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## Exploratory Study of Children with Sensory Processing Disorder (SPD) Without an Autism Spectrum Disorder (ASD) Diagnosis

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Exploratory Study of Children with Sensory Processing Disorder

Exploratory Study of Children with Sensory Processing Disorder (SPD)

Without an Autism Spectrum Disorder (ASD) Diagnosis

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**Abstract**

## Exploratory Study of Children with Sensory Processing Disorder

The purpose of this study was to explore the prevalence of children with sensory processing disorder (SPD) without an autism spectrum disorder (ASD) diagnosis. Examples of these diagnoses include attention deficit hyperactivity disorder (ADHD), cerebral palsy (CP), posttraumatic stress disorder (PTSD), Oppositional Defiant Disorder (ODD), and Reactive Attachment Disorder (RAD). This was an exploratory descriptive study that gathered quantitative data through the Sensory Processing Measure (SPM) Home Form. The SPM Home Form was provided by occupational therapy (OT) students and completed by the child's caregiver. The scores fell into three interpretive ranges: *Typical, Some Problems, and Definite Dysfunction*. Researchers hypothesized that SPD is equally prevalent in children with diagnoses other than ASD. Individuals that fell into the range of *Some Problems* or *Definite Dysfunction* for the total score were categorized as having SPD in this study. The SPM Home-Form was distributed and analyzed on two participants, one with an ADHD diagnosis and one with a PTSD diagnosis. The participant with an ADHD diagnosis was categorized as having SPD while the participant with a diagnosis of PTSD was not categorized as having SPD.

*Keywords:* Sensory Processing Disorder (SPD), Diagnostic and Statistical Manual of Mental Disorders (DSM-5), Sensory Processing Measure (SPM), Occupational Therapy (OT)

*Abbreviations:* AC CMH: Allegan County Community Mental Health, ADLs: Activities of Daily Living, ADHD: attention deficit hyperactivity disorder, ASD: Autism Spectrum Disorder, CNS: Central Nervous System, DSM-5: Diagnostic and Statistical Manual of Mental Disorders, GVSU: Grand Valley State University, IADLs: Instrumental Activities of Daily Living, ODD: Oppositional Defiant Disorder, OT: Occupational Therapy, OTR/L: Registered and Licenced Occupational Therapist, PTSD: posttraumatic stress disorder, RAD: Reactive Attachment Disorder, SBMD: Sensory-Based Motor Disorder, SDD: Sensory Discrimination Disorder, SMD: Sensory Modulation Disorder, SOR: Sensory Overresponsivity, SPD: sensory processing disorder, SPM: Sensory Processing Measure, SUR: Sensory Underresponsivity

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### Introduction

In the medical profession, it is well documented that there is a strong comorbidity between SPD and ASD. According to Chang (2014), “over 90% of children with ASD demonstrate atypical sensory behaviors” (p. 1). SPD is not currently a DSM-5 diagnosis, although this terminology is widely used throughout the medical field, research, and literature. It is estimated that 5-16% of children in the United States have SPD (Chang, et al., 2014). SPD is defined as “the inability to use information received through the senses in order to function smoothly in daily life” (Kranowitz, 2005, p. 9). SPD occurs when an individual's brain cannot properly organize sensory input and therefore cannot respond or adapt to sensory information adequately. Many children who do not have ASD also demonstrate behaviors consistent with SPD (Kranowitz, 2005). Currently, insurance providers more often cover all related services for children who have ASD, but may not cover sensory related therapies for a child without this diagnosis (American Academy of Family Physicians, 2018). This study aimed to provide further evidence of the prevalence of SPD in children who do not have an ASD diagnosis. Researchers want to know: What is the prevalence of SPD in children without ASD diagnoses? The SPM assessment tool was used to quantify this prevalence. A secondary outcome of this study is to document such evidence so that it can be used to advocate for increased insurance coverage supporting sensory intervention therapy for all children with SPD.

