RESEARCH ARTICLE

Young Autism Spectrum Disorder Children in Special and Mainstream Education Settings Have Similar Behavioral Characteristics

Michal Ilan,[†] Gal Meiri,[†] Liora Manelis-Baram, Michal Faroy, Analya Michaelovski, Hagit Flusser, Hagar Binoun-Chaki, Ronit Segev-Cojocaru, Orly Dotan, Hen Schtaierman, Idan Menashe, and Ilan Dinstein

In many countries, parents can place autism spectrum disorder (ASD) children in either mainstream or special education settings, which differ in their ability to provide structured early intervention programs. There are no clear guidelines for how to make initial placement decisions and ongoing debate about the benefits and drawbacks of each educational setting. Previous studies have mostly examined placement of school-age children and reported that those with poorer cognitive abilities and more severe ASD symptoms tend to be placed in special education. The placement of younger children has rarely been studied. Here, we utilized the database at the National Autism Research Center of Israel to examine whether ASD severity, cognitive abilities, and parent education influenced the placement of 242 children. We performed the analyses separately for 1–3-year-old children who were placed in daycare centers and 3–5-year-old children who were placed in pre-school kindergartens. Our analyses revealed surprisingly small differences across special and mainstream education settings, particularly in daycare centers. Cognitive scores and parent education were significantly higher in ASD children placed in mainstream education, but these differences were of moderate effect size and explained a relatively small percentage of the variability in placement choices (<15%). Indeed, we found considerable overlap in the characteristics of ASD children across educational settings, which suggests that initial placement decisions are performed with little regard to the children's abilities. Given the importance of optimal early intervention, further studies are warranted to determine whether children with specific abilities and needs benefit more from placement in either educational setting. ***Autism Res*** *2020, 00: 1–10.* © 2020 International Society for Autism Research and Wiley Periodicals LLC

Lay Summary: Currently, there are no clear recommendations for placing young children with ASD in special versus mainstream education settings. We examined the influence of ASD severity, cognitive abilities, and parent education on the initial placement of 242 children. While we found significantly higher cognitive scores and parental education in children placed in mainstream education, there was a remarkable overlap in the characteristics of children across both settings, suggesting that initial placement is performed with limited regard to the children's abilities.

Keywords: Autism; ASD; mainstream education; special education; inclusion; pre-school; daycare

Introduction

A large number of studies have demonstrated that children with autism spectrum disorder (ASD) exhibit larger developmental gains with intensive early intervention at pre-school ages [Zwaigenbaum et al., 2015]. These critical gains are likely due to the larger brain plasticity, learning abilities, and flexibility that characterize early pre-school development relative to older ages [Webb, Jones, Kelly, & Dawson, 2014]. This highlights the importance of placing ASD children in early educational settings that can deliver suitable interventions for the child's abilities and needs. Indeed, throughout the world, governments are investing considerable resources to establish and maintain early educational settings for children with ASD. The two common options are inclusive mainstream education settings (often with a personal assistant) or exclusive special education settings, where small groups of children receive specialized care from a relatively large staff of special education professionals. Placement decisions have dramatic financial ramifications, because special education settings are considerably more expensive to create and maintain in comparison to mainstream education settings [Chasson, Harris, & Neely, 2007]. According to

From the Psychology Department, Ben Gurion University, Beer Sheva, Israel (M.I., I.D.); National Autism Research Center of Israel, Ben Gurion University of the Negev, Beer Sheva, Israel (M.I., G.M., L.M.-B., M.F., I.M., I.D.); Pre-School Psychiatry Unit, Soroka University Medical Center, Beer Sheva, Israel (M.I., G.M., L.M.-B., M.F., R.S.-C., O.D.); Zusman Child Development Center, Soroka University Medical Center, Beer Sheva, Israel (A.M., H.F., H.B.-C.); Child Development Center, Maccabi Health Services, Beer Sheva, Israel (H.S.); Public Health Department, Ben Gurion University, Beer Sheva, Israel (I.M.); Cognitive and Brain Sciences Department, Ben Gurion University, Beer Sheva, Israel (I.D.)

[†]These authors contributed equally to this study.

Received March 10, 2020; accepted for publication September 4, 2020

Address for correspondence and reprints: Michal Ilan, National Autism Research Center of Israel, Ben Gurion University of the Negev, Beer Sheva, Israel. E-mail: ilanmic@post.bgu.ac.il

Published online 00 Month 2020 in Wiley Online Library (wileyonlinelibrary.com)
DOI: 10.1002/aur.2400

the Israeli Ministry of Education, in 2018 approximately one-third of ASD children (3–21 years old) in Israel were placed in mainstream educational settings while two-thirds were in autism-only special education settings.

There is ongoing debate regarding the potential benefits and drawbacks of placing children with ASD in mainstream or special education settings [Ravet, 2011]. Previous studies have suggested that children with ASD who are integrated into mainstream educational settings are likely to benefit from exposure to the social communication and behaviors of typically developing children. It has been suggested that this exposure enhances language and social abilities and encourages the development of academic skills [Harrower & Dunlap, 2001]. Indeed, children with ASD who are placed in mainstream educational settings exhibit significant improvements over time in social communication, intelligence quotient, and adaptive behaviors [Fisher & Meyer, 2002; Nahmias, Kase, & Mandell, 2014; Stahmer, Akshoomoff, & Cunningham, 2011]. Inclusion in mainstream education is also motivated by ethical considerations as a basic human right of children with ASD and their families [Allan, 2007].

In contrast, children with ASD who are placed in exclusive special education settings are likely to benefit from more intensive, structured, and coordinated intervention programs that are managed by a larger number of more experienced staff and the availability of specialized facilities [Mesibov & Shea, 1996]. Indeed, a large number of studies have demonstrated that young children with ASD who are placed in special education settings and receive intensive treatments exhibit significant improvements in cognitive and social abilities as well as adaptive skills [Harris, Handleman, Gordon, Kristoff, & Fuentes, 1991; Rogers & Vismara, 2008; Talbott, Estes, Zierhut, Dawson, & Rogers, 2016; Zachor & Ben Itzchak, 2010].

