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Service system and cognitive outcomes for young children with autism spectrum disorders in a rural area of Taiwan

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Abstract

Chiayi is a rural county located in southwestern Taiwan, and the effectiveness of its early intervention service system for autism spectrum disorders was studied in detail. A total of 71 children with autism spectrum disorders ($n = 35$) and developmental delay ($n = 36$) aged 2.5 years were referred from the only Early Intervention Reporting and Referral Center in Chiayi and followed up at 4 years. Results showed relatively low and varied services of early intervention for both groups during two time-point periods and a relative lack of specific early intervention programs for children with autism spectrum disorders. It was found, however, that cognitive abilities were increased for autism spectrum disorders and developmental delay groups. Additionally, the Early Learning Score at the initial evaluation could contribute to the high learner autism spectrum disorders subgroup. Parental socio-economic level was also determined to benefit the high learner developmental delay subgroup.

Keywords

autism spectrum disorder, early intervention, rural area, Taiwan, young children

Background

Autism spectrum disorder (ASD) is characterized by early core deficits in reciprocal social interaction and communication, and restricted and repetitive patterns of behavior, interests, or activities from *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association (APA), 2013). ASDs indicate a number of different subtypes, encompassing disorders referred to as autistic disorder, pervasive developmental disorder not otherwise specified (PDD-NOS), and Asperger's disorder from *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; DSM-IV-TR; Lord and Risi, 2000). Early identification of ASDs is possible under the age of 3 years (Charman et al., 2005; Chawarska et al., 2009) or even at the age of 1 year (Zwaigenbaum et al., 2013). With reliable earlier diagnosis, an early intervention (EI) program could be provided to facilitate children's positive outcome (Dawson et al., 2010; Kasari et al., 2006). If EI is important for children with ASDs, then it is critical to categorize what type of autism-related services can be accessed and utilized in the community. Previous studies had recruited families of autistic children with a wide age range in their samples. For example, Kohler (1999) recruited 25 families with 3- to 9-year-old children who had autism/PDD by conducting telephone interviews in western Pennsylvania, USA. It was found that families interact with a host of different services and professionals, including preschools, speech therapy clinics, respite care facilities, and parent classes. Thomas et al. (2007) surveyed 383 families in North Carolina, USA, that had a child with ASDs. These families were divided into three age subgroups: 4 years or younger (26%), 5–8 years old (52%), and 9–11 years old (22%). The investigators conducted a phone or in-person

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interview from 2003 to 2005. Thomas et al. believed that North Carolina was considered to have a comprehensive service system. However, they found that there was a large variation in the services used. In the youngest subgroup (4 years or younger), three-quarters of the families reported using one or more major treatment approaches, such as TEACCH (Treatment and Education of Autistic and related Communication Handicapped CHildren), Applied Behavioral Analysis (ABA), Floor Time, Defeat Autism Now, or Lovaas' Discrete Trial Training. The majority of children aged ⩽4 years were in speech/language therapy (SLT, 91%), followed by occupational therapy (OT, 60%), and social skills training (29%). McLennan et al. (2008) reported that among parents of young children with ASDs ($n = 64$ and mean age = 4.9 years) who received services at four specialty centers in Canada, SLT (88%) and OT (78%) were also the most common treatment services. In all, 64% of these children attended school. Of the children who attended schools, 83% had an educational assistant or a teacher's aide, 78% received SLT, and 73% received OT through the school system.

Irvin et al. (2014) reviewed studies published between 2001 and 2011 to identify the common services provided in the early years (3 to 9 years old). They reported that three broad categories of services existed including (1) educational, (2) traditional, and (3) alternative. The most common category is educational which includes focused intervention practices, such as Floor Time, Discrete Trial Learning, and the Picture Exchange Communication System. In the traditional category, SLT was the most common service, followed by OT. In the alternative category, complementary and alternative medicines (CAM) were also used by approximately one-third of children with ASDs.

In addition to service resources that might contribute to the outcome of young children with ASDs, other factors, such as intervention intensity and children's initial cognitive functioning, may be associated with outcomes. Regarding the intervention intensity factor, the first empirical study of Lovaas (1987) reported that an early intensive behavioral intervention (EIBI) could improve IQ substantially. The EIBI program was aimed at young children with autism who were below 48 months of age, with one-to-one therapy for 40 h/week, over at least 2 years. In the discussion, Lovaas (1987) recommended providing a minimum intervention of 40 h/week. With the accumulation of relevant EIBI research results, researchers also examined the efficacy of approaches with relatively low intensity. For example, Eldevik et al. (2009) reviewed 34 EIBI studies in which intervention intensity ranged from at least 13 h/week for 12–36 months. Their meta-analysis showed an average large effect size for full-scale intelligence change and an average medium effect size for adaptive behavior composite change. Nonetheless, the results supported the claim that higher intervention intensity was associated with more positive outcomes.

