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Sensory Processing Difficulties, Behavioral Problems, and Parental Stress in a Clinical Population of Young Children

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Abstract This study examined the relationship between sensory processing difficulties, parental stress, and behavioral problems in a clinical sample of young children with developmental and behavioral difficulties. We hypothesized that a high rate of sensory processing difficulties would be found, that there would be a high rate of comorbidity between sensory processing difficulties and behavioral problems, and that children's sensory processing difficulties and parental stress would be highly correlated. Parents of 59 children ages two to five who attended an out-patient clinic in a low income, urban community completed the Child Behavior Checklist, Parental Stress Inventory-Short Form and the Short Sensory Profile. Children in this clinical population showed a high prevalence (55.9 %) of sensory processing difficulties, a significantly higher rate than previously reported. Sensory processing deficits were correlated with behavioral difficulties and parental stress levels-suggesting that as sensory processing difficulties increase, so do behavioral difficulties and parental stress. Parents of children with sensory processing deficits had significantly higher levels of parental stress than parents of children without sensory deficits. Parenting stress levels were also clinically elevated for the cohort of children in which sensory processing difficulties and behavioral concerns co-existed. These findings suggest that treatment outcomes might improve and parental stress could be reduced if mental health clinicians were trained to identify and address sensory problems. This could result in more children being screened and treated for sensory processing difficulties and an eventual reduction in the rates of parental stress.

Keywords Sensory processing disorder · Short sensory profile · Parental stress · Behavioral difficulties · Preschool aged children

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Introduction

Children's ability to regulate sensation—the process of noticing, organizing, and integrating information from the environment and their body and then processing and responding appropriately—greatly contributes to self-regulation (Greenspan and Wieder 1997). Difficulty regulating sensory information such as touch, smell, taste, sound, body movement, or body position can lead to patterns of hyper-sensitivity to sensory stimuli or sensory-avoidance (shying away or intensively reacting to loud noises, bright lights, being held, etc.), hypo-sensitivity to sensory stimuli (needing high levels of sensory input such as firm touch or a loud noise in order to register the sensation), sensory-seeking behaviors (seeking constant and intense sensory input such as repeatedly crashing into walls or banging toys), or a mixed pattern of under-responsivity, sensory seeking and/or sensory avoidance (Dunn 2007).

Over the past several years, a wide range of estimates of the prevalence of sensory processing disorders has emerged in the literature. The 38-item Short Sensory Profile (SSP; McIntosh et al. 1999a), derived from the longer Sensory Profile (Dunn 1997), is a commonly used parent-report tool (Gunn et al. 2009; Gouze et al. 2009). The SSP has been shown to differentiate between children with average

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sensory functioning and those with poor sensory regulation (Ermer and Dunn 1998). Children with total scores falling within one standard deviation of the mean are rated as falling into the "typical performance" group, a "probable difference" rating is given to children with total scores falling between one and two standard deviations of the mean, and a "definite difference" rating is given to children scoring more than two standard deviations from the mean. In the original sample (comprised of a community sample of children of whom 91 % were Caucasian) 14 % of the children showed a "probable difference" and 2 % of the children showed a "definite difference" (McIntosh et al. 1999a). In other studies utilizing the SSP, significantly higher prevalence rates have been reported. For example, in Gunn et al.'s (2009) sample of urban, low income, mainly Latino preschoolers, 22 % of the children showed a "probable difference" and 28.6 % exhibited a "definite difference."

Two studies (Ahn et al. 2004; Gouze et al. 2009) suggest that, particularly among minority children, the original SSP cut-off scores may over-report sensory processing difficulties and should be recalculated. Ahn et al. (2004) based their SSP cut-off scores on findings from previous psychophysiologic studies of sensory processing difficulties, which showed correlations between parents' report of their child's sensory processing difficulties and results of physiological tests on children's sensory functioning (Mangeot et al. 2001; McIntosh et al. 1999b; Miller et al. 1999). Ahn et al. (2004) hypothesized that children that scored "positive" for their more stringent SSP criteria of three standard deviations below the mean in the total score, 2.5 standard deviations below the mean in two or more of the seven subscales, or four standard deviations below the mean in one subscale, would demonstrate sensory processing difficulties "consistent with criteria used to identify children with sensory processing disorders in ongoing psychophysiologic studies" (p. 290). Using these criteria, 5.3 % of children in their sample demonstrated sensory processing difficulties. Concerns regarding differences in scores between children with differing racial groups and socioeconomic status (SES) using the original SSP and Ahn et al. (2004) criteria, prompted Gouze et al. (2009) to question the community sample that was used to create the original SSP cut-off scores. Using a diverse community sample more representative of the general population, scores of 796 four-year-olds were utilized to calculate new cut-off scores based on the sample mean and standard deviation, (the same methodology that is used for the SSP and is documented in McIntosh et al. 1999a). This resulted in only 3.4 % of children showing a "definite difference" in sensory processing abilities (Gouze et al. 2009). The authors found that using their diverse community sample to generate their proposed cut-off score resulted in no differences in rates of sensory processing difficulties between racial groups. However, SES differences in rates of children with sensory processing difficulties remained when applying all three cut-off scores to their community sample. Although researchers are getting closer to agreeing on cut-off scores and prevalence rates within the community at large, more attention is needed in the area of understanding prevalence rates in the "clinical population"—children who have already been identified as having mental health and/or developmental difficulties (Gunn et al. 2009).

