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Treatment approach, autism severity and intervention outcomes in young children

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ABSTRACT

The current study examined the relation between autism severity at baseline, type of intervention employed and outcomes in young children with autism spectrum disorder (ASD). Seventy-eight children with ASD, aged 15–35 months ($M = 25.4$, SD = 4.2), received either applied behavioral analysis (ABA) or integration of several intervention approaches (Eclectic) in community center-based programs. Outcome was measured after 1 year of intervention using standardized autism diagnostic tests, and cognitive and adaptive skills evaluations. ASD diagnosis was highly stable (99%). Both intervention groups improved significantly in verbal cognitive abilities and in socialization and communication adaptive skills, but no significant difference between the intervention groups was documented. Less severe autism symptoms at baseline were associated with better progress in adaptive skills and in cognitive abilities. Within the group with less severe autism symptoms, those who received Eclectic intervention had a better outcome than those who received ABA in communication and socialization adaptive skills as reported by the parents, but not in the standardized cognitive test results. The child's baseline social abilities and deficits appear to be crucial variables for intervention outcomes and should be considered in treatment approach decision-making.

1. Introduction

Intervention outcome of children with autism spectrum disorder (ASD) has been the focus of many studies. Previous reports documented significant gains in various developmental domains for children with ASD receiving early intervention (Ben Itzchak & Zachor, 2007; Howlin, 2002; Lord et al., 2005; Magiati, Charman, & Howlin, 2007; Zachor, Ben Itzchak, Rabinovitch, & Lahat, 2007). Studies that focused on early intensive behavioral intervention (EIBI) documented significant progress in cognitive and educational functioning in about 47% of the children tested (Lovaas, 1987; McEachin, Smith, & Lovaas, 1993). Most intervention outcome studies found EIBI to be superior to an Eclectic approach, an integration of several intervention approaches, in progress in cognitive abilities (Cohen, Amerine-Dickens, & Smith, 2006; Eikeseth, Smith, Jahr, & Eldevik, 2002; Eikeseth, Smith, Jahr, & Eldevik, 2007; Eldevik, Eikeseth, Jahr, & Smith, 2006; Howard, Sparkman, Cohen, Green, & Stanislaw, 2005), adaptive skills (Cohen et al., 2006; Eikeseth et al., 2002, 2007; Eldevik et al., 2006; Howard et al., 2005) and autism severity (Zachor et al., 2007). However, a more recent study did not report significant differences between

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EIBI and other modes of intervention (Magiati et al., 2007). Currently, researchers are not conclusive regarding which intervention approach is more effective.

There are great individual differences in response to intervention in children with ASD. In recent years, the concept of autism spectrum has been extensively used in the classification of children according to the severity of their autism symptoms. However, the impact of pre-intervention autism severity on outcome of intervention has been addressed only in a few research studies (Ben Itzchak & Zachor, 2007; Magiati et al., 2007; Turner & Stone, 2007). The use of Autism Diagnostic Interview-Revised (ADI-R) (Lord, Rutter, & LeCouteur, 1994) and Autism Diagnosis Observation Schedule (ADOS) (Lord, Rutter, DiLavore, & Risi, 1999) diagnostic tools in recent years has enabled quantitative measuring of autism symptoms. Milder symptoms of autism in the social domain using the ADOS were associated with better post-intervention outcomes. Turner and Stone (2007) reported changes in autism classification to off-spectrum diagnosis. Ben Itzchak and Zachor (2007) described better gains in receptive and expressive language skills with intervention. Magiati et al. (2007) reported that pre-intervention ADI total raw scores contributed to the prediction of 'total progress rank' constructed by the authors. Research has not yet looked at whether children with a spectrum of autism severity show diverse responses to different intervention approaches.

1.1. Aims of the study

1. To examine the effect of the intervention approach (ABA, Eclectic) on outcome in cognitive, language, and adaptive skills and on changes in autism diagnosis categories.
2. To examine the relation between autism severity at baseline, type of intervention employed and outcome in adaptive skills.

