesha's use of functional verbal communication skills during play with their mothers was above baseline and near the median line of intervention. Additionally, Figure 3 shows that in the follow-up probe both children were using more spontaneous whole words to

communicate with their parents than they were in baseline or during intervention. Therefore, the children's social-communication skills maintained over time once the intervention was removed.

Parent Satisfaction with the Intervention

In order to assess if parents were satisfied with the intervention package that was specifically designed to be implemented in the home by low-income parents with children at risk for autism, they were asked if they would recommend the intervention. In particular, as part of an exit survey, they were asked if they would recommend the intervention to other families in their neighborhood who had young children with similar learning styles or behaviors. All four mothers said they would recommend participating in the intervention to their friends or other moms in their neighborhood, and two parents commented that they wish they would have had the opportunity to participate sooner so they could have supported their older children when they were young.

Interobserver Agreement

As described earlier, interobserver agreement was collected on 25% of all measures across dyads and conditions. Results of the interobserver agreement for parent and child measures are provided in Table 12. An interval-by-interval technique was used to calculate the interobserver agreement for all measures.

The parent's fidelity of implementation measure was scored using a one minute partial interval system across the 10-minute play session in all phases. The interobserver agreement had a mean of 97% with a range of 90%-100% across all 6 behaviors. The functional verbal communication measure was scored using a ten second partial interval system across the 10-minute play session. The interobserver agreement for the children's functional verbal communication had a mean of 94% with a range of 80%-100%. The parents' use of appropriate

proximity was scored using a 10 second whole interval recording system within the 10 minutes of play within their homes. The interobserver agreement was a mean of 91% with a range of 73%-100%. The parents change in their use of language while interacting with their children was measured using a partial interval system across the 10 minute play session. Lastly, the interobserver agreement for the parents use of positive language and directive statements was 93% (i.e., range 80%-100%), and 96% (i.e., range 86%-100%).

References

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Table 8

Parent Fidelity of Implementation

Strategies	Landa			Dana			Kris			Jackie		
	BL	IV	Δ	BL	IV	Δ	BL	IV	Δ	BL	IV	Δ
1. Show interest in the child's play or behavior	57% (20% - 90%)	97% (80% - 100%)	40%	98% (90% - 100%)	100% (100% - 100%)	2%	20% (0% - 40%)	87% (50% - 100%)	67%	44% (0% - 80%)	91% (40% - 100%)	47%
2. Follows the child's lead and child's interests	22% (0% - 60%)	92% (80% - 100%)	71%	48% (0% - 100%)	86% (40% - 100%)	39%	10% (0% - 40%)	71% (20% - 100%)	61%	19% (0% - 70%)	89% (40% - 100%)	70%
3. Recast single words, or recast vocalization with simple words	17% (10% - 30%)	54% (20% - 80%)	38%	5% (0% - 10%)	12% (0% - 30%)	7%	4% (0% - 10%)	27% (10% - 40%)	23%	8% (0% - 10%)	47% (0% - 90%)	39%
4.Provides positive praise	7% (0% - 10%)	37% (0% - 80%)	30%	10% (0% - 30%)	46% (20% - 70%)	36%	8% (0% - 30%)	29% (0% - 50%)	21%	5% (0% - 30%)	20% (0% - 40%)	15%
5. Provides clear learning opportunity (gesture model, or vocal Language	17% (0% - 30%)	70% (30% - 100%)	53%	15% (0% - 40%)	60% (30% - 70%)	45%	10% (0% - 40%)	36% (0% - 70%)	26%	3% (0% - 10%)	52% (20% - 90%)	50%
6. Reinforce Communicative attempts	5% (0% - 10%)	34% (0% - 100%)	29%	3% (0% - 10%)	32% (10% - 60%)	30%	4% (0% - 20%)	11% (0% - 30%)	7%	0% (0% - 0%)	27% (0% - 60%)	27%
Total Fidelity	21% (8% - 30%)	64% (42% - 87%)	44%	30% (15% - 40%)	56% (38% - 72%)	26%	9% (0% - 30%)	43% (30% - 58%)	34%	13% (2% - 30%)	54% (23% - 75%)	41%

Table 8. Parent Fidelity of Implementation. Table 1 displays the median percent of one minute intervals in which the parents implemented each of the strategies during a ten minute play session, with the range in parenthesis. Percentages and ranges are provided for each parent/child dyad for baseline (BL) and intervention phase (IV). Additionally, the percent change from baseline to intervention (Δ) is shown. The final row (i.e., Total Fidelity) represents the percent of the correct use of all six strategies within the play session and is used as the total parent fidelity implementation score.

Table 9

Tau-U Effect Size and Relevant Confidence Intervals

	Tau-U Effect Size	P-Value	CI95%
Parent Fidelity of Implementation	0.9619	0.00	0.6482<>1.00
Child Functional Verbal Communication	0.722	0.00	0.3868<>1.00

Table 9. Tau-U effect size and relevant confidence intervals. Tau-U is a nonparametric statistic based on the ratio of non-overlapping pairs between phases and the change in trend between phases. Therefore Tau-U provides an effect size that represents the magnitude of improvement between the baseline and intervention phase. Tau-u effect size is interpreted as .5-.69 having moderate effect and .70-1 having a large effect.

