



Child and family factors associated with the use of services for preschoolers with autism spectrum disorder

Dwight W. Irvin^{a,*}, Matthew McBee^a, Brian A. Boyd^b, Kara Hume^a, Samuel L. Odom^a

^a Frank Porter Graham Child Development Institute, University of North Carolina at Chapel Hill, CB#8180, Chapel Hill, NC 27599, USA

^b Division of Occupational Science, University of North Carolina at Chapel Hill, CB#7122, Bondurant Hall, Chapel Hill, NC 27599, USA

ARTICLE INFO

Article history:

Received 21 July 2011

Accepted 25 July 2011

Available online 8 September 2011

Keywords:

Autism

Service-use

Early intervention

Preschoolers

ABSTRACT

This study examines child and family characteristics thought to affect the dosage and type of common in-school and private services (i.e., speech language therapy (SLT), occupational therapy (OT) and applied behavior analysis (ABA)) received by children with ASD. Participants included 137 families and their preschool-aged children with ASD from four states: Colorado, Florida, Minnesota, and North Carolina. Our results indicated child and family characteristics did impact the type and dosage of services used. In the school setting, Hispanic children received a smaller dose of SLT and OT than White children. Children with greater cognitive impairments received more SLT and those with more severe symptoms of autism received a larger dosage of OT. In the private setting, higher levels of caregiver stress were related to increase usage of OT. Caregivers with a higher socioeconomic status were more likely to enroll their children in OT and ABA. Implications for practice and policy are discussed, including the need to better understand and remediate differences in service provision across socioeconomic and minority status.

© 2011 Elsevier Ltd. All rights reserved.

1. Introduction

Timely access to high quality, early intervention services may prevent or at least ameliorate the impact of autism symptoms on child and family well-being (Boyd, Odom, Humphries, & Sam, 2010; Dawson, 2008), and there appears to be a growing need for access to such services. In 2007 over 30,000 children in the U.S. between the ages of three and five received school-based services under the educational label of autism, a figure that has more than doubled since 2002 (Data Accountability Center, retrieved February 2011). Further, these data may reflect an underestimate as some children could be served under other education eligibility categories (e.g., developmental delay). Despite the benefit of and increased demand for high quality early intervention services, researchers have suggested that families and their children with ASD may have unequal access (Rogers & Vismara, 2008; Thomas, Ellis, McLaurin, Daniels, & Morrissey, 2007). The purpose of this study is to examine child and family factors that may affect access to special education and related services.

Early childhood special education (ECSE) and allied health (e.g., speech or occupational therapy) services are believed to improve the lives of children with autism spectrum disorder (ASD) and their families (Lord & Bishop, 2010). Ever-increasing evidence suggests that children with ASD who receive access to high quality services early in life may experience improved cognitive, adaptive, and/or social-communicative outcomes (Dawson et al., 2010; Schertz & Odom, 2007). Further, when these children receive quality services their caregivers are thought to experience decreased levels of stress (Lord & Bishop,

* Corresponding author. Tel.: +1 919 843 2291; fax: +1 919 966 1786.

E-mail addresses: dwirvin@email.unc.edu, dwirvin@unc.edu (D.W. Irvin), matt.mcbee@unc.edu (M. McBee), brian_boyd@med.unc.edu (B.A. Boyd), kara.hume@unc.edu (K. Hume), slodom@unc.edu (S.L. Odom).

2010), which is important because caregiver stress has been found to moderate children's response to intervention (Osborne & Reed, 2008). Finally, access to services early in life is also thought to be cost-effective and associated with considerable long-term savings in state health and educational expenditures (Lord & Bishop, 2010).

Presently, common types of services utilized by families of children with ASD include speech-language therapy (SLT), occupational therapy (OT) and therapy based on the principles of applied behavior analysis (ABA) (Bitterman, Daley, Misra, Carlson, & Markowitz, 2008; Hume, Bellini, & Pratt, 2005; Kohler, 1999; Patten, Baranek, Watson, & Schulz, 2011; Thomas, Ellis, et al., 2007; Thomas, Morrissey, & McLaurin, 2007). For example, Thomas, Ellis, et al. (2007) surveyed caregivers ($n = 383$) of children with ASD, aged 11 years old or younger in the state of North Carolina, and found high percentages of preschoolers receiving SLT (91%) and OT (60%) at their school, whereas other forms of services, such as adaptive physical education (4%) were less likely to be used. In this same study, SLT (29%) and OT (21%) were also among the more frequent services families with children 4 years old and younger accessed outside the school setting. In a multi-country study (e.g., Australia, United States), 36.4% of caregivers with a child with ASD reported currently relying on ABA therapy (Green et al., 2006).