2. Methods

2.1. Participants

A cohort of 114 children was recruited from seven center-based autism-specific early intervention community-based preschools. All the children underwent a clinical evaluation by a neurodevelopmental pediatrician. All the parents were interviewed using the Autism Diagnosis Interview-Revised (ADI-R) (Lord et al., 1994) by interviewers who established reliability as required. Children who were enrolled in the study met clinical diagnosis of autism based on DSM-IV (APA, 1994) criteria and the cut-off points on the ADI-R. Four preschools used applied behavior analysis (ABA) principles and three used an Eclectic approach (Eclectic). A governmental welfare committee decided the placement of children with a diagnosis of ASD to community-based intervention programs based on the family place of residence. Therefore, children were not randomly assigned to a specific intervention approach. Thirty-seven children were excluded because of additional major medical diagnoses or incomplete post-intervention assessments. The remaining 71 boys and 7 girls, aged 15–35 months, were divided into two groups based on the intervention approach. The groups did not differ statistically in age, baseline cognitive level, adaptive skills and severity of autism symptoms (ADOS new algorithm) (Gotham et al., 2008), parental education and parental ages (ANOVAs) (Table 1).

Informed consent was obtained from all parents for use of data from their child's chart in accordance with the institutional Helsinki committee at Assaf Harofeh Medical Center.

2.2. Interventions

Two intervention approaches, Eclectic and ABA, implemented in autism-specific preschools were compared. Both groups received the same budget per child from the same national agencies. Children stayed for 8 h a day in all the autism-specific

Table 1
Child's characteristics and parental demographic data in the ABA and Eclectic intervention groups.

		Eclectic ($N = 33$)	ABA ($N = 45$)	F
Child's age (months)	Mean (SD)	26.0 (4.6)	25.1 (3.9)	$F(1,76) = 1.02$, $p = .3$
	Range	15–33	17–35	
MSEL cognitive composite	Mean (SD)	73.3 (22.2)	72.2 (19.2)	$F(1,64) = .09$, $p = .8$
	Range	49–132	49–135	
Autism severity: ADOS new algorithm	Mean (SD)	20.1 (4.6)	20.9 (4.3)	$F(1,76) = .66$, $p = .4$
	Range	10–26	10–26	
Vineland adaptive behavior composite score	Mean (SD)	68.6 (6.3)	66.2 (9.6)	$F(1,67) = 2.40$, $p = .1$
	Range	59–81	49–75	
Maternal years of education	Mean (SD)	15 (2.7)	14.3 (2.2)	$F(1,74) = 1.51$, $p = .2$
	Range	11–22	11–20	
Paternal years of education	Mean (SD)	14.9 (3.1)	14.4 (2.8)	$F(1,72) = .50$, $p = .5$
	Range	10–20	8–20	
Maternal age (years)	Mean (SD)	34.2 (7.0)	32.4 (4.6)	$F(1,74) = 2.30$, $p = .1$
	Range	23–50	24–43	
Paternal age (years)	Mean (SD)	36.9 (5.6)	36.3 (5.5)	$F(1,71) = .17$, $p = .7$
	Range	26–60	28–50	

preschool programs regardless of the intervention type. In both programs support for parents and the professional team was provided by a social worker once a week.

The ABA-based program: The staff:child ratio was 1:1. Children received 20 h/week of 1:1 intervention. Each child's program comprised individualized goals and objectives to increase language, play, social, emotional, academic and daily living skills and to reduce inappropriate behaviors. Each individual program was updated once a week based on direct observational management. Various behavior analytic techniques were used including discrete trial, incidental teaching, shaping for positive reinforcement, successive approximation, systematic prompting and fading procedures, discrimination learning, task analysis and functional assessment and reinforcement procedures according to several treatment manuals (Leaf & McEachin, 1999; Maurice et al., 1996). The intervention team included the program supervisors, trained therapists, speech and language pathology (SLP), occupational therapy (OT) and special education preschool teachers. The supervisors held Masters Degrees in psychology or in special education and were all Board Certified in Behavior Analysis (BCBA). Each supervisor was responsible for designing, evaluating and modifying the individual intervention program. Each week the child's progress was measured and assessed by the supervisor who modified the program goals and intervention procedures as needed. The program was delivered by therapists who had graduated from a course in behavior analysis principles and were trained and supervised by the program supervisors. Each child had three different therapists to increase generalization of learned skills. The SLP and OT consulted the supervisor in their specific areas and their recommendations were implemented in the individual program. The special education preschool teacher coordinated the team work, daily communication with the parents, purchasing learning aids and conducted "group circle time" twice a day. Parents received weekly instructions for home treatment from the behavior analyst who supervised the child's program. Frequent direct observations of therapists implementing procedures, assessing differences between therapists' reports on the child's responses, and frequent feedback from supervisors were used.