Another factor, children's initial cognitive abilities, may predict EI efficacy. Longitudinal studies have demonstrated that children with ASDs with higher cognitive functioning and language ability at a preschool age generally exhibited better outcomes later in their school years or even in adulthood (Billstedt et al., 2007; Darrou et al., 2010; Stevens et al., 2000). Moreover, Howlin et al. (2009) reviewed the extant literature systematically and indicated that both higher initial IQ and less severe autism symptoms were associated with positive outcomes.

The prevalence of ASDs generally increased from 2004 to 2010 in Taiwan, with a prevalence of 9.1–16.4 per 10,000 in the age group of 3–5 years (Lai et al., 2012). A higher prevalence was observed in urban areas than in rural areas during this time period. Specifically, a higher prevalence was observed in urban areas (ranged from 10.5/10,000 to 23.7/10,000) than rural areas (ranged from 3.9/10,000 to 10.6/10,000), and the prevalence rate ratios ranged from 2.24:1 to 2.72:1. The reason may be more medical services, and a higher level of awareness of the disease by parents and related professionals in urban areas. Chen et al. (2008) in their cohort study, using the 1997–2004 National Health Insurance Research Database, found that an urban-city disparity may exist in medical help-seeking processes for autistic children as manifested by that suburban, and rural autism tended to receive diagnosis at an older age compared with urban ones. Chen's study provided the initial data about service utilization for children with autism among urban, suburban, and rural areas in Taiwan.

Although Taiwan is a small island country, with the total area of its current jurisdiction being only 36,193 km^2, more than 23 million people live there. More than two-thirds of the people live in the five largest metropolitan cities (Taipei City, New Taipei City, Taichung City, Tainan City, and Kaohsiung City) and receive relatively more medical, educational, and social welfare services than inhabitants outside these cities. For more than 20 years, at least 25 Early Intervention Reporting and Referral Centers (EIRRC) have been established for the service of developmental delays (DDs) and other developmental disabilities (Lai et al., 2011). Their creation was based on the regulation of the Ministry of Health and Welfare in Taiwan, with the original legislation being the Child Welfare Act of 1973, which was then modified to be the People with Disabilities Rights Protection Act of 2011. Chiayi is a rural county located in southwestern Taiwan and has only one EIRRC. Therefore, the first aim of this study was to survey the unitization of EI sources for families in the Chiayi area. The second purpose of the study was to investigate an association between EI and subgroups of high and low/moderate learners in both ASDs and DD groups, and to elucidate how the factors of initial cognitive function and EI impact the consequent outcomes.

Table 1. Demographics of ASDs and DD groups ($N = 71$).

	ASDs ($N = 35$)			DD ($N = 36$)			Group differences	
	T1	T2	Pair *t*-test	T1	T2	Pair *t*-test	T1, χ^2/t	T2, *t*
Sex (male, *N*)	31			23			5.94*	
Parental SES	58.0 (19.3)			51.5 (17.8)			1.47	
CA	29.5 (4.0)	48.6 (4.8)		28.5 (3.9)	47.1 (4.2)		1.08	1.37
MA	16.3 (4.3)	32.6 (9.6)	−13.46***	19.7 (3.7)	39.2 (7.5)	−24.41***	−3.53**	−3.23**
NVMA	20.5 (4.4)	35.8 (10.2)	−11.51***	22.5 (3.5)	42.6 (8.4)	−19.91***	−2.11*	−3.09**
VMA	12.2 (4.9)	29.5 (10.1)	−13.16***	16.9 (4.5)	35.8 (7.8)	−20.73***	−4.25***	−2.99**
DQ	55.6 (13.3)	67.5 (19.9)	−5.09***	69.6 (12.1)	83.4 (15.4)	−9.76***	−4.61***	−3.76***
ADOS								
Communication	5.4 (1.9)	4.7 (1.6)	1.83	2.3 (1.7)	2.2 (1.5)	0.37	7.08***	6.88***
Social	10.8 (3.2)	9.1 (2.7)	2.7*	4.5 (3.1)	2.3 (1.8)	4.12***	8.45***	12.59***
Communication + social	16.2 (4.7)	13.9 (3.9)	2.66*	6.8 (4.5)	4.4 (2.8)	3.01**	8.58***	11.63***
RRB	1.6 (1.3)	1.8 (1.3)	−0.62	0.4 (0.6)	0.4 (0.9)	0.17	4.8***	5.44***

ASD: autism spectrum disorder; DD: developmental delay; SES: Socio-Economic Status Index obtained from Huang (1998); CA: chronological age; MA: mental age; NVMA: nonverbal MA; VMA: verbal MA; DQ: developmental quotient; ADOS: Autism Diagnostic Observation Schedule; RRB: restricted and repetitive behaviors.

