Early Social Interaction Project for Children With Autism Spectrum Disorders Beginning in the Second Year of Life:

A Preliminary Study

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The Early Social Interaction (ESI) Project (Woods & Wetherby, 2003) was designed to apply the recommendations of the National Research Council (2001) to toddlers with autism spectrum disorders (ASD) by using a parent-implemented intervention that (a) embeds naturalistic teaching strategies in everyday routines and (b) is compatible with the mandate of the Individuals with Disabilities Education Improvement Act (IDEIA) of 2004, Part C. This quasi-experimental study is a preliminary effort by the authors to evaluate the effects of ESI on the social communication outcomes for a group of 17 children with ASD who entered ESI at age 2 years. The results indicated significant improvement on 11 of 13 social communication measures. The researchers compared the ESI group with a contrast group of 18 children with ASD who entered early intervention at age 3 years. The contrast group's results were comparable to those of the ESI postintervention group on communicative means and play, but the contrast group as a whole demonstrated significantly poorer performance on all other social communication measures. These findings offer promise for the use of parent-implemented interventions in promoting social communication for toddlers with ASD.

Mounting evidence now exists in regards to the effectiveness of intensive early interventions for a substantial proportion of young children with autism spectrum disorders (ASD; Dawson & Osterling, 1997; National Research Council [NRC], 2001). Furthermore, researchers have suggested that the age of entry into intervention is predictive of outcome. Children with ASD who participated in intensive interventions by 3.5 years of age had significantly better outcomes than their peers with ASD who received such interventions after age 5 (Fenske, Zalenski, Krantz, & McClannahan, 1985; Harris & Handleman, 2000). These findings support the importance of early identification and intervention in improving outcomes.

Effectiveness of Early Intervention for Young Children With ASD

The National Research Council (2001) conducted a systematic, thorough review of research on educational interventions for children with ASD from birth through age 8 years and concluded that a large body of research indicated significant progress in response to intervention for a substantial proportion of those children. Although the studies the NRC reviewed reflected a range of teaching techniques, the council concluded that a convergence of evidence identifies the following characteristics as essential active ingredients of effective interventions for children with ASD:

1. entry into intervention programs as soon as ASD is suspected;
2. active engagement in intensive instructional programming for a minimum of 5 hours per day, 5 days a week;
3. use of planned teaching opportunities that are structured over brief periods of time and repeated systematically;
4. sufficient individualized adult attention on a daily basis;

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5. inclusion of a family component, including parent training;
6. mechanisms for ongoing assessment and program evaluation, with corresponding adjustments in programming; and
7. priority given to instruction on (a) functional, spontaneous communication, (b) social instruction in various settings, (c) play skills that focus on play with peers and peer interaction, (d) new skill acquisition, generalization, and maintenance in natural contexts, (e) functional assessment and positive behavior support to address problem behaviors, and (f) functional academic skills, when appropriate.

Research conducted over the past 2 decades has identified core deficits in joint attention, shared affect, and conventional and symbolic aspects of communication and play in young children with ASD. It has also shown that these deficits are significant predictors of developmental outcomes (Mundy, Sigman, & Kasari, 1990; Sigman & Ruskin, 1999; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Wetherby, Prizant, & Hutchinson, 1998; Wetherby, Watt, Morgan, & Shumway, in press; Wetherby et al., 2004). These skills thus are important intervention outcome measures for children with ASD. Although a large number of studies have delineated core social communication deficits associated with ASD, very few of them have documented the effects of interventions on these deficits (NRC, 2001). In a multiple-baseline-design study involving four participants with ASD, Whalen and Schreibman (2003) demonstrated that changes in initiating and responding to joint attention can be systematically taught using pivotal response training. In a randomized-group-design study, Aldred, Green, and Adams (2004) implemented a monthly parent-training program for 14 preschool children in their treatment group and compared the outcomes to those for 14 children in a community-treatment control group. Aldred et al. found significantly lower scores on the *Autism Diagnostic Observation Schedule* (ADOS; Lord, Rutter, DiLavore, & Risi, 1999) scores, which indicated that there were fewer autism symptoms in the treatment group, and significantly better outcomes regarding parental positive synchronous communication and rate of child communicative acts; however, they found no significant difference between the two groups in the number of episodes in which the parent and child shared attentional focus. Aldred et al.'s results suggest that significant gains in some aspects of social communication can be achieved by teaching parents how to enhance their children's communication in a cost-effective treatment, but gains in joint attention may require a more intensive or different approach to intervention.

Meaningful changes that reflect core social communication deficits in children with ASD still need to be documented. The current research literature has indicated that researchers need to measure multiple aspects of social communication to better characterize this population and develop possible treatment outcomes. Even studies of the most effective treatments for children with ASD have shown variable outcomes (NRC, 2001), and a child's social communication skills before treatment may influence the response to treatment. Little is known about the potential impact of interventions that target the social communication skills of children with ASD younger than 3 years of age.

The vast majority of studies reviewed by the NRC (2001) included children from 3 to 5 years of age. Very limited research is available on children with ASD under age 3 years, primarily because the average age of diagnosis for autistic disorder is 3.1 years and for ASD is 3.9 years (Mandell, Novak, & Zubritsky, 2005). The results from two studies support the application of the NRC recommended practices for younger children. McGee, Morrier, and Daly (1999) reported on the outcomes for 28 toddlers with ASD who entered a center-based incidental teaching program at an average age of 2 years 5 months. The percentage of children who were verbal increased from 36% at program entry to 82% at program exit (mean age = 3 years 6 mos). Although these results are promising, the lack of a control group does not allow us to differentiate treatment effects from maturation and other confounding variables or to determine whether this sample of children with ASD is representative of the population as a whole. In a descriptive study of 35 toddlers with ASD, Stone and Yoder (2001) found a strong, positive association between the number of hours of speech therapy received between the ages of 2 and 3 years and language skills at age 4 years. These intervention findings suggest that beginning an intervention before 3 years of age may have a greater impact than beginning it at a later age. Advances in earlier screening and diagnosis add to the pressing need to develop early intervention programs that are (a) appropriate and effective for very young children with ASD and (b) consistent with the requirements of the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA), Part C, which address the provision of services within natural environments.