The Eclectic approach: This intervention integrated principles of different philosophies including Developmental (Rogers & DiLlla, 1991), Developmental Individual Difference Relationship (DIR) (Greenspan & Wieder, 1999) and The Treatment and Education of Autistic and Related Communication Handicapped Children (TEACCH) (Lord & Schopler, 1989). The staff:child ratio each day was 5:7. Each child's program comprised individualized goals and objectives in language, play, social, emotional, sensory-motor, academic and daily living domains. Each professional designed the intervention program of his/her own domain (e.g., SLP designed the language and play goals, OT the sensory-motor and daily living goals). The type of intervention philosophy employed in each individual program was planned based on the child's characteristics and the staff's decision and preferences. The child's progress in each of the learning domains was periodically reviewed and changes in the type and goals of intervention were modified accordingly. The intervention plan was not based on a formal treatment protocol but rather on the expertise of the professionals involved. The intervention team included a clinical psychologist, a special education preschool teacher, SLP, OT, cognitive trainer, music therapist and teacher's aids. The clinical psychologist provided guidance for parents and for the professional team and emotional intervention for the children (1 h/week of 1:1). The special education teacher coordinated the schedule of the intervention program, supervised the aids and delivered the "circle time" and other group activities. SLP, OT, cognitive trainer and music therapist provided individual treatment for 2 h/week (overall 8 h/week) and instructed the teachers' aids, each in their own area of expertise. Treatment goals were practiced in 1:1 sessions by the preschool team for an additional 10 h a week (total of 19 h/week of individual encounters with the child) and during group activities. In addition, the plan included a strong family intervention and active parental participation in the program. Parents arrived for 1 full day a week to observe the program's activities, to join the child's treatment, and to receive guidance for home practice.

The programs were similar overall in their budget per child, hours in the preschool setting, support for the parents and the staff and individual 1:1 treatments. Programs were different in several aspects: the intervention philosophy, the type of professionals involved and their responsibilities in the program, use of treatment protocols, measure of progress and data recording, and the extent of parental involvement.

2.3. Measures

2.3.1. Autism Diagnostic Interview-Revised (ADI-R)

A semi-structured interview administered to parents was designed to make a diagnosis of autism according to both DSM-IV (Lord et al., 1994) criteria.

2.3.2. Autism Diagnosis Observation Schedule (ADOS)

A semi-structured, interactive schedule designed to assess social and communicative functioning. The new ADOS diagnostic algorithm that classifies children into categories of autism, ASD or non-spectrum was used (Gotham et al., 2008; Lord et al., 1999).

2.3.3. Vineland adaptive behavior scales (Vineland)

The test assesses functioning in four adaptive skills domains: communication, daily living skills, socialization and motor skills (Sparrow, Balla, & Cicchetti, 1984).

2.3.4. Mullen Scales of Early Learning (MSEL)

The test evaluates cognitive abilities in visual reception, fine motor, expressive language and language comprehension domains. We defined a non-verbal cognitive measure composed of visual reception plus fine motor scores [both domains were highly correlated ($r = .63$, $p < .001$)], and a verbal measure composed of expressive plus receptive language scores [both domains were highly correlated ($r = .70$, $p < .001$)] (Mullen, 1995).