Table 10

Child Functional Verbal Communication

	Parent/Child Dyads							
	George (Landa)		*Sam (Dana)		Natesha (Kris)		Kevin (Jackie)	
Child Behaviors	BL	IV	BL	IV	BL	IV	BL	IV
Functional Verbal Communication	38% (20% - 50%)	83% (37% - 100%)	0% (0% - 0%)	3% (0% - 13%)	13% (0% - 27%)	33% (20% - 53%)	18% (3% - 37%)	50% (7% - 83%)
Percent Change	45%		3%		20%		32%	
Whole Words	6 (1 - 13)	16 (6 - 30)	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)	3 (1 - 6)	3 (0 - 9)	20 (2 - 38)

* Did not complete all phases of intervention

Table 10. Child Functional Verbal Communication. This table shows the median percent, with the range in percent below, of the ten second intervals observed in which the children used functional verbal communication during the ten minute play session. The bottom row provides additional information about the children's observed use of whole words.

Table 11

Parent Behavior Related to Interaction Quality

	Landa			Dana			Kris			Jackie		
	BL	IV	Δ	BL	IV	Δ	BL	IV	Δ	BL	IV	Δ
Positive Language Directed at any Child Percentage	36% (7% - 57%)	80% (57% - 100%)	44%	52% (23% - 67%)	79% (57% - 97%)	26%	17% (7% - 43%)	77% (53% - 93%)	60%	68% (50% - 93%)	90% (77% - 100%)	22%
Proximity Percentage	50% (0% - 83%)	87% (63% - 100%)	37%	99% (93% - 100%)	91% (80% - 100%)	-8%	33% (0% - 73%)	74% (37% - 100%)	40%	73% (3% - 100%)	87% (43% - 100%)	14%
Directive statements toward children Percentage	4% (0% - 13%)	3% (0% - 10%)	-2%	3% (0% - 20%)	1% (0% - 3%)	-3%	11% (0% - 17%)	2% (0% - 17%)	-9%	1% (0% - 10%)	0% (0% - 3%)	-1%

Table 11. Parent Behavior Related to Interaction Quality. This table shows the median percent, with the range in percent below, of the 10-second intervals observed in which the parents used positive language directed at their children, appropriate proximity, and directive statements during the 10-minute play session.

Table 12

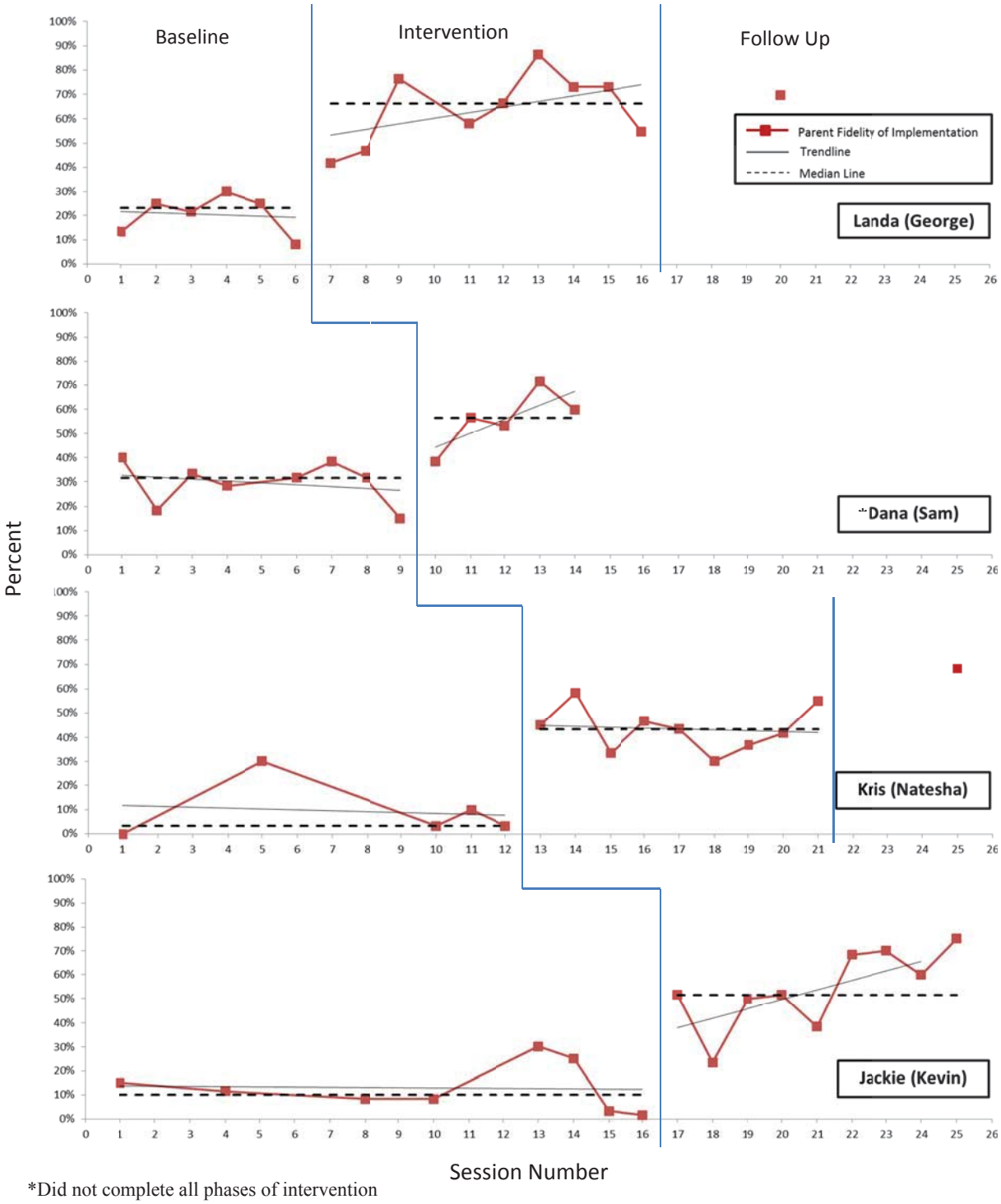
Interobserver Agreement for Parent and Child Measures