SPD is considered an umbrella term that encompasses three main categories: Sensory Modulation Disorder (SMD), Sensory Discrimination Disorder (SDD), and Sensory-Based Motor Disorder (SBMD) (Mitchell et al., 2015). Sensory modulation is the ability of the central nervous system (CNS) to control and synthesize neural messages from sensory input. For example, a person can focus on certain stimuli while ignoring others, therefore responding appropriately to situations within their environment. When an individual is not able to modulate their sensory input, SMD occurs (Mitchell et al., 2015). There are three subtypes of SMD: sensory overresponsivity (SOR), sensory underresponsivity (SUR), and sensory seeking/craving (SS).

SOR is characterized by “faster and more intense responses to sensory input from one or more sensory systems” (Mitchell et al., 2015, p. 2). These children might avoid certain movements or touch, be sensitive to specific tastes and textures, or become overwhelmed with visual input. On the contrary, a child

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that is SUR demonstrates a lack of response to sensory stimuli. Their low arousal levels make them unable to detect incoming sensory information, therefore appearing sluggish, lethargic, and inattentive. A child who is under responsive may struggle to notice how things feel on or within their bodies (Miller et al., 2007).

Children who are SS crave an extensive amount of sensory input and are attracted to outside stimulation. If a child is SS, they may intentionally engage in intense sensory interactions. Some examples of this may include rummaging through toys or other physical objects, seeking loud noises or visually stimulating objects, chewing on shirts, or spinning excessively. These actions can lead to unsafe and impulsive behaviors as well as inappropriate social interactions (Mitchell et al., 2015). There is a large overlap in the behaviors presented in SS and SUR because these individuals are trying to fulfill their sensory needs by obtaining more sensory input.

Another category that falls under SPD is SDD. This occurs when children have difficulty distinguishing one sensation from another or understanding qualities of sensory stimuli (Miller et al., 2007). For instance, they may have problems distinguishing the differences between certain tastes, smells, and sounds. Children with SDD typically have a lack of body awareness and poor proprioception. They may also have difficulty processing pain and protecting themselves due to their lack of protective reflexes (Kranowitz, 2005).

Individuals with SBMD have difficulties with movement due to poor sensory processing. Sensory based motor problems include two subtypes: postural disorder and dyspraxia. Postural disorder is defined as “difficulty stabilizing the body during movement or at rest to meet the demands of the environment or of a given motor task” (Mitchell et al., 2015, p. 138). It involves having difficulty with movement patterns, balance, poor muscle tone, and bilateral coordination. Dyspraxia is defined as “an impaired ability to conceive of, plan, sequence, or execute novel actions (Mitchell et al., 2015, p. 138). These individuals may appear awkward due to poor coordination in gross, fine, and oral-motor skills. It can be thought of as “clumsiness” where the child has problems performing coordinated and voluntary actions (Kranowitz, 2005). Clumsiness is a term used to describe poor coordination, movement, or action in a dysregulated fashion.

Although postural disorder and dyspraxia symptoms present similarly, each has distinct origins. Dyspraxia is defined as motor difficulties due to perceptual problems including visual-motor integration and kinaesthetic motor challenges. Therefore, individuals with dyspraxia are unable to effectively use their

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voluntary motor abilities due to underlying perceptual issues (Gibbs, Appleton, & Appleton, 2007). Postural disorder occurs due to decreased core strength and lack of endurance. Lack of core strength and endurance affects balance and coordination (Collins & Miller, 2012). In summary, postural disorder occurs due to strength and muscular problems whereas dyspraxia occurs due to perceptual issues within the nervous system.

Due to SPD not being classified as a disorder in the DSM-5, doctors have debated about whether SPD is a credible disorder or if it embodies symptoms of other diagnoses such as ASD or ADHD. While some may believe this is the case, others believe that one may have SPD without any comorbid diagnosis (American Academy of Family Physicians, 2018). The fact that SPD is not considered a medical diagnosis may cause issues for some individuals seeking services. This creates challenges for parents of children with SPD while they are attempting to find the best help for their child (Arky, 2019). Physicians may be unaware of what to diagnose these individuals with based on the symptoms they are presenting (Lipson, 2016). Diagnostics may become a barrier for children needing services as many insurance plans do not recognize SPD as a valid diagnosis.