Intervention Implementation in the Natural Environment

Earlier identification of and intervention for children of families who are seeking assistance through the public sector necessitates the provision of services within the "natural environment," as defined by the IDEA (Walsh,

Rous, & Lutzer, 2000). Interventions in the natural environment are approaches that maximize teaching and learning throughout the day by using routines, materials, and people familiar to the family members and the child (Dunst, Hamby, Trivette, Raab, & Bruder, 2000; Woods, Cripe, & Venn, 1997). Service providers support the caregivers' use of naturalistic teaching strategies with the child while undertaking their chosen activities, events, and chores of daily life. For example, a parent who identifies playing ball as a preferred routine would embed practice of his or her son's social communication goals by placing a ball on a shelf out of reach and waiting for the child to look at or reach toward the ball. The parent would model the word *ball*, wait for the child to repeat the word, and then take a turn throwing the ball and asking the child to throw it back, labeling it again while catching it.

The basic tenets of intervention in natural environments reflect many of the active ingredients of the NRC (2001) recommendations including the following:

1. children learn functional and meaningful skills;
2. learning occurs within daily caregiving, play, and social interactions with caregivers that are repeated throughout the day; and
3. caregivers mediate the teaching and learning process for the child as it occurs.

Recommended practice includes individualized, systematic embedding of intervention strategies by caregivers within their typical daily routines and promotes participation, learning, and generalization of skills for the child (Sandall, Hemmeter, Smith, & McLean, 2005). This philosophy is compatible with many of the contemporary behavioral and developmental approaches used for children with ASD (Dunlap & Fox, 1999; McGee et al., 1999; Prizant & Wetherby, 2005; Schwartz, Sandall, McBride, & Boulware, 2004) but is difficult to reconcile with more traditional discrete trial interventions (Lovaas, 1987; Smith, Buch, & Gamby, 2000).

Intensity is an essential consideration for families and service providers of children with ASD as they initiate the implementation of interventions within natural environments. Services delivered by professionals in the early intervention system average 2 to 3 hrs per week (Scarborough et al., 2004), which is far below the intensity level recommended by the NRC. Furthermore, children with ASD who participate in settings and activities with other children should not be expected to learn simply by being there. Inclusive opportunities must also contain adequate support for the child to learn from engagement with the materials, activities, other children, and caregivers in the environment (Strain, McGee, & Kohler, 2001). Providing adequate, meaningful opportunities within their daily routines and activities without systematic planning is very challenging for family members and service providers. The use of multiple daily routines that occur frequently, however, helps increase the amount of intervention time across the day and can include multiple caregivers as social communication partners to enhance the generalization of learning.

Although research has established the effectiveness of parent-implemented interventions for children with a variety of developmental disabilities, only a small number of these studies have included children with ASD (e.g., Girolametto, 1988; Kaiser, Hancock, & Nietfeld, 2000; Kashinath, Woods, & Goldstein, in press; Koegel, Bimbela, & Schreibman, 1996; Smith et al., 2000; Woods, Kashinath, & Goldstein, 2004). Parents can learn specific intervention techniques, such as modeling, shaping, prompting, reinforcing, and fading, to teach specific language forms and functions to their children (Charlop & Walsh, 1986), as well as "packaged" strategies, such as incidental teaching or pivotal response training, that promote communication (Kaiser et al., 2000; Koegel et al., 1996; Mahoney & Perales, 2005). Positive child outcomes subsequent to parent-implemented intervention have also been documented (e.g., Kaiser et al., 2000; Koegel et al., 1996; Laski, Charlop, & Schreibman, 1988). Parental use of intervention strategies has promoted positive change in a variety of child outcomes, such as an increased frequency of verbalizations and spontaneous speech (Laski et al., 1988), an increased use of target utterances (Kaiser et al., 2000), an increased percentage of engagement and responsivity in target tasks, and a decreased frequency of disruptive behaviors (Koegel et al., 1996).

Although researchers have found multiple positive outcomes for children with ASD as a result of parent interventions, little is known about the long-term impact on either the child or the parent. Nevertheless, recent research has shown the importance of teaching responsiveness to parents. In a longitudinal, descriptive study of 25 children with ASD, Siller and Sigman (2002) found that children (mean age = 50 months) whose parents showed higher levels of synchronization, defined as following the child's focus of attention and toy engagement, during initial play samples developed better joint attention skills 1 year later and better language outcomes 10 and 16 years later, compared with children of parents who showed lower levels of synchronization initially. The strongest predictor of the child's increase in initiating joint attention was the parent's initiation of joint attention that was synchronized to the child's attentional focus. The strongest predictor of gain in language was parent utterances that followed the child's attentional focus and allowed the child to continue the ongoing toy engagement.

Early Social Interaction Project

The Early Social Interaction (ESI) Project is an intervention program for toddlers who are at risk for ASD and their families. It was developed as a model demonstration project funded by the Office of Special Education Programs of the U.S. Department of Education. The program designers incorporated the NRC (2001) recommendations within the context of a family-centered, natural-environments approach, which is considered recommended practice for delivery of IDEA Part C services and supports (Sandall et al., 2005). The following major components of ESI (Woods & Wetherby, 2003) were relevant to this preliminary study:

1. *Routines-Based Intervention in Natural Environments:* The provision of support and intervention occurs in the natural environments of the child and family to enhance the child's participation in everyday routines and the family's participation in community activities. Each family identifies routines and activities important to them and their children that will become the context for the intervention. ESI occurs in the home and in a community-based, parent–child playgroup.
2. *Individualized Curriculum:* The curriculum is developed around the child's unique profile. A developmental framework that targets social interaction, joint attention, communication, imitation, play, and emotional regulation guides the individualized process (Prizant, Wetherby, & Rydell, 2000). The service provider and family members complete curriculum-based assessments to establish specific goals for the child. The goals are reviewed for progress and revised when accomplished.
3. *Parent-Implemented Intervention:* Interventionists teach families to create learning opportunities and use specific intervention strategies to encourage practice of the child's goals within daily routines. Collaborative problem solving and consistent planning by the service provider and family members allow the family members to take advantage of numerous teaching opportunities throughout the day and to feel confident about their abilities to engage the child in meaningful activities and to facilitate social communication skills.