Despite these differences across educational settings, longitudinal studies have rarely compared their efficacy in improving the development of ASD children with different characteristics. One recent study has reported that 3–5-year-old ASD children with lower adaptive and social-communication abilities made larger cognitive gains in inclusion programs as compared with ASD children placed in exclusive special education programs [Nahmias et al., 2014]. However, large-scale longitudinal studies are lacking and the effectiveness of each educational setting remains unclear. This hinders the establishment of clinical guidelines and leaves clinicians and parents to make somewhat arbitrary placement choices, particularly in situations where the child is young and both educational settings are equally accessible.

To date, several studies, mostly focusing on school-age children, have examined how the behavioral characteristics of ASD children influence educational placement decisions. While these studies have demonstrated that there is considerable overlap in the abilities and difficulties of children who are placed in both settings, older children who have more severe ASD symptoms, lower cognitive abilities, and more behavioral problems were more likely to be placed in special rather than mainstream education settings [Eaves & Ho, 1997; Lauderdale-Littin, Howell, & Blacher, 2013; Rattaz et al., 2019; Towle, Vacanti-Shova, Higgins-D'Alessandro, Ausikaitis, & Reynolds, 2018; White, Scahill, Klin, Koenig, & Volkmar, 2007]. It is currently unknown whether similar differences are apparent in young 2–5-year-old children who are placed in special or mainstream education settings, immediately after receiving their ASD diagnosis.

In Israel, after receiving a formal diagnosis, parents of ASD children choose whether to place their child in a mainstream or special education setting. Parents can change placement at the end of each school year, but previous research has demonstrated that school-age children tend to remain in the same setting for extended periods of time and rarely switch settings [Kurth & Mastergeorge, 2012; White et al., 2007]. The extent to which parents change the placement of pre-school children with ASD is unknown.

The Israeli Ministry of Education manages all mainstream and special education pre-school programs for children who are 3 years old and over, which are freely available to all children. ASD children younger than 3 years old are eligible for placement in a special education daycare center or allocation of an assistant that accompanies the child to a mainstream daycare center. All daycare centers in Israel are operated privately, but costs are subsidized by the Ministry of Welfare. Special education settings (daycare centers and pre-school kindergartens) typically include only eight ASD children and have a professional staff that includes special education pre-school teachers, speech therapists, occupational therapists, developmental psychologists, and other therapists. In contrast, mainstream education settings typically have 15–30 children and a limited staff of mainstream teachers who receive 1–2 h of weekly guidance from a special education teacher.

In the current study, we utilized a large population database managed by National Autism Research Center of Israel to compare behavioral and socio-demographic characteristics across ASD children who were placed in either educational setting. We focused on the initial placement into daycare centers and pre-schools with the specific goal of determining whether placement choices were influenced by the children's ASD severity, cognitive, and language abilities. We assumed that children with more severe symptoms in these domains were more likely to require intensive structured interventions that are easier to manage in special education settings.

Methods

Participants

This retrospective study examined data from the NARCI database (www.autismisrael.org). The database contains information from over 1000 ASD children who were diagnosed with ASD since 2015 in the southern district of Israel [Meiri et al., 2017]. The majority of children return to the center for an annual follow-up, which includes the same behavioral tests carried out during initial diagnosis. From this population, we selected a sample of 242 children who were 11–65 months old (mean age = 33.7 months). All participating children were diagnosed with ASD according to DSM-5 criteria by a developmental psychologists and either a child Psychiatrist or pediatric Neurologist. In addition, all children fulfilled ASD criteria according to the Autism Diagnostic Observation Schedule-2 (ADOS-2) assessment [Lord et al., 2012] and attended a follow-up meeting where parents completed a questionnaire with information regarding the child's initial educational placement. The sample included 100 children who were placed in daycare centers and 142 children who were placed in pre-school kindergartens (Tables 1 and 2). The study was approved by the Soroka University Medical Center Helsinki committee and conforms to the declaration of Helsinki.

Procedures and Measures

All participating children completed an ADOS-2 assessment that was administered by the same trained clinician who had over 10 years of clinical experience with ASD children and has performed >500 ADOS assessments to date. We used the total ADOS calibrated severity scores (i.e. comparison scores) as well as the calibrated Social Affect (SA) and Restricted and Repetitive Behavior (RRB) severity scores to compare the severity of ASD symptoms across children who completed different ADOS modules. These comparison scores transform the raw ADOS scores into a scale of 0–10 that takes into account the age of the child and the differences across ADOS modules [Hus, Gotham, & Lord, 2014]. Spoken language ability was estimated with the score of the A1 item on the ADOS Toddler module. This item lists five levels of spoken language ranging from 0 (language level appropriate to chronological age) to 4 (no use of significant words). In older children, we grossly estimated spoken language ability by comparing the number of children who were diagnosed with ADOS Module 1 (used with children who do not speak more than single words) versus Module 2 (used with children who speak in simple phrases). DSM-5 levels of support were indicated by an experienced physician (child neurologist or child psychiatrist) after a thorough clinical exam.

