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Inclusion for toddlers with autism spectrum disorders:

The first ten years of a community program

AUBYN C. STAHMER,
University of California, San Diego, and Rady Children's Hospital, San Diego, California

NATACHA AKSHOOMOFF, and
University of California, San Diego, and Rady Children's Hospital, San Diego, California

ALLISON B. CUNNINGHAM
University of California, San Diego

Abstract

The present quasi-experimental study examines the outcomes for a group of 102 children diagnosed with an autism spectrum disorder at age 2 who attended an inclusive toddler program (described by Stahmer and Ingersoll, 2004) until age 3. Outcomes on standardized developmental assessments indicate significant improvement, with large effect sizes, in developmental level, adaptive behavior and communication. Thirty-one of the children (31%) were functioning in the typically developing range when they exited the program at age 3, after an average of 8 months of intervention. Predictors of positive outcomes included length of time in the program, level of words and gestures use at entry and higher externalizing and lower internalizing behavior CBCL scores at entry. Implications for serving toddlers with autism in inclusive settings and suggestions for future research directions are discussed.

Keywords

autism spectrum disorders; community program; early intervention

A growing number of children with an autism spectrum disorder (ASD) are now diagnosed before their third birthday, increasing the need for appropriate and effective community intervention programs for toddlers. Researchers and educators alike typically agree that children with ASD benefit from early intervention services (e.g. National Research Council, 2001). Although most intervention researchers recognize the importance of social integration for children with disabilities, with data indicating that inclusion can lead to excellent outcomes for preschoolers with ASD (e.g. McGee et al., 1994; Schwartz et al., 2004), there have been few examinations of inclusion settings for toddlers with ASD.

Correspondence should be addressed to: AUBYN STAHMER, Child & Adolescent Services Research Center, 3020 Children's Way, MC 5033, San Diego, CA 92123-4282, USA. astahmer@casrc.org.

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Until recently, services for toddlers with ASD have been limited. It may be assumed that if children with ASD benefit from inclusion in the pre-school years, inclusion in the toddler years may also increase social and language behaviors. In a recent review of comprehensive treatment models for children with ASD, only three toddler inclusion models had published results. One inclusive program for toddlers with ASD, the Toddler Center of the Walden Early Childhood Program, has evidenced excellent child outcomes in both language and social behaviors, with 82 percent of the 28 children with ASD in the study using spoken words at program exit and 71 percent exhibiting an increase in their ability to play in proximity to other children from entry to exit (McGee et al., 1999). Recently, researchers from Project DATA, a toddler inclusion program that includes both individual and inclusive instruction, provided outcome data for eight toddlers with ASD (Boulware et al., 2006). All of the children made improvements and five of the children demonstrated very substantial gains on standardized assessments. In a study of 20 toddlers with ASD in our own community-based inclusion program, Children's Toddler School[1] (CTS; Stahmer and Ingersoll, 2004), we reported IQ gains similar to those reported in research studies of young children with ASD in both intensive one-to-one treatment programs (e.g. Cohen et al., 2006) and the aforementioned inclusion programs (Boulware et al., 2006; McGee et al., 1999). Children with ASD showed improvements in both standardized and functional measures of communication, social interaction, adaptive behavior, and play skills, as well as a reduction in ASD symptoms. These preliminary outcomes are very impressive. However, replication of these toddler inclusion results with larger numbers of children remains important.

Unlike many early intervention outcome research projects, which focus on the use of a single technique such as discrete trial training (e.g. Lovaas, 1987), incidental teaching (McGee et al., 1999, 2000), or Floortime(tm) (Greenspan and Wieder, 1998), the majority of publicly funded early intervention programs use a combination of methods in their treatment models. Both CTS and Project DATA use models that integrate various evidence-based techniques and developmentally appropriate practices. Initial studies have suggested that integration of intervention techniques does not impede child progress (Stahmer and Ingersoll, 2004; Dawson et al., 2009). The best practice committees in both New York and California recommend the use of a combination of treatments based on the needs of the child. However, there have been very few studies examining the efficacy of integrating best-practice treatment methods. Additional evidence is needed to validate that a systematic combination of treatments individualized to meet the needs of the child and family leads to good outcomes for toddlers with ASD.