Differences in service receipt can be related to family factors (Patten et al., 2011; Thomas, Ellis, et al., 2007). Thomas, Ellis, et al. (2007) explored family characteristics that affected out-of-school service use and found that high levels of caregiver stress and education level resulted in an increased likelihood of the child receiving services outside of the school setting. There is some evidence that minority families and those with lower incomes have more difficulty accessing these private therapeutic services for their child with ASD (Liptak et al., 2008; Montes, Halterman, & Magyar, 2009; Thomas, Ellis, et al., 2007). For instance, White caregivers are more likely to use private services, such as sensory integration, than non-White caregivers, and families with an annual income of \$50,000 or above are more likely to utilize a developmental pediatrician than those families making less than that amount (Thomas, Ellis, et al., 2007).

Child characteristics also affect service use. Green et al. (2006) surveyed caregivers about service use and their child's autism severity/type (i.e., Asperger's syndrome, mild autism or severe autism) and age. Those researchers found that children with more severe symptoms (79.7%) were more likely to participate in standard services (e.g., speech) than children with milder symptom presentations such as those with Asperger's syndrome (41.8%). There are somewhat mixed findings on the relationship between children's age and caregivers use of services. Thomas, Ellis, et al. (2007) found that children four years of age or younger were more likely to receive SLT than children ages five to eight. Whereas, Patten et al. (2011) identified a trend toward school-age children receiving more SLT than preschool-aged children when in- and out-of-school service use and dosage were combined. The authors speculated that the increase in SLT was related to children entering the school setting. Furthermore, in contrast to the Green study, Patten et al. did not find an association between receipt of services and children's overall severity of symptoms as measured by the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1988); however, severity of sensory symptoms was associated with families seeking out services for children at younger ages.

While previous research has contributed to the knowledge base on the types of services accessed as well as factors that affect service utilization among families of children with ASD, there are some inherent limitations. First and foremost, there is a paucity of studies on child and family factors associated with service use. Second, researchers that have examined child and family characteristics related to the types of services utilized have either focused solely on the private setting (e.g., Thomas, Ellis, et al., 2007) or combined services rendered in and outside the school setting (e.g., Patten et al., 2011). Few studies have explored the relationship between these factors and the type of ECSE or allied health service utilized in these settings separately (i.e., private vs. school-based settings). Lastly, research on child and family characteristics that may be related to the type and dosage of common services received in and outside of the school is scant.

The purpose of this paper is to examine the relationship between child and family characteristics and services utilized by families of children with ASD. The research questions were: (1) are children's receipt of school-based services or use of private services related to family SES, race and ethnicity or caregiver stress and (2) are children's receipt of school-based services or use of private services related to their gender, chronological age, cognitive ability, or autism severity?

2. Materials and methods

2.1. Participants

Participants included 137 children and their caregivers ($N = 130$ female, $N = 7$ male) from four states across the U.S. (i.e., Colorado, Florida, Minnesota, and North Carolina), who were part of a larger study examining preschool programs for young children with ASD. Children were ages 3–5 (mean age = 3.95), with a confirmed diagnosis of ASD based on the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 1999). There were two children that did not meet diagnostic criteria on the ADOS, but were kept in the analyses because they met the ASD cut-off on the Social Communication Questionnaire (SCQ; Rutter, Bailey, & Lord, 2003). In all cases, the race/ethnicity of the caregiver was the same as the race/ethnicity of the participant with ASD. Descriptive information on the study sample can be found in Table 1.

2.2. Instruments

Two project-created questionnaires, the *School-based Services Questionnaire* (SBSQ; Boyd et al., 2008a) and *Private Therapy Services Questionnaire* (PTSQ; Boyd et al., 2008b), were designed to measure school and private therapy services received by

Table 1
Descriptive statistics – participants with ASD.

	N	Percentage or mean	StdDev	Min	Max
Gender = male	130	86%			
Race/ethnicity = White	133	44%			
Race/ethnicity = Black	133	11%			
Race/ethnicity = Asian	133	5%			
Race/ethnicity = Multiracial	133	2%			
Race/ethnicity = Hispanic ^a	133	38%			
Age at enrollment in study (years)	132	3.97	0.61	2.9	5.15
Mullen: standard score	121	65.69	21.95	49	155
ADOS calibrated severity score	132	7.29	1.69	2	10
SES composite ^b	130	6.95	2.34	2.83	10
PSI: total raw score, calculated	123	85.98	18.58	44	144

^a Hispanic ethnicity was coded into a separate race category.