Cognitive scores were available for 175 of the children (72% of the children). The remaining 67 children were unable to successfully complete cognitive testing due to lack of cooperation. The cognitive ability of 62 children in daycare centers and 75 children in kindergartens was measured using the Bayley Scales of Infant and Toddler Development, Third Edition [Viezel, Zibulsky, Dumont, & Willis, 2014], that is suitable for children who are 1–42 months old. In the remaining 35 children in kindergartens, and three children in daycare centers, cognitive ability was assessed using the Wechsler Preschool and Primary Scale of Intelligence, Third Edition [Luiselli

Table 1. Behavioral and Socio-Demographic Characteristics of ASD Children Who Were Placed in Mainstream and Special Education Daycare Centers

Daycare centers					
	Mainstream (n = 28, males = 17)	Special (n = 72, males = 52)	Statistics	P	Cohen's D
Age of diagnosis (months)	26.3 (SD = 6.07)	25.3 (SD = 4.8)	t (40.8) = 0.8	0.43	0.19
ADOS comparison scores	7.86 (SD = 2.12)	8.58 (SD = 1.48)	t (37.8) = −1.66	0.1	0.39
ADOS - SA comparison scores	8.04 (SD = 1.51)	9.01 (SD = 1.44)	t (38.4) = −2.24	**0.03***	0.53
ADOS - RRB comparison scores	7.18 (SD = 1.44)	6.97 (SD = 1.38)	t (47.5) = 0.65	0.52	0.15
DSM-SA	Level 1: n = 0	Level1: n = 2 (2.9%)	$\chi 2$ (93) = 5.29	0.07	
	Level2: n = 14 (56%)	Level2: n = 21 (30.9%)			
	Level3: n = 11 (44%)	Level3: n = 45 (66.2%)			
DSM-RRB	Level1: n = 3 (12%)	Level1: n = 3 (4.4%)	$\chi 2$ (93) = 1.75	0.42	
	Level2: n = 14 (56%)	Level2: n = 42 (61.8%)			
	Level3: n = 8 (32%)	Level3: n = 23 (33.8%)			
Cognitive scores	80.6 (SD = 9.65)	74.1 (SD = 13.8)	t (47.9) = 2.14	**0.04***	0.54
Mother age at birth	31 (SD = 6.13)	30.7 (SD = 5.87)	t (48.5) = 0.21	0.83	0.05
Father age at birth	35.1 (SD = 8.8)	34 (SD = 7.6)	t (42.9) = 0.52	0.6	0.12
Mother education (years)	14.5 (SD = 3.03)	12.8 (SD = 2.46)	t (42.1) = 2.42	**0.02***	0.62
Father education (years)	13.6 (SD = 3.21)	12 (SD = 1.27)	t (27) = 2.3	**0.03***	0.65

SD: standard deviation.

*Significant differences across groups $P < 0.05$, uncorrected.

Table 2. Behavioral and Socio-Demographic Characteristics of ASD Children Who Were Placed in Mainstream and Special Education Pre-School Kindergartens

Pre-school kindergartens					
	Mainstream (n = 50, males = 38)	Special (n = 92, males = 74)	Statistics	P	Cohen's D
Average age of diagnosis (months)	40.6 (SD = 7)	38.8 (SD = 8.5)	t (117.5) = 1.36	0.17	0.23
ADOS comparison scores	6.78 (SD = 1.97)	7.36 (SD = 1.99)	t (101.6) = −1.65	0.1	0.29
ADOS-SA	6.62 (SD = 1.97)	7.25 (SD = 2.24)	t (112) = −1.72	0.87	0.3
ADOS-RRB	7.42 (SD = 1.47)	7.70 (SD = 1.59)	t (107.8) = −1.03	0.3	0.18
DSM-SA	Level 1: n = 5 (10.4%) Level2: n = 29 (60.4%) Level3: n = 14 (29.2%)	Level1: n = 7 (7.9%) Level2: n = 37 (41.6%) Level3: n = 45 (50.6%)	$\chi 2$ (137) = 5.84	**0.05***	
DSM-RRB	Level1: n = 7 (14.6%) Level2: n = 36 (75%) Level3: n = 5 (10.4%)	Level1: n = 8 (9%) Level2: n = 57 (64%) Level3: n = 24 (27%)	$\chi 2$ (137) = 5.47	0.06	
Cognitive scores	82.7 (SD = 11.4)	74.9 (SD = 13.3)	t (99.3) = 3.25	**0.002***	0.62
Mother age at birth	32 (SD = 5.2)	31 (SD = 5.7)	t (97.7) = 0.91	0.36	0.17
Father age at birth	35.4 (SD = 7)	34.1 (SD = 6.5)	t (81.8) = 0.97	0.33	0.19
Mother education (years)	14.5 (SD = 3)	12.8 (SD = 2.5)	t (78.8) = 3.33	**0.001***	0.7
Father education (years)	13.6 (SD = 3.2)	12 (SD = 1.3)	t (50.3) = 1.7	0.128	0.35

SD: standard deviation.
*Significant differences across groups $P < 0.05$, uncorrected.

et al., 2013], that is suitable for children who are 2.6–-7.3 years old. Both tests yield equivalent standardized scores with a mean of 100 and a standard deviation of 15. Bayley scores were previously reported to exhibit strong correlations with general intelligence scores as measured by the WPPSI [Bayley, 2006]. We, therefore, combined scores from the two tests in our analyses. Finally, parents of 166 participating children completed a background questionnaire that included questions about their education level (i.e. years of education).

Data Analysis

All statistical analyses were performed using SPSS (IBM, USA), separately for the two age groups (i.e. daycare centers and pre-school kindergartens). We compared children in mainstream education and children in special education using two-tailed t-tests (assuming unequal variance), Mann–Whitney tests (for ordinal variables), and Chi-Square tests (for categorical variables). We also used a one-way ANCOVA to assess differences in cognitive and ADOS scores across educational settings while controlling for parent education as a co-variate. In all cases, alpha was set to 0.05. In a final analysis, we examined the utility of logistic regression models with the ADOS-SA, ADOS-RRB, cognitive scores, and maternal education as predictors for estimating placement choices in either educational setting.

Results

We compared a variety of behavioral and socio-demographic characteristics between ASD children who were placed in special education and those in mainstream education (Tables 1 and 2). These comparisons were performed separately for children in daycare centers (age 11–36 months) and those in pre-school kindergartens (age 32–60 months). Approximately 28% and 35% of the children were placed in mainstream education settings in daycare centers and pre-school kindergartens, respectively. These percentages are in line with reports of the Israeli Ministry of Education stating that approximately one-third of children with ASD (ages 3–21) are placed in mainstream education settings while the rest are in special education settings.