Children with poor sensory regulation demonstrate a wide variety of difficulties across many domains including externalizing behavior problems (Mangeot et al. 2001), internalizing behavior problems (Hopkins et al. 2008), difficulties in emotional and attention regulation (Miller et al. 2004), and difficulties in many daily activities (Dunn 1997). Poor sensory regulation has been shown to impact temperament and the formation of personality (Fox and Polak 2004). Sensory over responsivity has been shown to be highly associated with early internalizing and externalizing behavior problems and poorly developed adaptive social behaviors (Ben-Sasson et al. 2009a). In a sample of 796 four-year-old children it was shown that, depending on the SSP cut-off criteria used, 33–63 % of the children who were rated to have poor sensory regulation using the SSP also met criteria for one or more psychiatric disorders of childhood (Gouze et al. 2009). However, the same study, along with Van Hulle et al.'s (2012) work showed that sensory processing disorders can and do exist independently of psychiatric disorders of childhood. Poor sensory regulation is a hallmark of autism spectrum disorders, often found in other neurodevelopmental disorders such as fragile X syndrome, and cystic fibrosis (Baranek et al. 2008; Ben-Sasson et al. 2007, 2009b; Cascio 2010). Neurological studies have identified differences in frontal lobe functioning (Yeo et al. 2003), parasympathetic nervous system functioning (Schaaf et al. 2010), and electroencephalography (EEG) data (Davies and Gavin 2007; Gavin et al. 2011) in children with poor sensory processing when compared with the brain functioning of children without reported sensory difficulties. The reportedly large comorbidity between sensory processing difficulties and other problems of childhood is notable and serves as an impetus to better understand the prevalence and connections between sensory and behavioral difficulties in clinical populations of young children.

Our study also seeks to explore the possible impact of sensory processing difficulties on parenting stress. Compared to groups of parents with typically developing children, higher levels of parenting stress are found in parents of children with medical and psychological diagnoses (Epstein et al. 2008), anxiety and depression (Rodriguez

2010), and ADHD and aggressive behavior (Anastopoulos et al. 1992). Donenberg and Baker (1993) examined the parental stress of non-autistic children with clinically significant levels of externalizing behaviors, children with no significant behavior problems, and children with autism. Compared with parents of normally developing children, parents of non-autistic children with externalizing behaviors revealed higher child-related stress and greater negative impact on their social life and feelings towards parenting. In addition, these parents reported stress scores nearly identical to parents of children diagnosed with autism. Donenberg and Baker speculate that the high levels of parenting stress could partly result from the ambiguity associated with the cause of externalizing behaviors. Parents with children who have been diagnosed with autism and other disorders are better able to understand the neurobiological origins of such difficult behavior and have an easier time getting connected to treatment, supportive services, and resources specific to the disorder (Donenberg and Baker 1993). Unlike children diagnosed with autism, children with externalizing symptoms are not always given a clear diagnosis, and their behavior may more easily be attributed to simply being a "bad child" or as a result of "bad parenting."

Sensory processing difficulties in children can have a significant impact on the family and parent–child relationship patterns (Dunn 1997). A child with sensory processing difficulties may react to the caregiver or his/her environment in ways that are unpredictable or seemingly without reason. For example, a child that has a low threshold for sensory stimuli may react adversely to a vocalization or touch from a parent or from a tag in their clothing that a typically developing child would not react to or even notice. The caregiver, in turn, may be confused by their child's reactions and experience a decreasing sense of competence in their parenting abilities. Demanding child characteristics have been shown to increase parental stress and suboptimal parenting practices (Abidin 1995). Thus, knowledge about a child's sensory patterns and triggers may help the caregiver understand and explain their child's behaviors and develop an action plan to make interactions more enjoyable and satisfying to both partners (Dunn 2001). Consistent with Donenberg and Baker's (1993) suggestion that the vague etiology of externalizing behavior problems in young children may greatly contribute to reportedly high levels of parental stress, a better understanding of their child's sensory difficulties may increase a parent's sense of competence, decrease negative parental attributions, and lead to a reduction in parental stress.