Values above are averages, with standard deviations in parentheses, unless otherwise indicated.

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Methods

Participants

The participants were children with a clinical diagnosis of ASDs or DD who were referred from the Chiayi Christian Hospital in Taiwan during the period from June 2005 to December 2007. The hospital hosts the only EIRRC in the Chiayi area. Chiayi is a county located in southwestern Taiwan, with a population of approximately 800,000 people and produces 8000 newborns per year. Chiayi is one of the rural areas with the lowest prevalence rate, ranging from 4.9 to 6.9 per 10,000, compared to urban areas, ranging from 12.4 to 16.8 per 10,000, during 2005–2007 (Lai et al., 2012). Ranges of the mean per capita disposable income during 2005–2007 in Chiayi were just half that of Taipei, the capital city of Taiwan (Directorate General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan, R.O.C. (Taiwan), 2015). Since the EIRRC was established to provide integrated services from the medical, educational, and social welfare sectors, almost all of the children who live in Chiayi County who need EI services are referred by the EIRRC. Thus, these participants are deemed to be sufficient to reflect the state of EI in Chiayi. The research protocol was approved by the Ethical Committee for Human Research at Chiayi Christian Hospital. Informed consent was obtained from all of the parents whose children participated in the study.

The eligibility criteria were as follows: (1) chronological age between 24 and 36 months and (2) no identified genetic/metabolic disorders or severe sensory/motor impairments. A total of 91 children were recruited by two child psychiatrists from the research team. Only 82 children finished the initial evaluation (Time 1, T1). After 1.5 years (Time 2, T2), 71 (86.6%) children completed the final assessment. The diagnostic process included a clinical evaluation based on DSM-IV-TR (APA, 2000) and the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) by the research team at both T1 and T2. The final diagnoses were made in the team meetings. First, all 71 children were included to provide information about the EI status of the children with ASDs ($n = 35$ at T2) and DD ($n = 36$ at T2) in Chiayi. Second, to explore the impact of the EI experience, two subgroups, high learners and low/moderate learners, were divided by the mean (= 10.47) of all of the children's Early Learning Score (ELS) change scores, which will be described in detail in the "Measures" section.

Procedures

Cognitive abilities were evaluated using the Mullen Scales of Early Learning (MSEL; Mullen, 1995). The characteristics of the participants in the ASDs and DD groups by T2 clinical diagnosis are summarized in Table 1. There was no significant difference between the two groups in age at either T1 or T2. The DD group had a higher mental age than the ASDs group at T1. Additionally, the DD group had lower ADOS scores than both ASDs groups at T1. There was no significant difference in the Socio-Economic Status (SES) index (Huang, 1998). Diagnoses of the participants in the DD group were 16 general DDs, 14 phonological disorder/expressive language disorder, and 6 mixed receptive-expressive language disorder. During the evaluation period of 1.5 years, a survey with an established format was conducted to record the EI services for the children received in medical and educational settings (see

Appendix 1). The EI services survey was divided into three main categories: (1) center-based interventions, (2) individual therapies, and (3) preschool inclusion. The center-based interventions included the day-care unit of the hospital for ASDs or specialized preschools for children with any type of developmental disability. Individual therapies included physical therapy, OT, speech therapy, cognitive education, and other therapies. These individual therapies might be received in a hospital or a clinic. The last category was preschool inclusion, in which the children with ASDs and DD attended regular preschools and learned together with typically developing children with little support from the special education system. Children who stayed in regular preschools all day would be considered to receive 6 h of service per day. Research assistants performed the survey over the phone each month to avoid parents' recall bias. Parents were asked to report both the treatment types and the actual hours given to their children in the past month. Therefore, any changed or new treatment types and receiving hours were recorded.

Measures

ADOS. The ADOS (Lord et al., 2000) is a semi-structured, standardized assessment of communication, social interaction, play, stereotyped behaviors, and restricted interests for children who have been referred with possible autism. A module is selected based on the child's language level. All of the children in this study were administered Module 1 (preverbal or single words for children over 30 months of age) or Module 2 (phrase speech at any age). A standardized diagnostic algorithm can be calculated. The ranges of algorithm totals are 0–24, both in Modules 1 and 2. Higher algorithm totals indicate higher autism severity. Diagnostic classification is made on the basis of exceeding the threshold on each of the two domains, communication and reciprocal social interaction, and exceeding a threshold for the total of the combined two domains above. Three ADOS classifications are Autism, Autism Spectrum, and Non-Autism Spectrum. In addition, the subscores for restricted and repetitive behaviors (RRBs; Gotham et al., 2007) were composed of the sum of three ADOS item raw scores: unusual sensory interests, hand mannerisms, and repetitive interests.