Outcomes for children with ASD are usually defined by performance on standardized measures of language, as well as cognitive and adaptive behavior. Optimal treatment outcomes in comprehensive early and intensive behavioral interventions have been related to age at start of treatment, initial learning rate, nonverbal IQ, imitation ability, and ASD severity (Harris and Handleman, 2000; Sallows and Graupner, 2005). Longitudinal research studies of young children with autism have found scores on standardized measures administered at age 3 to be stronger predictors of outcome in later childhood compared to

[1]Children's Toddler School has recently expanded and has been renamed Alexa's Playful Learning Academy for Young Children (PLAYC). We use CTS in this paper because that was the program name when these data were collected.

scores at 2 years of age (Charman et al., 2005; Thurm et al., 2007). In particular, these studies found that measures of non-verbal IQ at age 2 were predictive of later language scores, while measures of communication skills at age 3 were a stronger predictor of later language ability. Overall, early language ability and cognitive ability have emerged as the most robust predictors of overall prognosis for ASD during childhood, adolescence, and adulthood.

It is important to note, however, that a majority of these studies examined predictors of outcome in children in one-on-one early intervention settings, or where the intervention provided differed across children. More data are needed to support inclusion as an effective intervention for toddlers with ASD, and to examine predictors of positive outcomes in inclusion settings. The purpose of the present investigation is to present descriptive outcome data for a large number of toddlers with ASD enrolled in an inclusive community-based inclusion program and to examine predictors of positive child outcomes.

Method

Participants

Participants included a total of 102 children with ASD (87 boys, 15 girls) who participated in the Children's Toddler School for a minimum of 5 months (*M* = 8.3, range 5–15). Mean age at program entry was 28 months (range 21–33) and mean age at program exit was 36 months (range 35–40). The majority of the children attended regularly, with the mean rate of attendance being 86 percent of available days. The majority of the families were two-parent families and all of the children resided with their biological parents (see Table 1).

Eligibility for CTS entry included a *DSM-IV* diagnosis (American Psychiatric Association, 2000) of autistic disorder or pervasive developmental disorder–not otherwise specified (PDD-NOS) by a community-based clinician not associated with this research project, nonverbal mental age (12 months), and chronological age of 18 to 30 months. Funding for CTS was provided by the California Part C Early Start program, which requires children to exit the program at age 3. All families consented to participate in the program and signed an IRB consent form stating a willingness to allow their own and their child's assessment data to be included in a research database. This paper includes children entering in the program beginning in January, 1998, and exiting by November, 2008.

Measures and procedure

After referral to CTS for services and before beginning the program, pre-treatment measures were completed. The children in the study then participated in the CTS (program described below) for a minimum of five months (*M* = 8.3). Measures were repeated approximately one month before each child completed treatment in order to provide eligibility information to the school district. The program psychologist administered a standardized test of developmental functioning to each child at entry and exit. Children completed either the Bayley Scales of Infant Development, 2nd Edition (Bayley, 1993), or the Mullen Scales of Early Learning (Mullen, 1995) depending upon the date of entry into the program. The same test was administered to each child at entry and exit. The mental development quotient on the Bayley or the early learning composite (ELC) from the Mullen was used to determine change in child intellectual functioning. To assess child adaptive functioning, the program psychologist administered the Vineland Adaptive Behavior Scales (Sparrow et al., 1984) to the child's primary care provider (typically the mother) at entry and exit. Standard scores on each Vineland subdomain were used to compare changes from entry to exit. In addition, each child's parents completed the Gilliam Autism Rating Scale (GARS; Gilliam, 1995), an assessment of severity of autistic symptoms based on a national sample of individuals with autism. A score of 100 indicates a high probability that the child has autism. Lower scores indicate reduced probability of an autism diagnosis and fewer symptoms indicative of the disorder. Although this assessment was not standardized for children under the age of three, it can provide an estimate of change in behaviors associated with autistic behavior.