The following example illustrates an intervention that contains these components: Joshua, age 20 months, is not yet using words but is beginning to use intentional communication. His gestures consist of giving, reaching, and leading others by the hand. He rarely directs his gaze to others, he smiles but does not share positive affect, and his rate of communication is very low. If he is not redirected, Joshua will spend much of his time pacing or rolling objects. Joshua's family identified favorite play routines as listening to music in the family room and in the car, swinging, and collecting and dropping small objects. Although Joshua does not participate in many family or caregiving routines, he does request cereal and juice and is comforted by rocking in his rocking chair or watching videos. He gets very distressed when an object is removed or when activities cease. Initial goals for Joshua are to shift his gaze between people and objects, to request comfort when distressed, to display positive affect, to use a vocalization to gain attention, to imitate familiar actions in a turn-taking sequence, to use familiar objects functionally, and to make choices with gestures. Using a family-centered, natural-environment approach to early intervention, the family members and service provider(s) will discuss how Joshua's social communication goals will be practiced within the routines as they occur throughout the day and what the parents will do to support Joshua's communicative development. In this example, the parents learn how to use positioning to support Joshua's participation; make activities predictable with balanced turns; respond to Joshua's gestural, vocal, and facial signals to request and to stop interactions; and wait for Joshua to take a turn or communicate a choice. Intervention strategies are embedded in cereal and drink routines in which he is given a choice of juice or water or of a type of cereal at breakfast and is given smaller portions so that he must vocalize to request more. Joshua's father is usually responsible for breakfast while the mother drives older siblings to school. The father pulls up his chair to face Joshua in his high chair, watches for Joshua to make his initial drink request, offers him the choices, and models the label of the choice that he makes (i.e., apple juice). He takes a turn drinking his coffee after Joshua takes a drink, again watches for Joshua, and responds. The process of embedding goals occurs within each routine, as appropriate, and is jointly planned by the family members and service provider(s).

The purpose of our preliminary study on ESI was to evaluate the effects of an ESI parent-implemented intervention on social communication outcomes for a group of parent–toddler dyads. We developed two research questions:

1. Would we find differences in social communication measures between preintervention and postintervention for a group of children with ASD who entered ESI in the second year of life and participated in ESI for a year?

2. Would there be differences in the measures of social communication and language stage between the group of children who participated in ESI and a contrast group of children who entered the early intervention system at age 3 years?

Method

Participant Recruitment

Seventeen children and their families participated in ESI and formed the ESI group. We recruited these children from the ongoing longitudinal, prospective study of the FIRST WORDS® Project, which screens a general population sample of children under age 2 years to identify children at risk for ASD and other communication problems (see Wetherby et al., 2004). Project researchers use the *Communication and Symbolic Behavior Scales Developmental Profile* (CSBS DP; Wetherby & Prizant, 2002). Children in the ESI group met the following selection criteria:

1. a CSBS DP behavior sample was first videotaped when the child was between 12 and 24 months of age and again when the child was between 25 and 36 months of age and had participated in ESI for 12 months;
2. During the first behavior sample, the *Systematic Observation of Red Flags of ASD* (SORF; Wetherby et al., 2004) indicated significant red flags for ASD for that child, and he or she received a provisional clinical diagnosis of ASD;
3. when the child was 24 months old or younger, the family agreed to participate in ESI for a period of at least 12 months; and
4. the family agreed to participate in a diagnostic evaluation when the child was 36 months old.

We selected 18 children as the members of a third-year contrast group. These children ranged in age from 25 to 36 months of age and were recruited when they were first referred to community agencies serving children with developmental delays because they were suspected of having ASD. The contrast group children met the following selection criteria:

1. a CSBS DP behavior sample was first videotaped when the child was between 25 and 36 months old;
2. the child and family had not received any formal intervention services before the behavior sample was videotaped;
3. the child was suspected of having ASD; and
4. the family agreed to participate in a diagnostic evaluation when the child was 36 months old.

When they were 36 months old, all of the children in both groups received a diagnostic evaluation completed by an interdisciplinary team consisting of a licensed speech–language pathologist and a psychologist who were naive to the child's group assignment. The team used the following measures:

1. the *Mullen Scales of Early Learning* (MSEL; Mullen, 1995), to determine nonverbal and verbal developmental level;
2. the *Vineland Adaptive Behavior Scales, Interview Edition, Survey Form* (VABS; Sparrow, Balla, & Cicchetti, 1984), to provide an index of adaptive behavior; and
3. the ADOS, which is a semistructured, standardized assessment of communication, social interaction, and play or imaginative use of materials and is a validated diagnostic tool for ASD in children 2 years of age or older.

Based on the information gathered from the diagnostic evaluation, the team made a *best estimate diagnosis* using the diagnostic criteria for Autistic Disorder or Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS) as defined in the fourth edition, text revision, of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV-TR;* American Psychiatric Association, 2000). We use the term *best estimate diagnosis* here because the clinicians could make a judgment about how to put the information together to make a diagnosis. The team either did not make a diagnosis of Asperger syndrome or ruled it out due to the young age of these children. Children who received a diagnosis of Autistic Disorder or PDD-NOS and whose Communication and Social Interaction total score on the ADOS fell at or above the cutoff for autism spectrum was included in our study. The ADOS could not be completed for one child because his family lived at a distance and could not return for the follow-up evaluation. Because this child had been given a diagnosis of autism at 36 months of age by a pediatric neurologist and had qualified for special education in the public schools, we included him in the study.

A total of 35 children participated in this study. A timetable with the ages of the children in each group at the time of the behavior samples and the follow-up diagnostic evaluations is provided in Table 1. For the ESI group, we videotaped two behavior samples, a pre-ESI sample in the second year (M = 18.19 months, SD = 3.85) and a post-ESI sample in the third year (M = 30.72 months, SD =

3.66). For the third-year contrast group, we videotaped one behavior sample in the third year as soon as the child was recruited (M = 31.61 months, SD = 3.45). We found no statistically significant group differences in age at the third-year behavior samples or at the diagnostic evaluations for the post-ESI group and the third-year contrast group.

