

EARLY INTERVENTION ON CORE DEFICITS IN AUTISM

Connie Kasari, Stephanny Freeman, Tanya Paparella, Connie Wong, Susan Kwon, Amanda Gulsrud

Summary

Early intervention for young children with autism is examined in terms of active ingredients of dose, method, content, and timing. A newer development in early interventions is the re-focusing of interventions on core deficits of autism. Targeted interventions are examined for core deficits in autism, particularly deficits in joint attention and symbolic play. Findings are reviewed of a recent randomized controlled trial for facilitating joint attention and symbolic play in young children with autism. These data provide promising support for focusing on these areas of development in order to improve expressive language skills in children with autism.

Key Words: Joint attention – Symbolic play – Randomized controlled trial (RCT) – Active ingredients

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Corresponding Author

Connie Kasari, Ph. D., 3132 Moore Hall, UCLA, Los Angeles, CA 90095, kasari@gseis.ucla.edu

Early intervention services for children with autism are a well-established necessity. Nearly everyone agrees that intervention should begin early for a child diagnosed with this disorder. Yet few agree on what those services should be.

Several models of early intervention exist for children with autism. Reviews of the literature suggest that these various treatment models are generally effective with nearly half of all subjects making significant gains across areas of development (Dawson and Osterling 1997, Rogers 1998). However, few models have undergone scientifically rigorous methods to determine their active ingredients (Kasari 2002). Thus, it is impossible to determine what aspects of intervention are most effective, and more importantly for whom.

In this paper we consider several active ingredients of early intervention including dose, method, content and timing. We then focus on content of early interventions with a particular focus on two specific core deficits of young children with autism, joint attention and symbolic play skills.

Active Ingredients of Intervention

There are many aspects or ingredients of intervention that could lead to better outcomes. It may be that amount of intervention or *dose* is the most active ingredient. Dose is often referred to in number of hours of intervention per week. Hours per week may include a variety of different services (e.g., physical therapy,

speech therapy, social skills group), or may involve only one service (e.g., special education). Or perhaps it is the *method* used to teach children, as in applied behavior analysis (e.g., DTT—massed discrete trials), developmental approaches (e.g., Relationship Development Intervention—RDI—Gutstein or DIR Floortime approach—Greenspan) or integrated developmental and behavioral models (e.g., Pivotal Response Training—Koegel et al. 1999). Another possibility is that it matters *what* is being taught. Deficits that are specific or core to the disorder may need to receive greater attention than some other behavioral or developmental areas. Finally, the timing or *when* all of these active ingredients of intervention occur also may lead to better outcomes. To date, these aspects of intervention have received relatively little systematic and *scientifically rigorous* study. Fortunately this situation is changing as a number of studies are currently underway that should help professionals and families make informed decisions about interventions for a particular child (see STAART and CPEA center studies).

Dose. The most studied aspect of early intervention has been dose. Several studies have compared the number of hours of a specific intervention and found that more hours per week led to better outcomes (Lovaas 1987, Sheinkopf and Siegel 1998, Smith et al. 2000). The most cited study is one conducted by Lovaas (1987). In this study, children who received an average of 40 hours per week of one on one and intensive behavioral services for more than 2 years had better outcomes than children who received only 10 hours

per week. Outcomes were regular school placement in Kindergarten and within-normal ranges of cognitive ability for nearly half of the intensely treated participants. These findings created quite a stir among parents and professionals with many parents requesting 40 hours of intervention per week for their own children. In a replication of this study, Smith et al. (2000) found that outcomes were less positive with children who were more impaired than the participants in the Lovaas (1987) study. The data suggest that dose alone may not determine outcome; rather a complicated set of other factors may interact with dose, including a number of child characteristics.

While most published studies of dose have considered more or less of the same therapy, they have not controlled for the possibility that families may also be engaging in other therapies. Indeed, we do not know how outcome may be affected by a concentrated dose of one therapy versus a combination of therapies resulting in the same dose versus additional therapies that are added into a primary therapy. With respect to dose, however, a recent panel of National Academy of Science experts concluded that young children with autism should receive about 25 hours per week of intervention (NRC 2001). This recommendation results from clinical knowledge of best practices rather than controlled studies concerning dose. Future studies will need to tackle more carefully the number and type of hours that are necessary for best outcome of young children with autism.