Parents and healthcare providers have been reported as being curious about the benefits of having SPD included in the DSM-5 (Bennie, 2015). Insurance companies currently do not cover the costs of health care services for those with only SPD. If SPD is recognized as a disorder, insurers would cover therapy and other beneficial tools or equipment (Bennie, 2015). There are many issues that are common to SPD that occupational therapists can address through sensory based interventions. These services would be more accessible for families if they were insured as a result of SPD being a DSM-5 diagnosis (Arky, 2019). These benefits include interventions for reducing tactile defensiveness, improving tactile discrimination, body awareness, posture, coordination, balance, self-regulation strategies, and overall occupational engagement (Kranowitz, 2005). Increased research on causes and treatments would be an additional benefit of SPD being recognized as a DSM-5 diagnosis (Bennie, 2015).

The Person-Environment-Occupation and Performance (PEOP) model was the guiding theoretical construct of this research study. This model puts emphasis on the person and their interaction with their environment and occupations they engage in based on their abilities (Strong et al., 1999). This model aligns with this study because there is an emphasis on assessing whether one's client factors and environment will

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promote engagement in occupations. This model allows for the analyzation of how an individual interacts in their current environment. Additionally, the Sensory Integration frame of reference was considered throughout this study. Sensory integration looks at the eight senses (visual, gustatory, olfactory, auditory, tactile, interoception, proprioception, and vestibular). An assumption of sensory integration is that adaptive interactions are critical to engage in occupation, while children with sensory deficits are not properly able to adapt to their environment in order to engage (American Occupational Therapy Association, 2015).

### Methods

**Research Design.** This study was an exploratory research design conducted to obtain quantitative data on children with non-ASD DSM-5 diagnoses through their score on the SPM Home Form. SPD was reported as obtaining a score within the interpretive range of *Some Problems* or *Definite Dysfunction* on the SPM Home Form (interpretive ranges include *Typical*, *Some Problems*, and *Definite Dysfunction*).

**Participants and Sampling.** Grand Valley State University (GVSU) OT students utilized a convenience sampling method to recruit participants from Allegan County Community Mental Health (AC CMH). The participant inclusion criteria required the children to be within the age range of 5-12 years old and have a medical diagnosis, aside from ASD, which allowed for treatment through AC CMH. GVSU OT students provided AC CMH with a handout describing the study in order to inform caregivers about this opportunity to participate in the study. GVSU OT students collected data at AC CMH for 4 hours average each time in order for caregivers to ask questions and/or participate in the research study. All participants were provided with a consent/assent form. After completion of the consent form, caregivers were then provided with the SPM Home Form and the demographic questionnaire. Five forms were completed at AC CMH and immediately returned to the GVSU OT students. Additionally, one participant took the SPM Home Form home and was given a prepaid envelope to be mailed to GVSU but did not mail the envelope to the University. Two of the completed SPM Home Forms were not included in the analysis due to participants being over the age of 12. All information on completed forms remained de-identified.

**Measures.** The SPM is a norm-referenced assessment of sensory processing. It gathers information about social participation, vision, hearing, touch, taste and smell, body awareness, balance and motion, and planning and ideas (Parham, Ecker, Miller Kuhaneck, Henry, & Glennon, 2007). The SPM can demonstrate and

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highlight behaviors consistent with SPD. The SPM is a routine assessment that is frequently used in clinical pediatric settings. According to Parham et al. (2007), test validity and reliability has been demonstrated in the SPM. The SPM scales exhibits two main factors of reliability: internal consistency and test-retest reliability. Parham et al. (2007) states, "Analysis of scale structure and intercorrelations supports the scoring of separate sensory systems, praxis, and social participation scales on the Home and Main Classroom Forms" (p. 73). Additionally, the SPM Home scales demonstrate validity by correlating with another home-based measure of sensory function, the Sensory Profile 2. The SPM scales distinguish between typically developing and atypical clinically-referred children, with vigorous and meaningful effect sizes (Parham et al., 2007).