^b The SES composite is a sum of maximum caregiver education (reported on a 5 point scale) and family annual income (converted to a 5 point scale). A score of approximately 7 on the SES composite could represent a family where at least one caregiver has a graduate or professional degree (5 points) but a \$40k annual income (1.66 points) or a family where the maximum education is a high school diploma (2 points) but a >\$100k annual income (5 points). A range of possible combinations of income and education between these two extremes would yield similar scores on the SES composite.

children enrolled in the study. The SBSQ was designed to measure traditional services children received in school (e.g., SLT and OT) and was completed by the school staff. Staff responded “yes” or “no” to questions about whether their student received speech and language therapy and/or occupational therapy at school. The PTSQ was designed to measure services families are accessing outside of the school setting. Caregivers responded “yes” or “no” to whether their children currently receive speech and language therapy, occupational therapy and/or applied behavior analysis in the home or clinic setting. If the caregiver or school staff member responded “yes”, both the SBSQ and PTSQ included additional questions on the type and amount (number of sessions per month and number of minutes per session) of service. For each outcome, the number of sessions per month and the duration of each session were recorded. An “hours per month” metric was computed by multiplying the number of sessions per month by the number of minutes per session and dividing by 60.

2.3. Procedure

The SBSQ and PTSQ were completed in person, thus project staff either visited the child’s classroom or scheduled a home visit. This allowed the caregiver or teacher to ask any questions about completing the form. The forms were completed at the beginning of the school year. It should be noted that ABA therapy was only included on the PTSQ because the receipt of formal ABA therapy in the school setting was an exclusionary criterion for the larger study.

2.4. Additional measures

Mullen. The Mullen Scales of Early Learning (MSEL; Mullen, 1995) is a standardized, comprehensive assessment that measures gross motor (e.g., running), fine motor (e.g., stringing beads), visual reception (e.g., sorting) and language (receptive and expressive) abilities of children from birth through 68 months. The instrument has an internal reliability of 0.91 (Mullen, 1995), and the validity of the measure for children with ASD has been established (Akshoomoff, 2006).

ADOS. Considered to be the gold standard diagnostic instrument, the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999) is a semi-structured assessment that captures social interaction, communication, and play or imagination/creativity as well as repetitive behaviors and restricted interests. Researchers administer one of four different modules depending on the age and language abilities of the individual with ASD. The ADOS offers two domain scores: social affect and restrictive and repetitive behavior, and a total score. For this study, researchers used a recently developed algorithm that can be calculated across modules to obtain severity scores (range of 1–10) (Gotham, Pickles, & Lord, 2009). ADOS assessments were administered by research-trained and reliable administrators.

Parenting Stress Index, Short Form (PSI/SF). The Parent Stress Index Short Form (PSI/SF; Abidin, 1995) is 36-item self-report measure that assesses the stress level associated with the parent–child system. Individual items are on a five-point Likert scale ranging from strongly agree to strongly disagree. The measure consists of three factors related to parent stress: parental distress, parent–child dysfunctional interaction and difficult child. The instrument has favorable test–retest reliability (0.84) and internal consistency (0.91).

Family Demographic Questionnaire. The demographic questionnaire gathered information related to socioeconomic status. Socioeconomic status was defined as a composite of both the highest education level across caregivers and their combined family income, since these two variables were moderately correlated, ($r = 0.53$, $p < 0.0001$). Income was measured on a 6-point scale representing a range of income levels; education was coded across one of five categories, with assigned numeric values of one through five. Income was rescaled onto a five-point scale and was summed with the education value to yield an SES indicator that could range from two to ten.

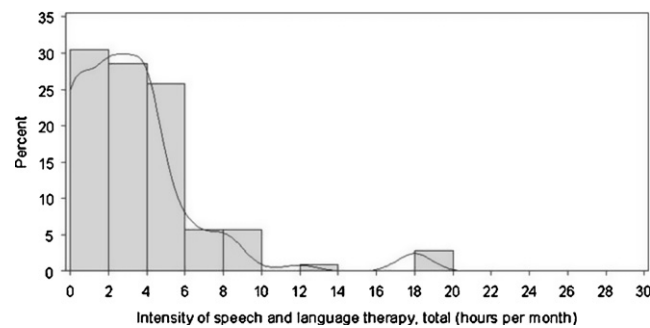


Fig. 1. Example of SLT dosage distribution.

2.5. Statistical models

First, histograms of the resulting service outcomes were examined. It was immediately clear that the outcomes were not normally distributed. As an example, Fig. 1 displays a histogram of the school-based speech and language therapy outcome.