Method. Although the Lovaas (1987) study did not compare methods of intervention, many professionals and parents used these data to argue that it was the Lovaas DTT method that resulted in best outcome. Methods of intervention have not been systematically and rigorously compared (e.g., random assignment of subjects to treatment group). Thus, we cannot currently determine if one method is superior to another. However, it is unlikely that one approach will be best for all children. It may be that some children would benefit more from a DTT approach while others may do better with PRT or DIS. It will be important for future studies to compare methods and test aptitude by treatment interactions. In other words, what characteristics of the child are best suited to the intervention method so that we can better determine the child and intervention fit.

Content. An active ingredient that has rarely been addressed is the content of interventions. That is, *what* is being taught. Nearly all intervention programs highlight intervention in the broad core deficit areas of social and language development. However, a number of early developing behaviors in typical development have been linked to later language and social interactions. Several of these behaviors have been considered candidates for core deficits because the behaviors are specific, universal, persistent and linked to later development. Some candidates for core deficits include imitation, joint attention, symbolic play and theory of mind. These behaviors have demonstrated specificity because children with autism show deficits in each of these behaviors when compared to matched groups of other children, including children who are developing typically and those with other developmental disabilities. Moreover, in each of the above examples, nearly all of the children with autism show the deficit regardless of

general developmental ability, thus demonstrating universality. The deficits also have shown persistence or stability over time and across ages. Finally, each of these behaviors appears linked in development to other important developmental outcomes, such as social interactions and language.

The effects of interventions on these core deficits are beginning to emerge in the literature. Interventions are not only targeting the area of deficit, but outcomes are beginning to expand beyond IQ to include measures of play, joint attention, imitation and theory of mind.

Timing. Finally, timing of intervention may play a critical role in outcome. Most believe that the earlier intervention begins the better the outcome. Although children with autism are typically diagnosed after three years of age, earlier diagnoses are becoming more common with increasing awareness of autism and better diagnostic tools. But even these very young children vary in their developmental abilities with some showing only slight delays in their development and others showing more severe delays or greater autism symptomatology. It makes sense that different interventions may be more effective for some children versus others. For example, the Smith et al. (2000) study showed that the same dose of intervention used in the Lovaas (1987) study was less effective with more severely involved children with autism. Could other methods or different content of intervention have been more effective? With all children we may find that we need to match developmental age with particular methods or particular content of intervention. Thus future studies should examine the match between timing (developmental age), intervention content, dose and methods.

Focus on Core Deficits

Many studies have shown that very young children with autism show characteristic patterns of ability and disability that set them apart from typically developing children, and even children with other types of developmental delay. Often the areas of disability are in the absence of a particular behavior. Thus, imitation, joint attention, and play skills are three areas of skill that are absent or impoverished in the children's repertoire. These skill areas develop early—within the first two years of life and are linked to later abilities in language and social development. Because children with autism are generally identified after two years of age, it is difficult to know which deficits are primary—for example, whether imitation deficits lead to joint attention deficits or vice versa? However, when children are diagnosed with autism, they generally show impairment in all of the early skills. If children do demonstrate some ability in imitation or play skills, for example, these skills are often not used socially. That is, the child may play with toys by him or herself, but rarely engages in social play—play that demonstrates a shared affect and engagement with another person.

In the sections below, we focus on joint attention and play skills—two areas of early development that we have examined in children with autism using both experimental and intervention studies.

Joint Attention. The young child communicates

with his caregiver long before he can actually talk. When the infant sees something of interest, he often shares this interest with his caregiver by engaging in looks and smiles. He may bring toys to the caregiver to show or point to indicate an interesting event. These types of behaviors are referred to as joint attention. Joint attention defines a mutual mental focus between two or more individuals on an object or an event. It implies a simultaneous sharing of experiences about a common world, and it is the intersubjective nature of the exchange that makes it of such social value.

These prelinguistic, triadic exchanges characterize communication between 6 and 18 months of age in typically developing children (Bakeman and Adamson 1984). The significance of young children's ability to engage in joint attention with others has been linked to children's language acquisition (Tomasello and Todd 1983, Tomasello et al. 1986, Tomasello and Farrar 1986, Carpenter et al. 1998). Thus children typically engage in joint attention behaviors prior to the acquisition of verbal language, and children with more joint attention show more sophisticated levels of language (Tomasello and Todd 1983).

