Parenting Stress and Sensory Processing: Children With Fetal Alcohol Spectrum Disorders

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key words: sensory processing, prenatal alcohol exposure, school-aged children

ABSTRACT

Sensory processing differences are reported in a high proportion of children with fetal alcohol spectrum disorders (FASD), but how these problems impact caregiver burden has not been investigated. Linear regression was used to examine the association between parenting stress and problems in sensory processing, along with other child and family characteristics, among 52 children aged 5 to 12 years with FASD. Participants also had clinically significant problem behaviors. Higher levels of child-related parenting stress were moderately correlated with more parent-reported sensory processing problems (r = *-.60). Regression findings revealed that parent-reported problems in children's behavior regulation, an aspect of executive function, and sensory processing deficits were the strongest predictors of child-related parenting stress, together accounting for 62% of variance. Children's sensory processing deficits and executive function impairments affect the parent–child system and should be central considerations when developing family-centered supports for children with FASD.*

Prenatal alcohol exposure can result in a continuum of neurodevelopmental disabilities known collectively as fetal alcohol spectrum disorders (FASD; Bertrand et al., 2004). Children with FASD demonstrate a range of neurobehavioral deficits often including sensory processing problems that can interfere with successful occupational performance and participation. Using validated caregiver report measures, high rates of sensory processing problems (80% to 88%) have been reported among clinical samples of children with FASD (Carr, Agnihotri, & Keightley, 2010; Franklin, Deitz, Jirikowic, & Astley, 2008; Jirikowic, Kartin, & Olson, 2008). Poor sensory processing has shown moderate associations with child characteristics including increased problem behaviors (Franklin et al., 2008) and poorer adaptive skills (Carr et al., 2010; Jirikowic et al., 2008) among school-aged children with FASD. However, the relationships between children's sensory processing difficulties and attitudes important to parenting success have not yet been examined in this clinical population, despite their importance for informing intervention.

It is well established that caregivers raising children with many types of neurodevelopmental disabilities report elevated levels of parenting stress (Estes et al., 2009; Hauser-Cram et al., 2001; Johnston et al., 2003; Webster, Majnemer, Platt, & Shev-

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ell, 2008). Over the long term, parenting stress may have deleterious effects on family relationships, maternal health and quality of life, and child behavioral outcomes in families raising children with developmental disabilities (Eisenhower, Baker, & Blacher, 2009; Hauser-Cram et al., 2001). Indeed, parenting stress is an overarching concern for caregivers raising children born prenatally exposed to alcohol and high rates of clinically elevated parenting stress have been found among caregivers raising school-aged children with FASD (Olson, Oti, Gelo, & Beck, 2009; Paley, O'Connor, Frankel, & Marquardt, 2006; Paley, O'Connor, Kogan, & Findlay, 2005).

In the effort to understand sources of parenting stress, common characteristics among children with developmental disabilities have been explored, such as intellectual level, magnitude of problem behaviors, and decrements in adaptive function. Important contributors differ across clinical populations. For example, among preschool children with autism spectrum disorders or developmental delays, the magnitude of child problem behaviors was the most significant predictor of parenting stress, whereas child intellectual level and adaptive function were not salient predictors (Estes et al., 2009). In contrast, lower child cognitive levels and poorer adaptive function were both associated with greater parenting stress among biologically vulnerable toddlers with varying developmental risk factors, including prenatal alcohol exposure, although problem behaviors were not considered (Secco et al., 2006).

Interestingly, sensory processing deficits have rarely been considered as a contributor to parenting stress in these populations. Yet, the behavioral sequelae that stem from sensory processing impairments (i.e., the need to avoid or seek sensation in ways that are different from children with typical development) may be stressful for parents. This is because associated behaviors can prolong or impede household routines, impact family participation in community activities or social events, and hinder the development of mutually positive and satisfying parent–child relationships (Dunn, 2007). To our knowledge only one study to date has systematically examined sensory processing and parenting stress. Epstein, Saltzman-Benaiah, O'Hare, Goll, and Tuck (2008) investigated the relationships between parenting stress and child characteristics in 39 children aged 5 to 12 years with Asperger syndrome. Findings revealed a significant, moderately high relationship between maternally reported sensory processing behaviors as measured by the Short Sensory Profile (SSP; Dunn, 1999) and higher levels of parenting stress ($r = -.56$; $p < .007$) on the Parenting Stress Index (PSI; Abidin, 1995) short form.

