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Comparing cognitive outcomes among children with autism spectrum disorders receiving community-based early intervention in one of three placements

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Abstract

Little comparative research examines which community-based preschool intervention placements produce the best outcomes for which children with autism spectrum disorders. Autism-specific placements can provide intensive evidence-based care; however, inclusion settings provide interaction with typically developing peers, the importance of which is increasingly recognized. This study examined the association between early intervention placement in three settings (autism-only, mixed disability, or inclusive) and cognitive outcomes upon entry into elementary school in an urban school district for 98 preschool-aged children with autism spectrum disorders. Initial child and demographic characteristics were similar among the three placements. Controlling for initial cognitive scores and other covariates, cognitive outcomes for children in inclusive placements were better than those of children in mixed disability settings. A consistent pattern emerged that suggested the particular importance of inclusive placements for children with initially greater social impairments, greater adaptive behavior impairments, and at least a baseline level of language skills. Opportunities to interact with typically developing peers may be particularly beneficial for certain subgroups of young children with autism spectrum disorders. The results provide preliminary insight into important child characteristics to consider when parents and providers make preschool early intervention placement decisions.

Keywords

autism spectrum disorders, community practices, early intervention, inclusion, preschool

Introduction

Despite the requirement of the Individuals with Disabilities Educational Act (PL-108-446) to provide free and appropriate public education for young children with autism spectrum disorders (ASD) in the least restrictive environment suitable for their needs, as well as the potential importance of experiences with typical peers for children with ASD, little research has investigated the relative benefits of various intervention environments for young children with ASD. Although consistent opportunities to interact with typically developing peers are often part of recommended practices for young children with ASD (e.g. Koegel et al., 2009; National Research Council, 2001; Strain et al., 1998; Tsai, 1998), most research to date has evaluated interventions implemented in more restrictive settings that do not routinely offer such opportunities for preschoolers with ASD (such as individual services provided in homes or clinics, or in classrooms consisting only of children with ASD). For example, of the 10 comprehensive early intervention (EI) programs for children with ASD identified by the National Research Council (2001) as having some empirical support, only two incorporated systematic, daily interactions with peers without disabilities. In a recent review of 30 comprehensive treatment models for children with ASD, only 4 were identified as inclusive (Odom et al., 2010). The studies of inclusive preschool programs for children with ASD suggest that preschoolers with ASD can make gains in cognitive, academic, language, functional, and social skills

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when placed in settings with their typically developing peers (e.g. Schwartz et al., 2004; Strain and Bovey, 2011; for reviews, see Ferraioli and Harris, 2011; Harrower and Dunlap, 2001; Odom et al., 2004). However, the internal validity and generalizability of many of these studies have been limited by their lack of control groups and small samples sizes. There is also debate as to the appropriateness of inclusive settings for children with ASD. Some researchers have argued that certain effective educational strategies for teaching children with ASD, such as specialized instructional techniques and environmental modifications, are not feasible in inclusion classrooms (Mesibov and Shea, 1996), and that children with ASD encounter peer rejection (Lowenthal, 1999; Odom et al., 2006). These mixed findings have led some to call for additional study of the importance of inclusion for young children with ASD (Rogers and Vismara, 2008).

Beyond the lack of consensus on the benefit of different preschool intervention settings, there is also little research on outcomes for young children with ASD treated by community providers. Although there have been a few studies investigating community-based EI services conducted in Europe (Eldevik et al., 2012; Fernell et al., 2011; Magiati et al., 2007, 2011) and Canada (Perry et al., 2008, 2011), to our knowledge to date, there have not been any such studies in urban school districts in the United States. The small body of research in this area suggests that although preschoolers with ASD make gains in cognitive ability, adaptive behavior, and language, and experience reductions in autism severity when receiving intervention in the community, community practices often do not result in the large gains observed in research trials (Magiati et al., 2007; Perry et al., 2008; but see Eldevik et al., 2012).

There is even less work comparing the impact of the various settings in which interventions are delivered (Parsons et al., 2011). The few studies in this area have been largely inconclusive, finding no differences between children receiving home-based early intensive behavioral intervention and those receiving care in autism-specific preschools (Magiati et al., 2007), or among a (a) 1:1 home-based program, (b) "generalist special nursery placement for children with all types of learning difficulty," and (c) an autism-only special nursery placement (Reed et al., 2007).