	Baseline	Intervention	Across All Phases
Parent fidelity of implementation	97% (90%-100%)	96% (94%-100)	97% (90%-100%)
Child functional verbal utterances	94% (80%-100%)	95% (80-100%)	94% (80%-100%)
Positive language directed at children	93% (83%-100%)	93% 80%-100%	93% 80%-100%
Directive statements toward children	94% (86%-100%)	97% (93%-100)	96% (86%-100%)
Appropriate use of proximity	94% (80%-100%)	90% (73-100%)	91% (73%-100%)

Table 12. Interobserver Agreement for Parent and Child Measures. This table shows the mean percent, with the range in percent below, of the interobserver agreement.

Figure 1

Parent Fidelity of Implementation



*Did not complete all phases of intervention

Figure1. Parent Fidelity of Implementation. This figure illustrates the parents' use of the intervention strategies across the baseline, intervention, and follow-up phase.

Figure 2

Child Functional Verbal Communication

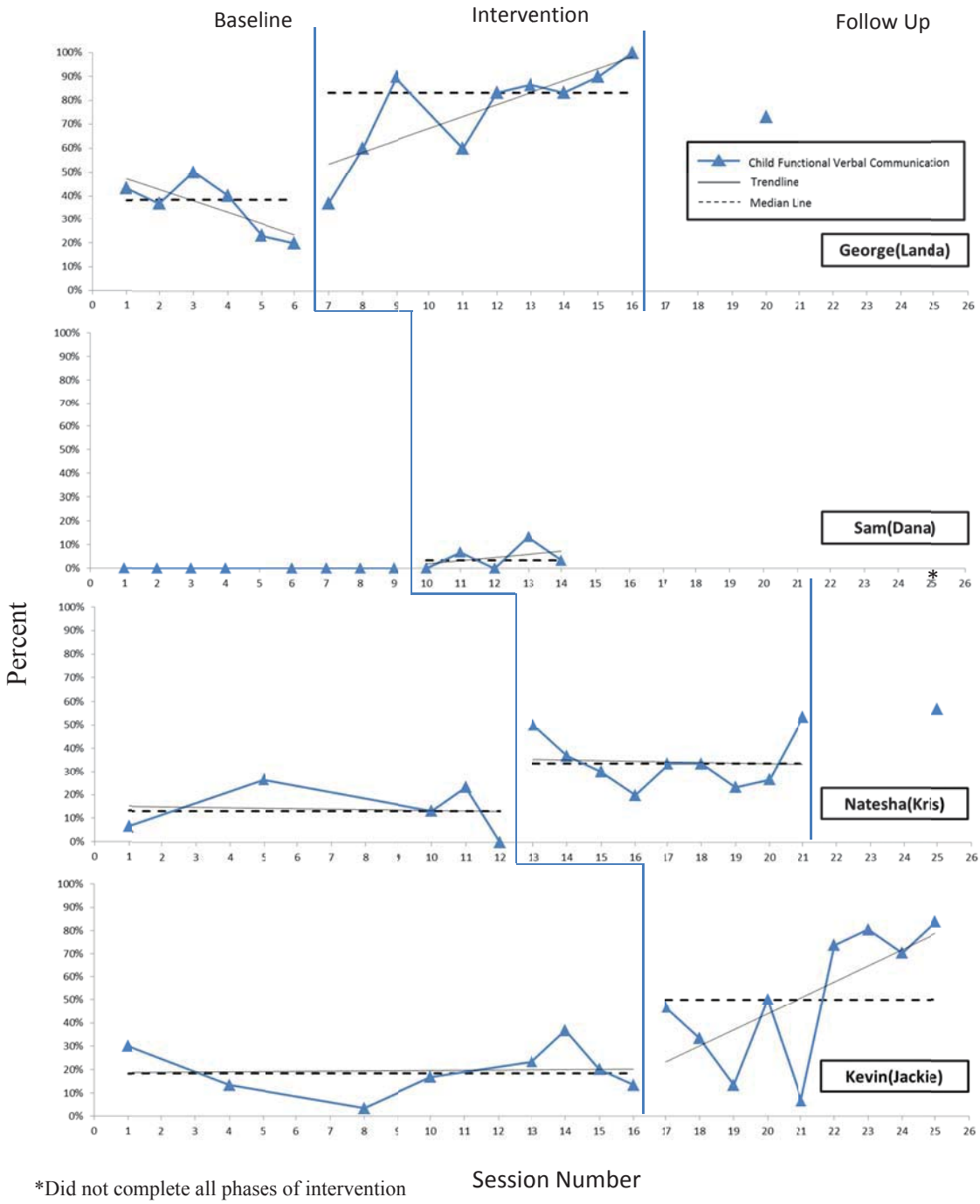


Figure 2. Child Functional Verbal Communication. This figure illustrates the percent of 10-second intervals the children were observed using functional verbal communication within the 10-minute play session across phases.