When challenging child characteristics co-occur with adverse parent and family factors, parenting stress can be compounded. Parent characteristics, family context, and life stress events have all been identified as important facets affecting the parent–child system (Abidin, 1995). Ecological factors that have been associated with parenting stress include the availability of parenting and social supports, income level and socioeconomic status, family structure, and maternal depression (Abidin, 1995; Guralnick, Hammond, Neville, & Connor, 2008; Johnston et al., 2003; Secco et al., 2006). The significance and relative contributions of each of these ecological factors vary widely among the populations studied. For families dealing with substance abuse issues, such as birth parents, these ecological risks may often be multiple and pervasive, which render factors such as family resources, social support, and overall life stress especially salient considerations for these families (Astley, Bailey, Talbot, & Clarren, 2000; Nair, Schuler, Black, Kettinger, & Harrington, 2003).

To date, two studies have examined the associations between parenting stress and maternal, family, and child factors among caregivers of children affected by prenatal alcohol exposure. Paley et al. (2005) used path analysis to explore the sources of stress among 42 high-risk mothers of preschool children with high levels of prenatal alcohol exposure. Child factors (e.g., externalizing behavior problems and intellectual level) and ecological factors (e.g., socioeconomic status, current maternal alcohol use, and available parent support resources) were analyzed. The model revealed that greater child externalizing behavior problems and fewer parent support resources best explained maternal stress above and beyond other child and family factors. Contributors to parenting stress were also examined among children with diagnoses across the fetal alcohol spectrum among a sample of 100 parent–child dyads (Paley et al., 2006). Greater child-related parenting stress, assessed using the PSI (Abidin, 1995), a standardized parenting stress questionnaire, was associated with parent reports of greater child externalizing and internalizing behavior problems, decreased adaptive function, and increased level of executive function impairment. Notably, child executive function impairment, measured by the overall General Executive Composite score on the Behavior Rating Inventory of Executive Function-Parent Form (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) was the strongest predictor of child-related parenting stress in this analysis.

Although it is clear that parents of children with FASD are highly stressed by characteristics of their

children and face other psychosocial risks, this clinical population is not yet well understood and interventions are still in the early stages of development. Given the high rates of sensory processing problems previously reported in this group of children with neurodevelopmental disabilities, this study aimed to determine whether poor sensory processing, in combination with other salient child and family characteristics, is a significant source of parenting stress among caregivers raising children with FASD.

Methods

Research Design

This was a descriptive study of 52 children, aged 5 to 12 years, with systematically diagnosed conditions falling under the umbrella term of FASD, all with clinical concerning behavior problems, who were enrolled in a two-group randomized control trial designed as an initial efficacy test of the Families Moving Forward (FMF) Program intervention model (see Bertrand & Interventions for Children With Fetal Alcohol Spectrum Disorders Research Consortium, 2009 [Study #5]; Olson et al., 2009). The FMF Program is a caregiver-focused behavioral consultation intervention that aimed to reduce challenging child behaviors and, ultimately, to enhance caregiving attitudes and parenting practices, meet family needs, promote caregiver self-care, and provide useful linkages to community services. The overall study was approved by the University of Washington Human Subjects Division. Data for the current descriptive study came from the baseline assessment, which took place prior to participant randomization or any intervention.

Participants

Children were recruited from the University of Washington Fetal Alcohol Syndrome Diagnostic and Prevention Network (FAS DPN) clinical database, which at the time of the study contained more than 1,500 patient records with patient consent and human subjects approval for research recruitment. Participants in the FAS DPN database represent a clinical population of individuals with confirmed prenatal alcohol exposure systematically diagnosed by an interdisciplinary team (Astley & Clarren, 2000; Clarren, Olson, Clarren, & Astley, 2000) using the FASD 4-Digit Diagnostic Code (Astley, 2004).