Most students received less than 6 h per month of the service, but some children received much more. Not only is the distribution bounded at zero, but the shape of the distribution strongly resembles distributions for count variables (i.e. variables cannot be less than zero, only integer values are allowed). Linear regression, with its assumption of normally distributed residuals, would not yield correct results for these data. Therefore, models for count variables were utilized in order to address the research questions. This required the outcome scores to be rounded to the nearest integer prior to analysis. There are four basic models for count data that are worth briefly considering:

- (1) *Poisson*. The Poisson model is the basic model for count data. The Poisson distribution has a single parameter that governs the mean and the variance of the distribution. This simplicity comes at a cost – the Poisson model is frequently unable to model real-world data when outcomes have either too many zero scores or a wider spread than would be expected given the mean. This last condition is called “overdispersion.”
- (2) *Negative binomial*. The negative binomial model is appropriate when data are overdispersed. An additional parameter, called alpha, allows the distribution to have more variance than would be allowed under the Poisson model.
- (3) *Zero-inflated Poisson*. The zero-inflated Poisson model is used when the Poisson distribution is reasonable, except there are too many zero counts. The model works by splitting the outcome into two parts. The first part considers whether the count is zero or nonzero. The second part models nonzero counts according to a Poisson distribution.
- (4) *Zero-inflated negative binomial*. This is the most complicated count model. It is used when data have both an excess of zeros and overdispersion.

All analyses were conducted with SAS version 9.2 using the new COUNTREG procedure. All four count models were fit to each outcome; model selection was performed by checking for convergence and comparing model fit according to the parsimony-adjusted fit indices (AIC and BIC) (Burnham, 2004). The best-fitting model that achieved convergence was selected for each analysis.

3. Results

Our results, in congruence with earlier studies (Bitterman et al., 2008; Hume et al., 2005; Kohler, 1999; Patten et al., 2011; Thomas, Ellis, et al., 2007), indicated that a substantial number of children were receiving common services in the form of in-school SLT (92%) and OT (67%) and private SLT (52%), OT (38%) and ABA (14%).

3.1. Family and child characteristics affecting service receipt and dosage

Research Question 1: Are children’s receipt of school-based services or use of private services related to family SES, race/ethnicity, or caregiver stress?

School-based services. The best-fitting model for both the SLT and OT outcomes was the negative binomial model. The outcomes were regressed on the SES composite score and PSI total score. Caregiver race dummy variables were included as covariates, with White caregivers serving as the reference group. The results are presented in Table 2. Neither SES nor the PSI score was associated with school-based services. There were statistically significant associations between caregiver race and outcomes. Students with Hispanic caregivers received significantly less SLT ($p < 0.0001$) and less OT ($p = 0.001$) as compared with students with White caregivers. Also, students with Asian caregivers received less OT ($p = 0.028$) than students with White caregivers.

Table 2

Results for school-based services by SES and caregiver stress.

Variable	Speech and Language Therapy (<i>n</i> = 105)		Occupational Therapy (<i>n</i> = 106)	
	Parameter (SE)	<i>p</i>	Parameter (SE)	<i>p</i>
Alpha parameter (overdispersion)	0.499 (0.125)	<0.0001	1.119 (0.312)	<0.001
Dosage: Intercept	0.860 (0.646)	0.183	1.174 (0.941)	0.212
Dosage: Caregiver race = Asian	−0.540 (0.401)	0.178	−1.641 (0.746)	0.028
Dosage: Caregiver race = Black	−0.415 (0.326)	0.203	−0.820 (0.487)	0.092
Dosage: Caregiver race = Hispanic	−0.888 (0.213)	<0.0001	−1.072 (0.315)	0.001
Dosage: PSI total score	0.004 (0.005)	0.470	−0.007 (0.008)	0.378
Dosage: SES composite score	0.042 (0.042)	0.321	0.045 (0.065)	0.489

Note: Model for both outcomes is negative binomial regression.

Private therapy services. The best-fitting model for the private SLT and OT service outcomes was the zero-inflated negative binomial model. This model is complex and consists of one model for the probability that the child did not receive the service (i.e., a zero count) and a second model for the amount of the service received. The ABA outcome had a highly intractable distribution (cannot be modeled by any known distribution), so it was dichotomized onto a 0/1 metric and modeled via logistic regression for this and all subsequent analyses. Results of the analysis are displayed in Table 3.

None of the explanatory variables were significantly associated with the dosage of service received. However, both the PSI score and the SES composite were significantly associated with the *probability* of receiving OT. The coefficient for the SES composite indicates that higher SES was associated with a lower probability of receiving zero private OT; in other words, high SES implies a higher probability of receiving private OT. The effect of the PSI score operated in the other direction, with high caregiver stress being associated with a higher probability of having zero private OT; thus, high stressed caregivers were more likely to utilize private OT for their child. In the logistic regression model for the ABA outcome, the SES composite is associated with a higher likelihood of receiving that service.

Research Question 2: Are children's receipt of school-based services or use of private services related to their gender, chronological age, cognitive ability, or autism severity?

School-based services. The best-fitting model for the SLT and OT outcomes was the negative binomial model. The outcomes were regressed on a measure of autism and cognitive severity, the ADOS severity score and the Mullen overall score, respectively, as well as their pairwise interactions with age, the main effect of age, and a dummy indicator of female gender. The ADOS, Mullen, and age variables were centered prior to analysis. Results may be found in Table 4.