Research Design

In this study, we used a quasi-experimental, one-group, pretest–posttest design (Shadish, Cook, & Campbell, 2002). We analyzed changes in pre- and postintervention measures of social communication and, in an effort to strengthen this design, also studied a no-treatment contrast group. We collected social communication measures from the contrast group at the same age as the treatment group at posttest and compared the results with those for the treatment group. The contrast group thus provides some information about the possible effects of maturation without treatment. Pretest measures were not available for the contrast group, however, because these children were not identified at an earlier age; therefore, we could not determine whether the groups were comparable at pretest.

Participant Demographic and Developmental Characteristics

A summary of participant demographics is presented in Table 2. Mervis and Klein-Tasman (2004) suggested that a probability value greater than .50 on tests of group differences indicates that groups are well-matched on a variable and that a probability value less than .20 indicates that groups are not matched on the variable. Based on these criteria, the groups were well-matched on mother's education and age and on the Hollingshead Index (Hollingshead, 1976), suggesting that the groups were comparable on socioeconomic status (SES). The groups were similar in terms of the percentage of boys and percentage of firstborn children. The groups were also similar in regards to the percentages of Caucasian and African American children, but the ESI group had slightly more Hispanic children and the third-year contrast group had more Asian children. The two groups thus were fairly similar with regard to most demographic aspects.

A summary of participant developmental characteristics at the time of the follow-up diagnostic evaluations at 3 years of age is presented in Table 3. Based on the Mervis and Klein-Tasman (2004) criteria, the groups were not matched on these developmental characteristics. The ESI group had significantly higher scores in regards to most aspects of developmental level.

Intervention Procedures

Interventionists consisted of five research assistants—four certified as speech–language pathologists and one early childhood education specialist. All five were experienced in early intervention with young children with ASD and their families, approved for Part C service delivery in Florida, and trained specifically to implement the parent intervention described. Each interventionist had a minimum of 3 years' experience (range = 3–20 years) in early intervention with children and families in home- and center-based models.

ESI is a parent-implemented intervention model designed to individualize social communication goals and monitor child progress, to identify family routines for targeted goals, to teach parents to implement teaching strategies within selected everyday routines, and to support family implementation of intervention. The role of the interventionists in this study was to teach parents to use a variety of intervention strategies within daily routines to increase opportunities to practice the social communication goals that were functional, predictable, and meaningful for the child and that were likely to occur throughout the day. The interventionists also provided information to address family concerns, such as challenging behaviors or family acceptance of the diagnosis of autism.

Intervention sessions were scheduled to accommodate family preferences, child attention, work/school schedules, and specific routines (e.g., dressing, snack and

TABLE 1. Timetable of Age in Months at Each Measure for the ESI and Third-Year Contrast Groups

	ESI group[a]				3rd-year contrast group[b]				
	Pre-ESI		Post-ESI				ANOVA comparison		
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*	*d*
CSBS DP behavior sample	18.19	3.85	30.72	3.66	31.61	3.45	0.55	.463	0.25
Diagnostic evaluation			36.67	6.94	38.27	9.38	0.33	.569	–0.20

Note. ESI = Early Social Interaction Project; CSBS DP = *Communication and Symbolic Behavior Scales Developmental Profile* (Wetherby & Prizant, 2002); F and p values are based on one-way ANOVA comparing ESI group post-ESI and third-year contrast group; Cohen's d is a measure of effect size.
[a]n = 17. [b]n = 18.

TABLE 2. Demographic Characteristics of the ESI and Third-Year Contrast Groups, With Definition and Range of Scores for Social Communication Measures

Child characteristic	ESI group[a]	3rd-year contrast group[b]	*F*	*p*	*d*
Boys (%)	88	78			
First born (%)	41	44			
Racial/ethnic group (%)					
Caucasian	65	61			
African American	12	17			
Hispanic	24	6			
Asian	0	17			
Parent's education (yrs.)					
Mother					
M	15.7	15.53	0.00	.949	0.10
SD	1.93	1.63			
Father					
M	16.35	15.41	0.64	.429	0.38
SD	2.50	2.40			
Parent's age at child's birth					
Mother					
M	31.55	30.17	0.05	.821	0.28
SD	3.44	6.26			
Father					
M	33.26	34.04	0.71	.410	–0.13
SD	3.87	8.48			
Hollinghead's Index of SES (1976)					
M	53.00	52.94	0.00	.987	0.01
SD	10.42	10.33			

Note. ESI = Early Social Interaction Project; *F* and *p* values are based on one-way ANOVA comparing ESI group post-ESI and third-year contrast group; Cohen's *d* is a measure of effect size.
[a]*n* = 17. [b]*n* = 18.

TABLE 3. Summary of Developmental Characteristics at the Diagnostic Evaluation at 3 Years of Age

	ESI group[a]		3rd-year contrast group[b]		ANOVA comparison		
Characteristic	*M*	*SD*	*M*	*SD*	*F*	*p*	*d*
Mullen Scales of Early Learning (1995)[c]							
Nonverbal DQ	81.98	23.93	64.23	17.74	6.16	.019	0.85
Verbal DQ	73.55	26.16	56.07	24.96	4.08	.052	0.68
Vineland Adaptive Behavior Scales (Sparrow et al., 1984)[d]							
Communication	77.06	19.76	62.76	16.91	5.14	.030	0.78
Daily living	75.88	10.51	65.88	19.53	3.46	.075	0.67
Social	77.06	16.35	64.41	18.99	4.33	.046	0.72
Motor	83.76	14.32	71.88	21.45	3.61	.068	0.66
Adaptive behavior composite	73.82	14.73	64.71	7.20	5.26	.031	0.83

Note. ESI = Early Social Interaction Project; *F* and *p* values are based on one-way ANOVA comparing ESI group post-ESI and third-year contrast group; Cohen's *d* is a measure of effect size.
[a]*n* = 17. [b]*n* = 18. [c]Developmental quotients (DQ) based on age equivalent divided by chronological age multiplied by 100. [d]Standard scores based on a mean of 100 and a standard deviation of 15.

meals, outdoor play, games, and songs) identified for intervention. We recommended two home visits per week to facilitate parent implementation and to monitor child progress. The number of home visits accomplished during a child's year of intervention varied, primarily due to family circumstances (e.g., birth of new siblings, vacations, family illnesses). The interventionists offered make-up sessions to maintain intensity. They conducted the interventions throughout the family's home and yard, with the specific locations based on the specific goals to be addressed and the family's choice of daily routines. The interventionists frequently followed the child and parent to encourage participation in a variety and sequence of routines and activities as they occurred. The interventionists used the strategy of joining the child and family in multiple routines and activities in their sequence of occurrence to increase the number of routines with embedded intervention and to promote generalization for the parents.