Our study seeks to better understand the prevalence of sensory processing difficulties in a clinical population of preschool-aged children referred for developmental and behavioral problems. We will explore the relationship between reports of parental stress, sensory processing difficulties, and externalizing and internalizing behaviors in a clinical population. Based on previous research (Ben-Sasson et al. 2009b; Gouze et al. 2009; Gunn et al. 2009), we hypothesize that a significant overlap will be noted between children with behavioral difficulties and sensory processing difficulties. Additionally, we will explore the impact of behavior problems and sensory processing difficulties on parental stress. Finding a relationship between reports of externalizing and internalizing behaviors and sensory deficits may provide parents with a potential neurological explanation for their children's problem behavior and help illuminate additional pathways for treatment.

Methods

Participants

Participants included 59 children and their parents, currently attending an inner-city outpatient clinic, which addresses social-emotional, behavioral, and developmental problems of young children through psychosocial therapeutic and comprehensive wraparound services. Inclusion criteria included children who were actively attending weekly outpatient clinical services and living with a biological or adoptive parent. Children in foster care were excluded due to issues in obtaining informed consent. Table 1 depicts descriptive statistics for participants. Children ranged between the ages of 3 and 5 years old ($\mu = 4.1$ years) to meet the validated age ranges of the assessment tools. Ethnic backgrounds of children included: 64.4 % Hispanic/Latino, 16.9 % African-American, 11.9 % mixed race/bi-racial, 5.1 % unknown and 1.7 % Caucasian. All children resided in a low income, urban community in New York. A large percentage of our sample resided in bilingual Spanish and English households (57.6 %) with an additional 8.5 % monolingual for Spanish and the remaining 33.9 % monolingual for English. Most children (89.9 %) were Medicaid recipients and 10.2 % were covered by private insurance. Children's diagnoses, gathered through chart review, included diagnoses from the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision (DSM IV TR) and, when appropriate diagnostic classification was not available in the DSM IV TR, from the International Classification of Diseases Volume 9. Diagnoses included a wide range of developmental and behavioral diagnoses. In our sample, 54.2 % of children were diagnosed with both behavioral and developmental disorders, 37.3 % were diagnosed with only one or more behavioral disorder(s), and 8.5 % were diagnosed with only one or more developmental disorder(s). Developmental diagnoses included speech and

language disorders (52.5 %), global developmental delays (10.2 %), autism (6.8 %), and developmental coordination disorder (6.8 %). Behavioral diagnoses included parent child relational problem (PCRP), (38.9 %) attention deficit hyperactivity disorder (23.7 %), disruptive behavior disorder (23.7 %), post traumatic stress disorder (10.2 %), adjustment disorder (8.5 %), oppositional defiant disorder (6.8 %), mood disorder not otherwise specified (5.1 %), selective mutism (5.1 %), disorder of childhood, not otherwise specified (3.4 %), and anxiety disorder (1.7 %). It is notable that only four children (6.8 %) were diagnosed with only PCRP—a "v-code" diagnosis indicating clinically significant behavioral and/or emotional symptoms in the child in which the target of therapeutic action is the relationship between parent and child), and the remaining 19 children (32.1 %) diagnosed with PCRP had multiple behavioral diagnoses.

Table 1 Descriptive statistics for child participants

Characteristic	Total *n* (%)	SSP scores		χ^2	*p*
		Typical *n* (%)	Definite *n* (%)		
Age	$\mu = 4.1$ years			1.10	0.578
Age 3	18 (30.5)	8 (44.4)	10 (55.6)		
Age 4	19 (32.2)	10 (52.6)	9 (47.4)		
Age 5	22 (37.3)	8 (36.4)	14 (63.6)		
Gender				1.01	0.316
Male	36 (61.0)	14 (38.9)	22 (61.1)		
Female	23 (39.0)	12 (52.2)	11 (47.8)		
Ethnicity				4.54	0.103
Hispanic/ Latino	38 (64.4)	14 (36.8)	24 (63.2)		
African-American	10 (16.9)	4 (40.0)	6 (60.0)		
Other*	11 (18.7)	8 (72.7)	3 (27.3)		
Insurance type				1.38	0.239
Medicaid	53 (89.8)	22 (41.5)	31 (58.5)		
Private insurance	6 (10.2)	4 (66.7)	2 (33.3)		
Caregiver language				1.38	0.441
English	40 (67.8)	19 (47.5)	21 (52.5)		
Spanish	19 (32.2)	7 (36.9)	12 (63.1)		
Diagnosis				3.27	0.195
Behavioral	22 (37.3)	13 (59.1)	9 (40.9)		
Developmental	5 (8.5)	2 (40.0)	3 (60.0)		
Both dev. & beh.	32 (54.2)	11 (34.4)	21 (65.6)		