In order to further assess communication skills, the Preschool Language Scales, −3 or −4 (depending upon the year of entry into the program; Zimmerman et al., 1992, 2002) was completed by the speech/language pathologist to provide standard scores of auditory comprehension and expressive communication. The MacArthur-Bates Communicative Development Inventories (CDI; Fenson et al., 2006) was completed by each child's parents upon entry and exit. This assessment provides a count of the number of words produced, phrases understood, and gestures used. The Child Behavior Checklist for Ages 11/2-5 (CBCL; Achenbach and Rescorla, 2000) was used to estimate emotional and behavioral problems. Children are considered to have significant behavior issues if they score in the clinical range (*t* score 64 or above) on the various scales of the CBCL. The Internalizing and Externalizing Behavior Scales were used for data analyses in this project.

Data analysis

Two-tailed paired sample *t* tests were used to determine significant changes in performance on standardized and norm-referenced tests. Paired Wilcoxon *t* tests for ranked data were used to determine significant changes in functional skills for each behavioral category. A Bonferoni correction was made to reduce the probability of type 1 error with multiple comparisons such that an alpha of .0028 indicated a significant result. With the exception of the CDI, standard scores were used in data analyses for all assessments. Standard scores factor in developmental maturation, and are thus a more stringent measurement of child progress. The CDI does not provide standard scores so raw data were used in those analyses.

Developmental trajectory comparisons were also conducted to compare expected developmental rate with and without intervention. This type of data analysis has been used by behavior analysts to assess the magnitude of change in one-group designs (see Romanczyk, 2000). The analyses require the use of age-equivalent data rather than standard scores.

A principal factor analysis was used to determine the factors used for the outcome measures when looking at predictors. Assessments covering major areas of deficit in children with ASD were used in the factor analysis. Multiple regression analysis was used to examine predictors of outcome at intake. Based on the literature and best fit of the data, the major predictor variables used in these analyses included length of time in the program, developmental functioning, adaptive functioning, problem behaviors, social behavior, and communication skills.

Overview of the program

CTS includes 8 toddlers with ASD: 4 who attend a morning session and 4 who attend an afternoon session. The program consists of a total of 21 hours a week of direct service. This includes 15 hours in the classroom, 4 hours of individual service outside the classroom, and 2 hours of in-home parent education for children with ASD. In addition, parents commit to using the techniques learned in parent education an additional 10 hours per week at home. However, there was no method to verify the use of these hours. Children receive intensive services in the inclusive classroom 3 hours a day for 5 days a week. The 8 typically developing toddlers each attend all day for day care purposes. The classroom has a 1:3 teacher to child ratio, is arranged like a typical toddler classroom, and utilizes a systematic blend of incidental teaching (McGee et al., 1999), Pivotal Response Training (PRT; Koegel et al., 1989), structured teaching (Lord et al., 1993) and interactive/developmental techniques (Ingersoll et al., 2005) in the context of the classroom. Two augmentative communication systems, the Picture Exchange Communication System (PECS; Frost and Bondy, 1994) and modified sign language, are also used with nonverbal children or children who appear to need visual support to use language appropriately. Interaction with typically developing toddlers is facilitated throughout the school day. The educational team works together to plan a curriculum appropriate for all children (typically developing and those with autism). Teachers do not follow a specific packaged curriculum, but follow developmentally appropriate practices. Teaching occurs during classroom activities such as free play, snack, outside play, special activity (e.g. art), circle time, and self-help activities (e.g. diapering, hand washing). In order to facilitate appropriate programming, the most naturalistic teaching strategies are used to meet curriculum goals. Each toddler with ASD receives individualized instruction, which may include discrete trial training (Lovaas, 1987), with one teacher and two children, for four hours weekly to allow for teaching specific skills not acquired in the classroom setting or that need additional practice. The family education component consists of weekly two-hour home visits with a teacher to help the parents learn naturalistic behavioral techniques. Parent participation is an integral part of the program. Parents are involved in goal setting and development for their children, goal review, choosing appropriate intervention strategies, developing positive behavioral supports, and in the transition process. Speech and occupational therapy consultation is conducted within the context of the classroom.

In the classroom, there are a variety of interesting toys and activities to pique children’s interest. Once a child becomes interested in a toy or activity the teacher uses that opportunity to provide a learning activity derived from individual goals. Teachers are trained to be ‘fun’ and to act as a ‘magnet’ for the children to encourage proximity between children with ASD and typically developing children. An example of strategy use in the classroom is as follows: If a child is engaged with a toy, the teacher typically begins an interaction using an incidental teaching model by approaching the child and waiting for a response, using an appropriate level of affect and enticement, and increasing the level of structure as necessary. For example, the teacher might comment on the child’s actions, model an appropriate action or provide a direct instruction depending upon the child's need. If the child does not respond, the teacher may move to a more structured technique such as PRT or PECS. All techniques may be used in a single session depending upon the child's needs that day. Children with ASD are encouraged to observe and interact with typically developing peers. For some children, tolerating proximity to peers is an initial goal, while other children focus on initiating interactions and imitating actions at circle time or asking each other for additional snack items.