A key component of ESI was the selection of routines that were preferred by the family, occurred at a high frequency, were motivating to child and parent, and included multiple opportunities to embed social communication outcomes as a method of increasing sufficiency of practice. Once the interventionists had identified routines, they used objects, equipment, and materials that typically belonged to the routine and its particular context. For example, indoor play routines included the child's favorite toys, music, or constructive materials, whereas outdoor play materials consisted of the child's ball, swingset, or scooter. The interventionists ensured that the materials the child and family typically used were included in the routines.

Another key ingredient was the careful selection of social communication goals. Goals were identified as priorities for the parent, were developmentally appropriate for the child, and had been marked as early red flags of ASD. The interventionist systematically introduced each parent to evidence-based, naturalistic teaching strategies that were appropriate for the child's identified social communication goals. We selected naturalistic intervention strategies to improve the parent's ability to encourage the child to initiate social communication and follow the child's attentional focus. These strategies included environmental arrangement, waiting, use of natural reinforcers, balanced turn-taking, modeling, contingent imitation, requesting imitation, and time delay (Hepting & Goldstein, 1996). The strategies were individualized based on the parent's observed skill level, evidence that the strategy use would be appropriate to influence their child's communication goals, and parent indication that the strategy could be implemented multiple times within routines (Kashinath et al., in press).

We individualized the methods for teaching parents to embed interventions within their routines to accommodate the interventionists' and parents' preferred teaching and learning styles, respectively. Parents could choose from easy-to-read handouts, videos, or demonstrations of specific strategies and examples of their use in family-identified routines. Interventionists either modeled the strategies within the routines and provided opportunities for parents to ask clarifying questions or provided opportunities for guided practice in which the parent implemented the intervention and the interventionist observed and supported the parent as needed. Parents and interventionists met to discuss strategy use and possible barriers to implementation and to identify additional instances of potential strategy use across routines. The parents had opportunities to determine the easiest-to-use methods of collecting data on the child's goals and their implementation of the strategies within routines. We solicited parent input regarding types of methods for parent teaching to increase the parents' satisfaction and ownership of the intervention. Each week, the interventionists observed the parents' implementing the intervention within the routines selected. If the parent did not embed the goal or use the intervention strategy, the interventionist would model and review the training and problem solve about what was working and what was challenging for the parent.

We monitored treatment fidelity through the completion of a self-assessment checklist to ensure that each home visit included the following components:

- initial review of child and family outcomes and intervention intensity since the previous visit;
- observation of and participation by the parent in multiple routines;
- guided practice in implementing the intervention for specific goals within the routines;
- discussion of what, when, how often, and where the interventions would occur between visits; and
- development of a plan for the next visit.

In addition to the home-based sessions, each child participated in a parent–child playgroup guided by two interventionists through the FIRST WORDS® Project for up to 12 parent–child dyads, with a blend of children with typical development and children with developmental delays. The children in the playgroups ranged in age from 18 months to 27 months. Each parent–child dyad attended the playgroups for 9 weeks during the year that they participated in ESI. The playgroups were held in a 600-square-foot room organized into play centers: music circle, books, dress up, doctor's office, baby washing, baby beds, blocks, trucks, toys, kitchen and feeding area, and fluid play activities. Each playgroup was organized around predictable opening and closing songs, book

times, and new play centers each week. The interventionists provided information and a handout about specific weekly topics. In addition to the weekly topics, the families had opportunities to focus on interacting with their child, to support peer interaction with other participants, and to receive feedback on their strategy use. The interventionists provided information to the families through discussion and handouts, responses to questions, modeling, and individual coaching by setting up opportunities and making suggestions. The topics included how and why young children communicate, responding to your child's communication, daily routines and games, games for young children, learning through the senses, sharing books with your child, communication and behavior in toddlers, and social interaction and play with peers. The playgroups offered the families opportunities to observe their child in a group with same-age peers and to network with other parents of children with and without ASD, which may be helpful to parents in adjusting to the realization that their child has ASD.

Child Measures of Social Communication

We used standard sampling procedures (Wetherby & Prizant, 2002) to derive measures of the child's use of social communication from the CSBS DP behavior sample. A parent was present during the full evaluation and was instructed to respond naturally but not to direct the child's behavior, to encourage spontaneous communication and play. The evaluation session began with a warm-up of about 10 min and lasted 30 to 40 min. The interventionist first presented the child with a series of communicative temptations (a windup toy, a balloon, bubbles, a jar with food, a bag with toys, and books designed for young children) to entice spontaneous communication and then gave the child a feeding toy set and stuffed animal for symbolic play and blocks for constructive play. The sample consisted of six activities during which the interventionist rated the child's skills, and also included probes of gaze/point follow and comprehension of object names, person names, and body parts that were interspersed between activities. One of four trained examiners who were blind to the child's diagnosis videotaped the behavior sample and scored it by using the standard CSBS DP procedures. Information about the reliability and validity of the CSBS DP has been reported in Wetherby, Allen, Cleary, Kublin, and Goldstein (2002); Wetherby, Goldstein, Cleary, Allen, and Kublin (2003); and Wetherby and Prizant (2002).

For this study, we examined individually the raw scores for individual items of the behavior sample to study five constructs of social communication measured with the CSBS DP, which are defined in Table 4, along with the range of possible scores for each measure.

Child Measure of Language Stage

We used the CSBS DP behavior sample criteria for language stage established by Wetherby and Prizant (2003) to determine the child's language stage at the time of each behavior sample, based on expressive language used. Those criteria were as follows: *Preverbal*—0 or 1 word; *Early one-word stage*—2 to 5 different words; *Late one-word stage*—6 to 9 different words; *Multiword stage*—10 or more different words and 2 or more different word combinations.