Parents and professional teams often must decide between components of comprehensive EI programs recommended for children with ASD (Koegel et al., 2009), such as placements in which staff have specific training in evidence-based practices for working with children with ASD (e.g. providers of applied behavior analysis (ABA) in restricted settings), and placements in which structured interaction with typically developing peers is available (e.g. inclusion settings). However, there is a dearth of empirical information on which to base these decisions, particularly when trying to use initial child characteristics to determine the most appropriate placement. Language, social-communication, adaptive behavior, IQ, object exploration, age, and autism severity have emerged as potential moderators of outcomes for preschool children with ASD in some studies of various treatment programs (e.g. Gordon et al., 2011; Harris and Handleman, 2000; Kasari et al., 2008; Perry et al., 2011; Remington et al., 2007; Yoder and Stone, 2006a, 2006b); however, their interaction with preschool settings in predicting outcomes has not been examined.

The purpose of this study was to provide preliminary evidence as to the effectiveness of inclusive, mixed disability (MD), and autism-only preschool EI placements in an urban community in the United States, and to investigate which placements were best for different subgroups of children with ASD.

Methods

Participants

Subjects were drawn from an intervention study for children with ASD in kindergarten-through-second-grade autism-support classrooms in a predominately African American public school district in an urban east coast American city. A total of 98 (19.9%) of the 492 enrolled children with ASD met the following inclusion criteria: (a) had parental consent to review their educational records, (b) had accessible records in the EI system, (c) received three-to-five EI services primarily in a classroom setting, (d) participated in the research trial directly after transitioning out of the EI system, (e) had complete cognitive assessment data available from their initial EI eligibility assessment (Time 1) and at the beginning of their first year of elementary school (Time 2), and (f) had a community diagnosis of ASD or met ASD criteria on the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999) during their first year of the research trial.

Procedures

Preschool educational records, which included evaluation reports, individualized education plans (IEPs), notices of recommended educational placements and additional screening and diagnostic reports, were reviewed, and child, family, and intervention characteristics were coded by two independent coders blind to study outcomes. The Differential Abilities Scales, Second Edition (DAS; Elliott, 2007) was administered by trained psychologists and research assistants as part of the elementary school intervention trial.

Dependent variable of interest

Outcomes at entry into elementary school (Time 2) were measured using the DAS (Elliott, 2007) administered by trained research staff who were blind to EI placement. The

DAS is designed to assess cognitive abilities in children ages 2 years 6 months through 17 years 11 months across a broad range of developmental levels. Age-normed standard scores (M = 100, standard deviation (SD) = 15) of general conceptual ability (GCA) were used for analysis.

Independent variables of interest

EI placement was the primary independent variable of interest. Placement was determined based on the decisions of service coordination teams, provider availability, and parent preference. It was coded based on the most recent intervention information available in the child's file. If information from the year before the child transitioned to elementary school was not available, it was assumed that the service provider did not change. Changes in preschool intervention placement noted in the child's file were coded dichotomously (yes/no). Based on information reported in the files and provided by the director of the three-to-five EI system as to the nature and type of settings served by specific providers, participants were classified as receiving one of three types of placement: inclusive, MD, and autism-only.

Inclusive. The child received intervention services in center-based programs run by a special education teacher for typically developing children that includes children with ASD (reverse mainstream), Head Start preschools or in community-based typical preschool or day-care settings. Opportunities for interactions with typical peers were noted on the IEP. According to program administrators, reverse mainstream and Head Start classrooms used the HighScope (Hohmann et al., 2008) curriculum. Children typically attended for 3 h a day, 3 days a week, but could attend up 6 h a day or 5 days a week. All lead teachers were certified or had degrees in early childhood education or special education; some had master's degrees. Associate teachers had associate's degrees. Reported student–teacher ratios ranged from 6:1 (six teachers and up to 18 kids) to 10:1 (with at least two teachers per classroom). For the children in our sample, speech therapy provided at the programs ranged from 30 min per month to 1 h per week. Children received up to an hour-and-a-half a week of occupational therapy and up to a half-an-hour a week of physical therapy. Some children received up to 2 h of special instruction a week in their typical preschool or day care.

MD. The child received intervention services at a center-based preschool in a setting that included children with developmental or other disabilities that qualified them for preschool EI services. According to program administrators, the MD classrooms used the Creative Curriculum® (Dodge et al., 2002) based on early learning standards. Children commonly attended MD programs between 2 and 3 h a day for 3 days a week, but the number of days per week varied between two and five. The reported student–staff ratio in all MD programs was at least 11:2. Some programs required lead teachers to have a bachelor's degree in Special Education or Early Childhood Special Education; others required certification in Early Childhood Education or Special Education or Certificate of Competency. Children in our sample received between 30 min and 1 h of speech therapy a week at their MD program. They also received up to an hour a week of occupational therapy and up to a half-an-hour a week of physical therapy.