Age at Diagnosis

Overall, children in daycare centers were diagnosed at an earlier age (mean = 25.5 months) than children in the pre-school kindergartens (mean = 39.4 months). Age of diagnosis, however, did not differ significantly between special and mainstream education settings in daycare centers (t (40.8) = 0.8, P = 0.43) or pre-school kindergartens (t (117.5) = 1.36, P = 0.17). This demonstrates that placement into special education or mainstream education was not influenced by the age of diagnosis (i.e. the time at which autism symptoms were formally recognized).

ADOS and DSM Symptom Severity

Children in daycare centers exhibited more severe ASD symptoms than children in pre-school kindergartens (Tables 1 and 2). However, we found only minor differences in ADOS comparison scores and DSM severity levels across educational settings (Tables 1 and 2, Fig. 1).

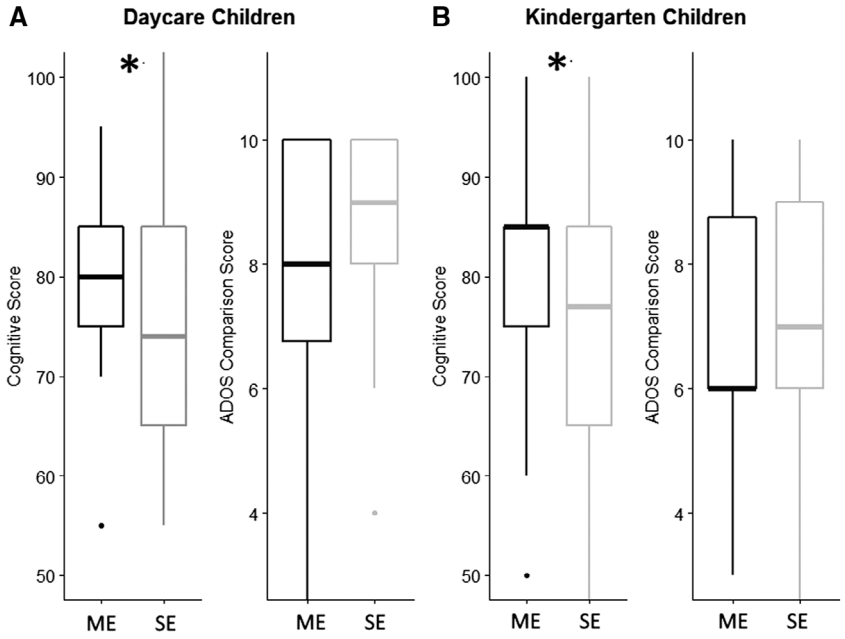

Figure 1. Cognitive and ADOS scores. (A) Box plot figures demonstrate the distribution of cognitive and ADOS scores of ASD children who were placed in mainstream education (black) and special education (gray) daycare centers. (B) Cognitive and ADOS scores of ASD children in pre-school kindergartens (same format as A). Asterisks: significant difference across groups ($P < 0.05$, two-tailed t-test). ME: mainstream education; SE: special education.

There were no significant differences across educational setting in the total ADOS comparison scores of children in daycare centers (t (37.8) = −1.66, $P = 0.1$, $d = 0.39$) or pre-school kindergartens (t (101.6) = −1.65, $P = 0.1$, $d = 0.3$). When separating the ADOS scores into their SA and RRB components, we found no significant differences across educational settings in ADOS-RRB scores of children in daycare centers (t (47.5) = 0.65, $P = 0.52$, $d = 0.15$) or kindergartens (t (107.8) = −1.03, $P = 0.3$, $d = 0.18$). There were significant differences across educational settings in the ADOS-SA scores of children in daycare centers (t (38.4) = −2.25, $P = 0.03$, $d = 0.53$), but not in kindergartens (t (107.8) = −1.72, $P = 0.09$, $d = 0.3$). Note that the ADOS-SA differences described above would not survive even the most lenient corrections for multiple comparisons (corrections were not performed to increase sensitivity).

Analysis of the levels of support that were assigned to each child by their physician according to DSM-5 criteria also revealed only minor, marginally significant, differences across educational settings. Children in special education daycare centers exhibited a trend for requiring higher levels of social support (χ^2 (93) = 5.92, $P = 0.07$), a difference that was significant across the kindergarten groups (χ^2 (137) = 5.84, $P = 0.05$). Similar findings were also apparent in the support levels of the RRB symptoms of the kindergarten groups (χ^2 (137) = 5.47, $P = 0.07$), but not the daycare groups (χ^2 (93) = 1.75, $P = 0.42$). These results were also not corrected for multiple comparisons.

In a separate analysis, we examined the placement of children with the most severe ASD symptoms who had ADOS calibrated severity scores of 9–10. We found that 24% and 28% of these children were placed in mainstream daycare centers and kindergartens, respectively. These percentages did not differ significantly from the percentages of the entire sample in both the daycare centers (χ^2 (100) = 0.89, $P = 0.34$) or kindergartens (χ^2 (142) = 1.44, $P = 0.23$).

Cognitive Abilities

Children in mainstream education exhibited significantly higher cognitive scores than those in special education (Tables 1 and 2). This was true both for children in daycare centers (t (47.9) = 2.14, $P = 0.04$, $d = 0.54$) and those in kindergartens (t (99.3) = 3.25, $P = 0.002$, $d = 0.63$). Note that children in mainstream education settings had, on average, cognitive scores that were 6.5 and 7.8 points higher than the children in special education (in daycare centers and kindergartens, respectively). This corresponds to approximately half of one standard deviation in standardized cognitive scores (in all standardized cognitive assessments one standard deviation equals 15 points). Hence, while the differences were

significant, their size was modest, with considerable overlap in cognitive scores across educational settings (Fig. 1).