Staffing and training

All teachers must possess a minimum of a BA from a four-year institution and have prior experience working with young typically developing children and children with autism or a degree and experience in early childhood education. All teachers must also meet infant/toddler classroom licensing standards for the State of California. Each teacher receives extensive training in each intervention technique through didactic instruction with the technique training manuals as well as hands-on experience in the appropriate program setting. Fidelity of implementation of the program is completed on a quarterly basis through direct observation and checklists completed by the program psychologist. Developmental feedback is provided to each teacher on a daily basis during the course of teaching.

A more detailed description of the program can be found in Stahmer and Ingersoll (2004).

Results

Standardized assessments

Results for standardized and norm-referenced assessments are summarized in Table 2.

Bayley Scales of Infant Development/Mullen Early Learning Scales—Bayley or Mullen scores were unavailable at intake for two children who were uncooperative during the testing sessions. These children were excluded, leaving 100 children for this analysis. The children exhibited a significant increase in developmental level as measured by standard scores on the Bayley or Mullen from intake (M = 63.9, SD = 13.3) to exit (M = 75.7, SD = 18.3; see Table 2). At intake, only six (6%) of the children were in the typically developing range (developmental level between 85 and 115), 24 (24%) of the children were in the mildly delayed range (developmental level between 70 and 84), and 70 (70%) children were in the significantly delayed range at intake (developmental level below 70). At exit, 31 (31%) of the children were functioning in the typical range, another 35 (35%) of the children were functioning in the mildly delayed range, and 34 (34%) of the children remained in the significantly delayed range. Pearson's chi-square test was used to examine whether the observed frequency distributions were significantly different at intake and exit. Results revealed statistically significant differences, $\chi^2 = 127.7$, $df = 2$, $p < .001$. Children functioning in the typical range of development expanded from 6 percent to 31 percent. Additionally 36 of the 70 children (51%) moved out of the severe range of functioning. Sixteen of the 70 children (23%) functioning in the significantly delayed range at intake were functioning in the average range at exit. Fourteen of the 24 children (58%) functioning in the mildly delayed range at intake increased their functioning to the average range after intervention.

Trajectory changes in mental age based on overall mental age scores on the Bayley or the Mullen are illustrated in Figure 1. The expected trajectory was estimated based on developmental level at intake, with the assumption that without intervention the same rate of development would continue. Clearly, typical child development does not always take a linear path, however this comparison allows us to illustrate how changes in development might be altered due to intervention (see Romanczyk, 2000). If the rate of change is greater than the expected rate of development, then the intervention is said to have a positive effect on the child's development. A typical developmental trajectory is illustrated as well. Similar results are seen when language and visual spatial development are examined separately; the figure therefore depicts overall development. Children with ASD increased on average from a developmental equivalent of 17.6 months at intake to 27.5 months at exit testing (performed on average at 35 months of age). This analysis indicates that the children's rate of development was 63 percent of the typical children's rate of development at intake and 79 percent of typical children's rate of development at exit testing, with an overall 16 percent increase in developmental progress.

