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Presenter Information

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A Review of Early Interventions for Children with Autism

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Abstract

This paper discusses how the complex needs of children on the autism spectrum have informed research and clinical practice in early autism interventions. In addition to the efficacy of a given approach in improving children's social, communicative, or adaptive behaviors, the costs associated with each treatment are also of great importance. Because children with autism present with a variety of different strengths and challenges, this paper will also discuss the developmental domains that each treatment is most capable of supporting. There is a strong focus in this paper on promoting the use of evidence-based practices, even though there is not necessarily a one-size-fits-all approach to providing intervention to children with autism and similar developmental disorders.

Keywords: Autism, Early Intervention, Language Development, Evidence-Based Interventions

Introduction to Autism Spectrum Disorder

Autism Spectrum Disorder is a developmental disability that is most often diagnosed in early childhood. Although its symptoms vary greatly, the DSM-V classifies those with autism as having "persistent deficits in social communication and social interaction across multiple contexts" (American Psychiatric Association, 2013). Specific manifestations may include struggling with social interactions or engaging in restricted, repetitive behaviors. The Autism and Developmental Disabilities Network recently identified that 1 in 68 eight-year-olds in the United States has an autism diagnosis, which is the highest recorded prevalence rate to date. Although 44% of those children were identified to have average or above average IQ, only 18% were considered to need no support services to ensure successful school performance (Centers for Disease Control and Prevention, 2016). Children with autism often receive support services in school and at home through private or community-based interventions that are designed to increase their independence and self-care skills across the lifespan. Adults with autism may live with their families, in group home settings, or independently with varying levels of assistance. Because autism affects individuals in a variety of ways, a successful support plan needs to address multiple developmental domains and goals.

The deficits that characterize autism do not impact all autistic people to the same degree. Some individuals may have severe challenges in using words to communicate even basic needs, while others may only have mild difficulties in organizing words during a fast-paced conversation. Similarly, some children develop dangerously aggressive or self-injurious behaviors; others only exhibit mild noncompliance in response to unpleasant situations. As a result of these differences, individuals with autism need targeted interventions that can improve one or more specific functional domains in order to improve their quality of life. Language

development, behavioral regulation, and social relationships are just a few of the areas in which autistic children may need targeted support. Over the last several decades, many interventions have been developed to help improve functioning for individuals with autism. Early childhood interventions have been an area of particular focus, as therapy can have a greater impact if children learn adaptive behavior patterns before maladaptive behaviors become ingrained. Treatment protocols have ranged from one-on-one interventions between a trained therapist and a child to the use of siblings demonstrating desired actions using video modeling (Lovaas, 1987; Reagon, Higbee and Endicott 2011). This paper will evaluate how these interventions have developed over time and which children are most likely to be successful with a given approach.

Early Intensive Behavioral Interventions

One of the most researched early childhood autism interventions is Early Intensive Behavioral Intervention (EIBI), which has been used with autistic children since the second half of the twentieth century. EIBI is based on operant conditioning, and heavily incorporates the concepts of reinforcement and shaping behavior over time. One of the most well-known early intensive behavioral interventions is Applied Behavior Analysis (ABA). ABA involves discrete trial training: children are repeatedly presented with a task, and each correct response elicits reinforcement from the instructor. Although ABA is not used exclusively with autistic children, its principles are particularly relevant when attempting to modify the behavior of that group. In Baer, Wolf, and Risley (1968), several dimensions of ABA were established. They state that ABA interventions must be applied, behavioral, analytic, technological, conceptually consistent, and capable of producing generalizable improvements in behavior. These terms will be defined in more detail in the following paragraphs.

Applied Behavior Analysis

First, ABA must target behaviors that are socially relevant to the individual performing them in order for therapy to be considered "applied" (Baer et al, 1968 p. 92). Second, the provider of therapy must establish control over a behavior through reinforcement in order for therapy to be "analytic" (Baer et al, 1968, p. 93). Therapists must also be clear when defining behaviors and response protocols to ensure consistency in treatment. For example, if a child has the goal of writing their name, there needs to be an operational definition of what the written product will look like. Perhaps reinforcement will be given only if the child can write their name legibly, using a pencil, within the space provided by lined paper. Additionally, a child may be expected to complete the task without being given visual clues or verbal reminders to complete their work. Such clear parameters for intervention are necessary in order to meet the requirement of being technological (Baer et al, 1968).

Baer et al. (1968) also states that ABA must have consistent conceptual systems. Although the exact technological details of each program vary, the underlying principles that guide providers are stable. Behavioral shaping is one such conceptual system in ABA. Shaping involves reinforcing behaviors that approximate the desired action, and then increasing the requirements for reinforcement over time. If a child who is learning to write their name can only do so initially by copying an example, shaping may take the form of removing one letter at a time from the example until the child can write their entire name from memory. Another child may need to strengthen their fine motor skills by initially writing large letters and gradually decreasing the size over time. These are just two specific examples of the larger concept of behavioral shaping. Finally, ABA interventions must demonstrate effective improvements in behavior that can generalize to a variety of settings. If a child with aggressive behavior issues

learns to avoid hitting others at school but still does so at home, therapists are responsible for modifying the program to increase generalization. These standards set by Baer et al., (1968) have been adopted by researchers for decades as interventions have been developed and modified.