There is now sufficient evidence that children with autism have specific and pervasive deficits in joint attention skills. The impairment in joint attention is in both the initiation and responsiveness of joint attention behaviors (Curcio 1978, Ricks and Wing 1975, Wetherby and Prutting 1984). Moreover, joint attention skills are uniquely impaired in children with autism. Only children with autism show deficits in joint attention when compared to mental-age matched children with mental retardation or typical development (Mundy et al. 1986), or to children with only language delays (Loveland and Landry 1986).

Not only does the joint attention deficit appear specific to autism, but it is also characteristic of the majority of young children with autism. Using discriminant function analyses, Mundy et al. (1986) examined specific joint attention behaviors as predictors of group membership. Among children with autism, mental retardation and typical development, group membership was successfully predicted by joint attention behaviors alone for over ninety percent of the children with autism. More recent studies also find that autism membership is uniquely predicted by impairment in joint attention (Dawson et al. 2004).

Of particular importance are studies that find joint attention skills predict both concurrent and future language skills (Mundy et al. 1986, Sigman and Ruskin 1999). Early nonverbal joint attention skills such as following another's gaze (Morales et al. 1998) and pointing and showing are related to subsequent language development for both typical children (Tomasello and Farrar 1986) and children with autism (Mundy et al. 1990, Mundy and Gomes 1998). In turn, language development by age five is associated with optimal social outcome for children with autism (Rutter 1982, 1982). Joint attention abilities are also considered as possible precursors of cognitive perspective taking or theory of mind (Baron-Cohen et al. 1994, Roeyers et al. 1998). Thus, it is becoming increasingly apparent that the ability to engage in joint attention with others plays a pivotal role in the development of social relatedness and social cognition.

These studies suggest that joint attention abilities are deficient in the majority of young children with autism and joint attention skills are important predictors of later language ability. Joint attention skills, then, seem to be critical targets for early intervention.

Symbolic Play. While some children with autism seem disinterested in toys and play in general, others have intense interest in toys, and may develop fairly good levels of functional play (e.g., using objects as they were intended, such as rolling the car and stacking blocks). However, the ability to use objects and toys in creative and flexible ways appears significantly impaired in young children with autism.

Symbolic play develops in the second and third years of life; thus the appearance of symbolic play is somewhat later than the appearance of joint attention skills in typically developing children. For children with autism with mental ages greater than 20 months, parents report an absence of pretend play in their children (Wing et al. 1977). This parental perspective has been confirmed by experimental studies that find that symbolic play occurs less frequently in children with autism compared to children with other disabilities and typical children whether matched on mental age or language age (Baron-Cohen 1989, Jarrold et al. 1994, Riguet et al. 1981, Sigman and Ungerer 1984). Moreover, when play occurs it is sustained for less time than in other children (Jarrold et al. 1996).

There is some evidence that children with autism may have the capacity for engaging in pretend play, but fail to do so spontaneously. When play interactions are structured and prompted by others, children with autism are able to produce more pretend play (Jarrold et al. 1996) although play still remains less frequent than that of typical children. However, several researchers find that if only one act is required of the child (for example, the child is asked to have the doll "wear" the hat) then children with autism appear as capable as comparison children (Charman and Baron-Cohen 1997, Jarrold et al. 1996, Lewis and Boucher 1995). Moreover, children with autism are capable of seeing pretend acts in others, as when they explain that someone else has poured 'pretend tea' or that the doll 'pretended to take a shower' (Jarrold et al. 1994, Harris et al. 1994). These studies suggest that there may be a level of underlying capacity for pretend play but for unexplained reasons children with autism do not spontaneously engage in such play acts (Jarrold 2003).

In judging pretense, one issue is whether the act represents *true pretending* for the child with autism. Some children with autism appear able to produce truly creative, flexible, and novel pretend play actions on objects but most fail to move beyond the obvious characteristics of the object and truly 'pretend'. Thus, children may learn to use one object to stand in for another, as when a block becomes food for the doll, but the ability to engage in these 'substitutions' rarely becomes truly generative, non-literal and enjoyable (Jarrold 2003).