MSEL. The MSEL (Mullen, 1995) evaluate cognitive functioning of children from birth to 68 months of age. The MSEL provides subtest scores for gross motor skills, visual reception, fine motor skills, and receptive and expressive language, and an overall cognitive score. ELS is calculated from the last four subtests' scores. In this study, the last four subtests were assessed. Because the age equivalents were not sufficiently precise for the older age, T scores, including ELS, were utilized for the analysis of children's improvement in this study.

Results

EI over 1.5 years

Table 1 shows the significant improvements in mental age (MA), nonverbal MA (NVMA), verbal MA (VMA), and developmental quotient (DQ) after 18 months in both ASDs and DD groups. Table 2 presented the types of EI services that these children received and their total hours per week. These results revealed high variance in total EI hours. Because these EI services were not present in a normal distribution, Mann–Whitney U tests were used. By comparing the three main types of EI, the results demonstrated that the ASDs group received more hours per week than the DD group in center-based treatment and individual therapy. In addition, there was a marginally significant difference in regular preschool between the two groups ($p = 0.06$), in that the ASDs group demonstrated fewer regular preschool hours than DD group.

Factors associated with high and low/moderate learners

The range of the changes in ELS during the 1.5 years were large, with −26 to 38 and a mean of 10.47 (standard deviation (SD) = 12.80). The high and low/moderate learners were defended by the ELS change scores, in which high learners were above the mean of the change score and low/moderate learners were lower than the mean. Individual changes were shown as Figure 1. In the ASDs group, there were 13 high learners and 22 low/moderate learners (Figure 1(a)). There were more high learners ($N = 22$) and fewer low/moderate learners in the DD group ($N = 14$, Figure 1(b)). Tables 3 and 4 showed the change of cognitive and language abilities assessed by the MSEL in the two groups. In the ASDs group, there were significantly different T scores in visual reception, fine motor, and ELS score at T1 between the two kinds of learners. High learners had higher visual reception and fine motor T scores than low/moderate learners at T1. There was no significant difference found in receptive language and expressive language domains at T1. As expected, the high learner ASDs subgroup was significantly higher than the low/moderate ASDs subgroup in all domains at T2. One-way analyses of covariance (ANCOVAs) were also conducted with T scores at T1 as covariates and T scores at T2 as dependent variables. The results revealed that after controlling the baseline scores, the high learner ASDs subgroup was still higher than the low/moderate ASDs subgroup in all domains at T2 (Table 3). In the DD group, there was no significant difference in the four domains and ELS at T1. Moreover, the high learner DD subgroup was significantly higher than the low/moderate DD subgroup in all domains at T2, even after controlling their baseline scores separately (Table 4).

Table 2. EI hours per week over 1.5 years.

Type	ASDs					DD					*Z*	*p*
	Mean	*SD*	Median	Min	Max	Mean	*SD*	Median	Min	Max		
Center-based treatment	6.6	10.7	0	0	29	4.9	10.1	0	0	29	−1.954*	0.017
Day-care unit	1.6	3.7	0	0	12	0	0	0	0	0		
Specialized preschool	5.1	10.8	0	0	29	4.9	10.1	0	0	29		
Individual therapies	1.3	1	1	0	3	0.7	0.8	1	0	3	−2.377[a]	0.051
Physical therapy	0	0	0	0	0	0.1	0.2	0	0	1		
Occupational therapy	0.5	0.5	0.4	0	2	0.3	0.4	0.2	0	2		
Speech therapy	0.5	0.5	0	0	2	0.3	0.3	0	0	1		
Cognitive education	0.2	0.4	0	0	1	0.1	0.3	0	0	1		
Others	0	0.1	0	0	0	0	0.1	0	0	1		
Regular preschool	6.1	7.7	3.1	0	27.4	12.1	12.0	9.9	0	29.8	−1.852[a]	0.064
Total	14.0	10.6	12.7	0.6	31.7	17.8	11.9	20.0	0	32.2	−0.978	0.328

EI: early intervention; ASD: autism spectrum disorder; DD: developmental delay; Others: other therapies performed in medical facilities; SD: standard deviation.
[a]$p < 0.07$.
*$p < 0.05$.

In addition to the initial cognitive and language abilities, the EI factor was also considered. Differences of the EI hours in high and low/moderate learner ASDs and DD groups were also examined at two time-points. There was no significant difference in the three types of EI hours in the two subgroups of the ASDs group (Table 5). However, there was a significant difference in regular preschool hours in the two subgroups of the DD group. The high learner subgroup received more regular preschool hours than the low/moderate learner subgroup in the DD group (Table 6). There was no significant difference in other EI hours in the DD group. The socio-economic factor was also considered. There was no significant difference in the SES index between high and low/moderate learners in the ASDs subgroup. However, a significantly higher SES index was found in the high than the low/moderate learners in the DD subgroup.