The Mullen score was significantly related to the dosage of school-based SLT. Lower Mullen scores (i.e., greater cognitive impairment) were associated with higher amounts of SLT. The ADOS severity score was significantly related to the amount of school-based OT, with higher ADOS scores being associated with more OT.

Private therapy services. Results for this model may be found in Table 5. The zero-inflated negative binomial model had the best fit for the private SLT and OT outcomes. Logistic regression was used to model the ABA outcome. For private SLT, neither

Table 3Results for private services by SES and caregiver stress (*n* = 117).

Variable	Speech and Language Therapy		Occupational Therapy		Applied Behavior Analysis	
	Parameter (SE)	<i>p</i>	Parameter (SE)	<i>p</i>	Parameter (SE)	<i>p</i>
Alpha parameter (overdispersion)	0.268 (0.110)	0.015	0.109 (0.073)	0.137		
Dosage: Intercept	2.433 (0.935)	0.009	2.596 (0.808)	0.001		
Dosage: Caregiver race = Asian	−0.038 (0.393)	0.924	−0.502 (0.531)	0.345		
Dosage: Caregiver race = Black	−0.889 (0.951)	0.350				
Dosage: Caregiver race = Hispanic	0.062 (0.253)	0.808	−0.056 (0.276)	0.838		
Dosage: PSI total score	−0.005 (0.008)	0.551	−0.002 (0.006)	0.765		
Dosage: SES composite score	−0.066 (0.054)	0.226	−0.101 (0.058)	0.079		
Prob service: Intercept	−0.293 (1.425)	0.837	0.946 (1.405)	0.501	−3.777 (2.121)	0.075
Prob service: Caregiver race = Asian	−0.875 (0.927)	0.346	−0.439 (1.007)	0.663	0.376 (1.192)	0.753
Prob service: Caregiver race = Black	1.855 (1.184)	0.117				
Prob service: Caregiver race = Hispanic	−0.448 (0.474)	0.344	−1.211 (0.503)	0.016	0.534 (0.664)	0.422
Prob service: PSI total score	0.021 (0.012)	0.097	0.028 (0.013)	0.031	−0.015 (0.017)	0.376
Prob service: SES composite score	−0.157 (0.100)	0.116	−0.271 (0.111)	0.015	0.355 (0.171)	0.038

Note: Models for Speech and Language Therapy and Occupational Therapy outcomes are zero-inflated negative binomial models. The model for the zero inflation part of the model is labeled "prob. service"; the model for the count part of the model is labeled "Dosage." The outcome for the zero-inflated model is that the count is zero. Therefore, positive coefficients indicate that the variable is associated with a higher probability of a zero count. The "caregiver race = Black" variable could not be included in the model for Occupational Therapy due to perfect prediction (i.e., all Black caregivers either received or did not receive OT, causing the model to be inestimable) (see Long, 1997 for a discussion on perfect prediction).

The Applied Behavior Analysis outcome was coded 0/1 and modeled via logistic regression. Positive coefficients indicate that the variable is associated with a higher probability of having the outcome. This is opposite to the directionality in the inflation part of the zero-inflated models.

Table 4

Results for school-based services by autism severity and age.

Variable	Speech and Language Therapy (n = 104)		Occupational Therapy (n = 106)	
	Parameter (SE)	p	Parameter (SE)	p
Alpha parameter (overdispersion)	0.517 (0.134)	<0.001	1.229 (0.324)	<0.001
Dosage: Intercept	1.768 (0.601)	0.003	−0.171 (0.881)	0.846
Dosage: ADOS severity	0.009 (0.060)	0.876	0.189 (0.096)	0.048
Dosage: ADOS × age	−0.038 (0.092)	0.678	−0.152 (0.147)	0.302
Dosage: Age (years)	−0.889 (0.909)	0.328	−0.674 (1.398)	0.630
Dosage: Gender = female	0.351 (0.302)	0.245	−0.901 (0.479)	0.060
Dosage: Mullen (overall score)	−0.013 (0.005)	0.014	−0.012 (0.008)	0.127
Dosage: Mullen × age	0.016 (0.008)	0.060	0.024 (0.013)	0.078

Note: Models for both outcomes are negative binomial models. ADOS, Mullen, and child age were grand-mean centered.

Table 5

Results for private services by autism severity and age (n = 117).