Almost 30% of the children (67 out of 242) were unable to complete the cognitive tests successfully, because they did not cooperate with the developmental psychologist who performed the test. The number of children who did not complete the cognitive tests did not differ significantly across daycare groups (χ^2 (100) = 1.135, $P = 0.567$), but was significantly larger in special education kindergartens in comparison to mainstream kindergartens (χ^2 (142) = 3.693, $P = 0.05$). This suggests that cognitive differences across the kindergarten educational settings may be potentially larger than estimated, if one assumes that non-cooperative children tend to have lower cognitive abilities.

In a separate analysis, we examined the placement of children with intellectual disability (i.e. cognitive scores that were < 70). Approximately 10% and 17.4% of children with intellectual disability were placed in mainstream daycare centers and kindergartens, respectively. These percentages were significantly lower than those of the entire sample for both daycare centers (χ^2 (64) = 4.97, $P = 0.02$) and kindergartens (χ^2 (109) = 5.93, $P = 0.01$). In line with the other analyses, these findings demonstrate that cognitive abilities had a larger impact on placement decisions in comparison to ASD severity. Nevertheless, a considerable percentage of children with ASD and intellectual disability were placed in mainstream education settings.

Language

We compared language abilities across groups using gross measures available from the ADOS assessments. The vast majority of ASD children who were in daycare centers were assessed with the ADOS toddler module. In this module, item A1 quantifies the spoken language abilities of the children (see Methods). When comparing the scores on this item, we did not find any significant differences in spoken language levels across children who were placed in mainstream and special education daycare centers (U (85) =605, $P = 0.36$).

All of the children in the pre-school kindergartens were assessed with modules 1 or 2 of the ADOS. The selection of module is indicative of spoken language abilities (i.e. module 2 requires higher language capabilities than module 1). There were significant differences in the module selected for assessments children placed in special versus mainstream kindergartens (χ^2 (122) = 10.63, $P = 0.001$). Specifically, more children with higher language abilities were placed in mainstream kindergartens (Fig. 2).

Parental Age and Education Level

Parental age at birth did not differ across educational settings in either daycare centers (mothers: t (48.5) = 0.21, $P = 0.83$; fathers: t (42.9) = 0.52, $P = 0.6$) or kindergartens (mothers: t (97.7) = 0.91, $P = 0.36$; fathers: t (81.8) = 0.97, $P = 0.33$). Parents of children in mainstream education, however, had more years of education. This was apparent in mothers and fathers of children in daycare centers (mothers: t (42.1) = 2.52, $P = 0.02$, $d = 0.62$; fathers: t (27) = 2.3, $P = 0.03$, $d = 0.65$) and in mothers and fathers of children in kindergartens (mothers: t (78.8) = 3.33, $P = 0.001$, $d = 0.7$; fathers: t (50.3) = 1.7, $P = 0.128$, $d = 0.35$).

Note that Information regarding parental education was available for ~68% of the sample (166 out of 242). The number of parents who did not fill out this information did not differ across special and mainstream education kindergartens (χ^2 (142) = 0.2, $P = 0.65$). In the daycare centers, significantly more parents in the special education did not complete the questionnaire in comparison to parents in mainstream education (χ^2 (100) = 6.315, $P = 0.012$). If one assumes that parents with lower education levels are more likely to skip questions regarding their education (e.g. due to embarrassment), the potential difference in parent education across daycare settings may be larger than that reported above.

Given the significant differences in parent education across special and mainstream education settings, we re-examined the cognitive score differences described above while controlling for parent education using an ANCOVA analysis. Note that the combination of cognitive and parent education data was available for only part of the initial sample (122 of the 242 children). Since maternal and paternal years of education were highly correlated in both daycare centers (r (69) = 0.576, $P < 0.001$) and kindergartens (r (88) = 0.537, $P < 0.001$), we created a new variable with the mean parental years of education for each child. Using parental years of education as a covariate in an ANCOVA revealed that cognitive scores were not significantly different across special and mainstream education groups in either daycare centers (F (1,45) =0.15, $P = 0.7$) or pre-school kindergartens (F (1,70) =1.8, $P = 0.19$). This demonstrates that controlling for parent education eliminates cognitive differences across special and mainstream education settings.

Characteristics That Predict Educational Placement

Given the differences described above, we tested whether we could predict initial educational placement in special or mainstream settings using two logistic regression analyses. First, we attempted to predict placement based on the cognitive and ADOS scores of the children while sep-