Finally, forward Wald stepwise logistic regression analyses were performed to determine the most influential contributor to ELS outcomes. Three variables—ELS at T1, SES index, and regular preschool hours—served as predictors and learner groups as the criterion-variable (high learner = 1 and low/moderate learner = 0). The results showed in the ASDs group, that the ELS at T1 (odds ratio (OR) = 1.16, 95% confidence interval (CI) = 1.04–1.29, Walds = 7.00, $p < 0.01$), and not SES index ($p = 0.85$) or regular preschool hours ($p = 0.18$), could predict the high learner ASDs subgroup. Otherwise, only the SES index (OR = 1.12, 95% CI = 1.03–1.22, Walds = 6.57, $p < 0.01$), and neither ELS at T1 ($p = 0.49$) nor regular preschool hours ($p = 0.065$), could predict the high learner DD subgroup.

Discussion

This study surveyed the types and hours of EI services for children with ASDs or DD at the age of 2.5–4 years from their parents via a monthly telephone interview. The results showed that regarding EI services utilization, the total hours per week which these children received were relatively low and varied. Second, while separating the high or low/moderate learner subgroups in the ASDs and DD groups, it was found that after controlling the baseline scores, the children in the higher learner group improved significantly in all of the domains and ELS in MSEL in both the ASDs and DD groups. However, only in the DD group, the regular preschool experience and the parental SES could contribute to the improvement in scores. Furthermore, through logistic regression analysis, it was again found that initial ELS score can contribute to the learner subgroups of ASDs. Regarding the DD learner subgroups, only parental SES was determined to contribute. These results will be explained in detail in the following.

Limited EI services in a rural area of Taiwan

Chiayi County is a rural area in Taiwan, and the EI services for children with ASDs and related developmental disabilities were still in their nascent stage during the period of the study. However, the results demonstrated that even with limited EI services, most children still improved. An examination of the data could reveal the reasons for this. First, for the group of ASD, the medians of most types of EI were zero, meaning that at least half of the children did not receive most available types of EI during the 1.5 years after they were clinically diagnosed. Even after 8 years, the EI services in the area are still gradually improving, there are three EIRRCs, and the utilization of medical services is increasing. However, the public preschool educational services are similar to the period of this study. In addition, like 8 years ago, there is only one day-care unit at a local hospital for ASDs and three specialized private preschools