Vineland Adaptive Behavior Scales, Interview Edition—Vineland scores for entry or exit were unavailable for four children, thus these children were excluded from this analysis. Results are shown in Table 2. Statistically significant changes were seen in the overall adaptive behavior composite. Significant increases in adaptive behavior as determined by standard scores on the Communication, Daily Living Skills and Socialization subdomains of the Vineland were evident from intake (Communication $M = 70.0$; Daily Living Skills $M = 69.5$; Socialization $M = 69.9$) to exit (Communication $M = 77.2$; Daily Living Skills $M = 72.5$; Socialization $M = 74.6$). There was not a significant change in the Motor Skills domain. On the Communication scale before entry into the program, 49 (50%) of children scored in the severely delayed range (standard scores less than 70), 44 (45%) in the mildly delayed range (70–84), and 5 (5%) in the average range of functioning (85–115). At exit from the program, 30 (31%) of children were functioning in the severely delayed range, 39 (40%) of children remained mildly delayed, and 29 (30%) of children were in the average functioning range. In the Daily Living Skills domain, 6 (6%) of children were functioning in the average range at entry and 11 (11%) of children in the average range at exit. In the Socialization domain, only 4 (4%) of children were functioning in the average range at entry and 21 (21%) were in the average range at exit. Pearson's chi-square test was used to examine whether the observed frequency distributions were significantly different between intake and exit. Results revealed statistically significant differences for the Communication, $\chi^2 = 123.1$, $df = 2$, $p < .001$, Daily Living Skills, $\chi^2 = 20.0$, $df = 2$, $p < .001$, and Socialization domains, $\chi^2 = 79.0$, $df = 2$, $p < .001$.

Symptoms of ASD

Gilliam Autism Rating Scale—GARS scores were unavailable for one child at program exit, thus he was excluded from this analysis. There was not a significant decrease in severity of autism from intake to exit as measured by the GARS. At both entry ($M = 83.8$)

and exit (M = 80.8), the GARS Autism Quotient fell within the below-average probability of autism range. No statistically significant changes were seen in either the communication or socialization domain scaled scores. A statistically significant decrease was seen in the stereotyped behavior domain scaled scores, indicating fewer stereotyped behaviors after intervention.

Communication

Parent report of vocabulary on the CDI increased significantly overall in the areas of words produced and understood, as well as the use of both early and late gestures (see Table 2). Standardized scores on the PLS-3 or PLS-4 also showed a statistically significant increase over time. At entry, the average language standard scores were in the significantly delayed range while at exit scores increased to the mildly delayed range on average.

Behavior

Scores on the CBCL did not change over time. However, the majority of children did not show clinically significant behavioral issues according to this measure at either time point. At entry into the program, only 20 children had Externalizing Behavior scores in the clinical range and 26 had clinically significant scores on the Internalizing Behavior scale. Similarly at exit, 20 children had clinically significant scores on the Externalizing Behavior scale and 22 children had clinically significant scores on the Internalizing Behavior scale.

Predictors of best outcome

Principal component analysis using direct oblimin rotation was conducted to examine the dimensionality of the outcome assessments. An initial exploratory factor analysis (EFA) of all of the measures described above suggested that a 2-factor solution best explained the data. The variance explained by the solution was 77.7 percent. Factor 1, the Developmental Factor, was conceptualized as a measure of overall developmental level, and accounted for 49.3 percent of the variance. The three items that had significant loadings on the Developmental Factor were the overall developmental level as measured by the Bayley or the Mullen (.89), and the Vineland Social (.89) and Communication (.93) domains. Factor 2, the Behavior Factor, consisted of three items related to behavior: the GARS autism quotient (.77), and the CBCL Internalizing (.87) and Externalizing (.87) Behavior scales. This factor accounted for 28.3 percent of the variance. These factor scores were used as the outcome variables for use in the regression analysis.

Predictors of outcome

Multiple linear regression was employed to determine which of the entry assessments or variables could be used to predict outcome as measured by the Developmental and Behavior Factors at exit. First, we examined the relationship between the entry variables that contributed significantly to each outcome factor. We did this in order to replicate previous studies that have found a relationship between pre-treatment IQ and pre-treatment adaptive behavior and treatment outcomes. When entered as a group, pre-treatment IQ and Vineland Communication and Social domain scores significantly predicted those same scores at outcome with an adjusted R^2 = .58 [$F(85) = 36.91$, $p < .001$]. Surprisingly, when these variables were entered into the equation separately, pre-treatment IQ was not significantly related to the Developmental Factor scores at exit. The Vineland Communication standard scores contributed the most variance ($B = .05$; $\beta = .48$; $p = .000$), followed by Vineland Socialization standard score ($B = .03$; $\beta = .24$; $p < .05$).