Autism-only. The child received services in a center-based autism support preschool program. There were three programs that had autism-support classrooms. According to program administrators, two programs used the Creative Curriculum® (Dodge et al., 2002) paired with ABA instructional and behavior management strategies. In one of these programs, some students were pulled out of the classroom and received one-to-one ABA for half of the program day. The third program reported that they incorporated a variety of treatment methods including ABA, TEACCH, Developmental, Individual Difference, Relationship-based (DIR®)/Floortime model, visual supports, sensory integration, and creative art therapies. Children in one of these classrooms commonly attended for 5 h a day, 5 days a week. The reported student-to-staff ratio ranged from 2:1 to 5:1. At their autism-only program, children received up to 2 h a week of speech therapy, up to an hour a week of occupational therapy, and up to half-an-hour a week of physical therapy.

Baseline measures of children's abilities. The Developmental Assessment of Young Children (DAYC; Voress and Maddox, 1998) was administered at Time 1 by a multidisciplinary evaluation team as part of standard community practice to determine eligibility for EI services. The DAYC is designed for use with children from birth through age 5 years, 11 months. It measures a child's abilities in five developmental areas (cognition, communication, social–emotional development, physical development, and adaptive behavior) through direct item administration, observation, and parent interview. Each of these assessment areas comprises a subtest with a standard score (M = 100, SD = 15). The DAYC was normed on a geographically diverse sample of 1269 children from the United States and Canada. The DAYC has adequate reliability and validity. Each of the subtests had excellent internal consistency (Cronbach's $\alpha \geq .95$) and test–retest reliability ($r \geq .94$). Construct validity was documented by significant correlations between the DAYC subsets at the total score of the Battelle Developmental Inventory: Screening Test (Newborg et al., 1988; $r \geq .47$, $p < .05$).

The primary DAYC subtests of interest were the cognitive, communication, social–emotional, and adaptive behavior subtests. The cognitive subtest consists of 78 items that measure conceptual skills and abilities, such as attention, memory, planning, decision making, and visual discrimination. Sample items from this subtest include "matches objects by color shape and size" (Item 34), "counts up to 5 objects" (Item 39), and "identifies 'first,' 'last,' and 'middle'" (Item 51). The communication subtest consists of 78 items that measure expressive and receptive language and verbal and nonverbal communication. Sample items from this subtest include "briefly stops activity when told 'no'" (Item 15), "uses at least 5 words" (Item 30), and "carries out 2-step unrelated commands" (Item 44). The social–emotional subtest consists of 58 items that measure a child's social awareness, relationships, social competence, and expression of emotions. Sample items include "plays well for brief time in groups of two or three children" (Item 26), "separates from parent in familiar surroundings without crying," and "talks about own feelings" (Item 42). The adaptive behavior subtest consists of 62 items that measure a child's independent functioning and self-help skills. Sample items from this subtest include "washes and dries face without assistance" (Item 33) and "uses all eating utensils" (Item 41).

Cognitive ability was measured at Time 1 using the cognitive subtest from the DAYC. While it is less than ideal to use different cognitive measures at different time points (such as the DAYC at Time 1 and the DAS at Time 2), this practice is relatively common when clinical research is conducted with children with ASD (see Perry et al., 2008), and there is some precedent for utilizing both the DAS and DAYC as measures of cognitive skills in children with ASD (see Howard et al., 2005).

Additional covariates of interest. Children's sociodemographic characteristics included sex, ethnicity, and household composition. Ethnicity was coded into five categories (i.e. Asian-Pacific Islander, Black-non-Hispanic, Hispanic, White-non-Hispanic, and other/unknown). The number of parents or guardians in the child's household at baseline (i.e. two parent/guardian household, one parent/guardian, or unclear/other) was also coded based on the EI records. In addition, we coded for whether children participated in birth-to-three EI programs prior to entering the three-to-five EI system. In the school district of interest, children can transition to kindergarten if they turn 5 years old before the start of classes in September. Parents can also elect to have their child attend preschool for another year before transitioning to elementary school. We therefore coded for whether children transitioned to elementary school in kindergarten or waited until first grade. Also, as previously mentioned, whether children changed settings during the course of three-to-five EI system was coded. Since children sometimes changed settings multiple times throughout their course of EI there were more than 18 possible placement combinations (e.g. (a) ASD-only; (b) ASD-only, then MD; (c) first ASD-only, then MD, and then inclusion; and (d) first ASD-only, then MD, then ASD-only). The small sample size precluded coding and investigating these changes more specifically. The ADOS (Lord et al., 1999), the "gold standard" semistructured observational assessment measure that uses a variety of social presses to assess symptoms of ASD, was administered at Time 2 by trained research staff in order to characterize the sample.