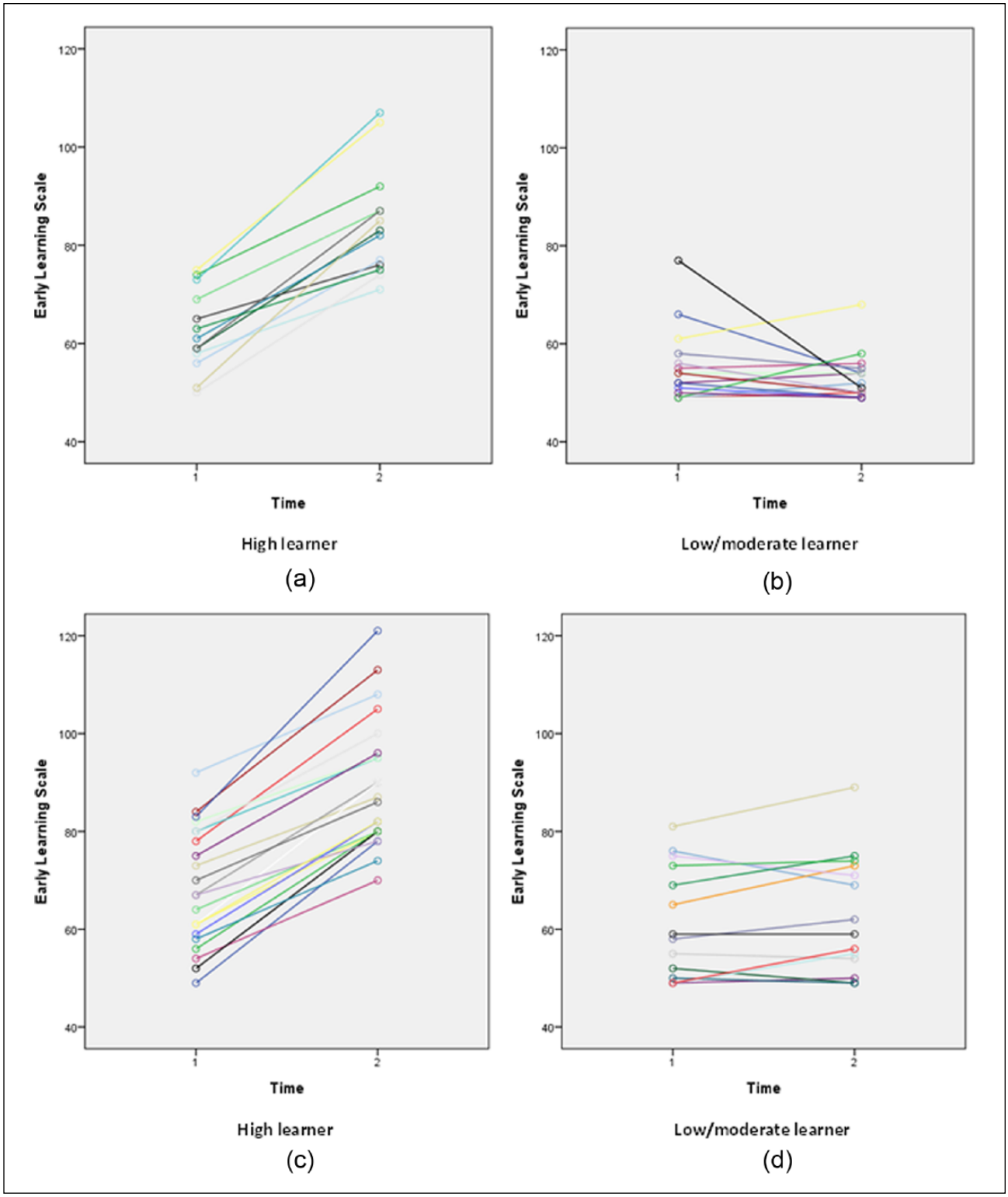

Figure 1. Individual changes of the Early Learning Score (ELS) in high learners and low/moderate learners of the (a) ASDs and (b) DD groups. A high learner is defined of equal or higher than the mean (= 10.47) of the ELS change of all of the children.

for all of the ASD, DD, and other disabilities (Special Educational Transmit Net, 2015). Moreover, the results also revealed that the children in both groups received limited individual therapies. Comparing the same time period in Taipei, the capital of Taiwan and a major metropolitan city, Chiang and Chu (in preparation) found that

Table 3. Cognitive and language improvements in high and low/moderate learner ASDs subgroups ($N = 35$).

	High learner ($N = 13$)		Low/moderate learner ($N = 22$)		Group differences				
	T1	T2	T1	T2	T1		T2		*F*
					t	*p*	*t*	*p*	
CA	29.23 (4.87)	47.62 (5.25)	29.64 (3.44)	49.18 (4.46)	−0.26	0.795	−0.94	0.354	
MSEL (T scores)									
Visual reception	23.15 (4.91)	41.23 (13.19)	21.18 (3.83)	22.36 (4.91)	1.33*	0.011	6.88**	0.0001	50.31**
Fine motor	23.92 (4.66)	31.77 (7.2)	22.09 (4.69)	21.41 (2.77)	1.12**	0.0001	7.29**	0.0001	38.74**
Receptive language	62.54 (8.29)	84.69 (11.24)	53.45 (6.97)	51.91 (4.53)	3.47	0.194	4.96**	0.0001	36.03**
Expressive language	29.23 (4.87)	47.62 (5.25)	29.64 (3.44)	49.18 (4.46)	−0.26	0.271	4.97**	0.0001	34.30**
ELS	31.31 (9.29)	43.38 (10.69)	24.05 (6.64)	21.82 (4.75)	2.69**	0.001	10.05**	0.0001	107.52**

ASD: autism spectrum disorder; CA: chronological age; MSEL: Mullen Scales of Early Learning; ELS: Early Learning Score.
Values above are averages, with standard deviations in parentheses.
*$p < 0.05$; **$p < 0.001$.

Table 4. Cognitive and language improvements in high and low/moderate learner DD subgroups ($N = 36$).

	High learner ($N = 22$)		Low/moderate learner ($N = 14$)		Group differences				
	T1	T2	T1	T2	T1		T2		*F*
					t	*p*	*t*	*p*	
CA	28.91 (4.1)	47.64 (4.42)	27.79 (3.62)	46.36 (3.84)	0.840	0.409	0.890	0.380	
MSEL (T scores)									
Visual reception	34.55 (10.5)	47.5 (11.62)	30.14 (10.07)	34.36 (11.59)	1.250	0.221	3.310*	0.002	8.88*
Fine motor	38.5 (9.91)	50.23 (14.83)	31.64 (10.28)	28.43 (9.25)	1.990	0.054	4.910**	0.0001	18.08**
Receptive language	29 (8.99)	43.5 (10.83)	26.86 (9.3)	28.71 (9.49)	0.690	0.496	4.180**	0.0001	20.51**
Expressive language	28.45 (6.4)	36.77 (9.12)	24.71 (4.6)	26.29 (7.3)	1.890	0.067	3.620**	0.001	8.37*
ELS	68.45 (11.99)	89.55 (13.3)	61.43 (11.52)	63.21 (12.13)	1.740	0.091	5.990**	0.0001	79.35**

DD: developmental delay; CA: chronological age; MSEL: Mullen Scales of Early Learning; ELS: Early Learning Score.
Values above are averages, with standard deviations in parentheses.
*$p < 0.01$; **$p < 0.001$.