Applied Behavior Analysis in Autism Interventions

One of the first researchers who developed ABA interventions for children with autism was O. Ivar Lovaas. His lab at UCLA, the Young Autism Project, has been one of the most influential sites in the development of early autism interventions. Lovaas used the principles of ABA to develop targeted programs to help nonverbal children develop speech and physically violent children gain impulse control, among other behavioral goals (Lovaas, 1987). The treatments he developed are based on operant conditioning, with the expectation that children alter their behavior when positive or negative consequences occur. Operant conditioning can be applied to ABA interventions through discrete trial training, also known as discrete trial teaching. Discrete trial training involves giving the child a single instruction and then reinforcing the child for following the instruction (Smith, 2001). If a therapist is working on a new skill with a child, the therapist may provide physical or verbal prompts to help the child complete the action. The therapist can then fade these prompts over time to allow the child to gain independence in following the instruction, which facilitates new skill acquisition (Smith, 2001).

In one study, 47% of children who received an experimental protocol designed by Lovaas went on to succeed in mainstream educational environments with no extra assistance (Lovaas, 1987). The therapy protocol used in this study was unprecedented in intensity; laboratory staff worked one on one with children for 40 hours each week in a variety of environments, and parents received extensive training on how to implement the procedure themselves. Although

several teaching approaches were used, discrete trial training was heavily relied upon (Lovaas, 1987). The goal was for treatment to "take place for almost all of the subjects' waking hours" (Lovaas, 1987, p. 5). In contrast, children in the two control groups received ten hours of therapy each week; Control Group 1 was served by the same therapists as the experimental group, while Control Group 2 received a similar intervention from an external agency. The study took place over the course of several years, and children were assigned to experimental conditions based on staff availability at the time when the research team first contacted potential participants. Every child received a set of programs that targeted individual behaviors, although there was a general intervention timeline that the experimental group followed, which is outlined below.

"During the first year, treatment goals consisted of reducing self-stimulatory and aggressive behaviors, building compliance to elementary verbal requests, teaching imitation, establishing the beginnings of appropriate toy play, and promoting the extension of the treatment into the family. The second year of treatment emphasized teaching expressive and early abstract language and interactive play with peers. Treatment was also extended into the community to teach children to function within a preschool group. The third year emphasized the teaching of appropriate and varied expression of emotions; preacademic tasks like reading, writing, and arithmetic; and observational learning (learning observing other children learn)" (Lovaas, 1987, P 5).

The ultimate goal of the intervention was for the participants to achieve similar functioning to peers in a mainstream classroom by the first grade. Success was defined by whether or not the children could function independently in a mainstream classroom after receiving therapy for 2-3 years. In the experimental group, 9 of the 19 children reached this milestone, while only one child among the two control groups did (Lovaas, 1987). The finding that nearly 50% of a group of

nonverbal, severely delayed children could eventually succeed independently after receiving an early intervention was groundbreaking. Lovaas (1987) established a higher degree of control over children's environments than any previous study had, and that has been difficult to replicate. Indeed, there are several barriers to a true replication of this study that have been outlined by researchers who were involved with the Young Autism Project in the 1970's and 1980's.

Challenges Associated with Applied Behavior Analysis Therapy

Many aspects of the treatment requirements for the ABA therapy that Lovaas (1987) used are no longer considered appropriate or feasible, which makes a true replication of the study impractical. The first of these is the use of physical punishment. Physical punishment was used in Lovaas (1987) to deter children from engaging in inappropriate behaviors, but doing so came with great controversy and is now considered unacceptable (Leaf and McEachin, 2016). Modern educators and therapists take this fact for granted, as allowing providers to physically punish children could very easily lead to abuse. Another obstacle involved with the original Lovaas (1987) model is the incredible sacrifice of money and time that parents were expected to make. Leaf and McEachin (2016) notes that parents had to quit their jobs for a full year in order to take place in the study, which the vast majority of parents would never be able to do. Additionally, parents were expected to master the application of a complicated behavioral therapy, which is unreasonable to expect of most people (Leaf and McEachin, 2016). These barriers have serious implications for both research and clinical practice. The results of Lovaas (1987) were revolutionary in that they demonstrated the potential of children with severe developmental delays; however, therapists cannot use the exact intervention model unless a child has access to significant financial resources as well as parents who are able to implement the therapy.

In the three decades since Lovaas (1987) was published, researchers have been grappling with the question of how to provide children on the autism spectrum with quality ABA interventions. This goal is two-fold: any therapies that are used must both be evidence-based and accessible. In this context, accessibility refers to the costs associated with treatment, financial and otherwise. Therapies that are impractical due to the investment of money or time that they require will not allow children to grow, even if they produce strong results in a research trial. Subsequent research on ABA and has considered this challenge, furthering our knowledge of the strengths and weaknesses of ABA therapy.

Attempt to Replicate the Lovaas Model

Smith, Groen, and Wynn (2000) used a randomized control trial to evaluate the impact of a modified version of the Lovaas protocol. The authors were students from the Lovaas lab, and they collectively had ten years of experience implementing interventions through the Young Autism Project when they started this study. The authors chose to decrease the requirements for the intensive program in order to make it more accessible to families with limited time and financial resources. Specifically, children in the experimental group received an average of 25-30 hours of intensive therapy each week from Young Autism Project students who were receiving supervision from the authors. This number is a significant reduction from Lovaas (1987), in which children received an average of 40 hours weekly from therapists and even more from parents. The control group in this study received parental intervention, with parents receiving five hours of training from Young Autism Project students weekly for three to nine months. Both groups received therapy that used the same instruction manual as Lovaas (1987). Therapists used discrete trial training methods to teach children basic life skills before moving onto tasks that were more complex (Smith et al, 2000).