Summary. These studies suggest that specific impairment for young children with autism concern ability in joint attention and symbolic play skills. These skills also are important to later development. Significant associations exist between joint attention skills and later language abilities (Charman et al. 2003, Loveland

and Landry 1986, Mundy et al. 1990), as well as symbolic play skills and social relationships (Sigman and Ruskin 1999).

But because these skills are highly representational and abstract they present particular challenges for intervention. How does one teach skills that involve cognitive representations of absent attributes, or require the use of a pointing gesture as a means to indicate something of interest to another? Indeed, these skills are rarely the direct focus of an intervention with children who have autism.

Interventions on joint attention. Limited evidence exists as to whether specific joint attention behaviors can be taught. In two studies, the focus was on changing the behavior of an adult in order to improve joint attention and/or language skills in the child. Lewy and Dawson (1992) manipulated the adult's behavior and then measured the effect of this manipulation on the child's joint attention and other social behaviors. When the adult was instructed to imitate the child's behaviors—the child-centered condition—the authors found that all of the children (with autism and mental retardation) improved their joint attention skills, particularly coordinated joint looks. Neither group of children made joint attention improvements in the contrasting condition in which the adult directed the child's play. Although these authors manipulated adult behavior to change child behavior in 2 different conditions they did not sustain the “intervention” over time, as in a series of intervention sessions. Still, joint attention skills were improved in 4-year old children with autism when the adult structured the environment in a particular way.

Drew et al. (2002) report marginal improvements in language development as the result of a parent-implemented and parent-reported intervention on joint attention skills and joint action routines. Although the Drew et al. study utilized a randomized controlled trial, the implementation of the treatment was by parents using speech therapists as consultants. Given the marginal differences between the intervention and the control group and the length of treatment—one year, the authors point to a number of problems including the reliance on parental implementation and reporting, and the commencement and uneven distribution of additional interventions for children in the control group. Thus, the control group of children actually received a greater dose of intervention on average than did the children in the experimental group.

In teaching joint attention skills to the child directly, a recent study utilized a single subject design and applied behavior analysis procedures to teach pointing and gaze shifting to 5 preschool children with autism (Whalen and Schreibman 2003). Results showed that all of the children improved in responding to joint attention gestures of the experimenter and 4 out of the 5 were able to improve in their initiation of joint attention gestures. At a 3-month follow up, all of the children continued to respond to joint attention, but joint attention initiations were not maintained. Moreover, generalization of the taught skills to interactions with an untrained adult (the mother) yielded only partial success with 2 of 4 children showing improvement.

Interventions on Symbolic Play. Play skills are commonly addressed in early intervention programs. Many programs focus on functional or imitative play

with somewhat less focus on symbolic or social play. Despite the clinical focus on play, studies on the efficacy of play interventions are rarely reported. The Denver Model (Rogers and DiLalla 1991, Rogers and Lewis 1989) features play ability as an important target for intervention with measures of play pre and post intervention. In a study of 49 children with autism, children who received the Denver model of treatment improved in their functional and symbolic play skills over 2 years (Rogers and DiLalla 1991).

Other studies of play interventions have relied on multiple baseline single subject designs. Although a number of studies have targeted teaching appropriate play skills to children with autism, these studies generally focus on children over age 5 and have as their primary goal an increase of social behaviors and decrease of inappropriate behaviors (Schreibman 1988). Rarely have children's developmental change in play skills been the target of intervention. However, Stahmer (1995) used pivotal response training techniques to teach symbolic play skills to 7 children aged 4 to 7 years of age. Comparing PRT methods for play and for language, results indicated that after PRT for play skills there was a significant increase in the amount and the complexity of symbolic play for children with autism. Another study compared teaching play skills at a child's chronological age or developmental age (Lifter et al. 1993) for 3 preschool aged children with autism. Results of this study indicated that children who were taught at the appropriate developmental play level acquired the play activities and generalized them more often than when taught play skills at their actual age level.