SSP scores using original cut-off criteria, *Typical* typical and probable performance on SSP, *Definite* definite difference on SSP; $N = 59$, * "other" category was created so that data could be analyzed and consists of 7 (11.9 %) mixed raced/bi-racial, 3 (5.1 %) unknown, and 1 (1.7 %) Caucasian children)

Measures

Child Behavior Checklist: Ages 1½–5 (CBCL)

The CBCL (Achenbach and Edelbrock 1983) is a parent-completed inventory that assesses children's behavioral, emotional, and developmental symptoms and is one of the most widely-used of its kind due to its strong construct, content, and criterion validity (Gunn et al. 2009). In addition to providing a total score and clinical cut-offs derived from a large representative sample, the CBCL provides many sub-scales which assess facets of internalizing and externalizing behavior problems. Based on a three point scale of never (0), sometimes (1), or always (2), parents are asked to respond to 100 questions regarding their children's behavior. *T*-scores of 65 or greater suggest that there is reason for clinical concern and the child is at risk. The scale demonstrates good psychometric properties with test–retest reliability correlations consistently between 0.80 and 0.90 and minimal effects of age, gender and SES on the validity of the scale (Rescorla 2005).

Parenting Stress Index Short Form (PSI-SF)

The PSI-SF is a parent-completed assessment of parenting stress which examines how child characteristics, parent characteristics and situational variables relate to total parental stress (Abidin 1995). The measure delineates three types of parental stress; Parental Distress—an impaired sense of competence in the parenting role, lack of social support, role-restriction, depression, and conflict with one's spouse; Parent–Child Dysfunctional Interaction–child fails to meet parents' expectations and interactions with the child are not pleasurable; and Difficult Child–characteristics of the child that make them difficult to manage. Using a both multiple choice questions and a 5-point Likert scale ranging from (1) strongly agree to (5) strongly disagree, the PSI-SF asks parents to respond to 36 statements such as "my child rarely does things that makes me feel good." The PSI-SF has been shown to be a reliable and valid measure of parental stress (Abidin 1995).

Short Sensory Profile (SSP)

The SSP (McIntosh et al. 1999a) is a 38-item parent-completed measure created to determine functional behaviors related to sensory processing difficulties in children age 3–10 in seven domains: tactile sensitivity, taste/smell sensitivity, movement sensitivity, under-responsive/sensation seeking, auditory filtering, low energy/weak, and visual/auditory sensitivity (Dunn 1999). The Short Sensory Profile is a short form of the Sensory Profile, and has been normed in English and Spanish. The SSP asks parents to reply to behavioral descriptions of various sensory-laden events ("avoids

going barefoot especially in sand or grass") using a 5-point Likert scale (always, frequently, occasionally, seldom, or never). Higher scores reflect more adaptive functioning and more normal performance. The SSP has been found to be a reliable tool with excellent validity (Ahn et al. 2004; Rodriguez 2010). Construct validity was established by showing that children with significant scores on the SSP has abnormal physiological responses as measured by electrodermal responses (EDR) during a standardized battery of sensory stimulating activities (Miller et al. 1999).

Protocol

Parents of children that met the inclusion criteria were invited to participate in the study by the child's treating clinician prior to the weekly therapy session. A bilingual researcher subsequently obtained informed consent and administered the SSP to parents in their preferred language of English or Spanish. While most parents completed the SSP in written form, parents who indicated reading difficulties were offered the option of having the questionnaire read to them. Medical chart review documented demographic variables as well as results of the CBCL and PSI-SF questionnaires which were administered in English or Spanish based on the caregiver's primary language. As with the SSP, parents were read the CBCL and PSI-SF questionnaires if they were unable to complete them in written form. The study was carried out with the approval of the Institutional Review Board at Albert Einstein College of Medicine.