The results of Smith et al (2000) favored the intensive approach, but were less dramatic than those of Lovaas (1987). Four of the 15 children in the experimental group were able to successfully transition into mainstream classrooms without support, while none of the 13 children in the control group had that outcome. The experimental group had significantly higher gains in IQ, visual-spatial skills, and language development than the control group did. However, there were no significant differences between groups in their everyday adaptive behavior skills as measured by the Vineland Behavior Scales. These outcomes suggest that early intensive interventions can be highly beneficial to children with autism and similar diagnoses, but the actual percentage of children who could go on to mainstream education is likely lower than the 47% achieved in Lovaas (1987). The reasons for this discrepancy are unclear, but several factors have been suggested.

Factors that may Modulate the Efficacy of Applied Behavior Analysis Therapy

The age at which therapy is first administered has long been considered a major factor in future outcomes for children with autism. This belief has even shaped public policy, as The Individuals with Disabilities Act provides for all children under the age of three to receive early intervention services such as ABA (CDC). Lovaas (1987) restricted participation to include only children who were 48 months or younger at enrollment, with the mean age among the experimental group being 34 months. Similarly, the average intake age in Smith et al. (2000) was 36 months. Initiating therapy early can help minimize developmental gaps between children on the autism spectrum and typically developing peers that would presumably develop over time. Additionally, teaching appropriate behavior to children can help prevent maladaptive behavior patterns from developing. The number of hours per week in therapy is another potential predictor of success. Although Lovaas (1987) technically only provided 40 hours per week of therapy,

parents were extensively trained on how to incorporate therapy procedures into their daily lives. As a result, children in the intensive group could have been receiving twice as many hours of intervention as their therapists alone were providing. In contrast, Smith et al. (2000) attempted to provide 30 hours of therapy each week to the intensive group, but they delivered closer to 25. Although some of their participants achieved similar outcomes to those in Lovaas (1987), the results were less consistent. This can be seen specifically in the educational outcomes of the two groups: nine of the 19 children in Lovaas (1987) went on to mainstream education without support while only four of 15 children in Smith et al (2000) had that outcome.

The child's intake IQ may be another predictor of success in EIBI therapy. Children received IQ tests at the time of enrollment in both Lovaas (1987) and Smith et al (2000). Due to the variance in IQ among autistic children, both the Bayley Scales of Infant Learning and the Stanford-Binet test were frequently used with children who had fewer or greater skills, respectively. On average, the children in Lovaas (1987) had an IQ of 63 at intake, compared to an IQ of 50 in Smith et al. (2000). However, although Lovaas (1987) found a significant effect of intake IQ on outcomes, Smith et al. (2000) did not. Subsequent research has investigated potential individual characteristics that may mediate the effect of IQ or intake age on outcomes

Most EIBI interventions do not take place within the heavily structured context of a randomized control study, and the variables that impact treatment efficacy in an experimental intervention may not correspond perfectly to those seen in typical community-based protocols. A prospective study (Smith, Klorfman, and Mruzek, 2015) evaluated children based on characteristics such as extraversion and repetitive motor behaviors prior to entering a two-year ABA treatment program. Children received services from a community provider for at least 15 hours each week, but researchers did not have oversight regarding the programs or include parent

training. Requirements for children included being 20-59 months of age and having received no more than 300 hours of EIBI prior to enrolling in the study. Because children were referred to the researchers by the same agency through which they received treatment, it was not practical to include a control group or completely restrict EIBI participation prior to enrollment. Children were assessed at intake, 12 months, and 24 months into the intervention. Intake age and initial performance on the Mullen Scales of Early Learning were the greatest predictors of performance on the VABS (Vineland Adaptive Behavior Scales) and the ADOS (Autism Diagnostic Observation Schedule) 24 months after enrollment. Improved performance on the ADOS at follow-up is a clinically significant outcome, as the ADOS evaluates children's functioning across many domains. One study describes the ADOS as a "semistructured, standardized assessment of social interaction, communication, play, and imaginative use of materials" (Lord et al, 2000, p.206). The finding that lower intake ages were associated with improved performance on the ADOS 24 months after enrolling in a community-based intervention has significant implications, namely that all possible efforts should be made to enroll children as early as possible

Surprisingly, the total number of hours of therapy that children received during this study did not impact outcomes (Smith et al., 2015). Many studies, such as Smith et al. (2000) have cited the inability to provide 40 hours per week as a weakness. In Lovaas (1987), children received a strict schedule of 40 hours per week of intervention from trained providers. Additionally, all of the participants' parents were trained extensively on how to implement the ABA treatment protocol when trained providers were not present. Because Lovaas (1987) was one of the first studies to demonstrate the efficacy of early intervention, it has served as a model to other researchers, particularly regarding the number of therapy hours children should receive

each week. While more research is needed, the finding that the number of hours spent in therapy each week may have less of an impact than intake age has serious implications. Reducing the number of hours children spend in therapy increases accessibility by decreasing costs, which is especially important if a child's potential for growth is time sensitive.

The Early Start Denver Model

The importance of starting intervention as early as possible has inspired researchers to develop approaches that are ideal for toddlers under three years of age. One intervention method that has been the subject of several studies is the Early Start Denver Model (ESDM), which is adaptable for use with children as young as 18 months (Dawson et al, 2009). Providers of this therapy follow and expand upon the natural interactions children enjoy with their environment. The authors of one study explain that “ESDM uses teaching strategies that involve interpersonal exchange and positive affect, shared engagement with real-life materials and activities, adult responsivity and sensitivity to child cues, and focus on verbal and nonverbal communication, based on a developmentally informed curriculum that addresses all developmental domains. Teaching strategies are consistent with the principles of ABA, such as the use of operant conditioning, shaping, and chaining” (Dawson et al., 2009, p. 3). This study was the first to use a randomized control trial to compare ESDM to a standard community intervention.