Interrater Reliability

We calculated interrater reliability for the CSBS DP behavior sample by using generalizability (*g*) coefficients for pairs of four independent raters on randomly selected videotapes of the behavior sample for at least 20% of the samples scored by each rater. A *g* coefficient approaches 1 as the variance accounted for by the participants is larger in comparison with the variance accounted for by raters. *G* coefficients that are at least .60 are considered acceptable for demonstrating interrater reliability (Mitchell, 1979). Rater 1 scored the largest number of samples and therefore was considered the expert to which the other raters were compared. The *g* coefficients for the social communication measures ranged from 0.76 to 1.00, with an average of 0.90 for Raters 2 and 3 and 0.92 for Rater 4, indicating that the raters exhibited high interrater reliability.

Results

Within-Group Differences in Measures of Social Communication

Our first research question was whether there were differences in measures of social communication from pre- to postintervention in the ESI group. Descriptive statistics on each of the social communication measures from the behavior samples collected for the ESI group at pre- and postintervention are presented in Table 5. We conducted a series of repeated-measures analyses of variance (ANOVAs) to evaluate within-group differences from pretest to posttest. We calculated Cohen's *d* statistic as the effect size index by dividing the mean of the paired differences by the average of the standard deviations for the pre- and postintervention measures. The results are presented in the far right column of Table 5. Regardless of sign, *d* values of .2, .5, and .8 represent small, medium, and large effect sizes, respectively (Cohen, 1988). We found significant within-group differences with large effect sizes from pretest to posttest for 11 of the 13 social communication measures. Two social communication measures—gaze shifts and shared positive affect—showed

TABLE 4. Definition and Range of Scores for Each Social Communication Measure

Social communication measure	Definition adapted from Wetherby & Prizant (2002)	Range
Social signals		
Gaze shifts	Social referencing defined as a 3-point alternating gaze shift between a person and an object	0–6
Shared positive affect	Clear facial expression of pleasure or excitement that is directed with gaze to another person	0–6
Gaze/point follow	Ability to follow another person's gaze and point at a distance (also referred to as *responding to joint attention*)	0–2
Rate of communicating	The child's rate of vocal or gestural communicative signals that serve a communicative function	0–18
Communicative functions		
Behavior regulation	Vocal or gestural communicative signals to regulate another person's behavior to request or protest an object or action	0–6
Social interaction	Vocal or gestural communicative signals to draw another person's attention to oneself to get the other person to look at, notice, or comfort him or her	0–6
Joint attention	Vocal or gestural communicative signals to direct another person's attention to an object or event to get the other person to look at or notice something of interest	0–6
Communicative means		
Inventory of gestures	Number of different conventional gestures (e.g., give, show, point, reach, wave) used	0–8
Inventory of consonants	Number of different consonants (e.g., b, d, g, m, n) used	0–10
Inventory of words	Number of different words used referentially and that approximate conventional words, spoken or signed	0–16
Symbolic capacity		
Understanding	Ability to understand object names, person names, and body parts without gestural cues	0–8
Inventory of actions	Number of different conventional actions with objects used	0–12
Actions to other	Number of pretend actions with objects toward other	0–6

differences with moderate effect sizes, which were nonsignificant trends.

Across-Group Differences in Measures of Social Communication

The second research question was whether there were group differences in measures of social communication between the ESI group post-ESI and the third-year contrast group. A group comparison of the social communication measures is presented in Table 6. We conducted a series of univariate ANOVAs, using a Welch correction for lack of homogeneous variances, to evaluate group differences. The ESI group had significantly better performance with large effect sizes on the three measures of social signals, rate of communicating, the three measures of communicative functions, and understanding. We did not find any statistically significant differences on the three measures of communicative means and both measures of play.

The third research question was whether there were group differences in measures of social communication between the ESI group pre-ESI and the third-year contrast group. A comparison of the social communication measures for the ESI group pre-ESI and the third-year contrast group are presented in Table 7. We conducted a series of univariate ANOVAs, using a Welch correction for lack of homogeneous variances, to evaluate group differences. The third-year contrast group had significantly better performance, with moderate to large effect sizes on all three of the measures of communicative means and on actions to others in play. We did not find any statistically significant differences between the third-year contrast group and ESI group pre-ESI on the three measures of social signals, rate of communicating, the three measures of communicative functions, understanding, and inventory of actions.

Differences on Language Stage

The last research question was whether there were within- and across-group differences on the measure of language stage. The number and percentage of children

TABLE 5. Social Communication Measures for the ESI Group Pre- and Post-ESI

Measure	Pre-ESI		Post-ESI		ANOVA comparison[a]		
	M	*SD*	*M*	*SD*	*F*	*p*	*d*
Chronological age (in mos.)	18.19	3.85	30.72	3.66			
Social signals							
Gaze shifts	4.18	1.67	5.18	1.51	3.24	.091	0.63
Shared positive affect	1.88	1.83	3.41	2.00	4.35	.053	0.80
Gaze/point follow	0.35	0.61	1.29	0.85	11.51	.004	1.29
Rate of communicating	8.71	5.36	16.18	2.56	24.88	< .001	1.89
Communicative functions							
Behavior regulation	3.59	2.12	5.53	0.63	12.98	.002	1.41
Social interaction	0.65	0.93	2.29	1.86	14.22	.002	1.18
Joint attention	0.65	0.93	2.94	2.16	18.00	.001	1.48
Communicative means							
Inventory of gestures	1.76	1.15	3.76	1.68	15.54	.001	1.41
Inventory of consonants	1.00	1.37	4.71	2.69	32.90	< .001	1.83
Inventory of words	0.18	0.53	6.00	5.18	21.23	< .001	2.04
Symbolic capacity							
Understanding	0.82	1.38	4.24	3.29	22.92	< .001	1.46
Inventory of actions	3.88	2.00	6.18	2.90	8.16	.011	0.94
Actions to others	0.53	0.80	2.82	1.70	32.89	< .001	1.83

Note. ESI = Early Social Interaction Project; *F* and *p* values are based on repeated-measures ANOVA comparing pre-ESI and post-ESI; Cohen's *d* is a measure of effect size.
[a]$n = 17$.