Variable	Speech and Language Therapy		Occupational Therapy		Applied Behavior Analysis	
	Parameter (SE)	p	Parameter (SE)	p	Parameter (SE)	p
Alpha parameter (overdispersion)	0.246 (0.110)	0.025	0.109 (0.073)	0.137		
Dosage: Intercept	2.460 (0.625)	<0.0001	1.507 (0.597)	0.012		
Dosage: ADOS severity	−0.016 (0.067)	0.806	0.022 (0.062)	0.725		
Dosage: ADOS × age	−0.059 (0.117)	0.613	−0.011 (0.090)	0.905		
Dosage: Age (years)	−0.687 (1.006)	0.495	−0.923 (0.823)	0.262		
Dosage: Gender = female	−0.550 (0.323)	0.089	−0.353 (0.282)	0.212		
Dosage: Mullen (overall score)	−0.012 (0.007)	0.070	−0.001 (0.006)	0.854		
Dosage: Mullen × age	0.018 (0.013)	0.149	0.019 (0.009)	0.024		
Prob service: Intercept	1.064 (1.357)	0.433	0.616 (1.383)	0.656	−1.186 (2.496)	0.635
Prob service: ADOS severity	−0.023 (0.142)	0.872	−0.040 (0.136)	0.771	0.017 (0.234)	0.941
Prob service: ADOS × age	0.192 (0.237)	0.417	0.127 (0.225)	0.574	0.179 (0.350)	0.608
Prob service: Age (years)	−1.881 (2.167)	0.385	0.232 (2.183)	0.915	−2.169 (3.527)	0.539
Prob service: Gender = female	−1.144 (0.760)	0.132	−0.134 (0.608)	0.825	−0.608 (1.129)	0.590
Prob service: Mullen (overall score)	−0.008 (0.015)	0.606	0.010 (0.012)	0.415	−0.020 (0.026)	0.445
Prob service: Mullen × age	0.011 (0.025)	0.674	−0.015 (0.021)	0.476	0.029 (0.038)	0.449

Note: The models for Speech and Language and Occupational Therapy are zero-inflated negative binomial models. The model for the zero inflation part of the model is labeled “prob. service”; the model for the count part of the model is labeled “Dosage.” The outcome for the zero-inflated model is that the count is zero. Therefore, positive coefficients indicate that the variable is associated with a higher probability of a zero count.

The Applied Behavior Analysis outcome was coded 0/1 and modeled via logistic regression. Positive coefficients indicate that the variable is associated with a higher probability of having the outcome. This is opposite to the directionality in the inflation part of the zero-inflated models. Age, ADOS severity, and Mullen scores were grand-mean centered.

the probability of receipt nor the amount of therapy was significantly related to any model variables. For private OT, no model variables were significantly related to the probability of receiving the treatment. However, the Mullen-by-age interaction in the model for the dosage of therapy was statistically significant, indicating that older children with higher Mullen scores received more private OT than young children with low Mullen scores. There was no significant main effect of age for the Mullen score.

4. Discussion

The purpose of this study was to examine common types as well as the dosage of ECSE and allied health services children with ASD receive in private and school settings as they relate to family (i.e., race/ethnicity, SES, caregiver stress) and child (i.e., autism severity, age, cognitive ability, gender) characteristics. Our findings both support and, in some cases, diverge from the existing literature on factors related to the type of ECSE or allied health service children receive.

4.1. Family characteristics

Research on the link between race/ethnicity and access/receipt of services is mixed (e.g., Patten et al., 2011; Thomas, Ellis, et al., 2007). Thomas, Ellis, et al. (2007) found that racial and ethnic minority families were less likely than White families to utilize private OT services (i.e., sensory integration therapy). Alternatively, Patten et al. did not identify race as a factor affecting type and dosage of services. Our study found that there were no racial or ethnic differences associated with the likelihood of use of private services. The dosage of in-school services children received, however, did differ in terms of race and ethnicity. Hispanic children with ASD received a smaller dose of OT and SLT in comparison to White children. Asian

families with a child with ASD also received a smaller dose of in-school OT. It must be noted that White families enrolled in the study had significantly higher SES than Black and Hispanic families; although, in our sample, children's cognitive ability or severity of symptoms did not differ by race/ethnicity. Still these findings may reflect that families with a higher SES could be in a better position to advocate for their child to receive higher dosages of services. A shortage of culturally competent or language-proficient ECSE and allied health service providers may also affect the amount of service children receive (Stapleford & Todd, 1998). In the field of ECSE there have been increasing calls to train culturally competent teachers because of the increasing numbers of children from different racial and ethnic backgrounds (Mandell & Novak, 2005).

Family SES has been cited in previous research as a factor affecting the receipt of services (Patten et al., 2011; Thomas, Ellis, et al., 2007). Thomas et al. found families with a child with ASD who had incomes over \$50,000 were more likely to use private SLT. We found that caregivers with a higher SES were more likely to enroll their child in ABA services and private OT. However, family SES was not associated with the use of private SLT or dosage of in-school or out-of-school OT and SLT services. The divergent findings may be a result of the composite SES variable (i.e., a score based on an aggregated caregiver education and income level) used in our study, whereas Thomas et al. examined indicators of SES separately.