This study utilized the SPM Home Form in order to determine if a child has SPD. The SPM Home Form consists of 75 questions for caregivers to complete based on their observations of their child's typical behaviors. OT students distributed the SPM Home Forms to the caregivers and were available to answer questions and provide instruction as needed. Caregivers were provided with a consent form explaining the purpose of the study. Once consent was provided, caregivers completed a demographic questionnaire and the SPM Home Form. Explanations and instructions were given as needed to ensure the caregiver understood the form and were able to provide accurate responses. Caregivers chose one of four responses on a likert-type scale from "never, occasionally, frequently, and always" regarding the rate of behavior observed from their child within the past month. Separate scores were collected for social participation, the five sensory systems, and motor planning in the home. A registered and licensed occupational therapist (OTR/L) scored the SPMs. The raw scores were converted to a T-score, which fell into one of three interpretive ranges: *Typical, Some Problems, and Definite Dysfunction* (Parham et al., 2007).

**Analysis.** Researchers collected completed SPM Home Form assessments and the de-identified demographic questionnaires that were distributed at AC CMH. The SPM Home Forms were scored by an OTR/L following the SPM Home Form scoring protocol. The OTR/L converted the caregivers responses on the likert-type scale from "never, occasionally, frequently, and always" into numerical values of 1-4 by use of the scoring worksheet attached to the SPM Home Form. These values were added together per category to provide raw scores as indicated on the scoring worksheet. Raw scores from the following categories were summed together to obtain the total sensory systems (TOT) raw score: vision (VIS), hearing (HEA), touch (TOU), taste and smell (items 41-45), balance and motion (BAL), and body awareness (BOD). Each raw score



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was converted to a T-score through utilization of the SPM Home Form Profile Sheet in order to allow for assessment and comparison to the standardized norm percentiles and interpretive ranges. Scores from the SPM Home Form were further analyzed by OT students with support from GVSU's statistics department to provide visual representations of the data through bar graphs.

### Results

A total of six SPM Home Forms were provided to caregivers. Three of the six participants (participants 1, 2, and 5) were excluded due to the age requirement of the study (individuals were over the age of 12) and one participant (participant 6) did not mail their completed SPM Home Form to the University. Therefore, data was collected and analyzed for two participants (participants 3 and 4). Participant 3 was a 7-year old female with a PTSD diagnosis. Participant 4 was a 7-year old male with an ADHD diagnosis. See tables 1 and 2 for data results including raw scores, t-scores, and interpretive ranges per sensory category. Figure 1 defines what each category within the SPM represent. Additionally, see Figures 2 and 3 for visual representation of the data.

SOC: Social Participation
VIS: Vision
HEA: Hearing
TOU: Touch
BOD: Body Awareness
BAL: Balance and Motion
PLA: Planning and Ideas
TOT: Total Sensory Systems

**Figure 1.** The eight areas of assessment categorized in the SPM Home Form.

**Table 1.** SPM Home Form Raw Scores

	SOC	VIS	HEA	TOU	BOD	BAL	TOT	PLA
<b>Participant 3</b>	25	14	8	12	16	11	67	12
<b>Participant 4</b>	24	18	8	13	18	18	82	15

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Note: This table shows the raw scores of each participant that completed the SPM. Higher raw scores indicate greater sensory dysfunction.