Analysis

Preliminary analyses included bivariate inspection of the data for undue influence. Analyses of variance (ANOVAs) and chi-square analyses were used to test for differences among the three placement groups on all variables at Time 1. Linear regression was used to test for associations between each variable of interest and cognition at Time 2. Because of concerns regarding statistical power, only covariates that were associated with the outcome variable at $p \leq .20$ were included in the final models. All continuous variables included as covariates were grand-mean centered to facilitate intercept interpretability. The final model used linear regression to compare cognitive outcomes among EI placements. We also tested interactions between EI placement and the baseline communication, social–emotional, and adaptive behavior DAYC subtests to determine whether some settings resulted in better outcomes for subgroups of children. To facilitate the interpretability of the findings, these interaction analyses were conducted using dichotomized variables. DAYC communication scores were dichotomized based on receiving a floor score (standard score < 50, the lowest possible standard score on the DAYC) as compared to not (standard score ≥ 50), which approximated a median split. DAYC social–emotional and adaptive behavior subtest scores were dichotomized based on a median split.

For each of the primary analyses, Hedges' g and its 95% confidence interval (CI) were calculated as a measures of effect size and precision, based on the adjusted mean difference, t value, and sample size using Comprehensive Meta-Analysis Version 2 (Borenstein et al., 2005). Hedges' g is a variation of Cohen's d (Cohen, 1988), correcting for potential bias due to small sample sizes (Hedges and Olkin, 1985). According to Cohen's effect size conventions (Cohen, 1992), the magnitude of Hedges' g can be expressed as small (.20), medium (.50), and large (.80).

Results

Participants

Children in the sample were on average 38.1 months old (SD = 7.0) when they were assessed for eligibility for three-to-five EI services and received intervention for an average of 2.1 years (SD = 0.6). Of the 98 participants (79 male), 37 received three-to-five EI in autism-only settings, 25 were in MD settings, and 36 were in inclusive settings. Consistent with the

Table 1. Participant characteristics by early intervention placement.

	Autism-only (*n* = 37)	MD (*n* = 36)	Inclusive (*n* = 25)	*p*
	n (%)/*M* (SD)	*n* (%)/*M* (SD)	*n* (%)/*M* (SD)	
Male	31.0 (83.8)	31.0 (86.1)	17.0 (68.0)	.18
Ethnicity				
Black	18.0 (48.6)	23.0 (63.9)	11.0 (44.0)	.04*
White	4.0 (10.8)	5.0 (13.9)	7.0 (28.0)	
Hispanic	5.0 (13.5)	6.0 (16.7)	1.0 (4.0)	
Asian/Pacific Islander	2.0 (5.4)	1.0 (2.8)	4.0 (16.0)	
Other/unknown	8.0 (21.6)	1.0 (2.8)	2.0 (8.0)	
Household				
1 parent	7.0 (18.9)	11.0 (30.6)	4.0 (16.0)	.36
2 parent	24.0 (64.9)	17.0 (47.2)	18.0 (72.0)	
Other/unknown	6.0 (16.2)	8.0 (22.2)	3.0 (12.0)	
Birth-to-three EI	28.0 (75.7)	24.0 (66.7)	16.0 (64.0)	.56
Time 1 age (months)	35.7 (4.3)	38.7 (7.9)	40.7 (7.9)	.02*
Time 1 DAYC				
Cognitive SS	64.7 (8.6)	65.3 (9.3)	64.6 (9.5)	.96
Social–emotional SS	65.0 (10.5)	67.2 (9.4)	67.9 (11.9)	.51
Median split low: SS < 70	19.0 (51.4)	17.0 (47.2)	12.0 (48.0)	.93
Adaptive behavior SS	73.3 (6.1)	77.0 (10.0)	76.4 (11.1)	.18
Median split low: SS < 76	22.0 (59.5)	12.0 (33.3)	13.0 (52.0)	.07
Communication SS	52.7 (6.4)	55.0 (8.6)	58.1 (9.8)	.04*
Split at floor: SS < 50	17.0 (45.9)	19.0 (52.8)	9.0 (36.0)	.43
Length of time in EI (years)	2.3 (0.6)	2.1 (0.7)	1.9 (0.6)	.11
Change EI placement	17.0 (45.9)	7.0 (19.4)	9.0 (36.0)	.05
Extra year of preschool	4.0 (10.8)	0.0 (0.0)	4.0 (16.0)	.06
Time 2 age (months)	67.3 (5.6)	67.0 (5.7)	67.4 (5.8)	.96
Time 2 cognitive SS (DAS)	57.1 (19.4)	54.4 (16.7)	66.0 (21.0)	.06
Time 2 ADOS severity score	6.8 (1.6)	6.5 (1.6)	5.8 (2.3)	.12