Data Analysis

Descriptive statistics and frequencies were compiled. Pearson's *r* correlations were performed between the subscale and total raw scores of the SSP, CBCL, and PSI-SF. Independent *t* tests and Chi-square analysis were performed to assess the group differences in sensory processing difficulties. One-way between subjects ANOVAs were used to further examine possible differences between SSP and PSI-SF scores based on each child's diagnosis. Based on the preponderance of use of McIntosh's original SSP criteria in the literature, children who scored in the "definite difference" category are used throughout the remainder of the analysis when discussing significant results. The total problem behavioral score, and internalizing and externalizing subscales of the CBCL qualified as statistically significant when a subject received a T-score of 65 or greater, indicating the 90th percentile. Total and subscale scores of the PSI-SF reached clinical significance when reaching the 85th percentile.

Results

Prevalence

In our clinical sample and using the original cut-off scores on the SSP, 55.9 % of children were rated in the "definite difference" category indicating likely sensory processing difficulties, 11.9 % had scores which fell into the "probable difference" category and 32.7 % scores in the "typical performance" category ($\mu = 134.57$, SD = 29.65). Chi square analysis showed there were no significant differences in demographic variables and diagnoses for children scoring above or below the cut-off scores (Table 1). Table 2 reports differences in prevalence rates using the criteria proposed by McIntosh et al. (1999a), Ahn et al. (2004), and Gouze et al. (2009) compared with the rates of sensory processing difficulties established in their original community samples. All three cut-off criteria resulted in significantly higher prevalence rates compared to previously reported estimates of prevalence based on community samples ($p < 0.001$). On the CBCL, 44.1 % of children had clinically-elevated total behavior concerns, 52.6 % of children showed clinically elevated externalizing problems and 30.5 % showed clinically elevated internalizing scores. Results from the PSI-SF revealed that 42.4 % of parents reported clinically-elevated levels of total parental stress.

Correlations

Pearson's *r* correlations revealed that there was a significant relationship between poor sensory processing functioning and total problematic behaviors ($r = -0.523$, $p < 0.001$), total internalizing behaviors ($r = -0.515$, $p < 0.001$), total externalizing behaviors ($r = -0.459$, $p < 0.001$), and parental stress ($r = -0.384$, $p = 0.003$) (Table 3). Although causality cannot be inferred, these results suggest that as sensory processing functioning worsens, the severity of behavioral problems and parental stress increases. The relationship between parental stress and externalizing behaviors ($r = 0.253$, $p = 0.059$), total problematic behaviors ($r = 0.249$, $p = 0.057$) and internalizing behaviors ($r = 0.153$, $p = 0.248$) did not reach significance.

Sensory Processing and Behavior Problems

Independent t-test revealed that children who scored in the "definite difference" category on the SSP had significantly higher means of CBCL scores for problematic externalizing behaviors ($\mu = 68.49$), internalizing behaviors ($\mu = 62.88$) and total behavioral problems ($\mu = 67.79$) than those with typical processing ($\mu = 57.26$, $t(50) = -3.67$; $\mu = 54.26$, $t(50) = -3.49$; $\mu = 56.05$, $t(50) = -4.29$; $p < 0.001$).

Table 2 Prevalence of sensory processing difficulties with proposed cut-off criteria compared to previous community sample prevalence rates

Cut off criteria	Current study prevalence rates			Previous community sample rates				
	n (%)			*n* (%)				
	Typical performance	Probable difference	Definite difference	Typical performance	Probable difference	Definite difference	χ^2	*p*
McIntosh et al. (1999a)/SSP	19 (32.2)	7 (11.9)	33 (55.9)	871 (83.99)	145 (13.98)	21 (2.03)	347.87	0.0001*
Gouze et al. (2009)	33 (55.9)	–	26 (44.1)	759 (96.6)	–	37 (3.4)	125.05	0.0001*
Ahn et al. (2004)	11 (35.6)	–	38 (64.4)	1700 (94.7)	–	96 (5.3)	369.22	0.0001*

Current study $N = 59$, McIntosh et al. (1999a) $N = 1{,}037$, Gouze et al. (2009) $N = 796$, Ahn et al. (2004) $N = 1{,}796$; Chi squares are comparing difference in rates of definite sensory processing difficulties in our study's clinical population versus previous community samples prevalence rates; * $p < 0.001$

Thirty-nine percent of children were co-morbid for both clinically significant total behavior problems on the CBCL as well as "definite" sensory processing issues on the SSP; 16.9 % had only "definite difference" sensory concerns, 5.1 % only clinical levels of total behavior problems, while 39 % had no clinically significant concerns on either measure.