Figure 3

Spontaneous Words

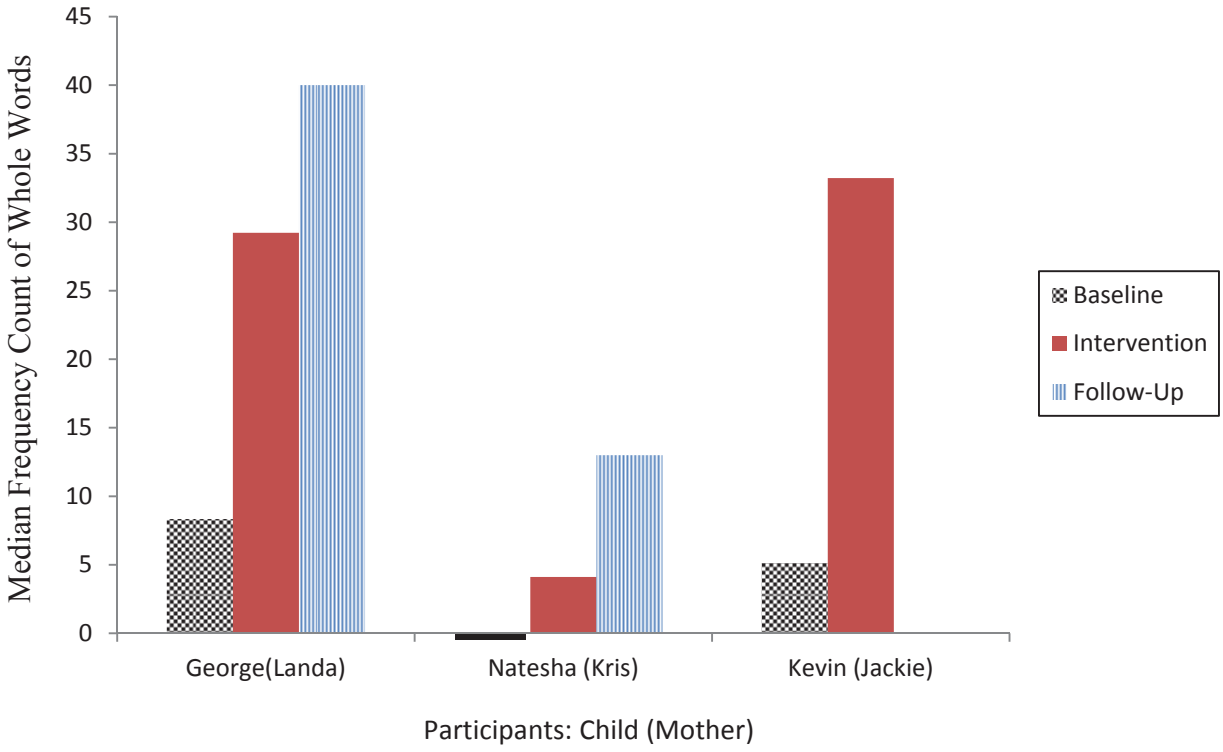
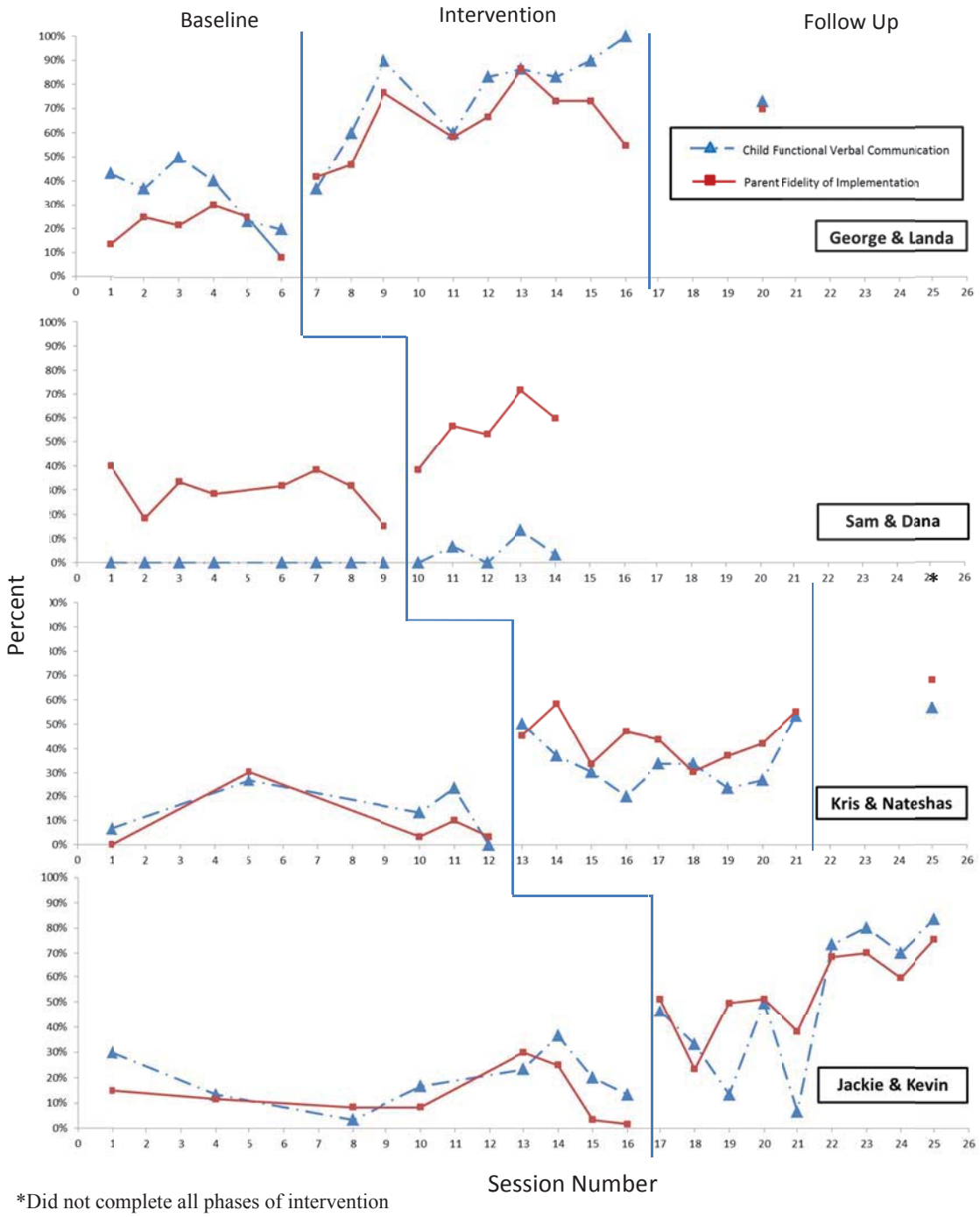


Figure 3. Spontaneous Words. This figure illustrates the median frequency count of whole words the children used within each phase during the 10 minute play session. Natesha had 0 words in baseline. Also Kevin did not have follow-up data therefore there is no bar present in follow-up.