The 4-Digit Diagnostic Code has been demonstrated to be a sensitive and reliable method to diagnose fetal alcohol syndrome (FAS) and other conditions on the fetal alcohol spectrum (Astley, 2004, Astley et al., 2009a, 2009b). The four digits of the code reflect the magnitude of expression of the key diagnostic features of FASD: (1) growth deficiency; (2) characteristic facial phenotype; (3) central nervous system damage/dysfunction; and (4) maternal alcohol consumption during pregnancy. The magnitude of expression of each feature is ranked independently on a 4-point Likert scale with "1" reflecting complete absence of the FAS feature and "4" reflecting a strong "classic" presence of the FAS feature. The 4-Digit Codes that fall under the umbrella of FASD can be subclassified into one of four unique clinical diagnostic categories from more severe to less severe: (1) FAS, characterized by growth deficiency, facial anomalies, and severe central nervous system dysfunction, (2) partial FAS/alcohol-exposed (without growth deficiency), (3) static encephalopathy/alcohol-exposed (severe central nervous system dysfunction without the FAS facial features), and (4) neurobehavioral disorder/alcohol-exposed (mild to moderate central nervous system dysfunction without the FAS facial features) (Astley, 2004).

Procedures

Following enrollment and informed consent, all children received a comprehensive baseline neurodevelopmental assessment and primary caregivers were interviewed and asked to complete standardized questionnaires during a research laboratory visit. Caregiver interviews were conducted by trained psychometrists with an educational background in social or human services. Child assessments were completed by psychology graduate students with advanced training in child psychopathology and psychometric assessment. All testers were trained on the test administration and scoring via pilot testing, achieving acceptable interrater reliability at baseline and midway through the testing period. Testers were aware that the participants had a diagnosis on the fetal alcohol spectrum, but had no knowledge of prior or current test results. Testers were not involved in the intervention.

The child assessment profiled each child's neurodevelopmental function, including sensory processing, and evaluated child strengths, social skills, behavior problems, and cognitive/linguistic abilities including executive function. Caregiver needs and attitudes, including parenting stress, were assessed, as were parenting practices, family characteristics, child life experiences, and demographics. The assessments were typically done as one visit (4.5 hours) with several breaks and refreshment during the session. A few children, usually those who were younger, were seen for two sessions to minimize fatigue. Adaptive behavior data were gathered via a semi-structured interview during phone calls to the

primary caregiver at a time convenient to the family following the baseline laboratory visit.

Instrumentation

PSI, Long Form (Abidin, 1995). This standardized questionnaire evaluates parenting stress for parents of children from 1 month to 12 years of age. Scores in each domain at or above the 85th percentile suggest clinically elevated stress. The Child Domain (PSI Child) taps current child characteristics that may be major factors contributing to stress in the overall child–parent system. The Parent Domain (PSI Parent) taps current caregiver factors that may contribute to overall stress and dysfunction in the parent–child system. The Life Stress Domain provides an indicator of the amount of stress a caregiver has experienced during the past 12 months outside the parent–child system (e.g., divorce or changes in income). Internal consistency is reported for the Child Domain (α = .70 to.83) and Parent Domain (α = .70 to .84). Test–retest reliability coefficients across three different studies are reported for the Child Domain (r = .63 to .82) and Parent Domain (r =. 75 to .91). Construct and predictive validity are reported across child and parent populations.

SSP (Dunn, 1999). The SSP is a standardized parent questionnaire that examines sensory processing behaviors for children aged 3 through 10 years. The SSP measures the following domains of sensory processing: (1) Tactile Sensitivity; (2) Taste/Smell Sensitivity; (3) Movement Sensitivity; (4) Underresponsive/Seeks Sensation; (5) Auditory Filtering; (6) Low Energy/Weak; and (7) Visual/Auditory Sensitivity. A total score is generated from each domain and lower scores indicate that problem behaviors occur more frequently. Raw scores are also classified into categories of typical performance (scores > -1.0 standard deviation from the mean), probable difference (scores -1.0 to -2.0 below the mean), and definite difference (scores < -2.0 from the mean). The SSP has good internal reliability (α = .70 to .90). Behavioral outcomes on the SSP are consistent with physiological outcomes in children with and without sensory modulation disorders (i.e., children with lower scores on the SSP show abnormal electrodermal skin response to sensory stimuli), supporting the SSP construct validity (McIntosh, Miller, Shyu, & Hagerman, 1999).