The foregoing studies suggest that focusing directly on play skills is most effective in changing play although one must take care that skills are not merely trained with little integration into the child's repertoire of ability. Teaching the child play skills that are at his or her developmental level may avoid the learning of play skills that are scripted or atypical in appearance. Future research should address issues of generalization to multiple partners and contexts as well as the issue of whether skills look ‘typical’ reflecting true pretending or sharing.

UCLA Study on Joint Attention and Symbolic Play

In a recent study, a randomized control design was used to compare targeted interventions of joint attention and symbolic play and a control condition (Kasari et al. in press). The goal of this study was to determine if joint attention and symbolic play skills could be taught to young children with autism and if changes in joint attention and symbolic play affected language growth over a year.

Sixty children with autism between 3 and 4 years of age were randomly assigned to a targeted joint attention intervention, a targeted play intervention or a control condition. Children met strict criteria for autism on the ADI-R and ADOS. Due to these requirements, and the fact that some children failed to finish the experiment, the final sample consisted of 20 children in the JA group, 21 in the Play group and 17 in the

control group. Children received a number of pre-treatment assessments including tests of joint attention and symbolic play, and standardized language and cognitive tests. A mother-child interaction was also collected. As a developmental framework was used in teaching children, these initial assessments yielded information about the specific targets for intervention.

All of the children who participated in this study came from the same early intervention program (EIP). The EIP was an ABA-based program that operated 6 hours per day, 5 days per week. Children often entered this program soon after a diagnosis of autism and remained for an average of 5 to 6 weeks. During this time, a standard applied behavior analysis program for children with autism was implemented with some discrete trial programming. However, neither joint attention nor symbolic play goals were targeted for intervention in this program. Moreover, the research intervention staff and the EIP staff were completely separate, and the EIP staff was blinded to the purposes of the study.

Children randomized to the joint attention or the symbolic play group were taken from the EIP individually for intervention in a separate treatment room. This generally occurred during the first thirty minutes of EIP in which parents dropped off their children and the children were left in the care of a child care worker who played with them. Thus, during the time the experimental intervention children received one on one training in joint attention or symbolic play, the control children were receiving one on one interaction with a child care worker. Intervention sessions were carried out daily for the duration of the child's stay in the EIP (generally 5-6 weeks), and each session lasted about 30 minutes. Thus, in this study, "dose" was controlled. The experimental interventions were low dose, only 30 minutes per day (2 1/2 hours per week) but the overall comprehensive intervention was high dose (30 hours per week).

Graduate students experienced in working with children with autism carried out the interventions and were randomized to treatment and to child. Both behavioral and developmental approaches were used to teach specific targeted joint attention or symbolic play skills in a small playroom near the EIP. Interventions began with determining what the child could already do, what types of skills were emerging, and what skills were absent. We based our decision to teach a particular goal on a developmental framework for how these skills emerge in typically developing children. Skills were taught one by one with mastery established before moving from one goal to the next.

In this study, our goal was not to compare methods of intervention but to use effective strategies that combined both behavioral and developmental approaches. Thus, children were taught the particular behavior using primarily a child-directed approach in which the interventionist followed and expanded the child's interests but also modeled and prompted appropriate initiations and responses. We used some discrete trials in order to "prime" the child to the behavior we were interested in having him or her learn. This combined approach resulted in children learning a particular goal (e.g., showing a toy) within just a few sessions. Children learned an average of 4 goals in the 5-6 weeks of intervention.

In order to examine the effectiveness of these tar-

geted interventions we videotaped child-experimenter sessions and coded child spontaneous initiations of the targeted behaviors. We also examined the child's interactions with other people, including their mothers and in other rooms besides our intervention room. Joint attention behaviors of interest were pointing, showing, giving to share, and coordinated joint looks. We also coded sustained efforts of joint engagement—when children engaged with others rather than alone or just with toys. Play behaviors included play types (the number of different spontaneous novel acts with a toy) and play level.

A number of significant findings emerged from this study. First, joint attention and symbolic play skills improved for children with autism within a relatively brief period of time, on average 5-6 weeks of daily intervention. On independent tests of joint attention, results indicated that children in the joint attention group demonstrated superior responding to joint attention skills and showing. During mother-child interactions, children in the joint attention group initiated more joint engagement with their mothers than did children in the other two groups. Similarly the play group showed superior symbolic play levels on both the independent test of play skills and during mother child interactions compared to both of the other groups. Thus, these results suggest that specific changes can be made in the areas targeted for intervention with young children with autism.