Next, we examined how entry variables not included in the Developmental Factor at entry predicted the outcome results. Variables that did not significantly contribute to the regression were removed in order to develop the best explanatory model. Since no a priori hypotheses had been made to determine the order of entry of the predictor variables, a direct method was used for the multiple linear regression analyses. Five entry variables produced the strongest predictor of the Developmental Factor at exit with an adjusted $R^2 = .54$ [$F(90) = 17.60$, $p < .001$]. These included number of months in the program, CBCL Internalizing and Externalizing Behavior Scale scores, and the number of gestures and number of words produced as measured by the CDI (see Table 3).

When examining the Behavior Factor, we also examined the relationship between the entry scores of the assessments used in the outcome variable first. Pre-treatment scores on the CBCL Externalizing and Internalizing Behavior scales and the GARS autism quotient significantly predicted those same scores at outcome, $R^2 = .46$ [F(85) = 36.91, $p < .001$]. When these variables were entered into the equation separately, the CBCL Internalizing scale was not significantly related to the outcome Behavior Factor. The CBCL Externalizing scale contributed the most variance ($B = .05$; $\beta = .45$; $p < .001$), followed by the GARS autism quotient ($B = .01$; $\beta = .22$; $p < .05$). No additional entry variables were predictive of the Behavior Factor at exit.

Discussion

This study represents the largest description of outcomes for toddlers with ASD in a community inclusion program. Overall, this quasi-experimental examination provides support for a community inclusion model that combines evidence-based intervention methods. Consistent with results seen in other programs, there was significant variability in outcome. However, overall the children made statistically and clinically significant gains in developmental level, receptive and expressive communication, and adaptive behavior. In fact, 31 percent of the children were functioning in the typically developing range at age three when they exited the program after an average of only 8 months of intervention.

One of the biggest limitations of these data is the lack of a control group of children with ASD either receiving no intervention or an alternate intervention. However, our results are very similar to the one-year outcomes of children with ASD in the experimental group in the recently published study by Dawson and colleagues (2009) examining the Early Start Denver Model, in which children received one-to-one intervention for a similar number of hours per week. That model also combines methods from applied behavior analysis, relationship-based techniques, and developmentally appropriate practices. This similarity may suggest that the children in the CTS program, overall, fare as well as children in a university-based program and progressed better than children who were receiving a less-intensive community intervention. In addition, examination of the developmental trajectory indicates a 16 percent increase in overall development based on standardized test scores. Although examination of our specific population with a matched control remains necessary, these descriptive results are promising.

The examination of the predictors of outcome at age three showed both similarities and differences to those seen in other studies. We did not find early IQ to be predictive of developmental or behavioral outcomes factor scores even at age three, however adaptive communication and socialization scores were predictive of outcome at age 3. When outcome variables themselves were not used in the model, the biggest predictor was the number of months in the program, which was highly correlated with age at program entry due to the program restrictions. Earlier age at program entry and length of intervention have been found to be related to better outcome in preschool age children (Harris and Handleman, 2000). As found in previous research, parent report of the use of gestures and the number of words produced on the CDI were also predictive of outcome (Luyster et al., 2007). Interestingly, the presence of externalizing behaviors and the absence of internalizing behaviors was predictive of better outcome even with the limited frequency of these reported problems.

We recently had the opportunity to follow a group of 29 children beyond age 3 who previously participated in the CTS program (Akshoomoff et al., in press). Children ranged in age from 4 to 12 years at the time of the parent survey and follow-up testing. Examination of changes in standard scores over time revealed that initial gains in these scores continued after the children left the toddler program. Significant improvements were seen in IQ and adaptive behavior, with 75 percent of children having average nonverbal IQ at follow up. Among the children who were in elementary school at the time of follow-up, 63 percent were in regular classroom placement with few supports. This is promising given that the children attended a variety of public programs after age three and skills were maintained or improved in these community programs.