BRIEF-Parent Form (Gioia et al., 2000). The BRIEF is a standardized caregiver report of executive functioning behaviors for children aged 5 to 18 years. The BRIEF has two indices, the Behavioral Regulation Index (BRIEF BRI) and the Metacognitive Index (BRIEF MCI), which combine to create the overall General Executive Composite score. The BRI and MCI were the variables of interest for this study, with higher T scores indicating more problematic behaviors. The BRIEF BRI and MCI have good test–retest reliability (r = .84; r = .88) and internal consistency (α = .96), respectively. The BRIEF has evidence of good convergent validity with other measures of inattention, learning, and impulsivity.

ASEBA Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2000, 2001). Problem behaviors were measured using the age-appropriate version of the CBCL. These are standardized parent questionnaires used to assess behavioral/emotional problems that have occurred during the past 6 months. The Total Problem T score was the variable of interest for this study. Higher T scores reflect the presence of more problem behaviors. Test–retest reliabilities ranged from r = .82 to .94 and internal consistency reliabilities ranged from α = .82 to .97. For both age-level versions of the CBCL, evidence for content validity, criterion-related validity, and construct validity is provided.

Vineland Adaptive Behavior Scales, Interview Edition, Survey Form, First Edition (VABS; Sparrow, Balla, & Cicchetti, 1984). The VABS is a semi-structured interview that examines a caregiver's assessment of the child's adaptive function in four domains: (1) communication; (2) daily living skills; (3) socialization; and (4) motor skills (for children younger than 6 years). The Adaptive Behavior Composite (VABS ABC), the study variable of interest, is a standard score derived from the component domain standard scores. There is extensive data to support construct and concurrent validity, and the VABS ABC has excellent test–retest reliability (intraclass correlation coefficient = .99) and interrater reliability (intraclass correlation coefficient = .98).

Kaufman Brief Intelligence Test (KBIT; Kaufman & Kaufman, 1990). The KBIT provides an estimate of verbal and nonverbal intellectual status for individuals aged 4 to 90 years. Results yield three scores: Verbal IQ, Nonverbal IQ, and an overall composite IQ. The internal consistency reliability for the IQ composite for 4 to 19 year olds is α = .92. Test–retest reliability is r = .90. The Verbal IQ score was the variable of interest for this study because the composite IQ score could not be calculated for four children with significantly different scores between the verbal and nonverbal scales.

Data Analysis

Child and family characteristics were summarized using means, standard deviations, range of values, and proportions. The relationships between

Table 1
Child and Caregiver Sociodemographic Characteristics (*N* = 52)

Variables	No. (%)[a]
Child gender (%)	
Male	27 (51.9)
Female	25 (48.1)
Child age (y)	
M (*SD*)	8.53 (2.03)
Low/high	5.0–11.85
Child race/ethnicity (%)	
White/Non-Hispanic	26 (50.0)
White/Hispanic	2 (3.8)
African American	4 (7.7)
Native Ancestry	2 (3.8)
Mixed Ethnicity	18 (34.6)
Primary caregiver type (%)	
Biological parent(s)	6 (11.5)
Biological grandparent	6 (11.5)
Adoptive parent	25 (48.0)
Foster parent	8 (15.4)
Legal guardian	2 (3.8)
Other (relative, stepmother)	5 (9.6)
Primary caregiver married/living with partner (%)	39 (75)
No. of children in current home	
M (*SD*)	2.67 (1.28)
Low/high	(1–7)
No. of significant earlier stresses (child)	
M (*SD*)	5.19 (2.28)
Low/high	(0–9)
Diagnosis (%)[b]	
FAS or partial FAS	10 (19.2)
Static encephalopathy/alcohol-exposed	21 (40.4)
Neurobehavioral disorder/alcohol-exposed	21 (40.4)
Annual household income	
< $15,0000	6 (11.5)
$16,000–39,000	8 (15.4)
$40,000–59,000	15 (28.9)
$60,000–79,000	8 (15.4)
$80,000–99,000	7 (13.5)
> $100,000	8 (15.4)

M = mean; SD = standard deviation; FAS = fetal alcohol syndrome.
[a]Percentages may not total 100% due to rounding.
[b]See Astley (2004) for a full description of the 4-Digit Diagnostic Code diagnoses.