Sensory Processing and Diagnosis Category

A one-way between subjects ANOVA was conducted and showed that mean SSP scores were not significantly different between children with only behavioral diagnoses ($\mu = 144.77$), only developmental diagnoses ($\mu = 130.00$), or who had both developmental and behavioral diagnoses($\mu = 128.28$, F(2, 56) = 2.17, $p = 0.124$). This means that in our sample, presence of, or comorbidity with a developmental diagnosis did not significantly impact SSP scores.

Table 3 Pearson's *r* correlations between raw total scores on the SSP, CBCL and PSI-SF and subscales

Scale	SSP total score	PSI-SF total score
CBCL		
Total	−0.523**	0.249
Internalizing behavior	−0.515**	0.153
Externalizing behavior	−0.459**	0.253
PSI-SF		
Total	−0.384**	
Parental distress	−0.273*	
Parent–Child dysfunctional interaction	−0.266*	
Difficult child	−0.496**	

SSP short sensory profile, *CBCL* child behavior checklist, *PSI-SF* parenting stress index short form; $N = 59$; * $p < 0.05$; ** $p < 0.001$

Parental Stress

Parents of children with "definite difference" sensory processing scores reported higher levels of total parenting stress ($\mu = 96.76$) than parents of children with typical processing ($\mu = 80.92$, $t(57) = 2.45$, $p = 0.017$). Interestingly, when exploring the subscales of the PSI-SF it was found that parents who reported that their children had "definite difference" sensory processing difficulties also reported significantly higher levels on the difficult child subscale ($\mu = 38.82$) than parents of children who did not score in the "definite difference" range on the SSP ($\mu = 29.88$, $t(57) = 3.81$, $p < 0.001$). Significant differences on the two other subscales of the PSI-SF, parental distress and parent child dysfunctional interaction, were not found. Parents who reported that their child had significant total behavioral problems did not report significantly higher levels of total parenting stress ($\mu = 97.54$) than those with subclinical behavioral concerns ($\mu = 84.46$, $t(57) = 1.79$, $p = 0.054$). However, significantly higher rates of parental stress was found when comparing children who scored in the clinically significant range on the externalizing problems subscale of the CBCL ($\mu = 97.79$) compared to those who did not ($\mu = 82.03$, t(57) = 2.45, $p = 0.043$). Significantly higher rates of total parental stress were found when children scored in both the "definite difference" range of the SSP and the clinical range of total behavior problems on the CBCL ($\mu = 98.62$) compared to those who did not ($\mu = 84.89$, t(57) = 2.01, $p = 0.049$). Finally, a one-way between subjects ANOVA showed no statistically significant difference between total parental stress levels in parents of children with only behavioral diagnoses ($\mu = 81.14$), only developmental diagnoses ($\mu = 93.20$), and children with both developmental and behavioral diagnoses ($\mu = 95.19$, F(2, 56) = 2.07, $p = 0.136$).

Discussion

Children who presented in our clinic due to developmental and/or behavioral concerns had a high prevalence of

sensory processing difficulties identified by the proposed cut-off criteria of the SSP: 55.9 % by the original McIntosh et al. (1999a) criteria, 64.4 % by the Ahn et al. (2004) criteria and 44.1 % by the criteria suggested by Gouze et al. (2009). Like children with autism who have reported rates of sensory processing difficulties as high as 40–88 %, the children in our study presented with similarly high rates of sensory processing difficulties (Kientz and Dunn 1997; Talay-Ongan and Wood 2000). Children diagnosed with one or more behavioral disorder(s) in our study did not have statistically different SSP scores when compared with children with only developmental diagnoses or children who were comorbid for both developmental and behavioral diagnoses. When examining the highest prevalence rate that resulted from the cut-off criteria proposed by Ahn et al. (2001) we noted that many of the children in our study (57.6 %) met their criteria for sensory processing difficulties due to having more than one SSP subscale with scores more than four standard deviations away from the subscale's normed mean. The severity of sensory processing difficulties demonstrated by scoring this far from the normative sample's mean is notable and indicates that not only do many children who present in clinical settings show signs of sensory processing difficulties—but their symptoms and difficulties are severe in nature.