2.4. Procedures

Children underwent comprehensive evaluations at pre-intervention (T1) and after 1 year of intervention (T2). Of the 78 children who completed the ADOS at T1, 71 had the Vineland and the MSEL. At T2, 77 children completed the ADOS, of whom 75 had the Vineland and 69 the MSEL. All interviewers and examiners had previously established reliability on the ADI-R and ADOS tests as required. Assessments were conducted either at the "Autism Center" or at one of the intervention facilities depending on the parents' transportation constraints. When assessments were conducted in the "Autism Center" the examiners were blind to the intervention type and pre-intervention measurements. When assessments were conducted in the intervention facility the examiners were blind to the first measurement but not to the intervention type. None of the examiners were involved in any stages of the intervention process.

2.5. Data analysis

To compare improvement in the two intervention groups, four two-way MANOVAs [2 interventions (Eclectic, ABA) $\times$ 2 times (pre- and post-intervention)] with repeated measures on time were applied over the MSEL and Vineland raw and standard scores. Univariate ANOVAs were performed over the sub-domains in each analysis. To examine the effect of T1 autism severity and the type of intervention used on outcome in adaptive skills, the entire group was divided into high and low autism severity subgroups. High and low ADOS groups were defined based on the median scores of T1 ADOS new algorithm. Since the groups differed in their T1 Vineland and MSEL scores, two 2×2 MANCOVAs (2 interventions $\times$ 2 high/low ADOS) for the Vineland and MSEL standard scores were performed at T2, controlling for the T1 scores.

3. Results

3.1. Effects of intervention approach on outcome

Improvement was measured by change in autism diagnostic category, cognitive abilities and adaptive skills.

3.1.1. Autism diagnostic categories

To examine change in autism severity, the new ADOS criteria for classification of autism, ASD and non-spectrum (Gotham et al., 2008) at T1 and T2 were used. Diagnosis stability was very high at T2, as 71 children (91%) remained with a classification of autism. At T2, of the 45 children in the ABA intervention group, three (6.7%) improved their ASD classification (one child no longer met criteria for ASD and 2 children moved from autism to ASD classification). Two children (4.4%) deteriorated and moved from ASD to a classification of autism. Of the 33 children in the Eclectic program, two children moved from autism to ASD classification (6%). Thus, both intervention groups showed similar stability and change of autism symptoms.

3.1.2. Cognitive abilities

Evaluation of progress in cognitive abilities yielded significant time-effect ($F(4,60) = 51.17$, $p < .001$, $\eta^2 = .780$); however no interaction of intervention groups and time was found. Significant time-effect was noted for all the MSEL domains (raw scores) (Table 2).

Furthermore, significant time-effect ($F(4,54) = 9.51$, $p < .001$, $\eta^2 = .413$) was noted for changes in MSEL standard scores (Table 2), indicating that rate of progress was faster than the time-period elapsed. Analyses of each domain revealed significant time-effect only for the receptive language ($F(1,56) = 25.28$, $p < .001$, $\eta^2 = .307$) and expressive language ($F(1,57) = 26.05$, $p < .001$, $\eta^2 = .314$) domains.

3.1.3. Adaptive behavior skills

Evaluation of Vineland raw scores before and after 1 year of intervention yielded a significant time-effect ($F(4,63) = 56.36$, $p < .001$, $\eta^2 = .782$). Analyses of each domain revealed significant time-effect in all the examined domains (Table 2). No interaction of intervention groups and time was found. A similar analysis was performed over the Vineland standard scores and yielded a significant time-effect ($F(4,63) = 3.19$, $p < .05$, $\eta^2 = .168$). Analyses in each domain revealed significant time-effect only in the communication ($F(1,66) = 25.13$, $p < .001$, $\eta^2 = .276$) and socialization ($F(1,66) = 7.85$, $p < .01$, $\eta^2 = .106$) domains. In contrast, motor skills standard scores significantly decreased with time ($F(1,66) = 31.09$, $p < .001$, $\eta^2 = .320$).

Table 2
MSEL cognitive and Vineland adaptive skills raw scores (RS) and standard scores (SS): comparison of ABA and Eclectic interventions over time.