PSI outcomes and salient child and family characteristics were explored statistically prior to the regression analysis (e.g., chi-square for categorical variables and Pearson correlation coefficients for continuous variables). Child sociodemographic variables examined were age, gender, number of stressful life events, and diagnosis on the fetal alcohol spectrum. Child characteristics examined were sensory processing (SSP Total raw score), IQ (KBIT Verbal IQ standard score), executive function (BRIEF MCI and BRIEF BRI T scores), problem behaviors (CBCL Total Problems T score), and adaptive function (VABS ABC standard score). Family characteristics considered were caregiver marital status, caregiver type, gross annual income, and number of children in the home. Variables that were statistically significant were then entered as independent variables into a stepwise linear regression to examine their relationship with the PSI. The stepwise F to enter in the regression analysis was set at a p value of less than .05 and F to remove was set at a p value of less than .10. Data were analyzed using Statistical Package for Social Sciences Version 18.0 software (SPSS, Inc., Chicago, IL).

Results

Sociodemographic data are presented in Table 1. This was a diverse sample of school-aged children with FASD and their caregivers from the standpoint of variables such as child ethnicity, gender, and socioeconomic status. The proportion of children in the care of their biological parent(s) in the study sample was small (11.5%); however, the proportion of children in the care of their biological parent(s) is also small (30%) in the FAS DPN clinical population from which they were drawn (Astley, 2010). The sample was representative of the larger clinical population in terms of gender and white/non-white participants, but this sample included a higher percentage (48%) of adoptive parents and caregivers reporting higher gross annual income levels.

Descriptive statistics for measures of parenting stress and child characteristics are presented in Table 2. A striking 92% of parents reported clinically elevated levels of stress (raw scores > 85th percentile) on the PSI Child Domain, compared to only 21% and 8% of the sample reporting clinically elevated stress on the Parent Domain and Life Stress Domain, respectively. Because most parents did not demonstrate clinically elevated levels of stress in the Parent Domain or Life Stress Domain, the regression analysis focused only on child-related parenting stress using the PSI Child as the dependent variable.

Table 2
Descriptive Statistics for Child Measures and Parenting Stress

Measures	*M* (*SD*)	Low/High
Child Function		
SSP[a] Total Score	126.8 (18.9)	73–176
VABS ABC Composite[b]	66.0 (11.2)	42–93
CBCL Total Problems[c]	70.9 (6.0)	51–86
BRIEF-BRI[d]	75.2 (9.0)	54–95
BRIEF-MCI[e]	71.3 (7.3)	53–87
KBIT Verbal[f]	94.4 (12.9)	75–130
Parenting Stress		
PSI[g] Child Domain	141.5 (19.1)	94–183
PSI[g] Parent Domain	126.6 (21.1)	85–182
PSI[g] Life Stress Domain	7.8 (6.3)	0–23

M = mean; SD = standard deviation.
[a]Short Sensory Profile (SSP; raw score).
[b]Vineland Adaptive Behavior Scales (VABS ABC standard score; M = *100;* SD = *15).*
[c]Child Behavior Checklist (CBCL T score; M = *50;* SD = *10).*
[d]Behavior Rating Inventory of Executive Function Behavior Regulation Index (BRIEF-BRI; T score; M = *50;* SD = *10).*
[e]Behavior Rating Inventory of Executive Function Metacognitive Index (BRIEF-MCI; T score M = *50;* SD = *10).*
[f]Kaufman Brief Intelligence Test (KBIT Verbal; standard Score; M = *100;* SD = *15).*
[g]Parenting Stress Index (PSI; raw score).

Table 3
Significant Correlations Between Child-Related Parenting Stress and Child Characteristics

Measure	1	2	3	4	5
SSP[a]	–	.30*	-.57**	-.39**	-.60**
VABS[b]	–	–	-.41**	-.45**	-.40**
CBCL[c]	–	–	–	.63**	.63**
BRIEF BRI[d]	–	–	–	–	.70**
PSI Child[e]	–	–	–	–	–

[a]Short Sensory Profile (SSP; raw score).
[b]Vineland Adaptive Behavior Scales (VABS ABC; standard score; M = *100;* SD = *15).*
[c]Child Behavior Checklist (CBCL; T score; M = *50;* SD = *10).*
[d]Behavior Rating Inventory of Executive Function Behavior Regulation Index (BRIEF-BRI) (T score; M = *50;* SD = *10).*
[e]Parenting Stress Index Child Domain (PSI Child; raw score).
**p < .05, two-tailed. **p < .01, two-tailed.*

Regarding child characteristics, this sample of children with FASD displayed estimated intellectual level in the average range, coupled with well-below average adaptive function. A high proportion of the children had sensory processing difficulties. On the SSP, 83% of the children were categorized with "definite differences," 12% had "probable differences," and only 5% had typical performance. The children also showed high levels of clinically significant behavior problems and clinically concerning executive function impairments in the domains of behavioral regulation and metacognition.