In our preschool-aged clinical population we found high levels of comorbidity of reported sensory processing difficulties and internalizing and externalizing behavioral problems. As previously noted (Gunn et al. 2009; Hopkins et al. 2008; Mangeot et al. 2001), it is important to continue to highlight this trend due to the likely connection between sensory difficulties and internalizing and externalizing behavioral problems. Our study shows that when children are rated by their parents as having sensory processing difficulties, they also have significantly higher means of problematic externalizing behaviors, internalizing behaviors, and total behavioral problem scores than those with typical sensory processing. Although one possible explanation for this high correlation could be that the SSP produces "false positives" for children with behavioral problems and/or psychopathology, previous work has shown that even when a modified version of the SSP is used with questions related to temperament or behavioral difficulties removed there is a high correlation between sensory processing difficulties and psychopathology (Gouze et al. 2009). These results highlight the notion that addressing behavioral problems without understanding and addressing accompanying sensory difficulties may hinder progress in treatment as targeted behavioral difficulties may mask underlying sensory processing difficulties.

Although at the outset we wondered if children with developmental diagnoses would be more likely to present with significant sensory difficulties, in our clinical population the presence of, or comorbidity with, a developmental diagnosis did not significantly impact SSP scores. The connection between developmental difficulties and behavioral problems has been well documented; parents of young children with developmental delays and disorders rate their children with more behavioral problems than non-delayed children (Baker et al. 2002, 2003). Our finding that there was no statistically significant difference in sensory processing scores between groups of children with only behavioral diagnoses, only developmental diagnoses, or comorbid developmental and behavioral diagnoses underlines the importance of screening all children who present in behavioral health settings for sensory processing difficulties. Addressing behavioral or developmental problems without understanding and addressing accompanying sensory difficulties may hinder progress in treatment as the targeted behavioral difficulties may be masking underlying sensory processing difficulties. Sensory needs must be considered regardless if they are occurring with accompanying behavioral, emotional, and/or developmental disorders, or if they are occurring on their own.

Finally, we found that parents of children with "definite difference" sensory processing difficulties reported higher levels of total parenting stress than parents of children with sensory processing abilities in the typical range. As sensory processing problems increase in severity, so did levels of parental stress. Parents of children who were rated as having "definite difference" SSP scores reported significantly higher levels of stress in the "difficult child" subscale of the PSI-SF, while showing no difference in stress levels on the two other subscales which are connected to the parent's own feelings and relationship with his or her child. While causality is not clear, this finding could suggest that the stress that parents experience could be related to the manifestation of their child's sensory processing difficulties. Interestingly, while t-tests showed that parents of children with clinically significant externalizing behavior scores were more stressed than parents of children with subclinical externalizing behavior scores, Pearson's r correlations revealed that parental stress did not similarly increase as total, externalizing, or internalizing behavioral problems worsened. This finding could be due to our small sample size and should be further explored as other studies have established the strong relationship between behavior problems and parenting stress (Donenberg and Baker 1993; Walker and Cheng 2006). Parents of children with both "definite difference" scores for sensory processing and clinically significant total behavior problems had significantly higher levels of stress compared to children who had only severe behavioral problems or "definite difference" levels of sensory processing difficulties. The reportedly high stress levels of parents is cause for concern and highlights the importance of better detection and treatment of children's sensory processing difficulties.

Previous research has illustrated the reciprocal and mutually amplifying nature of children's behavior problems and parental stress (Donenberg and Baker 1993; Baker et al. 2003). If a child does indeed present with sensory processing difficulties, identifying the specific problems and helping parents understand and address their child's sensory difficulties will likely lead to more efficient reduction in negative symptomatology and a reduction in parental stress. Additionally, given that parental stress often accompanies poorly diagnosed behavioral difficulties (Donenberg and Baker 1993), identification of sensory deficits may provide parents with a potential constitutional explanation for their children's behavioral problem. Increasing parents' understanding of the possibly neurological basis of the behavior may provide an understandable explanation of the problem behavior, may help illuminate additional pathways for treatment, and could increase parental understanding and empathy of their child's experience and difficulties.

Early identification of sensory processing difficulties and an increase in referrals for occupational therapy will hopefully lead to a reduction in childhood difficulties and parental stress. In addition, we are hopeful that new pathways for multi-disciplinary evaluation and treatment will emerge as the mental health field becomes more aware of the signs and symptoms of sensory processing difficulties in young children. One such documented intervention focuses on enhancing the quality of mothers' interactions with their toddlers diagnosed with sensory processing difficulties (Jaegermann and Klein 2010). The brief intervention included showing mothers videos of their toddler in action paired with video feedback regarding their toddlers' sensory profile and fundamentals of quality parent–child interactions. The protocol was successful in increasing parental empathy, increasing parents' use of appropriate teaching behaviors, and in improving the parent's support of their child's communication behaviors. The authors showed that a dyadic intervention was more effective in increasing the quality of mother–child interaction with children with sensory processing difficulties compared with children who were provided with individual occupational therapy focused on sensory processing.