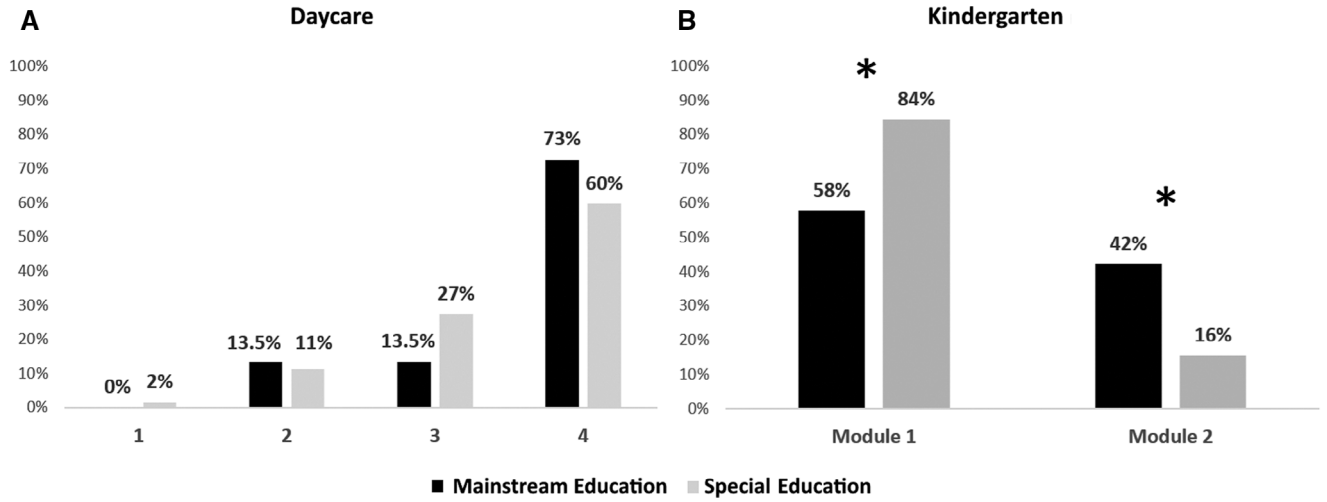

Figure 2. Spoken language levels. (A) Language scores from item A1 of the ADOS toddler module, which was used to assess most of the children placed in daycare centers. (B) Percentage of children in pre-school kindergartens who were assessed using module 1 (lower language abilities) versus module 2 (higher language abilities) of the ADOS. Black: mainstream education. Gray: special education. Asterisks: significant difference across groups ($P < 0.05$, Chi-Square test).

arating the ADOS scores into their ADOS-SA and ADOS-RRB components. Note that these data were available for only 175 of the children who successfully completed the cognitive assessments. The resulting regression model was significant (χ^2 (3) = 19.63, $P < 0.001$), with a pseudo *R*-square (Cox and Snell method) of 0.11, and two significant predictors: ADOS-SA ($\beta = 0.18$, $P = 0.016$) and cognitive ($\beta = -0.04$, $P = 0.003$) scores. In a second model, we also added maternal years of education as an additional predictor (these data were available for 122 of the children). The resulting model was also significant (χ^2 (3) = 17.28, $P = 0.002$), with a pseudo *R*-square (Cox and Snell method) of 0.14, and two significant predictors: ADOS-SA ($\beta = 0.19$, $P = 0.046$) and maternal education ($\beta = -0.22$, $P = 0.01$). Note that cognitive scores were no longer a significant predictor in the second model.

While the regression models described above were able to explain a significant amount of variability in placement choices (i.e. the models performed significantly better than chance), over 85% of the variance in placement choices remained unaccounted for.

Discussion

The results of this study suggest that initial placement of young children with ASD in mainstream or special education settings is performed with limited regards to the child's ASD severity, cognitive abilities, or language abilities, particularly in 1–3-year-olds who are placed in daycare centers. Differences in ASD severity across educational settings were remarkably weak, with no significant differences in total ADOS scores, no significant differences in ADOS-RRB scores, and only minor differences in ADOS-SA scores and DSM support levels (Tables 1 and 2). Language abilities did not differ significantly in the daycare groups, but were significantly lower in ASD children placed in special education kindergartens. Cognitive abilities differed across educational settings in both daycare centers and kindergartens, with children in special education exhibiting significantly lower scores (Tables 1 and 2). However, the effect size of this finding was modest and there was considerable overlap in the cognitive abilities of ASD children across educational settings (Fig. 1).

The factor that seemed to have the largest influence on placement decisions was parental education. Parents of children placed in mainstream education had significantly more years of education than parents of children placed in special education (Tables 1 and 2). Furthermore, including parent education as a co-variate in an ANCOVA analysis eliminated the cognitive differences described above. This suggests that parent characteristics have a primary influence on placement decisions, which is larger than that of the children's abilities.

Incorporating parental education, cognitive scores, and ADOS scores into a single logistic regression model yielded prediction of educational placement that was significantly higher than chance. However, even this combined model explained <15% of the variance (pseudo *R*-square) in placement decisions. This demonstrated that >85% of the variance in placement decisions were not explained by these factors and suggests that the majority of initial placement decisions are either made arbitrarily or are based on other factors that we did not measure in the current study.

Educational Placement and Parental Education

Our results suggest that parental level of education was the largest contributing factor in educational placement decisions. In Israel, children who are placed in mainstream education do not receive structured intervention from speech and language therapists, occupational therapists, and physiotherapists in their educational setting. Thus, parents have to arrange and coordinate these services on their own, requiring considerable efforts, and often incurring additional costs. In contrast, children placed in special education settings receive such services within the educational setting, often as part of a structured intensive early intervention program.

Our findings show that parents of children placed in mainstream education had significantly more years of education in comparison to parents of children in special education (Tables 1 and 2). Similar findings were reported in previous studies in France [Rattaz et al., 2019] and the United States [Kurth, Mastergeorge, & Paschall, 2016]. We speculate that more educated parents, who are likely to have larger financial abilities, tend to choose mainstream education setting given their socioeconomical ability to organize and fund essential treatments outside the educational setting.

Another factor that is likely to motivate parents with higher education to place their children in mainstream education has to do with ethical considerations that drive advocacy for inclusion [Pellicano, Bölte, & Stahmer, 2018]. Like other western countries, the Israeli government passed a law that established equal rights and opportunities for individuals with disabilities [Ministry of Justice, 1998]. This law ensures equal access to mainstream education services as a basic right of ASD children. Research in other countries, however, has demonstrated that utilization of such access is often significantly higher in affluent communities where parents have higher socioeconomic and education levels [Kurth et al., 2016]. We speculate that Israeli parents with higher levels of education, like those in other countries, are more likely to pursue inclusion in mainstream education programs for ethical reasons. Additional studies examining these issues are highly warranted for equating the opportunities given to parents with different socioeconomic abilities and their children.

Educational Placement and Cognitive Abilities

Several studies have reported that lower cognitive abilities are associated with higher likelihood of placement in special as opposed to mainstream educational settings. This was reported for school-aged children in the United States [White et al., 2007], Canada [Eaves & Ho, 1997], Singapore [Aljunied & Frederickson, 2011], and France [Rattaz et al., 2019]. Indeed, first grade teachers consider cognitive abilities as the most important behavioral characteristic when making recommendations about placement decisions [Segall & Campbell, 2014].