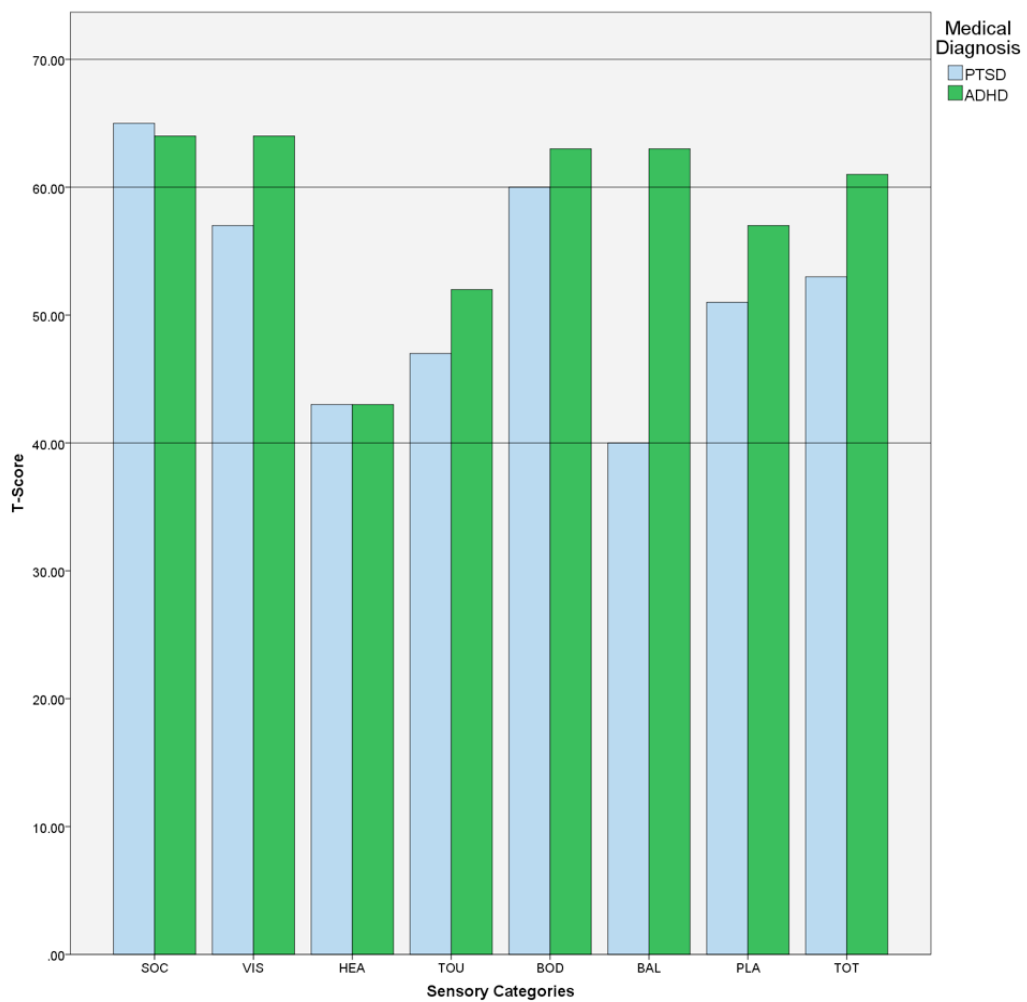
**Table 2.** SPM Home Form T-score and Interpretive Ranges

Category of Assessment	Participant 3 (PTSD)		Participant 4 (ADHD)	
	T-score	Interpretive Range	T-score	Interpretive Range
<b>SOC</b>	65	*Some Problems	64	*Some Problems
<b>VIS</b>	57	Typical	64	*Some Problems
<b>HEA</b>	43	Typical	43	Typical
<b>TOU</b>	47	Typical	52	Typical
<b>BOD</b>	60	*Some Problems	63	*Some Problems
<b>BAL</b>	40	Typical	63	*Some Problems
<b>TOT</b>	53	Typical	61	*Some Problems
<b>PLA</b>	51	Typical	57	Typical

Note: Shows the T-scores for each sensory category and the interpretive range from typical (40T-59T), some problems (60T-69T), to definite dysfunction (70T-80T) that each T-score falls within.