		Intervention				Time	
		ABA		Eclectic		$F(1,63)$	η^2
		T1	T2	T1	T2		
MSEL cognitive scores							
Visual	RS	29.9 (5.3)	35.9 (7.5)	25.6 (4.7)	32.6 (7.4)	89.58***	.587
	SS	42.3 (12.7)	42.4 (18.2)	37.7 (12.1)	43.1 (17.0)	2.88	.48
Fine motor	RS	25.2 (4.9)	30.7 (6.0)	24.2 (4.1)	27.9 (4.6)	109.12***	.634
	SS	33.0 (14.0)	33.0 (14.6)	34.1 (12.9)	33.7 (14.5)	.36	.001
Receptive language	RS	20.6 (9.7)	28.7 (10.7)	17.5 (8.5)	26.1 (8.2)	117.49***	.651
	SS	34.4 (15.2)	40.1 (14.2)	29.6 (14.8)	37.7 (12.8)	25.3***	.307
Expressive language	RS	17.0 (8.4)	26.8 (11.0)	16.8 (7.8)	25.9 (10.0)	103.28***	.621
	SS	28.8 (11.3)	35.6 (15.0)	31.4 (12.5)	39.0 (14.3)	26.0***	.314
		Intervention				Time	
		ABA		Eclectic		$F(1,66)$	η^2
		T1	T2	T1	T2		
Vineland adaptive behavior scores							
Communication	RS	19.6 (9.0)	42.0 (16.3)	22.8 (12.1)	44.3 (15.7)	165.49***	.715
	SS	67.0 (7.8)	72.9 (14.7)	69.5 (10.7)	78.8 (16.2)	25.1***	.276
Daily living	RS	17.4 (6.7)	35.8 (13.5)	19.5 (6.5)	36.7 (15.2)	136.11***	.673
	SS	67.7 (7.0)	67.8 (10.9)	69.4 (6.0)	73.0 (14.6)	1.66	.025
Socialization	RS	25.8 (5.5)	38.8 (10.7)	28.0 (6.2)	42.4 (11.5)	120.38***	.646
	SS	67.8 (7.7)	69.6 (12.4)	70.7 (7.7)	77.4 (14.4)	7.85	.106
Motor skills	RS	33.5 (5.8)	43.1 (7.0)	35.1 (4.6)	45.8 (6.1)	161.21***	.710
	SS	86.2 (11.4)	72.0 (12.9)	88.1 (11.0)	84.5 (13.0)	31.1***	.320

*** $p < .001$.

3.2. The relation between autism severity at baseline, type of intervention employed and outcome

3.2.1. Outcome in cognitive abilities

The MANCOVA for the MSEL standard scores yielded autism severity effect ($F(4,52) = 5.85$, $p < .001$, $\eta^2 = .310$). The low ADOS group improved significantly more than the high ADOS group in the MSEL visual ($F(1,55) = 9.29$, $p < .01$, $\eta^2 = .144$), receptive language ($F(1,55) = 4.84$, $p < .05$, $\eta^2 = .075$) and expressive language ($F(1,55) = 19.69$, $p < .001$, $\eta^2 = .264$) domains. Separated MANCOVAs for each ADOS group indicated that progress at T2 was significant for both the low ($F(4,25) = 6.80$, $p < .001$, $\eta^2 = .521$) and the high ($F(4,30) = 7.33$, $p < .001$, $\eta^2 = .494$) ADOS group. The two groups improved significantly in the visual and receptive and expressive language domains but the effects were greater for the low ADOS group (Table 3). No autism severity and intervention interaction effect was found ($F(4,52) = .87$, $p > .05$, $\eta^2 = .063$).

3.2.2. Outcome in adaptive skills

The MANCOVA for the Vineland standard scores yielded autism severity group effect ($F(4,61) = 6.43$, $p < .001$, $\eta^2 = .313$). The low ADOS group improved significantly more than the high ADOS group in the Vineland communication ($F(1,67) = 23.52$,

Table 3
Outcome in MSEL and Vineland standard scores for the low and high ADOS groups.