Our results extend these findings, to some degree, to earlier ages and the initial placement decision made immediately after receiving the ASD diagnosis. Cognitive scores were indeed significantly lower in ASD children who were placed in special versus mainstream education settings (Tables 1 and 2). However, the difference across settings, on average, was only 6.5 and 7.8 points in daycare centers and kindergartens, respectively. This corresponds to approximately half of one standard deviation in standardized cognitive scores. In contrast, previous studies with older children have reported much larger differences of, on average, 12 [White et al., 2007], 25 [Aljunied & Frederickson, 2011], and 30 [Eaves & Ho, 1997] points. Cognitive differences across special and mainstream education settings were, therefore, weaker at early ages with considerable overlap in cognitive scores across groups, particularly in the youngest children who attended daycare centers (Fig. 1).

Note that cognitive scores were available for only 70% of the children in our sample. There was no significant difference in the number of children who completed cognitive assessments in special education and mainstream daycare centers, suggesting that comparison of cognitive scores in this age group was not affected by missing data. However, significantly more children in special education kindergartens did not complete cognitive assessments relative to children in mainstream kindergartens. If one assumes that the children who do not complete cognitive testing have lower cognitive scores, this may lead to an under-estimation of the cognitive differences across groups. Hence, true cognitive differences in the kindergarten age group may be larger than estimated. Taken together, it seems that cognitive scores have a growing influence on placement decisions as the children grow older.

Educational Placement and Language Abilities

To the best of our knowledge, previous studies have not examined the impact of language abilities on educational placement. To address this point, we examined difference in gross language abilities as identified by the clinician who administered the ADOS assessments. This data revealed that language abilities may indeed have an impact on the placement choice of the older children in the kindergarten groups such that children with better language abilities were more often placed in mainstream education (Fig. 2B). However, language abilities did not seem to have an impact on placement choices for the younger children who were similarly distributed in special and mainstream daycare centers (Fig. 2A). A more systematic and sensitive assessment of language differences across

the two educational settings, using standardized language tests that yield expressive and receptive language scores, is highly warranted.

Educational Placement and Autism Severity

Our results are in line with findings from previous studies, which have reported no statistically significant differences in total ADOS scores across educational settings [White et al., 2007]. When specifically examining social behaviors, one study has reported significant differences in Vineland communication and socialization scores [Rattaz et al., 2019], but this was not found in another study [White et al., 2007]. Our findings demonstrate that ADOS scores did not differ significantly across special and mainstream education groups. There were only minor differences in ADOS-SA scores in the daycare group when not correcting for multiple comparisons (Tables 1 and 2). There was indeed considerable overlap in ADOS scores across the educational settings (Fig. 1) and the percentage of children with severe ASD symptoms (i.e. ADOS comparison scores of 9–10) who were placed in mainstream education was not significantly different from that of the entire sample. These findings suggest that autism severity has remarkably little impact on early placement decisions.

Limitations

A major limitation of the current study is that we did not measure several behavioral characteristics that are likely to have an impact on placement decisions of ASD children. These include adaptive behaviors, which tend to be lower, and aberrant behaviors, which tend to be higher, in ASD children placed in special education settings [Rattaz et al., 2019; White et al., 2007]. Integrating these and other measures of sensory sensitivities, medical comorbidities, anxiety, and language capabilities may reveal important differences across children in the two educational settings.

Conclusions

The uniqueness of this study was its focus on the initial educational placement of a relatively large group of 242 young children with ASD. To the best of our knowledge, this is the first study to systematically examine placement decisions in Israel. The results reveal some similarities with previous studies of older, school-aged, ASD children, including significantly higher cognitive scores in children who are placed in mainstream education setting. Differences across the educational settings, however, were dwarfed by the remarkable overlap in behavioral abilities of ASD children placed in either setting. These findings highlight the lack of clinical guidelines regarding initial educational placement and demonstrate that placement decisions are made in a somewhat arbitrary manner. Longitudinal studies using additional standardized measures of adaptive behaviors, language abilities, sensory sensitivities, and challenging behaviors are highly warranted for determining the efficacy of initial educational settings for children with different abilities and difficulties.

Acknowledgment

The National Autism Research Center of Israel is funded by a grant from the Israeli Ministry of Science and Technology.

Conflict of interest

The authors declare no conflict of interest.

References

Aljunied, M., & Frederickson, N. (2011). Cognitive indicators of different levels of special educational support needs in autism. Research in Autism Spectrum Disorders, 5(1), 368–376.

Allan, J. (2007). Rethinking inclusive education: The philosophers of difference in practice. In Inclusive education: Cross cultural perspectives. Dordrecht, Netherlands: Springer.

Bayley, N. (2006). Bayley scales of infant and toddler development (3rd ed.). San Antonio, TX: Harcourt Assessment.

Chasson, G. S., Harris, G. E., & Neely, W. J. (2007). Cost comparison of early intensive behavioral intervention and special education for children with autism. Journal of Child and Family Studies, 16(3), 401–413.

Eaves, L. C., & Ho, H. H. (1997). School placement and academic achievement in children with autistic spectrum disorders. Journal of Developmental and Physical Disabilities, 9, 277–291. https://doi.org/10.1023/A:1024944226971

Fisher, M., & Meyer, L. H. (2002). Development and social competence after two years for students enrolled in inclusive and self-contained educational programs. Research and Practice for Persons with Severe Disabilities, 27, 165–174.

Harris, S. L., Handleman, J. S., Gordon, R., Kristoff, B., & Fuentes, F. (1991). Changes in cognitive and language functioning of preschool children with Autism. Journal of Autism and Developmental Disorders, 21(3), 281–290.