As noted earlier, caregiver stress affects service use (Thomas, Ellis, et al., 2007), and the utilization of services is believed to affect caregiver stress (Lord & Bishop, 2010). Thomas, Ellis, et al. (2007) reported that a specific form of intervention, the Picture Exchange Communication System (PECS) was less likely to be utilized by caregivers who had lower levels of stress, but that stress level did not affect the likelihood of private SLT and OT use. Conversely, caregivers in this study were more likely to utilize private OT services if they were experiencing high levels of stress. The findings of Patten et al.'s study (2011) might provide an explanation for this finding. Those researchers found that children with more sensory symptoms (e.g., hypersensitivity to sound) have caregivers with higher stress levels, which in turn, may prompt caregivers to seek out additional OT services. Interestingly, caregiver stress level did not appear to affect the utilization of private SLT and ABA services.

4.2. Child characteristics

Previous research has reported differences in the utilization of services related to the severity of a child's autistic symptoms. Patten et al. (2011) found that children with more severe *sensory* symptoms began services earlier, but that overall severity of autistic symptoms did not relate to differences in service use. Thomas, Ellis, et al. (2007) reported children with less severe symptoms were more likely to receive PECS outside of the school setting. In this study, children with more severe autistic symptoms, as measured by the ADOS, received a higher dose of in-school OT services, which was the only difference in dosage and receipt of services related to symptom severity. Taken together, the findings across studies do not demonstrate a clear link between receipt of services and the severity of children's symptoms, perhaps a result of different measures of autism severity being utilized.

Several researchers have presented evidence that the receipt of ECSE and allied services is related to children's age (Green et al., 2006; Patten et al., 2011; Thomas, Morrissey, et al., 2007). Our results suggest that older, more cognitively able children did not have a higher probability of receiving private OT; however, when families did utilize this service their child received a larger dose than younger, less cognitively able children. Children with more cognitive impairments, however, received a larger dosage of in-school SLT. Thus, child factors appear to differentially affect what services children receive in and outside of school.

4.3. Study limitations

There are several limitations to this study that must be noted. First, participants were from a larger multi-state project examining preschool programs for students with ASD, and the service patterns of participants for this study may not generalize to families who choose not to participate in an experimental study. A second limitation is that we did not measure complementary and alternative therapies the child was receiving (e.g., special diets, biomedical treatments). It is possible that some caregivers may be choosing alternative therapies over private common ECSE services. Third, the "hours per month" of services was a sum of group based and 1 to 1 time with an adult; therefore, the intensity of services received by some children may be overestimated.

4.4. Conclusions

As previously noted, ensuring access to high-quality ECSE and allied health services benefits children with ASD and their families as well as society (Lord & Bishop, 2010). Our study extends the existing literature by both confirming previous findings and raising new questions about associations between service use and child and family characteristics. In addition, we provide needed information on family and child characteristics that may be related to service receipt in the school setting and dosage in both school and private settings. We believe the evidence presented will be beneficial to policy makers and advocates who are attempting to remediate differences in access to and the dosage of essential early intervention services for children with ASD.

Future research that investigates receipt and dosage of services using a multi-state sample that considers geographic (e.g., urban vs. rural) and district level features may illuminate additional differences in service use across the United States.

Multi-state studies are also needed on ethnic minority service use and the number of available culturally competent service providers. For instance, states with large non-English speaking Hispanic populations and a limited number of Spanish-speaking service providers may result in some families having limited access to services. This research could help state officials effectively petition national policy-makers for additional professional development funds.

More research also is needed to clarify the link between family (e.g., caregiver stress, SES) and child (e.g., autism severity) characteristics and the receipt of services, since these relationships appear to be inconsistent across studies. Lastly, research on the relationship between the receipt of services and family and child characteristics, and how this relationship affects outcomes is sorely needed. This information could illuminate the compounding effects of poverty and access to a smaller dosage of ECSE and allied health services on the social and cognitive abilities of children with ASD.

Acknowledgements

The research reported here was supported by the Institute of Education Sciences, U.S. Department of Education, through Grant R324B070219 to the University of North Carolina at Chapel Hill. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