No significant correlations were found between the PSI Child Domain score and the child sociodemographic characteristics of age, gender, number of stressful life events, and diagnosis on the fetal alcohol spectrum or the family characteristics of caregiver marital status, caregiver type, gross annual income, and number of children in the home. Four measures of child neurobehavioral characteristics (BRIEF BRI, SSP, CBCL Total Problems, and VABS ABC) were significantly correlated with child-related parenting stress (PSI Child; see Table 3) and with each other. These four child neurobehavioral characteristics were entered into the regression equation as independent variables. Table 4 presents the regression analysis examining the relationship between these four child characteristics and the dependent variable of caregiver-reported parenting stress on the PSI Child Domain.

The overall model predicting child-related parenting stress was significant, at $F = 39.60$, $p < .001$. In this model, the BRIEF BRI and SSP Total score together explained 62% of variance in child-related parenting stress. The BRIEF BRI was the strongest predictor of parenting stress, whereas the SSP accounted for an additional R^2 change of .12.

Discussion

Child-related parenting stress occurred frequently and at high levels within the diverse group of caregivers raising children with FASD. To understand sources of stress in this clinical population, sensory processing behaviors were considered along with more commonly explored child and family characteristics associated with caregiving stress. Sensory processing differences together with the powerful variable of parent-reported problems in children's behavioral regulation (an aspect of executive function) were the strongest predictors of child-related stress in this sample of caregivers raising children with FASD. Assessment of differences in children's sensory processing captured variance beyond that explained by executive function impairments alone. Thus, for children with FASD with challenging behavior problems, difficulty modulating sensation, as perceived by their caregivers, had a significant and independent effect on daily parenting stress. This effect has important clinical implications be-

Table 4
Stepwise Regression Analysis: Child Characteristics Contributing Variability to Child-Related Parenting Stress (Parenting Stress Index: Child Domain)

	β	B (SE)	R^2(adjusted R^2)	Δ R^2
Step 1				
Constant	–	28.52 (16.21)	.50 (.49)	.50
Executive Function: Behavior Regulation (BRIEF-BRI)[a]	.71	1.50 (.21)	–	–
Step 2				
Constant	–	101.03 (23.25)	.62 (.61)	.12
Executive Function: Behavior Regulation	.56	1.19 (.20)	–	–
Sensory Processing (SSP)[b]	-.38	-.39 (.10)	–	–

Note. *Four measures of child characteristics were made available for stepwise entry into the regression equation (BRIEF BRI, SSP, CBCL Total Problems, and VABS ABC).*
[a]*Behavior Rating Inventory of Executive Function, Behavioral Regulation Index (BRIEF BRI).*
[b]*Short Sensory Profile (SSP).*

cause sensory processing knowledge can provide an additional and unique perspective to add to our understanding of parenting challenges reported by caregivers of children with FASD.

Consistent with previous findings among children with FASD (Paley et al., 2006), a strong association between child-related parenting stress and executive function impairment was seen. Results from the current study expand what is known about this common characteristic of children affected by prenatal alcohol exposure and its impact on caregivers (Kodituwakku, 2009; Vaurio, Riley & Mattson, 2008). The BRIEF BRI, assessing a child's inhibitory control and ability to shift cognitive set (e.g., make transitions, alternate attention) and modulate emotions was clinically elevated and strongly and significantly correlated with parenting stress. In contrast, the BRIEF-MCI, which taps behaviors representing a child's ability to initiate, plan, and organize, and use working memory for problem-solving, was not significantly correlated with child-related parenting stress. Decrement in children's behavior regulation skills was the aspect of executive function that contributed most to child-related caregiver burden and stress.