Figure 4

Parent Fidelity of Implementation and Child Social Communication

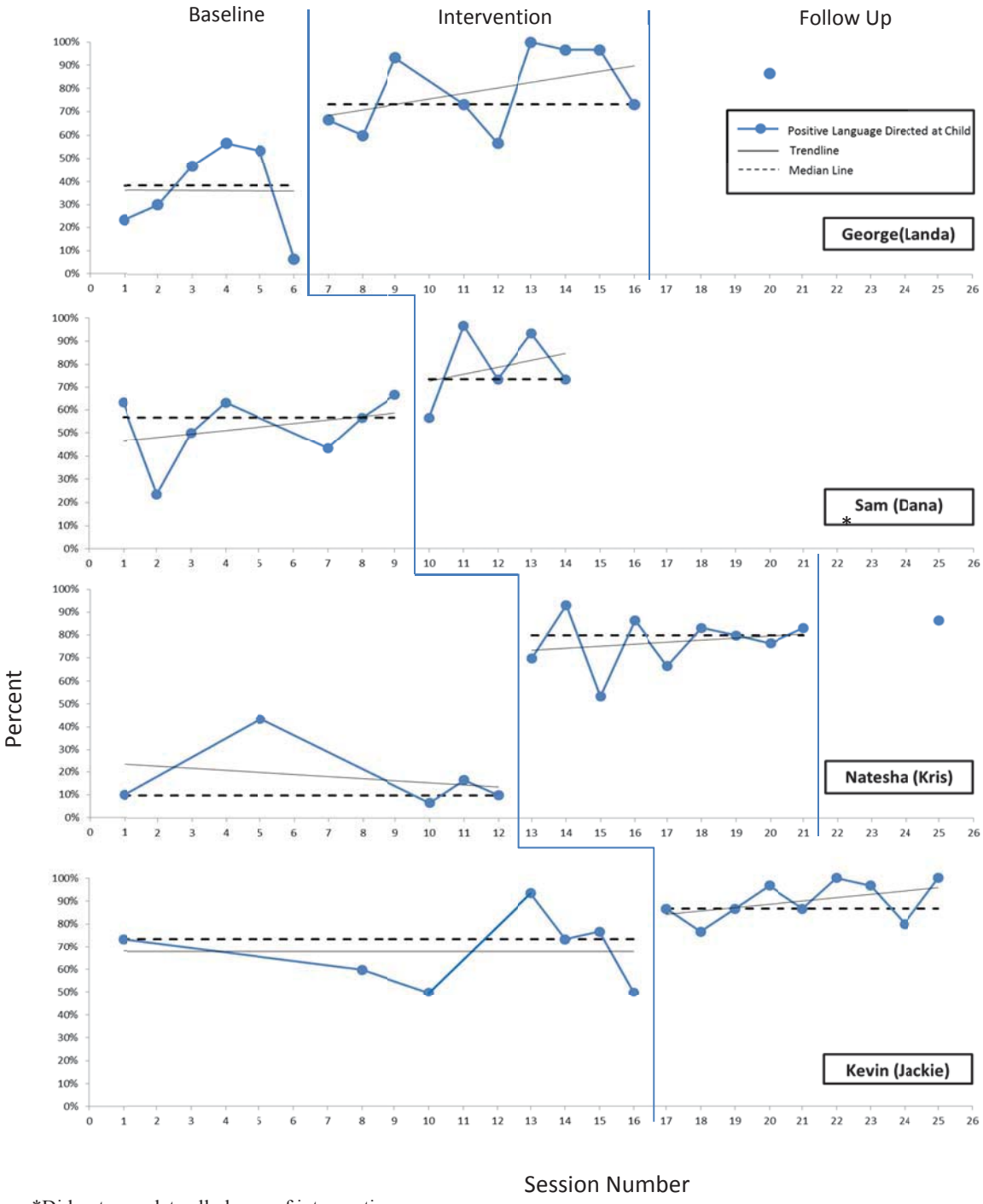


*Did not complete all phases of intervention

Figure 4. Parent Fidelity of Implementation and Child Social Communication. The parent's fidelity of implementation is reciprocated in the children's measure of functional verbal communication showing a close relationship between the two variables.

Figure 5

Parent's Use of Positive Language



*Did not complete all phases of intervention

Figure 5. Parent's Use of Positive Language. This figure illustrates the percent of 10-second intervals the parents were observed using positive language directed at the children within their homes within the 10-minute play session across phases.

Chapter 5: Discussion

This study expands on the early intervention literature focused on infants and toddlers at risk for autism. Though several studies show positive results for increasing social communication skills with young children with autism (Wong et al., 2014), few have embraced the guidelines of Part C of IDEA(Infant-Toddler Programs) (Schertz, Baker, Hurtwiz, & Benner, 2010) and even fewer have included underrepresented groups such as parents with low income and diverse cultural and educational backgrounds. This study utilized a social-communication intervention that was parent-implemented and specifically designed to meet the needs of low-income families with young children with autistic characteristics receiving early intervention services through Part C of IDEA. The treatment model blended strategies from parental responsiveness interventions (Aldred, Green, &Adams, 2004; Mahoney & Perales, 2003, Kong & Carta 2001, Yoder & Warren, 2002) and naturalistic teaching procedures (Hart & Risley, 1975; Koegel, O'Dell, & Koegel, 1987; Hancock & Kaiser, 2002) in order to teach and embed fundamental applied behavioral analysis techniques to address core need areas associated with autism within the home environment. This chapter will first include a summary of findings followed by limitations of the study, implications for research, and implications for the field.

Summary of the Findings

The efficacy of the social-communication intervention was assessed across parent-child dyads utilizing a concurrent multiple baseline-probe design (Horner & Baer, 1978). This study assessed whether parents who participated in the parent education program were able to implement the intervention and change their behavior as they interacted with their children in

their homes. Additionally, this study examined if the change in parent behavior directly affected the children's social-communication skills.

The results indicate that the parents who are low income and represent diverse cultural and educational backgrounds were able to learn the social-communication intervention in a brief 10 week study and implement the strategies within their own homes. All parents showed substantial increases from baseline in the use of intervention strategies while interacting with their children. Additionally, positive changes were observed in the parents' behavior in areas not directly targeted within the intervention package, such as an increase in appropriate proximity and positive language while playing with their children.