ADOS: Autism Diagnostic Observation Schedule; MD: mixed disability; EI: early intervention; DAYC: Developmental Assessment of Young Children; SS: standard score; DAS: Differential Abilities Scales.
*$p < .05$.

urban public school district in which this study was conducted, 52 children were identified as Black-non-Hispanic, 16 as White-non-Hispanic, 12 as Hispanic, 11 as other or were missing this information, and 7 as Asian-Pacific Islander. A measure of autism severity was unavailable at Time 1; at Time 2, average ADOS calibrated severity scores (Gotham et al., 2009) fell in the autism range (M = 6.4, SD = 1.8). Participant characteristics are reported in Table 1.

As seen in Table 1, the sex of the participants, type of household they lived in, whether they participated in the birth-to-three EI system, and the average number of years they received intervention as part of the three-to-five EI system did not statistically significantly differ among the three EI placement groups ($p \geq .10$). The number of participants that had remained in preschool for an extra year instead of transitioning to kindergarten also did not statistically significantly differ among the three groups (p = .07). The children in three EI placement groups did not have statistically significant differences in their average baseline DAYC cognitive (p = .98), social–emotional (p = .51), or adaptive behavior standard scores (p = .18), nor did they differ in the number that fell above or below the median on their social–emotional, adaptive behavior, and communication scores ($p \geq .07$). The three EI placement groups did differ, however, in the ethnicity (p = .04), age (p = .02), and DAYC communication standard scores (p = .04) of the participants at Time 1. The number of children who changed EI placement settings also differed among the three groups (p = .05).

Main effects of EI placement

As presented in Table 2, children who attended inclusive preschool placements had significantly higher Time 2 DAS GCA scores than those in MD placements (p = .02, g = 0.63, CI = (0.12, 1.15)), controlling for ethnicity and Time 1 DAYC cognitive, social–emotional, adaptive behavior, and communication scores (i.e. the covariates

Table 2. Unadjusted and adjusted models of Time 2 cognitive scores.

	Unadjusted coefficient	p	Adjusted coefficient	p
EI placement				
Reference group: inclusive		.06		
Mixed disability	−11.5		−11.3	.02*
Autism-only	−8.9		−6.5	.17
Female versus male	5.5	.26	—	—
Ethnicity				
Reference group: Black		.04*		
White	14.9		11.1	.04*
Hispanic	7.1		11.2	.05
Asian/Pacific Islander	−6.7		−7.2	.31
Other/unknown	1.0		5.8	.32
Household				
Reference group: 2 parent		.27		
1 parent	7.1		—	—
Other/unknown	−1.6		—	—
Birth-to-3 EI versus no birth-to-3 EI	1.5	.74	—	—
Time 1 age (months)	3.2	.41	—	—
Time 1 cognitive standard score	0.9	<.01	0.5	.04*
Time 1 social–emotional standard score	0.6	<.01*	0.2	.44
Time 1 adaptive behavior standard score	0.4	<.01*	0.3	.27
Time 1 communication standard score	1.0	<.01*	0.4	.20
Change EI placement versus no change	−2.7	.52	—	—
Length of time in EI (years)	−0.8	.79	—	—
Extra year of preschool vs. no extra year	−4.5	.50	—	—

EI: early intervention.
*$p < .05$.

whose unadjusted association with the outcome had a p value <.20). Children in inclusive placements made on average an 11.3 point greater cognitive gain than children in MD placements. Children in inclusive settings also made on average an 6.5 point greater cognitive gain than children in autism-only placements; this difference was not statistically significant ($p = .17$, $g = .35$, CI = (−0.15, 0.86)). Time 2 cognitive scores of children in autism-only placements and MD placements did not significantly differ ($p = .23$, $g = .28$, CI = (−0.18, 0.74)). Time 1 cognitive scores were also a statistically significant predictor of outcomes ($p = .04$).