TABLE 6. Social Communication Measures for the ESI Group Post-ESI and the Third-Year Contrast Group

Measure	Post-ESI group[a]		3rd-year contrast group[b]		ANOVA comparison		
	M	*SD*	*M*	*SD*	*F*	*p*	*d*
Child chronological age (in mos.)	30.72	3.66	31.61	3.45			
Social signals							
Gaze shifts	5.18	1.51	3.28	1.71	12.17	.001	1.18
Shared positive affect	3.41	2.00	1.31	1.38	9.50	.005	1.24
Gaze/point follow	1.29	0.85	0.61	0.70	6.72	.014	0.88
Rate of communicating	16.18	2.56	11.94	5.51	8.64	.007	1.05
Communicative functions							
Behavior regulation	5.53	0.63	4.11	1.81	9.80	.005	1.16
Social interaction	2.29	1.86	0.89	1.28	6.70	.015	0.89
Joint attention	2.94	2.16	1.39	1.54	5.92	.021	0.84
Communicative means							
Inventory of gestures	3.76	1.68	2.72	1.53	3.68	.064	0.65
Inventory of consonants	4.71	2.69	3.72	3.08	1.02	.321	0.34
Inventory of words	6.00	5.18	3.94	4.40	1.59	.216	0.43
Symbolic capacity							
Understanding	4.24	3.29	2.00	2.40	5.22	.030	0.79
Inventory of actions	6.18	2.90	5.00	2.28	1.77	.193	0.46
Actions to others	2.82	1.70	2.56	1.72	0.21	0.65	0.15

Note. ESI = Early Social Interaction Project; *F* and *p* values are based on one-way ANOVA comparing ESI group post-ESI and Third-year contrast group; Cohen's *d* is a measure of effect size.
[a]$n = 17$. [b]$n = 18$.

at each language stage for the ESI group at pre- and postintervention and for the third-year contrast group are presented in Table 8. The percentage of children who were verbal (i.e., early one-word, late one-word, and multiword stages) in the ESI group at preintervention (*M* age = 18.19 mos) was 5.9% and increased to 76.5% of children at postintervention (*M* age = 30.72 mos), compared to 55.6% in the third-year contrast group (*M* age = 31.61 mos).

Discussion

These findings expand on the previous research on parent-implemented early intervention to a group of young children with ASD in three critical ways. First, the study delineates the specific social communication outcomes achieved during intervention beginning in the second year of life. Comparison of the social communication skills of the study children before and after their parents participated in ESI indicated large, significant differences on all parameters measured by the CSBS DP except shared positive affect and gaze shifts. We found a large difference (d = .80) for shared positive affect from pre- to post-ESI; however, this was a nonsignificant trend (p = .053). We detected a moderate difference (d = .63) for gaze shifts, which also was a nonsignificant trend (p = .091). A ceiling effect for the ESI group post-ESI may have accounted for the moderate effect size and lack of significant improvement on gaze shifts, because the mean was 5.18 (*SD* = 1.51) and the maximum score was 6. Improved performance on social communication measures, particularly on the measures related to joint attention (i.e., gaze shifts, shared positive affect, gaze/point follow, and communicating for joint attention) has not been documented in previous research on parent-implemented interventions for children with ASD. This result is promising. In a less-intensive parent-implemented intervention, Aldred et al. (2004) were not able to demonstrate improvements in parent-child shared attentional focus.

By examining specific parameters of social communication for children receiving the intervention and comparing them to children who did not receive the intervention, we can begin a preliminary exploration of the impact of the intervention on specific social communication outcomes. Although it was not possible to know whether the ESI group was comparable to the third-year contrast group during the second year of life, the pattern of differences across groups is interesting and may be sugges-

TABLE 7. Social Communication Measures for the ESI Group Pre-ESI and the Third-Year Contrast Group

Measure	Pre-ESI group[a]		3rd-year contrast group[b]		ANOVA comparison		
	M	*SD*	*M*	*SD*	*F*	*p*	*d*
Child chronological age (in mos.)	18.19	3.85	31.61	3.45			
Social signals							
Gaze shifts	4.18	1.67	3.28	1.71	2.48	.125	0.53
Shared positive affect	1.88	1.83	1.31	1.38	0.24	.626	0.36
Gaze/point follow	0.35	0.61	0.61	0.70	1.37	.250	−0.40
Rate of communicating	8.71	5.36	11.94	5.51	3.10	.087	−0.59
Communicative functions							
Behavior regulation	3.59	2.12	4.11	1.81	0.61	.440	−0.30
Social interaction	0.65	0.93	0.89	1.28	0.41	.525	−0.20
Joint attention	0.65	0.93	1.39	1.54	3.01	.094	−0.60
Communicative means							
Inventory of gestures	1.76	1.15	2.72	1.53	4.43	.043	−0.70
Inventory of consonants	1.00	1.37	3.72	3.08	11.61	.002	−1.20
Inventory of words	0.18	0.53	3.94	4.40	13.01	.002	−1.50
Symbolic capacity							
Understanding	0.82	1.38	2.00	2.40	3.20	.085	−0.60
Inventory of actions	3.88	2.00	5.00	2.28	2.39	.130	−0.50
Actions to others	0.53	0.80	2.56	1.72	20.28	< .001	−1.60

Note. ESI = Early Social Interaction Project; F and p values are based on one-way ANOVA comparing ESI group pre-ESI and third-year contrast group; Cohen's d is a measure of effect size.
[a]n = 17. [b]n = 18.

tive of the role of maturation on improved outcomes. Compared to the ESI group members post-ESI, who were the same age, the third-year contrast group members displayed significantly poorer skills on the measures of social signals, rate of communicating, communicative functions, and understanding. In contrast, they performed similar to the ESI group post-ESI on inventory of gestures, consonants, and words and on measures of symbolic play. These similarities in the two groups suggest that the improvements that the ESI children showed in communicative means and symbolic play may have been due to maturation. The differences between the ESI group post-ESI and the third-year entry group suggest that children's outcomes in social signals, rate of communicating, communicative functions, and understanding may have been affected by participation in ESI.