MSEL cognitive scores	*M* (SD)	T1	T2	$F(1,33)$	η^2	T1	T2	$F(1,28)$	η^2
Visual		35.6 (10.7)	31.9 (11.4)	4.00*	.108	72.4 (9.8)	82.1 (13.4)	13.36***	.323
Fine motor		28.4 (12.1)	27.3 (12.5)	.44	.013	40.0 (12.1)	39.2 (13.8)	.21	.008
Receptive language		24.1 (8.2)	31.3 (10.9)	16.34***	.331	40.3 (16.4)	46.8 (11.8)	10.24**	.268
Expressive language		24.0 (7.0)	27.2 (8.6)	7.60**	.187	35.7 (12.8)	47.6 (12.7)	22.98***	.451
Vineland adaptive behavior scores	*M* (SD)	T1	T2	$F(1,37)$	η^2	T1	T2	$F(1,29)$	η^2
Communication		64.7 (7.2)	67.2 (11.5)	2.25	.057	72.4 (9.8)	82.1 (13.5)	36.38***	.556
Daily living		67.4 (6.8)	65.0 (9.5)	2.70	.068	69.8 (6.1)	76.6 (13.7)	7.52**	.206
Socialization		67.7 (7.7)	66.4 (10.4)	.53	.014	70.8 (7.6)	81.3 (13.2)	23.35***	.446
Motor skills		82.2 (11.4)	73.6 (13.0)	40.92***	.525	89.3 (10.6)	82.5 (14.5)	4.96*	.146

* $p < .05$.
** $p < .01$.
*** $p < .001$.

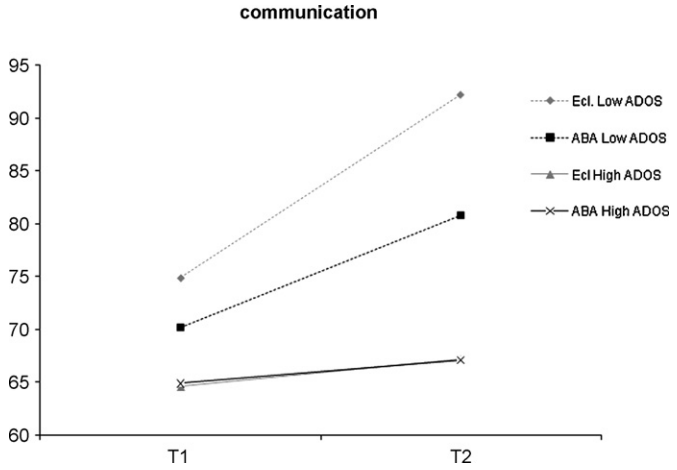

Fig. 1. Outcomes in the Vineland communication domain for the low and high ADOS groups in the ABA and Eclectic intervention groups.

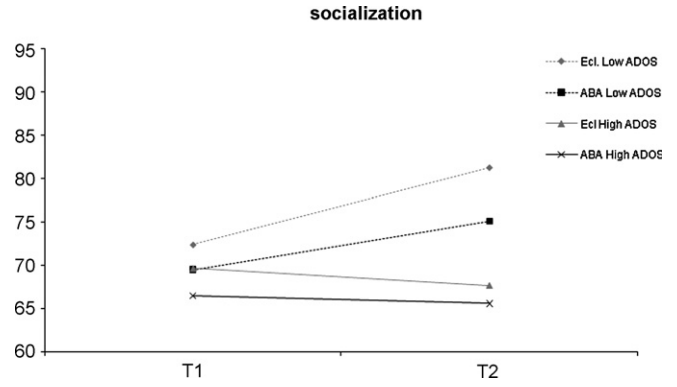

Fig. 2. Outcomes in the Vineland socialization domain for the low and high ADOS groups in the ABA and Eclectic intervention groups.

$p < .001$, $\eta^2 = .282$), daily living ($F(1,67) = 6.84$, $p < .05$, $\eta^2 = .102$) and socialization ($F(1,67) = 19.15$, $p < .001$, $\eta^2 = .242$) domains. Separated MANCOVAs for each ADOS group indicated that progress at T2 was significant only for the low ADOS group ($F(4,26) = 11.40$, $p < .001$, $\eta^2 = .637$). Both groups decreased in the Vineland motor skills domain scores but the effect was greater for the high ADOS group (Table 3).