There are two important findings from this study that differ from previous studies. First, all of the significant findings are in *spontaneous initiations* of newly learned behaviors. Most studies of joint attention, in particular, have greater success in teaching responsiveness than in teaching initiations (Whalen and Schriebman 2003). Second, children were able to generalize the skills they learned in interaction with an expert therapist to their mothers who were not the treatment providers. Previous studies have noted problems in generalization from treatment sessions to different people and contexts (Hwang and Hughes 2000, Whalen and Schriebman 2003). In this study, when playing with their mothers, children in the joint attention intervention showed more child-initiated joint attention and children in the play intervention showed more novel types of symbolic play and increased play levels. Both treatment groups were significantly different from the control group of children, and effect sizes were large.

Summary. The results of this study suggest significant improvements in child initiations of behavior and in generalization of these behaviors beyond the treatment context. Previous studies have found both of these areas remain problematic. Thus, a question arises as to why these results are different from other studies targeting the same content (i.e., joint attention and play skills), and specifically whether dose, method, and timing played a significant role. Replications of this study are likely necessary in order to tease apart some of these issues.

These data are the first to our knowledge of a randomized design in which young children with autism both acquired and generalized skills in areas considered core deficits of the disorder. While the results of the UCLA RCT are significant, it is important to determine if these short-term gains are maintained over

time, and if they can change the course of language development.

Effect of Joint Attention on Language Development

Children with autism are seriously delayed in their development of language (Lord and Rhea 1997) and this delay is often what prompts families to seek a diagnosis. Yet language outcomes are also highly variable among children with autism. Some children develop age-appropriate language skills while others remain nonverbal. Longitudinal studies show that by the age of 10-13 years, half to about three-quarters of children with autism will develop some language (Lord and Schopler 1989, Sigman and Ruskin 1999). Given the often cited study that children who speak by the time they are 5 or 6 years of age have the best outcome (Rutter 1970), parents and professionals are understandably concerned about interventions on language development during the preschool years.

In explaining the variability in language outcome, several studies have shown that early skill in joint attention predicts later language development. Thus, in a longitudinal study of children with autism who were initially tested during the preschool years, greater responding to joint attention bids from an adult (e.g., following the direction of a point) predicted language skills 1 to 8 years later (Mundy et al. 1990, Sigman and Ruskin 1999).

In teaching joint attention skills to children with autism, then, an important question is whether changes in joint attention skills can affect children's language development. Thus, in the UCLA RCT study, joint attention, symbolic play, and language skills were reassessed in all children at 6 and 12 months post intervention. We hypothesized that positive changes in joint attention would result in positive changes in language development in children with autism at 12 months post intervention.

First, we examined whether joint attention and symbolic play gains were maintained over the 12 month period (Kasari et al. in preparation). There were some consistencies and some differences in these results. First, the gains made by children in the joint attention group continued to grow but there was less specificity. At 12 months, children in both the joint attention and play groups were superior to children in the control group on child initiated joint attention. In contrast, children in the play group continued to grow in play types and play level and were superior to both of the other groups at 12 months. Thus, these data suggest that the greatest gains were maintained for children in the play group, and both the play and joint attention groups continued to show significantly greater skill than the control group.

Language results indicate that over 12 months, the control group made approximately 7.5 months gain in expressive language skills on the Reynell Developmental Language Scales. In contrast, the joint attention and the play groups made approximately 15-17 months gain. Both experimental groups were significantly different from the control group but not different from each other.

These results suggest that both experimental groups continued to perform better than the control group in joint attention, play and language skills. One question is whether these results could be due to other interventions that children engaged in once they left the experimental intervention program. We tracked the types and amount of intervention that children engaged in once they left the EIP. Dose remained high for all of the children. The smallest dose was 20 hours per week and the greatest was 46 hours per week. Both the highest and the lowest dose were in the play group. Most children received a combination of ABA-intervention in the home and speech and occupational therapy. Somewhat surprising was that overall the control group received the greatest amount of intervention during the year, and the play group received the least amount of services. Thus, these data do not support differences in post-intervention services that might affect the results.