Table 5. Differences of early intervention hours per week and parental SES in high and low/moderate learner ASDs groups.

	High learner ($N = 13$)	Low/moderate learner ($N = 22$)	*Z*/*t*	*p*
Early intervention	13.41 (10.08)	14.40 (11.12)	−0.24	0.811
Center-based treatment	3.75 (8.25)	8.34 (11.72)	−0.72	0.474
Individual therapies	0.97 (1.01)	1.48 (0.98)	−1.44	0.151
Regular preschool	8.70 (8.37)	4.57 (7.11)	−1.57	0.118
Parental SES	53.85 (17.71)	60.45 (20.10)	−0.98	0.33

SES: Socio-Economic Status Index obtained from Huang (1998); ASD: autism spectrum disorder.
Values above are averages, with standard deviations in parentheses.

most children with ASDs were not only diagnosed earlier and received EI sooner but were able to choose from a wider range of medical and educational services. These choices included different EI models, such as Pivotal Response Treatment (PRT), Relationship Development Intervention (RDI), and Floor Time, in day hospital units in medical settings and also in public or private educational settings. Regarding individual therapies, the number of children with ASDs in Taipei who received the intensity of treatment of SLT and OT is nearly three times greater than the number of children living in Chiayi County. However, the most common individual therapies were OT,

Table 6. Differences of early intervention hours per week and parental SES in high and low/moderate learner DD groups.

	High learner ($N = 22$)	Low/moderate learner ($N = 14$)	Z/t	p
Early intervention	20.21 (10.45)	10.44 (9.66)	−1.31	0.189
Center-based treatment	2.80 (7.93)	8.31 (12.35)	−1.63	0.104
Individual therapies	0.72 (0.79)	0.79 (0.71)	−0.29	0.768
Regular preschool	16.69 (11.04)	5.52 (9.93)	−0.93*	0.003
Parental SES	58.86 (19.04)	40.00 (5.78)	4.34**	0.001

SES: Socio-Economic Status Index obtained from Huang (1998); DD: developmental delay.
Values above are averages, with standard deviations in parentheses.
*$p < 0.01$; **$p < 0.001$.

followed by speech therapy. Similar to studies performed in Western countries, SLT and OT constituted the two most common treatment services (Irvin et al., 2014; McLennan et al., 2008; Thomas et al., 2007).

The variance observed in EI was similar to that found in recent studies carried out in the United States that examined younger children (under 24 months of age) with ASDs (Lord et al., 2012) and a similar age range from Turner and Stone's (2007) study. How do we explain the reason for this high variability? Bowker et al. (2011) indicated that parental choice of intervention was influenced by their children's specific diagnosis, treatment type, and geographical location. Similarly, the parents in our study anecdotally informed us that parental SES, living location, and related resources for EI influenced their choices.

In a rural area, such as Chiayi County, EI resources, such as home-based services programs, professional services, and local education facilities, are serving at far from optimal levels (Sun and Chang, 2011). Due to a lack of resources for comprehensive intervention programs, parents living in this area had to seek alternative resources by themselves to the best of their ability. This means that parents needed to invest significant amounts of time traveling to and from different service settings. Usually, this meant a half day in a special preschool or day-care unit of a hospital (3 h) plus two types of individual therapy at the same or different hospitals or clinics (each time constituting one half-hour, as designated by the National Health Insurance of Taiwan) in order to accumulate more intervention hours for their children. However, this schedule of travel constituted a major burden for the parents. For the parents, due to limited EI resources in the medical or educational system, they often chose a regular preschool instead if it was available after their children received the diagnosis. In the beginning, no child with ASDs and finally 18 (51.4%) entered regular preschools at T2. Regular preschools provide a general preschool education, but little specific EI for ASDs. If a child with ASDs has low adaptive function or challenging behaviors, he or she might be rejected from the preschool due to current teacher overload or to avoid imposing additional difficulties upon them.