All child participants within this study showed an increased use of functional verbal communication. Additionally, children whose parents completed the intervention program showed an increased use of whole words as they play with their parents. These findings indicate the parents' implementation of the strategies and change in social behaviors during play time directly influenced their children's use of functional verbal communication at home.

Limitations of the Study

The findings of this study should be considered with the following limitations. First, as is the case with single case design the generalizability of the positive findings are limited. All of the participants were from the same urban area and may not be reflective of other parents with low-income whom live in different areas such as small rural towns or have different life circumstances such as teenage parents living with relatives. This intervention was specifically designed for parents living in poverty in an urban area with limited access to additional resources; however, parents with different cultural, educational or economic backgrounds may not benefit as much from this intervention, particularly if they are already using the strategies at

a high rate within their home. The majority of the parent participants' baseline scores were very low for basic interaction behaviors, including showing interest in the child's play or behavior, following the child's lead in play, or even being within the child's space to support play and provide comfort. Therefore, it is unclear if the positive findings found from this study will generalize to other families with different interaction styles, higher income and education levels who live in other areas of the country.

A second limitation is that the measurement used for fidelity of implementation did not accurately depict the parents' correct use of strategies. Although all four parents demonstrated a clear positive change in their behavior from baseline to intervention, exceeding a change of 40% for some strategies, the parents did not consistently implement the intervention with high rates of fidelity, which was defined as implementing all strategies at a rate of 70% or higher. The definition and style of scoring fidelity was based on previous parent implemented interventions for young children with autism (Koegel & Koegel, 2006). However, as previously noted, parent-implemented intervention studies are more likely to use highly-educated white stay-at-home mothers as participants, women who typically start with higher baselines and therefore have less change to make to meet the fidelity cut off. Thus, it is likely that using the same approach for measuring fidelity of implementation may not have provided a clear picture of the positive changes in the parents behavior. A measure that allowed for a closer examination of foundational strategies may have been more appropriate.

A third limitation of this study was that it was a brief parent education program with limited follow up data. The parents participated in a 10 week parent education program, and it is possible that if the parents had a longer time in the parent education program, that their fidelity scores would have been higher therefore providing a higher dose of intervention to their children.

Table 8 in the previous chapter shows that all parents learned to follow their child's lead in play and show interest in their child's behavior while playing together, but some parents struggled to consistently provide clear language opportunities, while others inconsistently provided reinforcement for their child's communicative attempts. Therefore, additional time in intervention may have been beneficial to allow parents more time to master strategies they found challenging. The attrition rate however may have been higher. One parent-child dyad was unable to finish the study because of a family crisis that forced them to move during the middle of intervention, and another family left the area in search for employment and a safer neighborhood in a larger city once the intervention portion of the study had concluded. Therefore there was limited follow-up data, however the follow-up data collected for the other two parents showed that they actually implemented the intervention strategies at higher rates in the follow-up probe than in their last session of intervention. These findings suggest that the parents continued to use the intervention strategies once the intervention was over and that providing the parents with additional time to practice integrating the strategies may have increased the rate in which they implemented the intervention with fidelity.

A fourth limitation relates to a plausible alternative explanation for the change in parent behavior. That is, it is possible that the change in parent behavior is more closely related to how the intervention was implemented, and the increased focus on parent participation rather than the actual strategies within the intervention package. Specifically, several of the intervention package strategies were briefly mentioned in baseline by the early interventionists as possible strategies the parent could choose to implement or try; (i.e., following the child's lead in play or recasting vocalizations). The use of the strategies, however, remained low in baseline, and some parents weren't even within proximity of the child to play or interact. Thus, prior to the

intervention, parents were not performing some of even the simplest strategies of which they were already aware. As part of the design of the study, the routine of the home visits was consistent and parents were asked to play with their children and to try new strategies with their children on every visit. Each session started with the parent playing with their child for 10 minutes without any interruptions from the researcher, followed by feedback from the researcher, then only one or two new strategies were discussed each visit, followed by modeling by the researcher and then active problem solving wherein the parent was asked to try the new strategies (additional details are provided in Appendix D in chapter 3). Also the parents were required to schedule two 60 minute visits a week to focus specifically on implementing the intervention, and this time did not include service coordination or updating the IFSP. Thus parents received an increase in services focused specifically on interacting and engaging their child within their homes.

Lastly, all the participants(i.e., parent/child dyads) were receiving early intervention services and continued to receive service coordination during the course of the study. The service coordinators provided resources about accessing preschool, childcare, diapers and transportation as well as providing information about safe housing and explaining complicated medical reports. The service coordinators also scheduled co-visits with a psychologist if the families requested additional support with mental health concerns (see Table 7 in Chapter 3 for additional details). It is possible that the quality of service coordination, and the ability of the service coordinator to meet the parent's request for supports with everyday needs, could affect the parents' ability to focus on and implement the intervention. However, the directors of the community agency and the lead researcher both agreed it would be unethical to withhold access to service coordination to the families during the course of the study, and no measure was used to

evaluate the quality of service coordination. Therefore it is unclear if the quality and level of service coordination provided may have impacted the outcomes of this study.