Moderators of intervention placement effects

EI placement and social–emotional ability. As presented in Figure 1, among children with low social–emotional scores at Time 1, children who attended inclusive placements had higher Time 2 DAS GCA scores than those in autism-only ($p = .03$, $g = 0.79$) or MD ($p < .05$, $g = 0.74$) placements, controlling for ethnicity and for Time 1 DAYC cognitive, adaptive behavior, and communication scores. In the low Time 1 social–emotional subgroup, children who attended inclusive placements had on average 13.9 point and 13.4 higher DAS GCA scores at Time 2 than children in autism-specific and MD placements, respectively. Time 2 DAS GCA scores for autism-only and MD placements did not significantly differ from one another in the low social–emotional subgroup ($p = .93$, $g = 0.03$). Among children with high social–emotional scores at Time 1, Time 2 DAS GCA scores did not significantly differ among the three placements ($p > .07$, $g < 0.58$).

EI placement and communication ability. As presented in Figure 2, among children with higher communication scores at baseline, those who attended an inclusive EI placement had significantly higher Time 2 DAS GCA scores than those who attended a MD EI placement ($p = .02$, $g = 0.82$), controlling for ethnicity and for Time 1 DAYC cognitive, social–emotional, and adaptive behavior scores. Children who attended inclusive settings had on average a 14.1 point higher Time 2 DAS GCA scores than those in the MD placements. The cognitive outcomes of children in this subgroup who attended autism-only placements did not significantly differ from those who attended the other settings ($p > 0.15$, $g < 0.47$). Among children who floored on the DAYC communication subtest at Time 1, Time 2 DAS GCA scores did not significantly differ among the three placements ($p > .26$, $g < 0.45$).

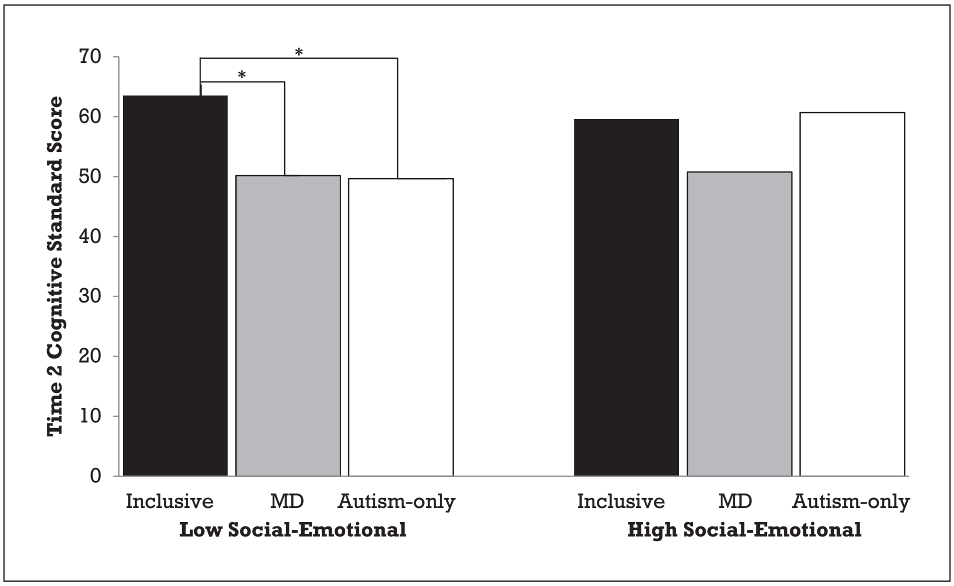

Figure 1. Time 2 adjusted cognitive scores regressed onto early intervention placement and Time 1 social–emotional level.
Note: Adjusted for Time 1 DAYC cognitive, communication, and adaptive behavior standard scores, and for ethnicity. Low social–emotional: standard score < 70 and high social–emotional: standard score ≥70.
MD: mixed disability; DAYC: Developmental Assessment of Young Children.
*$p < .05$.