Comparison of the third-year contrast group members with the ESI group members pre-ESI, who were a year younger, further supports the role of maturation and impact of intervention on the ESI children. The third-year contrast group performed similar to the ESI group pre-ESI on social signals, rate of communicating, communicative functions, understanding, and inventory of actions in play; however, they performed significantly better on communicative means and pretend play actions. In other words, maturation alone may result in gains in communicative means and aspects of symbolic play, which are often the focus of traditional interventions for children with ASD. However, maturation does not appear to influence the other social communication measures, which are core deficits of ASD. Collectively these findings support the effectiveness of early intervention on the social communication skills of toddlers with ASD and suggest that intervention beginning in the second year of life can have a positive impact on core social communication deficits of ASD. This supports the recommendations of the NRC (2001) for earlier identification and intervention targeting core social communication skills, which is particularly important because the social communication skills in which the ESI group showed improvement are strong predictors of language outcomes in children with ASD (e.g., Sigman & Ruskin, 1999).

It has been reported that 50% of children with ASD remain nonverbal by middle childhood (Tager-Flusberg, Paul, & Lord, 2005); however, this percentage is smaller among children who received early intervention. In this study, the percentage of ESI group children who were nonverbal at preintervention at 1.5 years of age was 94.1%. This percentage decreased to 23.5% postintervention at 2.5 years of age, compared to 44.4% of the

TABLE 8. Language Stage for the ESI Group Pre- and Post-ESI and the Third-Year Contrast Group

Measure	ESI group[a]		3rd-year contrast group[b]
	Pre-ESI	Post-ESI	
Chronological age (in mos.)			
M	18.19	30.72	31.61
SD	3.85	3.66	3.45
Preverbal			
No.	16	4	8
%	94.1	23.5	44.4
Verbal			
Early one-word			
No.	1	4	5
%	5.9	23.5	27.8
Late one-word			
No.	0	6	2
%	0.0	35.3	11.1
Multiword			
No.	0	3	3
%	0.0	17.7	16.7
Total			
No.	1	13	10
%	5.9	76.5	55.6

Note. ESI = Early Social Interaction Project.
[a]n = 17. [b]n = 18.

third-year contrast group members, who were also 2.5 years of age. Consistent with other early intervention studies of toddlers with ASD (Lord, Risi, & Pickles, 2004; McGee et al., 1999), these findings are encouraging in that larger percentages of future generations of children with ASD are likely to acquire functional language.

Finally, this study offers preliminary evidence that ESI is a feasible model for providing Part C early intervention services to young children with ASD and their families through the use of a family-centered developmental framework. Utilizing professional time to teach parents how to embed specific social communication skills in everyday routines, activities, and places is a cost-efficient early intervention method for children with ASD and is consistent with the regulations of IDEA Part C regarding the provision of an intervention in the natural environment. In addition, parent-implemented intervention is a service delivery option that may be able to provide the intensity of active engagement recommended for children with ASD, at least for parents who are successful in learning how to use these strategies and are able to apply them across a variety of routines with adequate intensity. The strategies taught in ESI provided the parents with a repertoire of ways to follow the child's focus of attention and build social communication skills within their typical daily routines, thus enhancing opportunities for generalization (Kashinath et al., in press). Although the parents were not required to document the time spent on a daily basis implementing the intervention within routines as a component of the project, each family was required to identify multiple routines for embedding intervention at the initial interview and continued to identify and practice additional or different routines with the interventionist during weekly sessions. They also discussed the child's progress on the identified goals within the routines and participated in the planning process for the upcoming week with the interventionist.

The findings of Siller and Sigman (2002) support the critical importance of teaching parents to use strategies that increase responsiveness to their child's interactional focus. Although it is beyond the scope of this study to measure changes in the parents' interaction strategies, the findings of Siller and Sigman suggest that parents' ability to support shared attention may be a mediating variable affecting children's gains in social communication and language stage.

The limitations of this study are inherent in the quasi-experimental design. As noted previously, we could not ascertain that the groups were matched at age 2 years. The sample size is relatively small for a group design, but this is understandable, given the age of the children and that ASD is a low-incidence disability. The intervention was designed not for research purposes but rather for demonstration of a family-centered, developmental model within a local, early intervention, service delivery system. The actual intensity of the intervention that the ESI children received from their parents and the parents' accuracy in using the strategies was not documented in this study. Future research should be conducted to provide further support for the effectiveness of parent-implemented interventions for very young children with ASD. These findings do support the need to conduct a randomized-group-design study in which pretest measures are available and comparable groups can be documented in regard to social communication and development level before intervention. Because it is not ethical to withhold intervention, future studies could compare parent-implemented interventions with clinician-implemented interventions. Documenting the intensity of parent implementation of strategies and investigating whether intensity is a moderator variable on child-outcome measures are also important goals for future research. Finally, studies should examine whether child outcomes from parent-implemented interventions maintain over time and generalize across settings. It is possible that an intervention implemented by the parents very early in the child's development will lead to better maintenance and generalization than a clinician-implemented intervention if the parents continue to follow the child's attentional focus.

The differences in social communication measures from pre- to postintervention for the ESI group may be more notable in that studies have found that the second year of life has been associated with developmental regression in language and communication and other developmental domains for children with ASD (21%–48%; Davidovitch, Glick, Holtzman, Tirosh, & Safir, 2000; Goldberg et al., 2003; Lainhart et al., 1997; Lord, Shulman, & DiLavore, 2004; Rogers, 2004) and occurs most often between the ages of 18 months and 21 months (Goldberg et al., 2003; Shinnar et al., 2001). The findings on developmental regression are particularly interesting in light of recent brain research studies suggesting that an overgrowth of the brains of children with ASD occurs over the first few years of life (Courchesne et al., 2001; Lainhart et al., 1997; Piven, Arndt, Bailey, & Andreasen, 1996; Sparks et al., 2002). Mundy and Burnette (2005) posited that the early social orienting and joint attention deficits of children with ASD "lead to a critical impoverishment in the first years of social information input, which contributes to the course of atypical neurodevelopment in autism" (p. 661). This leads to the following question: Can very early intervention prevent or attenuate the subsequent cascading effect on neurodevelopment and behavioral outcomes that potentially arise from early impoverished social interactions? This study provides preliminary evidence suggesting that intervention beginning in the second year of life may have an effect on social communication and a secondary effect on developmental outcome. ◆

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