Targeting Younger Children and Including Parents as Providers

Dawson et al (2009) included 48 children between the ages of 18 and 30 months, and 24 of each were randomly assigned to one of the two experimental conditions. The parents of children in the ESDM group chose several objectives from the ESDM curriculum, such as expressive language and fine motor skills, to target with their children. These children received an average of 15.2 hours of therapy per week from trained providers, and parents were trained to

deliver five or more hours of therapy each week themselves. Parents reported spending 16.3 hours per week, on average, implementing the ESDM protocol with their children; therefore, children in the ESDM group received an average of 31.5 hours per week of intervention. Children in the ESDM group were also allowed to seek or continue services such as speech therapy or developmental preschools as their families chose to do so. The children in the comparison group did not receive direct intervention from the researchers, but they were given referrals and recommendations for the same community services that were available to the ESDM group. Parent reports indicated that the comparison group received an average of 9.3 hours of individual therapy (speech, ABA, etc.) and 9.1 hours of group therapy (autism-focused preschool) each week, for a total of 18.4 hours of therapy each week.

The children receiving ESDM made significantly greater gains than the children who received standard community interventions on measures such as the Mullen Scales of Early Learning, which is a widely used tool for measuring child development. Children in the ESDM condition also experienced better outcomes with IQ, development of adaptive behaviors, and autism diagnosis status. These results suggest that the intensive treatment schedule offered to the experimental group was beneficial to their development, due to the greater amount of time spent in therapy. However, it is also worth noting that while the ESDM group received more total hours of intervention, both groups received 15-20 hours each week from trained providers; the rest of the ESDM hours were provided by parents. The ESDM outcomes on IQ and adaptive behavior were similar to those experienced by children who received the intensive one-on-one intervention in Smith et al (2000). In Smith et al (2000), children received 25-30 hours per week of ABA intervention from trained providers who had extensive experience working with the UCLA Young Autism Project. It is encouraging that children who received approximately half of

their therapy from parents (Dawson et al, 2009) made similar gains to children who received therapy exclusively from professionals (Smith et al, 2000). The results from Dawson et al. (2009) have since inspired many other studies regarding the efficacy of ESDM, some of which have focused particularly on the role of parents in its implementation.

One study investigated the strength of parent-delivered ESDM in comparison to professional-delivered ESDM by measuring how many dependency-free life years (DFLY) children gained from receiving one of those two treatments (Penner et al., 2015). The measure of DFLY is a projection of how long autistic individuals will likely be able to support themselves between the ages of 18 and 65. It is a condensed measure of the financial productivity and self-sufficiency that an individual is likely to achieve throughout the entirety of their adult life. Although adult productivity cannot be perfectly quantified, an estimate of one DFLY could be the equivalent of 50 work weeks. For example, if an individual is able to work a two-hour shift at the local grocery store each week, they would work roughly 100 hours (2.5 full-time work weeks) each year after factoring in vacations and sickness. After 20 years, they would have worked the equivalent of 50 full-time work weeks, or approximately one DFLY. In this study, professional-delivered ESDM protocol was projected to provide children with 2.51 DFLY while a parent-delivered ESDM protocol was projected to provide 2.15 DFLY (Penner et al., 2015). Although the children who received intensive treatment were expected to have greater independence, due to the higher DFLY prediction, that treatment was also significantly more expensive. The authors of this study found that for parents who were not willing to spend over \$58,000 per DFLY gained, the parent-delivered model was preferred (Penner et al., 2015). Considering that many families do not make more than \$58,000 per year in total income, it is unlikely that the intensive intervention would be accessible for all children. The finding that

parents are willing to sacrifice some of their child's gains in exchange for a more affordable intervention is important. Additionally, parents preferred the method that required more effort, which suggests that parents can sacrifice time more easily than money. These insights provide strong support for the continued investigation and development of parent-delivered interventions.

Developing parent-led intensive therapy methods for children with autism has a variety of benefits. When parents work directly with their child, they are able to foster positive bonding experiences that can enhance the parent-child relationship. As discussed in Penner et al. (2015), parent-led interventions can potentially save families tens of thousands of dollars over the course of their child's life. Additionally, interventions that involve individuals with a pre-existing connection to a child with autism can promote an essential aspect of development that intensive, skills-acquisition focused therapies often neglect: joint attention.

Joint Attention in Children with Autism

Joint attention involves two people coordinating their attention toward a third object or person. It is a foundational aspect of social interaction, and children with autism routinely fail to display joint attention during infancy. Children with autism engage in actions such as pointing at an interesting object or showing a toy to a caregiver only half as often as children with other developmental disabilities such as Down Syndrome (Mundy, Sigman, and Kasari, 1990). When children share and recognize joint attention with others, it provides a gateway into conversations about common experiences. In typically developing children, increases in joint attention predict an increase in expressive language between the ages of 15 and 21 months (Tomasello and Farrar, 1986). There is likely a bidirectional relationship between joint attention and language. When a parent-child pair attends to an object for a long time, they have a longer opportunity to talk about

it; similarly, talking about an object of shared interest increases the length of an interaction (Tomasello and Farrar, 1986). Oftentimes, parents begin to notice that their child may have autism when they do not exhibit joint attention after the parents' repeated attempts to establish shared interest in the environment.