High and low/moderate learners and related factors

The second part of this study aimed to elucidate which factors contribute to the improvement in the ASDs and DD groups. Two different kinds of learners, high and low/moderate, were defined. Compared to the DD group, the ASDs group had a lower proportion of high learners. Moreover, the high learners showed greater initial cognitive abilities than the low/moderate learners. Even when controlling these initial cognitive abilities, the high learners still improved significantly more in all of the domains of cognitive function than the low/moderate learners at T2. In addition, the usage of EI hours between high learners and low/moderate learners was not significantly different. Logistic regression analysis also revealed that only initial ELS could contribute to the different learner groups. Regarding the DD group, there was no difference on any domain of cognitive abilities between high learners and low/moderate learners at T1. However, the higher learners developed more improvements in all of the domains of cognitive abilities than the low/moderate learners at T2. High learners also used more hours per week in regular preschool, and their parental SES was also higher, than the low/moderate learners. Logistic regression analysis also showed that parental SES score can contribute to the different learner groups. In addition, the experience of regular preschool also made a marginally significant contribution to the different learner groups.

These findings revealed the following implications. First, for children with ASD, it is possible that due to the limited EI resources or lack of specificity, their cognitive outcome could only depend primarily on their own initial abilities, and thus they likely could not receive benefit from the EI service system. However, for children with DD, although EI accessibility and usage were limited, parental SES seems to play a critical role in their development. In other words, the higher the SES of the parents, the more accessibility and economic ability they could afford and utilize. Furthermore, regular preschool possibly constitutes one more useful channel for improving their development. Therefore, when the children with DD have more chances to interact with typical children in a

structured classroom, they will probably benefit from this type of experience.

Limitations, conclusions, and suggestions

This study possesses certain limitations. First, since there is no control group in this study, selection biases and maturation might affect the results. Although almost all of children who were referred from the EIRRC were included, children who lived in more distant townships might have never sought EI services. The EI services and the development of those children are as yet unknown. Second, the data were collected about 8 years ago. Even though we are confident that the current situation is quite similar to the situation this study had investigated, current data should be collected and compared if possible. Third, the amount and type of EI in Chiayi County might be more or less unique, compared to other rural areas in Taiwan, thus perhaps limiting the generalizability of the findings. Fourth, the method for dividing the high and low/moderate learners according to the ELS mean from all of the participants in this study might be arbitrary. Another method of subgrouping, such as low learners with no progression, might be more appropriate. However, recruiting a larger sample will be necessary to clarify this issue.

Despite the abovementioned possible limitations, this study demonstrated that young children with ASDs and DD living in a rural area of Taiwan receive limited services, including inadequate hours and fewer autism-specific service choices. Although the initial data showed that both children with ASDs and DD could improve on all of the domains of cognitive function, the children with ASDs seem to require more autism-specific services to improve their development in a rural area. The risk of a lack of autism-specific services might cause some children with ASDs to not progress well. How to improve the quantity and quality of EI might constitute a major and worthwhile challenge for governments and all who aim to ameliorate the current situation. Moreover, this might not just be the case in rural areas of Taiwan but might also be suitable for rural areas globally. We have the following suggestions in this regard: (1) governments need to increase budgets and invite professionals and related parental advocacy groups to strengthen the medical and educational services and research for individuals with ASD; (2) due to a lack of high-quality services in this area, some EI programs which focus on specific target goals for parent-implemented programs, such as JASPER (joint attention symbolic play engagement and regulation) or reciprocal imitation training, which have been validated in Western countries (Ingersoll, 2012; Kasari et al., 2015), can be referred to parents in this area first, and then the evidence-based comprehensive EI program, such as PRT and Early Start Denver Model, and other evidence-based program should be introduced systematically; and (3) the number of new female residents due to marriage from Mainland China and southeastern countries, such as Indonesia and Vietnam, was increasing during the study period in the rural area (DGBAS of Executive Yuan, R.O.C. (Taiwan), 2015). In our study, we found two mothers from Mainland China and Vietnam whose children have ASDs or DD. What are the perspectives of parenting from their cultures? How do they negotiate with the family members if different medical or educational perspectives happened? This presents one more challenge to the practitioners and researchers in rural areas of Taiwan.

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Appendix 1

Early intervention services utilization record form

Early Intervention Services Utilization Record Form

Date of survey: Date of the last survey:
Interviewer:
Research number/name:
Date of birthday: Sex:
Interviewee/relative: Contact information:

A. Did you child receive any types of early intervention services provided by hospitals or clinics?

	Start Date	Number of sessions per week	Hours per session	Note (End date, absent, etc.)
Day Care unit				
Physical therapy				
Sensory-motor integration				
Occupational therapy				
Speech-language therapy				
Cognitive education				
Other therapies (specify)				

B. Did you child go to any preschool?

General preschool				
With/without special education services				

C. In addition to the above treatment, which treatment did your child receive?
Type/name (specify)

D. Note