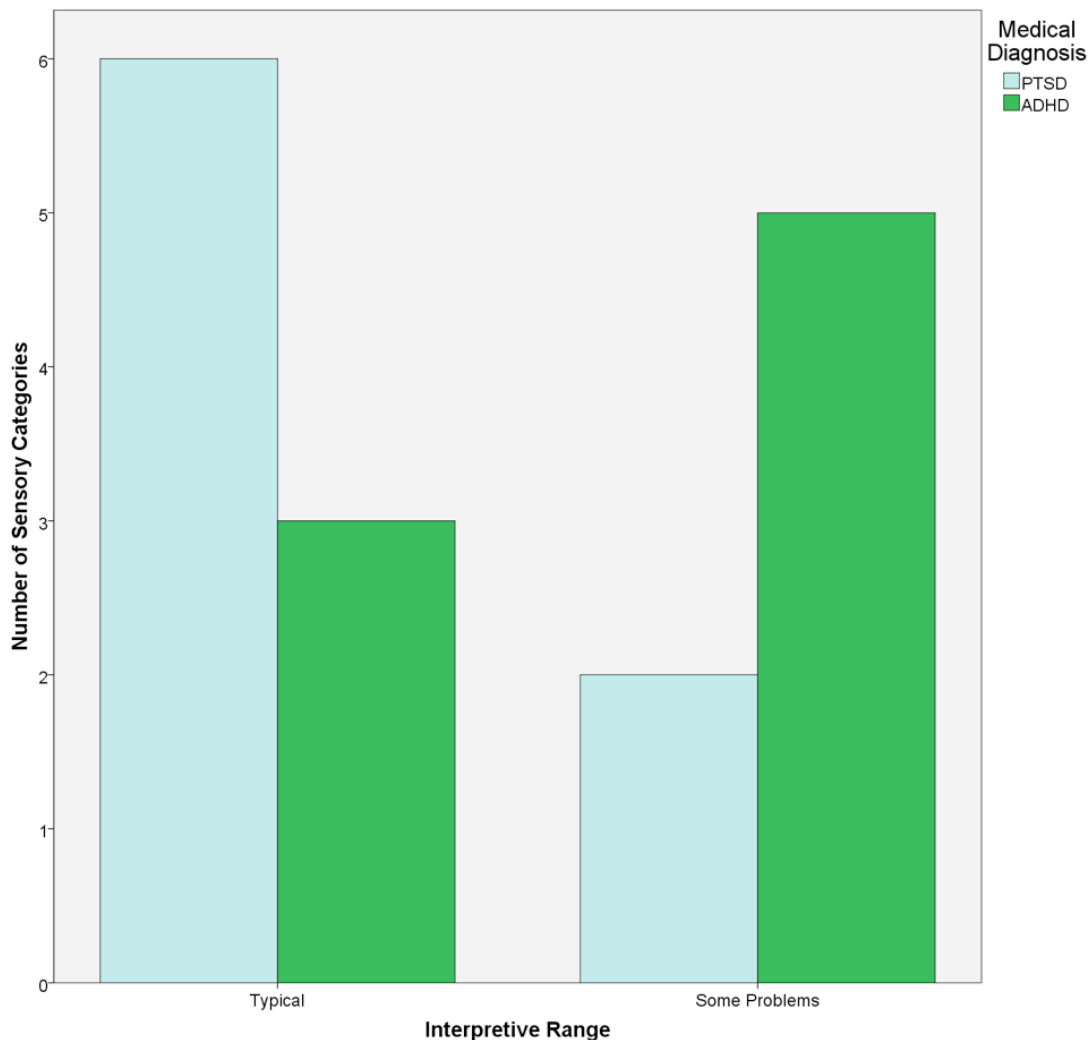
\*Indicates falling into the category of having SPD as defined in this study

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**Figure 2:** T-score and Sensory Categories. The bar graph displays the T-scores each participant received. Interpretive ranges: Typical range (40T-59T), Some Problems (60T-69T), and definite dysfunction (70T-80T).