There are several limitations to our study. This study relies on parents' report of stress and their child's difficult behaviors. While the CBCL, PSI-SF and SSP have been established as having excellent validity (Abidin 1995; McIntosh et al. 1999a; Rescorla 2005; Roberts 2011) and the SSP has been shown to identify sensory processing difficulties which can also be captured using expert ratings and physiological tests (McIntosh et al. 1999a; Miller et al. 2012), it is important that future work continues to establish the validity of parent-report measures. Recent work has highlighted possible overlap between ADHD symptoms and the auditory filtering and underresponsive/seeks sensation subscales of the SSP leading some researchers to utilize a modified SSP when screening children with diagnosed cases of ADHD for sensory processing difficulties (Miller et al. 2012). While this is a limitation of the scale, the same group reported distinct differences on the SSP, specifically greater impairment on the other subscales, between children presenting with ADHD or comorbid for both problems versus children with only sensory processing difficulties (Miller et al. 2012). These results, combined with findings of Gouze et al. (2009) reporting significant correlations between sensory processing difficulties and psychopathology despite the removal of overlapping questions from the SSP, provide support for utilizing the scale in its entirety. The children in our sample reside in the poorest urban county in the United States (Roberts 2011), and the majority are racial minorities and are from low SES backgrounds (using eligibility for Medicaid as a proxy for income status) (Krieger et al. 2006). In addition, 66.1 % of children were from bilingual or monolingual Spanish households and 52.5 % of children in the sample were diagnosed with a speech and language disorder. It has been shown that these factors—children primarily from racial minority groups, children with low SES, children in bilingual households, and children with speech and language difficulties may be more frequently shown to have "probable" or "definite difference" scores on the SSP due to possible measurement problems with the tool (Gouze et al. 2009; Gunn et al. 2009). Although we did not find differences in scores due to gender or ethnicity as documented in previous literature (Gouze et al. 2009), the lack of difference in our sample may be the result of our relatively small sample size. This limitation also highlights the need for this population to be studied more thoroughly, as well as the need to confirm the entirety of our results in a larger sample size. Additionally, high parental stress may lead parents to develop a negative view of their child and possibly over-report their children's perceived difficulties (Epstein et al. 2008). Finally, many of the children who attend our clinic have experienced trauma, symptoms of which could mimic sensory processing difficulties, for example sensitivity to sudden noises or over-reactions to being touched.

Better identification and acknowledgement of children's sensory processing difficulties may lead to more comprehensive treatment in behavioral health settings. In our clinic and likely many others, the SSP is not routinely administered at admission. Given the high prevalence of sensory processing difficulties found in our study, routine administration of the SSP seems warranted. Better identification may not only lead to better understanding of the needs of children served but also help to shape and dictate the interventions applied. For example, a child with severe sensory avoidant behavior who is not identified as having

sensory processing difficulties might be labeled as non-compliant or as displaying symptoms of oppositional defiant disorder. Rather than taking a behavioral approach, such as rewarding for compliance and ignoring "negative" behaviors, clinicians who adopt a sensory-friendly approach might help parents understand the neurological underpinnings behind their child's avoidance of loud noises, unwanted touch, or strong tastes. Clinicians might then support the parent in adapting the environment and their interactions to reduce stressful sensory input, resulting in a reduction of their child's previously erroneously described "oppositional" behaviors. Using a sensory processing lens in tandem with best practices in developmental and behavioral assessment and intervention will likely better explain and address problem behavior and may result in more expedient and positive treatment outcomes.

As the sensory processing field continues to evolve, we hope that training of mental health professionals in assessing and addressing sensory processing difficulties will increase and improve. Future research should investigate the hypothesis that better identification and treatment of sensory processing difficulties in young children with developmental and/or behavioral difficulties could lead to improved treatment outcomes including a reduction in behaviors problems and parental stress. As work moves forward in the area of physiological measures of sensory processing difficulties we are hopeful that consensus will emerge regarding SSP cut-off criteria. Additionally, as a significant overlap between externalizing and internalizing behavior and sensory processing difficulties was found, examining the CBCL in hopes of identifying the questionnaire items that are highly correlated with "definite difference" scores on the SSP could lead to the development of a useful CBCL sensory subscale. The subscale could then be used as an initial screening tool for the prevalence of sensory processing difficulties. Given the CBCL's wide use in the field, identifying such a scale seems valuable and useful. Better understanding, screening, and treatment of sensory processing difficulties in the clinical population will likely lead to improved treatment outcomes, a reduction in parental stress, and improvements in the relationship between parents and children with sensory, developmental, and behavioral concerns.

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