Summary. The results from several studies on early developmental deficits (joint attention and symbolic play) in children with autism suggest that skills can be taught to children using a variety of methods. Results appear better for responses than initiations, and generalization to non-treatment providers remains an issue. The UCLA study, using a randomized controlled design, and a combination of methods suggest that both joint attention and symbolic play skills were acquired and generalized by young children with autism. More importantly both active treatments had significant effects on language development. What will be important to determine in future studies is whether these types of interventions can be extended to interventionists who are not expert therapists (e.g., mothers or peers) and whether these types of interventions can be translated from research laboratories to real life settings (e.g., schools).

Individual characteristics affecting intervention outcome

Another consideration for future intervention studies is the effect of particular child/family characteristics on treatment success. We know that not all treatments are equally effective with all children (Kellam et al. 1994). Thus, an important issue concerns the characteristics of the parent and the child him or herself, and whether we can predict treatment success based on child or parent characteristics.

The issue of child characteristics is particularly important because autism is a spectrum disorder. Both developmentally and behaviorally, children can differ widely in their symptom presentation. However, in a review of outcome data of eight programs, none of the investigators reported whether a positive response to intervention was related to such specific child characteristics as IQ or language ability (Dawson and Osterling 1997).

Considering joint attention ability, for example, there are child characteristics that may affect treatment effectiveness. Children with autism vary in the extent to which they exhibit joint attention behavior, with higher functioning children (higher MAs) displaying more joint attention skill. For example, Mundy et al.

(1994) found that, compared to controls, children with autism with mental ages around 18 months were impaired on both low and high level joint attention behaviors (eye-contact, coordinated joint attention looks versus pointing and showing behaviors). Children with autism with mental ages around 30 months, however, were impaired only in the high-level joint attention behavior. Arnold et al. (1993) also found that 2 year old children with autism with mental ages around 18 months were much less likely to produce coordinated looks and vocalizations. Thus timing of intervention may be critical. For very young children who are not yet producing joint attention behaviors, a focus on joint attention skills may spur greater development in this area. Improvement in joint attention may then facilitate their acquisition of language.

Another consideration for children not yet producing joint attention behaviors is to focus on requesting behaviors. In typical development, joint attention and requesting behaviors emerge simultaneously. Thus a child may learn to point to request and point to share at roughly the same time. For children with autism, requesting skills appear easier to attain than joint attention skills. Thus, one approach to teaching joint attention may be to use requesting skills as a scaffold into joint attention skills.

A second characteristic that may be critical to intervention success is how much the parent (or teacher) "buys-into" the intervention approach and goals. There are many intervention options available. If parents or teachers choose their intervention approach, they may have greater investment in seeing that the intervention works. Parental or teacher belief in the intervention has not been investigated systematically, but may be an important consideration in future studies.

Finally, caregiver stress associated with child characteristics may affect treatment success. In a previous study, we found that caregivers who reported high levels of parenting stress associated with child characteristics were less engaged in interactions with their children with autism (Kasari and Sigman 1997). Moreover, implementing an intervention with their child has the potential to either add to parental burden or to lessen that burden. Thus, future studies should be mindful of the parenting burden or stress that may be associated with particular interventions.

There are many other child and caregiver characteristics that may affect treatment. Future studies will need to systematically assess these characteristics in order to determine the best fit between family, child and treatment approach.

Summary. Early intervention efforts with children with autism are beginning to focus on active ingredients. Dose appears to be important with higher doses of intervention leading to better outcomes (Sheinkopf and Siegel 1998, Lovaas 1987). Intervention approach seems effective for about half of all children treated regardless of type of approach (Dawson and Osterling 1997, Rogers 1998); however studies employing applied behavior analysis procedures dominate this literature. Studies have not systematically tested differences in approach. Recent evidence suggests that focusing on core deficits in young children with autism, specifically joint attention and symbolic play can be

effective (Whalen and Schreibman 2003, Kasari et al. in press). More importantly, changing core deficits may be important for changing developmental outcome (e.g., language) (Kasari et al. in preparation). Although these results are promising we need greater information on aptitude by treatment interactions in order to answer questions about who benefits from what types of interventions and when. Future studies are needed that further examine active ingredients of early intervention for young children with autism using scientifically rigorous methodologies.

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