In addition, a significant interaction of intervention type and autism severity was found in regard to T2 Vineland communication ($F(1,60) = 4.94$, $p < .05$, $\eta^2 = .076$) and socialization ($F(1,60) = 6.22$, $p < .05$, $\eta^2 = .094$) scores (Figs. 1 and 2).

In the low ADOS group those who received Eclectic intervention gained significantly more than those who received ABA in the Vineland communication ($F(1,29) = 36.38$, $p < .001$, $\eta^2 = .556$) and socialization ($F(1,29) = 25.35$, $p < .001$, $\eta^2 = .446$) domains. In the high ADOS group there was no significant difference between the two intervention groups in the Vineland gains.

4. Discussion

The present research compared two intervention approaches for young children with ASD, ABA and Eclectic, provided in autism-specific community preschools. Both intervention groups improved significantly, but there were no significant group differences over time in any of the outcome measures, change in autism diagnostic classification, cognitive abilities, or adaptive skills. These results emphasize the importance of early autism-focused intervention but indicate that the type of intervention is not a major factor.

A limited number of studies have compared the effectiveness of ABA versus Eclectic intervention programs. Most studies reported superior results in cognitive, language, and adaptive skills for intensive, over 30 h/week, of behavioral intervention over Eclectic approaches (Cohen et al., 2006; Eikeseth et al., 2002; Howard et al., 2005; Zachor et al., 2007). Several differences between these studies and the current one might explain the different results. For example, the intensity of 1:1 treatments was between 30 and 40 h/week in the ABA superior groups (Cohen et al., 2006; Howard et al., 2005) but only 20 h in our work. In most previous studies, ABA was provided in home-based settings (Cohen et al., 2006; Howard et al., 2005)

while here it was implemented in a center-based preschool format. Finally, the mean age of our participants (25.4 months) at the start of treatment is younger than in other comparative studies [e.g., 30–37 months in Howard et al., 2005, 4–7 years in Eikeseth et al., 2002]. Similar to our results, Magiati et al. (2007) reported that young children treated in home-based ABA and autism-specific nurseries showed similar improvements in cognitive, adaptive, play, language and autism severity. These results suggest that the plasticity of the brain at this early age enables significant response to any intense and focused treatment.

The current study finds high stability of ASD diagnosis made at age two using the new ADOS algorithm in both intervention groups, with 91% of the children remaining with an autism classification and 99% with an ASD category after 1 year. These results emphasize the reliability of the ASD diagnosis in our sample without false positive cases at baseline. These findings are in accordance with the results of short-term stability (90%) of the autism diagnosis described by Chawarska, Klin, Paul, and Volkmar (2007). In contrast, Turner and Stone (2007), who used the old ADOS algorithm to assess diagnosis stability between the ages of 2 and 4 years, reported that 32% of the children diagnosed with ASD at 2 years did not meet the criteria for ASD at age 4. Using different algorithms for the ADOS and looking at the 2-year outcome in this study versus 1-year change in autism classification in our study might explain the differences in stability rates. The new ADOS algorithm includes the stereotyped behavior domain, in addition to the reciprocal social interaction and language and communication domains in the old algorithm. This new algorithm gives a more accurate description of autism symptomatology and, therefore, more children remain in the ASD classification. Other studies that looked at diagnostic classification as an outcome measure of intervention lacked the use of rigorous methods for an autism diagnosis (Eaves & Ho, 2004; Lovaas, 1987; Sheinkopf & Siegel, 1998; Strain & Cordisco, 1994; Wolery & Garfinkle, 2002).

Significant progress was observed in the cognitive abilities domains when using raw scores. However, significant changes in standard scores were noted only for the verbal (receptive and expressive) cognitive domains, meaning that achievements in these areas were beyond what was expected by maturation. The teaching curriculum might focus on language themes and practice in related areas (e.g., imitation), specifically supporting language development. Previous studies noted significant global cognitive gains with intervention but they do not specify which domains mostly improved (Cohen et al., 2006; Eikeseth et al., 2002; Howard et al., 2005; Magiati et al., 2007).