Harrower, J. K., & Dunlap, G. (2001). Including children with autism in general education classrooms: A review of effective strategies. Behavior Modification, 25(5), 762–784.

Hus, V., Gotham, K., & Lord, C. (2014). Standardizing ADOS domain scores: Separating severity of social affect and restricted and repetitive behaviors. Journal of Autism and Developmental Disorders, 44(10), 2400–2412.

Kurth, J., & Mastergeorge, A. M. (2012). Impact of Setting and Instructional Context for Adolescents With Autism. The Journal of Special Education, 46(1), 36–48. https://doi.org/10.1177/0022466910366480.

Kurth, J. A., Mastergeorge, A. M., & Paschall, K. (2016). Economic and demographic factors impacting placement of students with autism. Education and Training in Autism and Developmental Disabilities, 51(1), 3–12.

Lauderdale-Littin, S., Howell, E., & Blacher, J. (2013). Educational placement for children with autism spectrum disorders in public and non-public school settings: The impact of social skills and behavior. Education and Training in Autism and Developmental Disabilities, 48(4), 469–478.

Lord, C., Rutter, M., Di Lavore, P., Risi, S., Gotham, K., & Bishop, S. (2012). Autism and diagnostic observation schedule, Second Edition (ADOS-2) Manual (Part I): Modules 1–4. Torrance, CA: Western Psychological Services.

Luiselli, J., Happé, F., Hurst, H., Freeman, S., Goldstein, G., Mazefsky, C., … Newman, D. B. (2013). Wechsler preschool and primary scale of intelligence. In F. R. En Volkmar (Ed.), Ecyclopedia of autism spectrum disorders. New York, NY: Springer.

Meiri, G., Dinstein, I., Michaelowski, A., Flusser, H., Ilan, M., Faroy, M., … Menashe, I. (2017). Brief report: The Negev hospital-university-based (HUB) autism database. Journal of Autism and Developmental Disorders, 47(9), 2918–2926.

Mesibov, G. B., & Shea, V. (1996). Full inclusion and students with autism. Journal of Autism and Developmental Disorders, 26(3), 337–346.

Ministry of Justice. (1998). *Equal rights for persons with disabilities law, 5758–1998*. Retrieved from https://www.justice.gov.il/En/Units/CommissionEqualRightsPersonsDisabilities/Equal-Rights-For-Persons-With-Disabilities-Law/Pages/Equal-Rights-For-Persons-With-Disabilities-Law.aspx

Nahmias, A. S., Kase, C., & Mandell, D. S. (2014). Comparing cognitive outcomes among children with autism spectrum disorders receiving community-based early intervention in one of three placements. Autism, 18(3), 311–320.

Pellicano, L., Bölte, S., & Stahmer, A. (2018). The current illusion of educational inclusion. Autism, 22(4), 386–387.

Rattaz, C., Munir, K., Michelon, C., Picot, M. C., Baghdadli, A., Baghdadli, A., … Vespirini, S. (2019). School inclusion in children and adolescents with autism spectrum disorders in France: Report from the ELENA French Cohort Study. Journal of Autism and Developmental Disorders, 50(2), 455–466.

Ravet, J. (2011). Inclusive/exclusive? Contradictory perspectives on autism and inclusion: The case for an integrative position. International Journal of Inclusive Education, 15(6), 667–682.

Rogers, S. J., & Vismara, L. A. (2008). Evidence-based comprehensive treatments for early autism. Journal of Clinical Child and Adolescent Psychology, 37(1), 8–38.

Segall, M. J., & Campbell, J. M. (2014). Factors influencing the educational placement of students with autism spectrum disorders. Research in Autism Spectrum Disorders, 8(1), 31–43.

Stahmer, A. C., Akshoomoff, N., & Cunningham, A. B. (2011). Inclusion for toddlers with autism spectrum disorders: The first ten years of a community program. Autism, 15(5), 625–641.

Talbott, M. R., Estes, A., Zierhut, C., Dawson, G., & Rogers, S. J. (2016). Early Start Denver Model. In R. R. Lang, T. Hancock, & N. N. Singh (Eds.), Early intervention for young children with autism spectrum disorder. New York, NY: Springer.

Towle, P. O., Vacanti-Shova, K., Higgins-D'Alessandro, A., Ausikaitis, A., & Reynolds, C. (2018). A longitudinal study of children diagnosed with autism spectrum disorder before age three: School services at three points time for three levels of outcomedisability. Journal of Autism and Developmental Disorders, 48(11), 3747–3760.

Viezel, K., Zibulsky, J., Dumont, R., & Willis, J. O. (2014). Bayley scales of infant and toddler development, third edition. In C. R. Reynolds, K. J. Vannest, & E. Fletcher-Janzen (Eds.), Encyclopedia of special education: A reference for the education of children, adolescents, and adults disabilities and other exceptional individuals (4th ed.). Hoboken, NJ: John Wiley & Sons, Inc.

Webb, S. J., Jones, E. J. H., Kelly, J., & Dawson, G. (2014). The motivation for very early intervention for infants at high risk for autism spectrum disorders. International Journal of Speech-Language Pathology, 16(1), 36–42.

White, S. W., Scahill, L., Klin, A., Koenig, K., & Volkmar, F. R. (2007). Educational placements and service use patterns of individuals with autism spectrum disorders. Journal of Autism and Developmental Disorders, 37(8), 1403–1412.

Zachor, D. A., & Ben Itzchak, E. (2010). Treatment approach, autism severity and intervention outcomes in young children. Research in Autism Spectrum Disorders, 4(3), 425–432.

Zwaigenbaum, L., Bauman, M. L., Choueiri, R., Kasari, C., Carter, A., Granpeesheh, D., … Natowicz, M. R. (2015). Early Intervention for children with autism spectrum disorder under 3 years of age: Recommendations for practice and research. Pediatrics, 136, S60–S81.