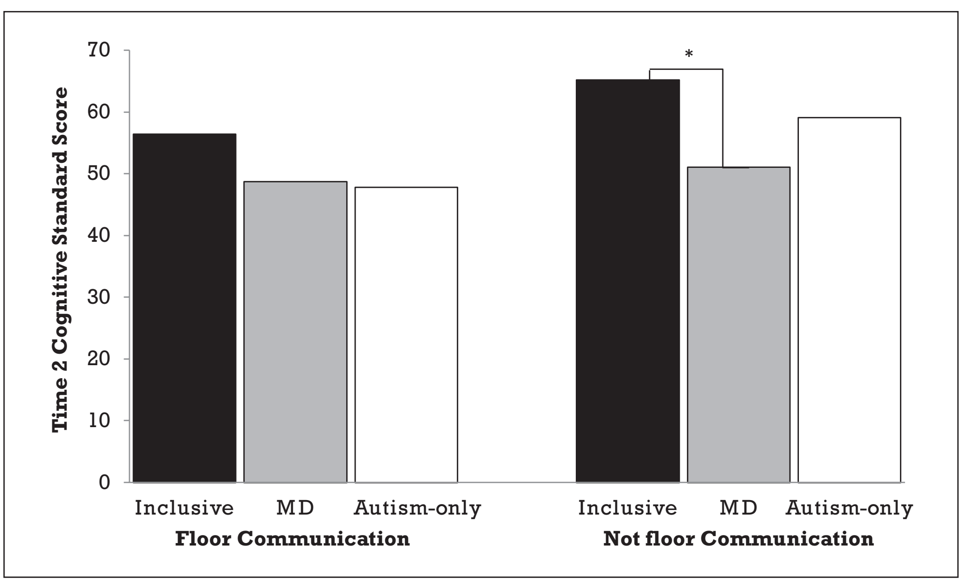

Figure 2. Time 2 adjusted cognitive scores regressed onto early intervention placement and Time 1 communication level.
Note: Adjusted for Time 1 DAYC cognitive, adaptive behavior, and social–emotional standard scores, and for ethnicity. Floor communication: standard score < 50 and not floor communication: standard score ≥50.
MD: mixed disability; DAYC: Developmental Assessment of Young Children.
*$p < .05$.

EI placement and adaptive behavior. As presented in Figure 3, for children with low adaptive behavior scores at Time 1, children in inclusive placements had significantly higher Time 2 DAS GCA scores than those in MD placements controlling for ethnicity and for Time 1 DAYC cognitive, social–emotional, and communication scores ($p < .01$, $g = 1.22$). In this subgroup, children in an inclusive placement had 21.6 point higher scores than children in the MD placements and 10.3 point higher scores than children in the autism-only placements. The differences in outcomes for the autism-only placement as compared to the other placements were not statistically significant ($p > .07$, $g < 0.58$).

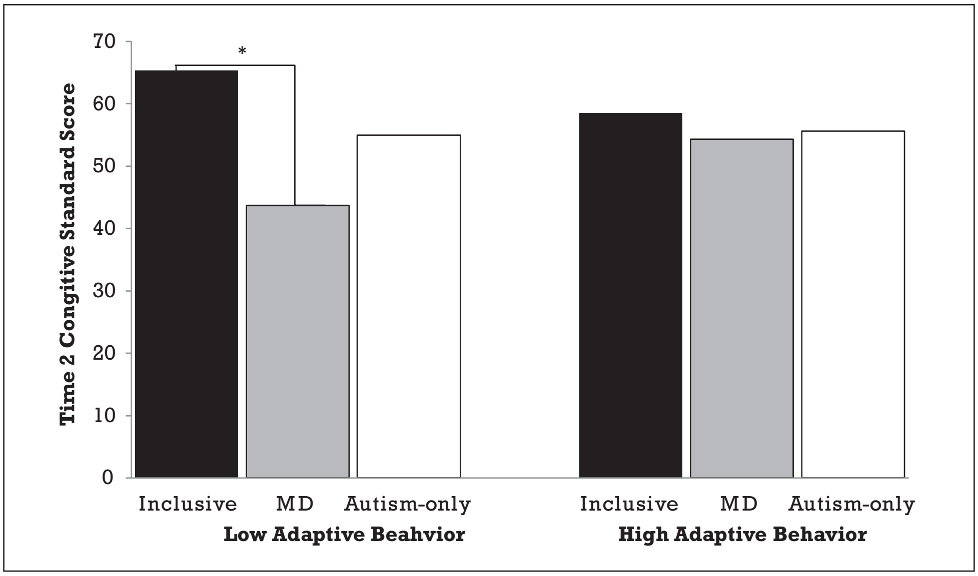

Figure 3. Time 2 adjusted cognitive scores regressed onto early intervention placement and Time 1 adaptive behavior level.
Note: Adjusted for Time 1 DAYC cognitive, communication, and social–emotional standard scores and for ethnicity.
Low adaptive behavior: standard score < 76 and high adaptive behavior: standard score ≥76.
MD: mixed disability; DAYC: Developmental Assessment of Young Children.
*p < .05.

Among children with higher adaptive behavior scores at Time 1, Time 2 DAS GCA scores did not significantly differ among the three placements ($p > .50$, $g < 0.23$).