There are some important limitations to this study that must be mentioned. This study utilized a quasi-experimental pre-post treatment study design and lacked a control group. These data would be strengthened by a comparison group of toddlers participating in other community-based services, such as non-inclusive group settings or in-home treatment programs. Predictors of outcome in in-home programs using similar methodologies would help clarify which children would benefit most from an inclusion setting. In addition, pre- and post-treatment assessments were completed by psychologists associated with the program, which runs the risk of introducing bias. The use of the GARS may have limited our ability to see change in autism symptoms in our study group. We are now using evidence-based measures of autism symptoms that have better sensitivity and specificity to address these issues. In addition, data presented here cover a 10-year period and in that time there may have some subtle programmatic changes. In an attempt to account for this we have collected fidelity data throughout the 10-year period that provide an indication of consistency and hope to examine this issue further in the future. Like other comprehensive programs for children with autism we have not identified the active ingredients or critical elements of the program. Therefore it is unclear whether the dosage, exposure to typically developing peers, the home program, and/or other aspects of the program all contribute equally to these outcomes. Parsing out the critical elements of comprehensive programs is an important next step in autism intervention research. Lastly, children were not randomly assigned to this program. Toddlers were specifically selected for the program from the local regional center based on perceived appropriate placement, as well as a nonverbal IQ minimum. Therefore, these results may not generalize to all children with ASD. However, it is likely that any program used in a community that has multiple program options will be subject to selection bias. Therefore, these results are appropriate for the population of children likely to participate in such a program.

This study provides additional support for structured toddler inclusion programs for children with ASD meeting minimum requirements. These data also support previous research suggesting that beginning intervention as early as possible may lead to improved outcomes. Gesture use and early word use may predict better outcomes in this population. Further examination of the benefit of group programming for young children with ASD, including differential effects on social interaction skills, will be an important future step.

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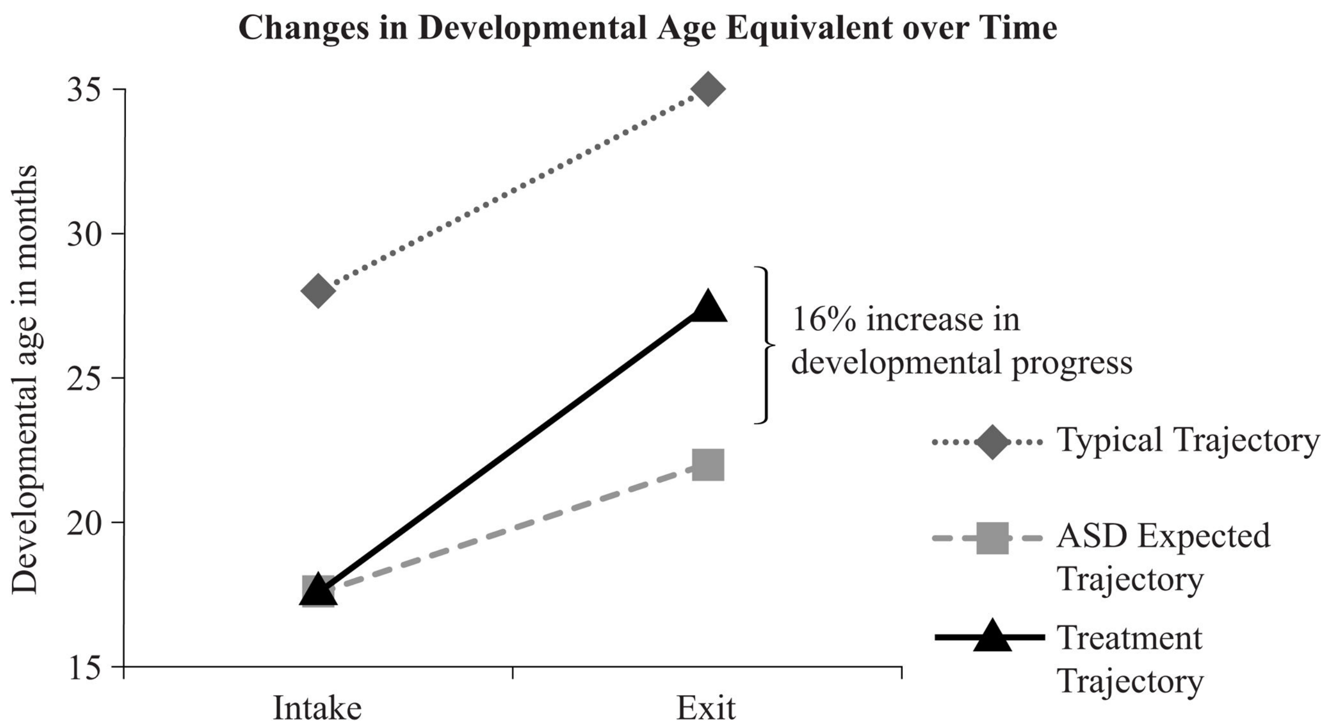