A lack of joint attention may be accompanied by speech delays, limited eye contact, and absence of gestures (Mundy et al, 1990). These symptoms can exacerbate one another, as a child who does not express interest in the environment may not acquire the words that typically developing children use to describe their surroundings. As a result, many of the early intensive interventions that autistic children receive are focused on teaching the skills that they do not gain throughout their early years. Several of these approaches have already been discussed, and they have demonstrated significant potential in helping children function more effectively at home and in classroom settings. However, there are certain limitations to the model of a child spending dozens of hours each week learning from an adult instructor through discrete trial methods. Toddlers and young children learn primarily through play, and focused instruction does not provide the unstructured learning environment that allows for critical aspects of social development to take place. In order to provide children on the autism spectrum with the best possible outcomes, interventions that target social development need to be available in addition to therapies that target language acquisition and adaptive behavior.

Because young children primarily interact with their parents, naturalistic therapies that involve parents as facilitators have been used to target the development of joint attention. One study specifically focused on teaching parents how to use daily routines as opportunities to increase the frequency of eye contact, social engagement, and verbal reciprocity using an intervention known as Pathways (Rollins et al, 2014). The researchers met with parents once a

week to teach engagement techniques and to review the parent's fidelity in applying the previously learned skills. The participants included four boys under three years of age and their mothers. The participants were diagnosed with autism prior to enrollment to the study, and the researchers confirmed diagnostic status using the Autism Diagnostic Observation Schedule-2.

All of the children had previously enrolled in EIBI therapy through the Texas Early Childhood Intervention program (ECI) for approximately five hours per month; three of the children had received twelve months of EIBI while the fourth had only been enrolled for one month. None of the children has access to services other than those provided by ECI prior to the start of the study. Because the goals of traditional EIBI focus on skills such as requesting and labeling, the Pathways program provided supplemental support for children to work on targeted social goals. Parents were trained on topics such as how to identify and control appropriate reinforcers, and how to reward eye contact and social engagement in such a way that those behaviors would be reinforced. These skills were then applied to all aspects of the family's daily routine, and researchers filmed and critiqued a ten-minute video of the parent implementing the techniques during each training session. By the conclusion of the intervention, three of the four children demonstrated gains in eye contact, social engagement, and verbal reciprocity. A fourth target, increased nonverbal turn-taking, improved among two of the four children. With such a small sample size, it is difficult to determine the factors that influenced the children's outcomes.

The mothers who participated in the Pathways intervention gave consistently positive ratings regarding its effectiveness and ease of use. One advantage of the Pathways program is that therapy providers only trained parents for one hour each week, yet the techniques allowed for the children to receive intervention at all times that their mothers were present. As was done in this study, parent-mediated interventions can be used alongside other therapies in order to

provide children with opportunities to grow in a variety of areas. This can be particularly helpful for children who have limited access to community therapy services. Because the Pathways model in particular requires very low time commitment from parents, it is accessible to families with a variety of socioeconomic statuses.

Intervening during Infancy: Preventing Developmental Gaps from Widening

Although social deficits and language impairments are classic signs of autism, there is a limited understanding of how these issues may manifest when children are too young to clearly communicate. A prospective longitudinal study of infants at high risk for autism identified several potential factors that contribute to the development of autism (Bryson et al., 2007). High risk status is primarily assigned to younger siblings of children with an autism diagnosis, as roughly 20% of younger siblings are also diagnosed with autism (Ozonoff et al., 2011). Bryson et al. (2007), thoroughly observed nine infant siblings throughout their first 36 months of life, by which time all children had received an autism diagnosis. At 36 months of age, all of the children were again tested for autism by a blind clinician to confirm their status; seven of the children met diagnostic criteria while the other two were within two points of diagnostic cutoffs. Behavioral observations of the children revealed behavioral markers between the ages of six and twelve months that may be predictive of future autism diagnosis status. These included absent or fleeting eye contact, little to no social smiling, repetitive movements or visual fixations, negative affect, and difficulties with self-soothing; eight out of the nine children exhibited these abnormalities. Additionally, five of the nine children experienced a marked decrease in IQ between 12 and 24 months of age, while a sixth experienced such a regression between 24 and 36 months of age. Although it is possible that these children experienced abnormal development

from birth, the observable signs that delays were present did not appear until between the ages of six and twelve months (Bryson et al., 2007).

The relationship between atypical development in the first year of life and later IQ is still uncertain, but subsequent research suggests that delays begin to develop between six and twelve months of age (Ozonoff et al., 2010). In Ozonoff et al. (2010), 25 infant siblings of autistic children were matched with 25 infant siblings of typically developing children. Initial assessments at six months did not reveal any differences between the two groups, but by twelve months of age there were significant differences in gaze to faces and directed vocalizations, with high-risk infants also showing decreased social smiling by 18 months. When the children in Ozonoff et al. (2010) reached 36 months of age, parents were asked to retrospectively report the trajectory of their child's symptom development. Although 19 children experienced a regression of expressive language use or social behaviors during the course of the study, only four of these children's parents reported such skill loss. This finding suggests that parents may not be noticing the signs of autism, which could cause delays in pursuing a diagnosis and appropriate intervention services. Additionally, since deficits can be detected within the range of six to twelve months, therapy protocols that target the earliest social behaviors need to become available to families. Traditional ABA therapy cannot be used with children until several years after the first signs of autism may present, and even ESDM is only suitable starting at 18 months of age.