In adaptive skills progress, we observed a differential pattern of change with intervention. In the communication and socialization domains, striking progress was noted even when standard scores were used. In the daily living skills domain, progress was seen only when raw scores were used. A decline in standard scores after 1 year was noted for the motor skills domain. It is suggested that this pattern of progress is related to the content of the treatment plan which focused more on autism-specific deficits (language, communication, socialization) and less on daily living skills and motor skills. Previous studies differed in their adaptive skills progress, reporting either significant gains (Cohen et al., 2006; Eikeseth et al., 2002; Howard et al., 2005) or decline in standard scores at post-intervention assessment (Magiati et al., 2007).

Our second objective focused on the relation between autism severity at baseline, type of intervention employed, and outcome in adaptive skills and cognitive abilities. Having less severe autism symptoms at baseline (ADOS) was associated with better progress in adaptive skills and in cognitive abilities. Gains in cognitive abilities were apparent for the two autism severity groups, but greater gains were noted for the group with milder autism symptoms. However, significant progress in adaptive skills was only found for the mild autism severity group.

An interesting and innovative finding of this study relates to the impact of the intervention type on adaptive and cognitive outcomes of the two autism severity groups. The group with less severe autism symptoms who received Eclectic intervention had a better outcome in adaptive communication and socialization skills than children with similar autism severity who received ABA. No such relation was found for the cognitive abilities outcome. Adaptive behaviors are based on parental report and reflect the generalization of acquired skills in the natural environments. Cognitive abilities are based on standardized assessment and reflect the child's potential for learning. This is the first attempt to identify children with ASD who progress better with a specific intervention approach. When comparing the two intervention programs it is apparent that the Eclectic approach has a very strong parental involvement, while the ABA approach is more child centered. In the Eclectic program, the parents participated 1 full day a week in their child's preschool, learned how the therapists work with the child, practiced intervention and received individual and group training. Therefore, parents could take this knowledge to the home setting and implement it there successfully. However, only children who had milder autism symptoms benefited from this parental intervention. These results may suggest that for children with less severe social-communicative symptoms, intensive parental involvement in the child's program can translate into better progress in adaptive skills at home. It is also possible that children with less severe impairments benefit more from incidental, less structured teaching implemented by professionals with expertise in developmental processes. However, the fact that only parental reports (Vineland) show better progress which was not observed in cognitive gains (MSEL) is less supportive of this assumption.

Regarding methodological issues, the strength of this study relies on a large number of children who met inclusion criteria and had extensive standardized tests at both evaluation times. Additionally, the two intervention groups were closely matched and did not differ in autism severity, cognitive abilities, adaptive skills, age, parental variables, and governmental allocated budget.

The findings of this study should be interpreted in light of a number of limitations or considerations. One of the limitations is the lack of full randomization in the selection of the two intervention groups. However, the only criterion for enrollment in a particular intervention program was the place of residence and not the parent's or the professional's preferences. The results of this study might reflect the outcomes of intervention carried out in public settings, while in theoretical experimental designs rigorous control is possible.

Several important clinical implications emerged from this study. The results emphasize the importance of very early diagnosis and intervention in ASD. Progress was noted not only in cognitive and adaptive measures but also in the core symptoms of autism. Clinicians should convey this information to the parents of newly diagnosed children and encourage early intervention and routine follow-up evaluations. Although a large body of research supports the advantage of behavioral intervention over other Eclectic approaches, the results of this and other recent studies show no significant differences in outcome when children are very young and receive intensive treatment.

The child's baseline social abilities and deficits appear to be crucial variables for intervention outcomes and should be considered in treatment approach decision-making. Parental involvement in the intervention process should be highly encouraged in early intervention programs for young children with ASD.

In future studies, other child and family characteristics should be explored in regard to prediction of outcome and for selecting the preferred type of intervention.

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