Discussion

In this study, children with ASD in any of three different EI settings—inclusion, MDs, and autism-only—did not differ significantly on the majority of baseline child and family characteristics. Children in inclusive settings, however, experienced greater average gains in cognitive scores than some children who attended placements without typically developing peers. The relative benefit of inclusive preschool placement over MD placements on cognitive outcomes was particularly apparent among children with more severe social impairments, with lower adaptive behavior skills, and with at least some expressive or receptive communication, as indicated by medium-to-large and large effect sizes. Among children with more severe social impairments, inclusive preschool placements also had a relative benefit over autism-only settings, as indicated by a medium-to-large effect size. Consistent with most previous research (Ben-Itzchak and Zachor, 2007; Harris and Handleman, 2000; Perry et al., 2011), children's initial cognitive scores were a strong predictor of later outcomes.

This study is unique in its investigation of outcomes in elementary school of children with ASD having received three-to-five EI from community providers in an urban American school district. However, some study limitations are important to consider. First, the conclusions are limited by the use of one cognitive measure at Time 1 (the DAYC) and another at Time 2 (the DAS). It would be more consistent to use the same measure at both time points. It is likely, however, that the use of two different measures increases the error variance, attenuating observed results and biasing findings to the null. Second, because subjects were sampled from autism support classrooms, it is possible that the sample does not include the highest achievers in EI, who are more likely to be mainstreamed in elementary school. Most of the children with ASD in this school district, however, receive their elementary education in autism support classrooms. Perhaps more importantly, children who end up in general education classrooms are probably more likely to have come from inclusion settings, thereby again biasing the results in the opposite direction as what was found. The third study limitation is the use of retrospective chart data. Unlike in randomized trials that control for potential threats to internal validity arising from history, maturation, and selection effects, in this study, it is possible that unmeasured variables contribute to both placement decisions and cognitive outcomes. For example, baseline characteristics that were not measured directly, such as autism severity, may have played a role in placement decisions. Information unavailable in the children's records, such as teacher experience, student–teacher ratios, hours of all behavioral intervention received (including interventions not coordinated by the EI system), receipt of medical interventions, and children having attended multiple placement settings may have impacted cognitive outcomes. In addition, the inability to measure the specific curricula and other practices used in these programs and assess the fidelity of their implementation limits our understanding of the specific mechanisms responsible for the observed outcomes. The use of a quasi-experimental design precludes us from drawing strong inferences about causality, and a randomized control trial is required to conclusively establish the relative benefits of inclusive preschool programs on cognitive outcomes for children with ASD, and the relative benefits of these programs for children of different abilities. However, the minimal differences between the groups at baseline, the statistical controls included in all analyses, and the magnitude of the effect sizes serve to increase confidence in the robustness of these findings and the potential importance of inclusive programming for children with ASD.

Despite these limitations, there are important research and practical implications of these findings. The observed relative benefit of the inclusive placement for some children with ASD suggests that the increased opportunities to interact with and learn from typically developing peers may be particularly important for the cognitive outcomes of some children with ASD. Peer modeling through integrated play groups has been demonstrated to improve imitation skills, social behaviors, and nonsocial engagement (Garfinkle and Schwartz, 2002), as well as play skills and communication (Smith et al., 2002; Zercher et al., 2001) for children with ASD. The mixed disability placement may be particularly inadequate for some children with ASD because it provides the fewest opportunities either to interact with typically developing peers (as in the inclusive placements) or receive autism-specific intervention (presumably available in the autism-only placements). Differences among the placements in the use of evidence-based practices, the experience and training of teachers, and the quality of the classrooms are all other possible factors that may have affected outcomes and are worthy of future study.

The findings regarding the interaction of clinical profile and setting are intriguing. To obtain the benefits associated with inclusion, children may require some baseline language skills. This skill may be a necessary building block to engaging in and learning from interactions with the typically developing peers present in these settings. Inclusion settings may also be particularly beneficial for children with low social–emotional and adaptive behavior skills by enabling interactions with peer models who utilize more sophisticated social, emotional, and adaptive strategies.

While we believe these findings to be robust and provocative, the retrospective nature of the study warrants cautious interpretation of the findings. Prospective research, including careful measurement of potential active intervention ingredients and randomized allocation to treatment groups, is critically needed to determine which mix of peer interaction and autism-specific programming will maximize outcomes for which children in community settings.

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Declaration of conflicting interest

The opinions expressed are those of the authors and do not represent views of the Institute or the US Department of Education.

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