One therapy method that targets infants less than one year old has already helped create positive outcomes for some children. Even though autism diagnostic measures are suitable for diagnosing infants, interventions have been developed to support the development of infants who are considered to have a high risk of developing autism. This group primarily includes children

who have older siblings with autism (Ozonoff et al, 2011). A pilot study of a parent-implemented intervention called Infant Start showed that high-risk infants ages 7-15 months who enrolled in the program were much less likely to be diagnosed with autism at 36 months than similar infants who did not receive any interventions (Rogers et al., 2014). Even more encouraging is that Infant Start is a low-intensity intervention; enrolled parents received 12 weekly one-hour training sessions followed by 6-12 weeks of follow-up meetings to help maintain the skills that they learned (Dawson et al., 2014). Infant Start is a naturalistic intervention similar to ESDM, but its curriculum is informed by typical developmental milestones that are achieved starting at just 8 months old, an even younger age than the starting age for ESDM. Parents chose 5-6 goals to work on throughout the 12-week training, with common goals including improvement of eye contact, social play, and speech production (Dawson et al., 2014). Parents were instructed to introduce preferred activities and toys to their children and encourage their children to maintain social engagement throughout the play session. At the 36-month follow-up evaluation, only two of the seven children who enrolled in the Infant Start program had received an autism diagnosis. Three of four children in a control group, which consisted of similarly high-risk children whose parents declined to enroll, were diagnosed with autism at 36 months (Dawson et al., 2014). Additionally, the Infant Start group was more symptomatic at age nine months, but that trend reversed throughout the course of the study. This suggests that the Infant Start approach is suited for improving the delays that start to appear during the first year of life, which could prevent children from needing more intensive therapies when they are older. These findings are very hopeful for the future of parent-led and infant centered interventions, but since the sample was so small more research on this treatment is needed.

Low-Intensity Interventions

Interventions that are designed for infants are, by necessity, less intensive than EIBI programs. However, EIBI is far from only beneficial therapy for toddlers and older children, and less intensive approaches can indeed have unique benefits. Parents and other caregivers can more easily learn how to implement a minimally intensive therapy protocol, which increases the number of people that a child on the autism spectrum can effectively learn from. This model provides a more naturalistic environment for autistic children than an intensive, one-on-one setting. One limitation of ABA interventions is that same-age peer interaction is often not included, which can be detrimental to social development. Some researchers have addressed this limitation by designing interventions that include same-age peers, particularly an autistic child's siblings. In addition to parents, typically developing siblings of children with autism have a unique relationship with the autistic child that can allow for novel therapy approaches. Although they are not well-suited for helping with intensive interventions, siblings are frequently available to participate in therapy, and structured intervention sessions can allow for social opportunities that may not otherwise be available.

Including Siblings as Part of the Intervention Team

In one study, experimenters trained siblings of autistic children on skills such as getting their sibling's attention, creating opportunities to exchange toys, and providing their sibling with verbal praise (Tsao and Odom, 2006). Target children ranged from three to six years of age, while their siblings were four to 11 years of age; in two of the dyads, the autistic sibling was older. Intervention took place twice weekly at either the children's home or in a generalization setting chosen by the parents. The study used a multiple-baseline design; one child entered intervention after three weeks of baseline sessions, then each subsequent child received intervention after the previous child demonstrated progress. During baseline sessions, the

researchers would watch children play naturally together for 10 minutes without any direction unless the autistic sibling left the room or engaged in aggressive behavior. During intervention sessions, the typically developing sibling received 10 minutes of training on a specific social skill. Then, they played with their sibling for 10 minutes while receiving corrective guidance from parents and the researchers on how to implement the technique. Intervention sessions took place for five to six weeks and were followed up with one to three weeks of maintenance sessions for all but one of the dyads. During the maintenance sessions, siblings did not receive instruction but were observed to determine if they continued implementing the strategies that they were taught.

The results were encouraging but inconclusive due to the very small sample size. All of the children spent a greater percentage of time engaging in joint attention during intervention than baseline, and three of the four also increased their social initiation rates. These improvements were mostly maintained during several follow-up maintenance sessions, although some regression did occur (Tsao and Odom, 2006). In one of the dyads, the typical sibling did not wish to receive training after the first few intervention sessions. She elected to continue participating in the study by demonstrating how she played with her sibling as she had done in the baseline sessions (Tsao and Odom, 2006). Because this sibling was only four years of age, this outcome suggests that typical siblings may need to be school-age in order to participate in these types of interventions effectively. Three of the four siblings increased the rate at which they initiated social interaction in this study, which suggests that these interventions may benefit typically developing children who struggle to play with their autistic siblings. The one typically developing sibling who decreased her rate of initiation was also the oldest child in the study at 11 years of age. The researchers noted that her use of social strategies helped her initiate social

interactions with her younger brother more appropriately, which led to an increased response frequency from him and an overall decrease in initiation attempts from her (Tsao and Odom, 2006). These findings suggest that training typically developing children on how to use specific approaches when interacting with their autistic siblings can benefit both children. In particular, autistic children can achieve gains in joint attention, which is a crucial aspect of their development. Subsequent research has further investigated how to include typically developing siblings in early autism interventions in ways that benefit both groups of children.

In the last decade, researchers have increasingly used technology to provide sibling-inclusive therapy to young children on the autism spectrum. In Reagon, Higbee, and Endicott (2006), researchers used videotaped skits to demonstrate a scripted social interaction to a four-year-old child with autism. Prior to the study, the target child could make requests and label objects, but he did not engage in pretend play at home or at school. The videos used in this study depicted scenes approximately one minute in length with themes such as cowboys and firefighters. The older sibling served as an actor in the video as well as a play partner, with the target child replacing the role of one of the on-screen characters that was acted out by a peer. The researchers found that the target child was able to learn the lines and actions of his character for each of the four scripts, and that the target child and his older sibling could fully act out the skit with minimal prompting and no extraneous reinforcement. These outcomes suggest that video modeling can both successfully teach social skills to children on the autism spectrum and that acting out scripted skits is a preferred activity for both children on the spectrum and their typically developing siblings.