Implications for Research

First and foremost, this study provides empirical evidence that parents living in poverty with multiple risk factors are capable of implementing social-communication interventions within their homes which positively influence their child's social communication development. Therefore, future research focusing on parents as primary implementers of intervention for infants and toddlers with autistic characteristics should include parents who are culturally, economically, and educationally diverse. Diverse parents must be included as participants in the autism early intervention research in order to increase the generalizability and ultimately the use of those practices as evidence based interventions for underserved populations. Additional research is needed to evaluate how to effectively deliver information to parents as a part of parent-implemented intervention models and increase active learning in homes of diverse families receiving early intervention services.

Another important contribution to the literature is a demonstration that utilizing a technical eclectic approach that systematically blends different intervention models(Odom, Hume, Boyd, & Stabel, 2012) is effective in the home environment for infants and toddlers with autistic characteristics. This new way of selecting the specific strategies in order to target specific outcomes and design individualized treatment packages is particularly important for the service delivery model under Part C of IDEA, which requires family participation, individualization, and research-based practices. Although scholars recommend the use of technical eclectic approaches that blends multiple theoretical backgrounds, including applied behavioral analysis and developmental practices for school-aged children (Odom, Hume, Boyd,

& Stabel, 2012), this study extends the discussion of the importance of technical eclectic approaches to children under three who show early indicators of autism where the intervention is delivered by the parent within the home. Currently, there is not one intervention program that works for all families and their children with signs of autism. Therefore future research should evaluate how evidence-based practices across theoretical orientations can be systematically blended within the guidelines of Part C of IDEA in order to develop highly efficacious yet individualized interventions that can be implemented within the current service model.

Based on the findings of the present study as well as previous research, efforts to develop interventions that can be translated directly to the community early intervention system under Part C by IDEA is critical. Parent implemented intervention studies need to be conducted within the environment in which families actually live, under the guidelines of Part C of IDEA, with diverse participants in order to evaluate the true efficacy of interventions for infants and toddlers. Some of the most efficacious early intervention programs for children with autism have found minimal to no effect once translated from the clinic to a more natural setting or when parents become implementers (Carter et al., 2011; Rogers et al., 2012). Therefore, the need is great for intervention packages designed specifically for the implementation within the Part C system, which includes parents of low income, those with mental health concerns and those without high levels of education implementing interventions in their own homes.

Lastly, although results gathered utilizing the experimental methodology of single case multiple baseline suggest that the change in the parent and child behavior was a result of the social-communication intervention, which included established evidence-based practices or recommended practices within the field of early intervention the results have not yet been replicated or validated across multiple groups of participants. Also the intervention package

has not been evaluated or utilized in other studies. Therefore, the intervention package at best can be characterized as an evidence-supported program (Wong et al., 2013) and additional studies are needed with a larger sample size across multiple locations affected by poverty to evaluate the efficacy of the intervention package (Horner, et al., 2005).

Implications for Practice

The results of this study also have promising implications for practitioners supporting families with infants and toddlers receiving early intervention. All of the parents who participated in the intervention learned to implement the intervention package. Additionally, the parents who participated in the study stated they would recommend the intervention to other families in their neighborhood, and families living in similar cities with children with similar behaviors. Therefore, early interventionists supporting families with low-income with similar family dynamics (i.e., using subsidies to meet their everyday needs and familial history of child abuse) may want to consider using a similar method for providing information to families, and a similar intervention model. Early interventionist may want to focus on having structured home-visits that includes a predictable routine and designated time targeting active parent participation with their children in session without any corrective feedback. Additionally early interventionists may want to consider selecting evidence-based practices from multiple theoretical approaches to develop an individualized parent-implemented intervention that supports the needs of the families within the Part C system, while addressing core areas of need for children with characteristics of autism.

Summary

This study had similar findings to other parent-implemented studies(e.g. McConachie & Diggle, 2007; Meadan et al., 2009) and found that the parents although economically

disadvantaged with self-identified mental health concerns, were able to learn and implement the intervention strategies with their children within their own homes. The change in the parent's behavior, and use of the intervention strategies within their own homes positively impacted their child's social communication development. All children showed an increase in their use of functional communication while interacting with their parents. These findings highlight the need for future research to include culturally economically and educationally diverse participants particularly when the parents are the primary implementer for their young child with autism. In summary, this study provides preliminary support for utilizing a technical eclectic approach that systematically blends different intervention models in order to address the needs of families with low-income implementing interventions within their own homes while utilizing evidence focused intervention practices to address core areas of development often affected by autism (Odom et. al.,2012; Stahmer, Schreibman, & Cunningham, 2011).

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