References

- Abidin, R. R. (1995). *Parenting Stress Index* (3rd ed.). Odessa, FL: Psychological Assessment Resources.
- Akshoomoff, N. (2006). Use of the Mullen scales of early learning for the assessment of young children with autism spectrum disorders. *Child Neuropsychology*, 12, 269–277.
- Bitterman, A., Daley, T. C., Misra, S., Carlson, E., & Markowitz, J. (2008). A national sample of preschoolers with autism spectrum disorders: Special education services and parent satisfaction. *Journal of Autism and Developmental Disorders*, 38, 1509–1517.
- Boyd, Hume, Alessandri, Gutierrez, Sperry, & Odom. (2008a). *Private Therapy Services Questionnaire (PTSQ)*. Unpublished instrument, University of North Carolina at Chapel Hill.
- Boyd, Hume, Alessandri, Gutierrez, Sperry, & Odom. (2008b). *School-based Services Questionnaire (SBSQ)*. Unpublished instrument, University of North Carolina at Chapel Hill.
- Boyd, B. A., Odom, S. L., Humphries, B. P., & Sam, A. M. (2010). Infants and toddlers with autism spectrum disorder: Early identification and early intervention. *Journal of Early Intervention*, 32, 73–96.
- Burnham, K. P. (2004). Multimodel inference: Understanding AIC and BIC in model selection. *Sociological Research Methods*, 33, 261–304.
- Data Accountability Center. (2011). Part B child count 2008 and 2002. Retrieved from <http://www.ideadata.org/PartBData.asp>
- Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorder. *Development and Psychopathology*, 20, 775–803.
- Dawson, G., Rogers, S., Munson, J., Smith, M., Winter, J., Greenson, J., et al. (2010). Randomized, controlled trial of an intervention for toddlers with autism: The Early Start Denver Model. *Pediatrics*, 125, 17–23.
- Gotham, K., Pickles, A., & Lord, C. (2009). Standardizing ADOS scores for a measure of severity in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 39, 693–705.
- Green, V. A., Keenan, A. P., Itchon, J., Choi, A., O'Reilly, M., & Sigafos, J. (2006). Internet survey of treatments used by parents of children with autism. *Research in Developmental Disabilities*, 27, 70–84.
- Hume, K., Bellini, S., & Pratt, C. (2005). The usage and perceived outcomes of early intervention and early childhood programs for young children with autism spectrum disorder. *Topics in Early Childhood Special Education*, 25, 195–207.
- Kohler, F. (1999). Examining the services received by young children with autism and their families: A survey of parent responses. *Focus on Autism and Other Developmental Disabilities*, 14(3), 150–158.
- Liptak, G. S., Benzoni, L. B., Mruzek, D. W., Nolan, K. W., Thingvoll, M. A., Wade, C. M., et al. (2008). Disparities in diagnosis and access to health service for children with autism: Data from the national survey of children's health. *Journal of Developmental & Behavioral Pediatrics*, 29, 152–160.
- Long, J. S. (1997). *Regression models for categorical and limited dependent variables*. Thousand Oaks, CA: Sage.
- Lord, C., & Bishop, S. L. (2010). Autism spectrum disorders: Diagnosis, prevalence, and services for children and families. *Social Policy Report*, 24(2), 1–27.
- Lord, C., Rutter, M., DiLavore, D., & Risi, S. (1999). *Autism Diagnostic Observation Schedule (ADOS)*. Los Angeles, CA: Western Psychological Services.
- Mandell, D. S., & Novak, M. (2005). The role of culture in families' treatment decisions for children with autism spectrum disorders. *Mental Retardation and Developmental Disabilities*, 11, 110–115.
- Montes, G., Halterman, & Magyar, C. I. (2009). Access to and satisfaction with school and community health services for US children with ASD. *Pediatrics*, 124, 407–413.
- Mullen, E. M. (1995). *Mullen Scales of Early Learning*. Los Angeles, CA: Western Psychological Services.
- Osborne, L., & Reed, P. (2008). The relationship between parenting stress and behavior problems of children with autistic spectrum disorders. *Exceptional Children*, 76, 54–73.
- Patten, E., Baranek, G. T., Watson, L. R., & Schulz, B. (2011). Therapeutic interventions for children with autism and their associated child and family characteristics. *Focus on Autism and Other Developmental Disabilities*, in press.
- Rogers, S. J., & Vismara, L. A. (2008). Evidence-based comprehensive treatments for early autism. *Journal of Clinical Child Adolescent Psychology*, 37, 8–38.
- Rutter, M., Bailey, A., & Lord, C. (2003). *The Social Communication Questionnaire manual (SCQ)*. Los Angeles, CA: Western Psychological Services.
- Schertz, H. H., & Odom, S. L. (2007). Promoting joint attention in toddlers with autism: A parent-mediated developmental model. *Journal of Autism and Developmental Disorders*, 37, 1562–1575.
- Schopler, E., Reichler, R. J., & Renner, B. R. (1988). *The Childhood Autism Rating Scale*. Los Angeles, CA: Western Psychological Services.
- Stapleford, J., & Todd, C. (1998). Why are there so few ethnic minority speech and language therapists? *International Journal of Language and Communication Disorders*, 33(Suppl.), 261–266.
- Thomas, K. C., Ellis, A. R., McLaurin, C., Daniels, J., & Morrissey, J. P. (2007). Access to care for autism-related services. *Journal of Autism and Developmental Disorders*, 37, 1902–1912.
- Thomas, K. C., Morrissey, J. P., & McLaurin, C. (2007). Use of autism-related services by families and children. *Journal of Autism and Developmental Disorders*, 37, 818–829.