Discussion and Comparison of Methods

One important aspect of Reagon, Higbee, and Endicott (2006) is that the target child already had foundational language skills at the start of the study. Additionally, he also did not engage in restricted, repetitive, or aggressive behaviors that prevented him from being receptive to the video tutorials. Skills such as expressive language or self-regulation can be impaired among young children with autism to incredibly varying degrees. As a result, it is important that parents, researchers, and therapists be aware of a child's strengths and weaknesses when developing an intervention protocol. Some interventions, such as the video training model, can be easily modified to ensure the length, content, and dialogue of the videos provides an appropriate level of engagement for the target child to learn effectively (Reagon, Higbee, and Endicott, 2006). Although at least some expressive language would be ideal for the use of a video modeling approach, any child who can attend to the video and follow simple directions could be a good candidate for the use of video modeling to teach social initiation and verbal reciprocity. The other interventions described in this paper also have strengths and weaknesses in terms of the baseline skills that children need in order for efficacy to be established, as well as limitations in the domains where they can promote growth.

Applied Behavior Analysis can be highly effective at increasing children's use of expressive language, adaptive behavior, and academic skills (Lovaas, 1987). Importantly, these improvements can benefit children who initially demonstrate low IQ and severe delays across virtually all developmental areas (Lovaas, 1987; Smith et al 2000). Additionally, because ABA was used in behavioral shaping prior to Lovaas (1987), ABA-based interventions can be modified as a child grows to help them achieve age-appropriate goals even after early intervention ends. For children who exhibit severely aggressive, non-compliant, or self-injurious behaviors, that flexibility is essential for long-term positive outcomes. However, not all children

on the autism spectrum display features such as low IQ or maladaptive behaviors. Many children on the spectrum struggle more with developmental goals such as language acquisition, social reciprocity, and motor skills. Typically, children will begin to see growth in those areas long before the age of 34 months, the average age of enrollment in Lovaas (1987). Therefore, interventions that are designed to promote development in infants and young toddlers fill an essential gap that is caused by the limitations of ABA therapy.

Researchers have used ABA-based principles, such as behavioral shaping, to develop the Early Start Denver Model to provide effective behavioral intervention to very young children. The authors of the first random, controlled trial of ESDM note that it is "a comprehensive early behavioral intervention for infants to preschool-aged children with ASD that integrates applied behavior analysis (ABA) with developmental and relationship-based approaches. The ESDM was designed to address the needs of toddlers with ASD as young as 12 months" (Dawson et al, 2009, p. 2). The inclusion of techniques that promote the role of relationships in a child's life provides concrete opportunities for social development to children who are diagnosed with autism or at high risk of being diagnosed. Children have seen improvements in domains such as IQ and adaptive behavior after receiving ESDM treatment, outcomes which are similar to those seen when children undergo ABA therapy (Lovaas, 1987; Dawson et al, 2009). Therefore, there is reason to believe that ESDM should be provided to children at least one year of age who have risk factors for developing autism, such as having an older sibling with an autism diagnosis. ESDM also includes parents as providers of therapy, which is not always the case in ABA programs (Smith et al, 2000; Smith et al, 2015). The inclusion of parents can increase accessibility, decrease costs, and provide opportunities to stimulate age-appropriate social

interactions for infants and toddlers. These aspects of early intervention can be vital for a child's success, which is why other interventions have adopted them as well.

Similarly to ESDM, the Pathways model incorporates family members as therapy providers. However, while ESDM also provides ABA-based instruction, Pathways focuses more directly on creating naturalistic opportunities for children and parents to work on reciprocal social exchange (Rollins et al, 2014). That distinction can be helpful for families who have access to ABA through community service providers, but who are unsure of how to stimulate their child's social development through age-appropriate play. The participants in the initial investigation of Pathways were all at least three years of age, so it is uncertain if the techniques would be appropriate for very young children (Rollins et al, 2014). However, because many children are not diagnosed with autism before the age of three, it is important that therapies can target essential social skills that autistic children are often delayed in. In this way, Pathways and ESDM both satisfy the need for interventions that involve parents and focus on relationships while accounting for a variety of circumstances that families may face when seeking treatment for a child's developmental delays. In an ideal world, however, all families would have the resources to identify that their child is struggling at the earliest possible time. For this reason, researchers are investigating how to serve children even younger than twelve months of age.

Infant Start is one of the first therapy programs to target infants, with participants in experimental trials being as young as seven months of age (Rogers et al, 2014). This study was remarkable in that children who were identified as having both risk factors and early signs of autism were ultimately not diagnosed as having any developmental disorder. By comparison, children who received ESDM starting at ages of twelve months or older generally still received a diagnosis of Pervasive Developmental Disorder-Not Otherwise Specified, which indicates that

mild symptoms associated with autism are present (Dawson et al, 2009). Both of these therapies will need further research, especially Infant Start, but the early results are very encouraging for the potential that children have to overcome the challenges they face, even in infancy. Educating parents on the behavioral markers that can predict autism outlined in Bryson et al (2007) is another essential goal that clinicians, therapy providers, and community resources will need to address in the near future. Parents will not seek out therapy unless they can identify the relevant delays when such issues surface. When parents understand the developmental milestones and characteristics that they should be aware of, they will be greatly empowered to provide their children with the resources that they may need.

Conclusion

Ultimately, children with autism and those who are at risk of being diagnosed deserve supports that can promote optimal happiness and independence. The interventions described here provide an overview of the types of assistance that a child and their family may need based on the autistic child's symptoms and the family's circumstances. Therapy programs can target many aspects of the child's daily life to provide comprehensive support for a variety of goals and needs. Designing therapy programs around the child's needs, as well as those of their family, ensures that limited time and resources will be used in the most effective way. Personalized intervention approaches will also make sure that all therapy goals are directed toward increasing the child's quality of life. Using evidenced-based practices to promote growth in the areas where each child needs it most will be of utmost importance as communities work to serve individuals on the autism spectrum.