Interestingly, measures of the children's level of adaptive function (VABS ABC) and behavior problems (CBCL Total Problems) did not explain additional variance in the regression model once executive function and sensory processing impairments were taken into account. This was most likely due to the strong intercorrelations between these four measures of child behavior (BRIEF-BRI, SSP, VABS-ABC, and CBCL Total Problems). It is also possible that with the moderate sample size of this study, the unique contributions of adaptive behavior and problem behavior to parenting stress were not detected in the model. Indeed, this sample of children demonstrated significant decrements in age-appropriate self-care, socialization, and communication skills and had clinically concerning problem behaviors. Previous studies of families raising children with prenatal alcohol exposure or FASD substantiate these adaptive skill and behavioral challenges (Jirikowic, Gelo, & Astley, 2010) and their relationship with more caregiver stress (Paley et al., 2005, 2006).

Conceptually, a neurodevelopmental viewpoint that interprets maladaptive behaviors as underlying "brain-based" difficulties offers insight into these strong interrelationships (Olson, Jirikowic, Kartin, & Astley, 2007; Olson & Montague, 2011). The relevant "brain-based" difficulties for children with FASD that stress parents appear to be challenges in both the child's sensory processing and executive function. Impairments in these neurodevelopmental domains may underlie many of the challenging, dysregulated behaviors that significantly compromise adaptive function in children with FASD and make parenting so difficult.

The pattern of caregiver stress reported in this study differs from earlier investigation of the sources of parenting stress among families raising children with FASD. The most significant issue for the current sample was child-related stress. This sample of relatively low-risk caregivers, even though a diverse group of birth, kinship, and foster and adoptive parents, did not on average report elevated levels of stress regarding the parenting role or overall life stress on the PSI. Demographics may explain

why these findings differ from earlier studies of this issue. A high percentage of families in the current study were two-caregiver families, who were educated beyond high school graduation and reported low moderate to high income levels. Unlike the high-risk families examined earlier by Paley et al. (2006), where family resources were a significant predictor of stress in both parent and child domains, the environmental factors expected to be related to parenting stress (i.e., marital status, family type, and income) did not show significant associations. One exception was the number of children in the household, which was significantly associated with parenting role-related stress (-.30; $p < .05$). Thus, most families in the current study presumably had adequate family resources to meet basic needs and access social support.

Limitations

Although this study used a systematically diagnosed sample of children with FASD, the children in this sample were recruited for an intervention study and selected because they presented with clinically concerning behavior problems. Thus, the sample may not be representative of all children affected by prenatal alcohol exposure and their caregivers. However, child problem behaviors are the primary reason families raising children with FASD seek clinical diagnosis and professional supports (Jirikowic et al., 2010), so this sample is likely to represent those who seek treatment and for whom treatment must be provided. Although caregivers of different types were represented in the study, which is common among this clinical population, a high proportion of caregivers in this study were adoptive parents. This limits the generalization of findings, particularly in regard to birth parents raising children with FASD. Further research is needed to understand the correlates of parenting stress among biological parents and whether types of stress differ by family structure, and these efforts are underway (Salmon, 2008).

Measurement limitations of the SSP are also noted, because 17% of participants in the study were 11 years of age, just outside the range of norms for the SSP (3 to 10 years). However, a post-hoc analysis did not find a significant relationship between age and SSP scores. Finally, the primary outcomes used in this regression analysis were based on parent questionnaires. Future research should validate parent report measures using performance-based child assessments, such as direct testing of executive function (e.g., classic executive function measures, ecologically valid assessments of executive dysfunction, and multi-tasking), and physiological reactivity to sensation. These methods may shed additional light on the strong interrelationships found between caregiver perceptions of sensory processing behaviors, the executive function of behavior regulation, and child problem behaviors.

Conclusion

Both the occupational therapy practice framework and standards for best practices for children with disabilities speak to the need for family-centered approaches and interventions that view the child within the context of the family and environment (American Occupational Therapy Association, 2008; Guralnick, 2001). Knowing the pivotal factors that place the parent–child system at risk in a specific clinical population can guide development of targeted family-centered interventions that support the co-occupation of parenting. For children with FASD, treatment approaches that educate parents about both their children's sensory needs and type of executive function impairment and use strategies for accommodating or remediating these impairments may be promising ways to empower parents with information and tools to help them solve day-to-day parenting challenges. Interventions that help parents raising children with FASD feel more efficacious, improve their cognitive appraisal of their children, and support positive parenting behaviors are being examined (Bertrand & Interventions for Children with Fetal Alcohol Spectrum Disorders Research Consotium, 2009; Olson et al., 2009) and warrant attention as a means to buffer child-related parenting stress and enhance child and family resiliency.

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