Figure 1.
The expected developmental trajectories for typically developing children, and children with ASD (based on entry scores) and the actual developmental trajectory for children with ASD, based on overall age equivalents on the Mullen (1995) or Bayley (1993) assessments

Table 1

Participant demographic information

Time enrolled in the program	
Mean (range)	8.33 months (5–15 months)
Diagnosis	
Autistic disorder	55%
Pervasive developmental disorder – not otherwise specified	45%
Percent attendance[a]	
Mean (range)	86% (75%–97%)
Age at program entry	
Mean (range)	28.06 months (21–33 months)
Marital status of parents	
Married	88%
Separated	1%
Divorced	3%
Single	5%
Race/ethnicity of participant children	
Asian/Pacific Islander	8%
Black	4%
Hispanic	7%
White	62%
Multi-racial	14%
Unknown/Other	7%

[a]Percent of available school days the child came to school.

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Table 2

Children's mean scores on standardized assessments at program entry and exit

	Entry score Mean (SD)	Exit score Mean (SD)	*t* score	*p* value*	Effect size
Chronological age (87 boys, 15 girls)	28 mo (2.74)	36 mo (.74)	–	–	–
Developmental quotient (Bayley [1993] or Mullen [1995], $n = 100$)	63.9 (13.3)	75.7 (18.3)	−8.398	.000*	.416
Adaptive functioning (Vineland, $n = 98$)					
Adaptive Behavior Composite	68.6 (8.5)	72.2 (10.9)	−4.296	.000*	.163
Communication	70.0 (10.2)	77.2 (14.0)	−7.720	.000*	.410
Daily Living Skills	69.5 (7.7)	72.5 (9.7)	−3.968	.000*	.148
Socialization	69.9 (8.5)	74.6 (10.9)	−5.471	.000*	.243
Motor Skills	83.7 (8.5)	85.5 (16.9)	−1.023	.304	.011
Autism symptoms (GARS, $n = 101$)					
Communication	6.9 (4.0)	7.8 (3.3)	−2.140	.035	.049
Social Interaction	6.9 (2.8)	6.4 (3.0)	1.844	.069	.025
Stereotyped Behavior	8.2 (2.9)	7.1 (3.3)	3.576	.001*	.110
Autism Quotient	83.8 (15.8)	80.8 (19.5)	1.370	.174	.009
MacArthur CDI ($n = 99$)					
Words Produced	67.5 (80.1)	197.3(141.7)	11.282	.000*	.527
Words Understood	157.2(109.5)	243.6(122.2)	−7.589	.000*	.358
Early Gestures	10.4 (3.8)	12.8 (4.2)	−5.564	.000*	.279
Late Gestures	19.8 (9.7)	27.4 (11.0)	−8.007	.000*	.483
Preschool Language Scales ($N = 102$)					
Receptive Language	45.6 (37.5)	64.8 (37.5)	−5.149	.000*	.206
Expressive Language	49.0 (37.8)	65.4 (39.6)	−4.395	.000*	.159
Child Behavior Checklist ($n = 87$)					
Externalizing Behavior	57.3 (8.0)	58.3 (8.8)	1.317	.191	.020
Internalizing Behavior	59.7 (8.8)	58.4 (8.1)	−1.968	.093	.032

* A Bonferroni correction was used such that a *p* value of .0028 indicates a statistically significant result.

Note. GARS = Gilliam Autism Rating Scale (Gilliam, 1995); CDI = MacArthur-Bates Communicative Development Inventories (Fenson et al., 2006).

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Table 3

Multiple regression of entry assessments for developmental level factor

Variables	B	SEB	β	T	p value
Months in program	.168	.037	.388	4.6	.000
CDI Total Gestures	.038	.008	.467	4.9	.000
CBCL Externalizing	.029	.013	.218	2.2	.030
CBCL Internalizing	−.029	.011	−.264	−2.7	.008
CDI Words Produced	.005	.001	.436	4.5	.000

Note. CDI = MacArthur-Bates Communicative Development Inventories (Fenson et al., 2006); CBCL = Child Behavior Checklist for Ages 1½–5 (Achenbach and Rescorla, 2000).