References

- American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Arlington, VA: American Psychiatric Publishing.
- Baer, D. M., Wolf, M. M., Risley, T. R. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, 1, 91-97.
- Bryson, S. E., Zwaigenbaum, L., Brian, J., Roberts, W., Szatmari, P., Rombough, V., and McDermott, C. (2007). A prospective case series of high-risk infants who developed autism. *Journal of Autism and Developmental Disorders*, 37, 12-24. doi: 10.1007/s10803-006-0328-2
- Dawson, G., Rogers, S. J., Munson, J., Smith, M., Winter, J., Greenson, J... Varley, J. (2009). Randomized, controlled trial of an intervention for toddlers with autism: The Early Start Denver Model. *Pediatrics*, 125, e17-e23. doi: 10.1542/peds.2009-0958
- Leaf, R. and McEachin, J. (2016). The Lovaas model: Love it or hate it, but first understand it. In *Comprehensive models of autism spectrum disorder treatment* (pp. 7-43). Switzerland: Springer.
- Lord, C., Risi, S., Lambrecht, L., Cook, Jr., E., Leventhal, B., & DiLavore, P. et al. (2000). The Autism Diagnostic Observation Schedule—Generic: A standard measure of social and communication deficits associated with the spectrum of autism. *Journal of Autism And Developmental Disorders*, 30(3), 205-223. doi:10.1023/a:1005592401947
- Lovaas, O. I. (1987). Behavioral treatment and normal educational and intellectual functioning in young autistic children. *Journal of Consulting and Clinical Psychology*, 55 (1), 3-9. doi: 0022-OC6X/87/J00.15

- Mundy, P., Sigman, M., Kasari, C. A longitudinal study of joint attention and language development in autistic children. *Journal of Autism and Developmental Disorders*, 20(1), 115-128. doi: 0162-3257/90/0300-0115\$06.00/0
- New Autism Data. (2016). Centers for Disease Control and Prevention
- Ozonoff, S., Iosif, A., Baguio, F., Cook, I. C., Hill, M. M., Hutman, T., Rogers, S. J., Rozga, A., Sangha, S., Sigman, M., Steinfeld, M. B. and Young, G. S. (2010). A prospective study of the emergence of early behavioral signs of autism. *Journal of The American Academy Of Child & Adolescent Psychiatry*, 49(3), 256-266.e2. doi:10.1016/j.jaac.2009.11.009
- Ozonoff, S., Young, G. S., Carter, A., Messinger, D., Yirmiya, N., Zwaigenbaum, L., Bryson, S., Carver, L. J., Constantino, J. N., Dobkins, K., Hutman, T., Iverson, J. M., Landa, R., Rogers, S. J., Sigman, M. and Stone, W. L. (2011). Recurrence risk for autism spectrum disorders: A Baby Siblings Research Consortium study. *Pediatrics*, 128 (3) e1-e8. doi:10.1542/peds.2010-2825
- Penner, M., Rayar, M., Bashir, N., Roberts, S. W. Hancock-Howard, R. L., Coyte, P. C., (2015) Cost-effectiveness analysis comparing pre-diagnosis autism spectrum disorder (ASD)-targeted intervention with Ontario's autism intervention program. *Journal of Autism and Developmental Disorders*, 45, 2833-2847.
- Reagon, K.A., Higbee, T.S., & Endicott, K. (2006). Teaching pretend play skills to a student with autism using video modeling with a sibling as model and play partner. *Education and Treatment of Children*, 25, 517-528.
- Rogers, S. J., Vismara, L., Wagner, A.L., McCormick, C., Young, G., Ozonoff, S. (2014). Autism treatment in the first year of life: A pilot study of infant start, a parent-

implemented intervention for symptomatic infants. *Journal of Autism and Developmental Disorders*, 44, 2981-2995.

Schreibman, L., Dawson, G., Stahmer, A. C., Landa, R., Rogers, S. J., Halladay, A. (2015).

Naturalistic developmental behavioral interventions: Empirically validated treatments for autism spectrum disorder. *Journal of Autism and Developmental Disorders*, 45, 2411-2428.

Smith, T. (2001). Discrete trial training in the treatment of autism. *Focus on Autism and Other Developmental Disabilities*, 16(2), 86-92.

Smith, T., Groen, A. D., Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal of Mental Retardation*, 105, 4. 269–285.

Smith, T., Klorfman, R., and Mruzek, D. W. (2015). Predicting outcome of community-based early intensive behavioral intervention for children with autism. *Journal of Abnormal Child Psychology*, 43, 1271-1282. doi: 10.1007/s10802-015-0002-2

Tomasello, M., and Farrar, M. J. (1986). Joint attention and early language. *Child Development*, 57(6), 1454-1463. <http://www.jstor.org/stable/1130423>

Tsao, L. and Osom, S. L. (2006). Sibling-mediated social interaction intervention for young children with autism. *Topics in Early Childhood Special Education*, 26(2), 106-123.

Vivanti, G., Paynter, J., Duncan, E., Fothergill, H., Dissanayake, C., Rogers, S. J., The Victorian ASELCC Team (2014). Effectiveness and feasibility of the Early Start Denver Model in a group-based community childcare setting. *Journal of Autism and Developmental Disorders*, 3140-3153. doi:10.1007/s10803-014-2168-9