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**Figure 3:** Interpretive ranges. This bar graph displays the number of categories that fell within the typical interpretive range or the some problems interpretive range for each participant. No categories fell within the definite dysfunction range.

## Discussion

**Interpretation.** This data from this study yielded the possibility that SPD may be present in other DSM-5 diagnoses, rather than solely ASD. These findings are related to previous research. Previous research indicates that SPD is prevalent in 5-16% of children in the United States (Chang, et al., 2014). Many children who do not have an ASD diagnosis also show symptoms of SPD (Kranowitz, 2005). This is well-known to pediatric therapists who currently practice with this population. Moreover, there is a gap in the literature that states SPD exists in individuals without an ASD diagnosis.

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Our findings relate to the guiding model, PEOP. The person variables, environment, and occupational performance interact with one another. The participants in this study were assessed on their abilities to participate in their daily life and how their sensory systems contribute to behaviors. Additionally, the Sensory Integration frame of reference applies to our findings. Sensory functioning related to behaviors in the home was assessed through the SPM Home Form. Participant 3 was found to have some problems in social participation and body awareness. However, this participant was found to be typical in the total score. This indicates that participant 3 is not categorized as having SPD. Participant 4 was found to have some problems in social participation, vision, body awareness, and balance and motion. Participant 4 was found to have some problems in the total score as well. This indicates that Participant 4 is categorized as having SPD.

**Strengths and Limitations.** Strengths of this study included bringing awareness of this topic to other healthcare providers rather than solely occupational therapists. Moving forward, this study hopes to generate future conversations regarding SPD being a legitimate diagnosis in the DSM-5. Researchers are hopeful that more occupational therapists and other healthcare workers will advocate for therapy services being covered by insurance for individuals with SPD. This pilot study strived to fill the gap in the lack of research about this important topic. An additional strength of this study was that a grant was provided for researchers to purchase the SPM Home Forms. Having the resources available to use was valuable, as assessments are costly to purchase.

The limitations of this study include the limited time frame to collect data. Researchers only had five weeks to collect and analyze the data. Additionally, the study only had one community partner for data collection which significantly limited the number of participants. The reduced number of participants created a limited variety of DSM-5 diagnoses. Only two diagnoses, ADHD and PTSD, were included in the study and the analysis. Due to the lack of diagnoses the results are not fully generalizable to the public due to this limited participant pool. Lastly, more statistically significant results could be found if researchers used a quantitative correlational design. If a quantitative correlational study was utilized, it would show the direct relation between two variables in an objective manner.

**Application to Profession.** Occupational therapists specifically work with individuals with SPD due to the various challenges that result from this disorder which may inhibit engagement in daily occupations. A multitude of occupations are impacted for a child with SPD such as play and leisure, education participation,

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social participation, sleep, Activities of Daily Living (ADLs), and Instrumental Activities of Daily Living (IADLs) (Koenig & Rudney, 2010). Examples may include difficulties with feeding, handwriting, dressing, and toileting. Various studies also support a correlation between children with sensory processing issues and lower academic achievement due to impairments such as difficulty with attention and an increased risk of learning disabilities (Koenig & Rudney, 2010). Challenges with self-care skills are also observed in children with SPD due to tactile sensitivities which may impact an array of participation in activities such as food choices while eating, bathing/showering, and grooming (Koenig & Rudney, 2010). Utilizing PEOP, an emphasis may be placed on analyzing a child's environment and making appropriate modifications to increase their engagement with the task at hand. For example, a child experiencing an inability to concentrate due to the overwhelming sensory information in the classroom (i.e. loud noises), noise cancelling headphones could be provided to assist the child with concentration and regulation. Additionally, the sensory integration frame of reference can guide treatment by providing children with strategies to help them adapt their own behaviors and increase self-regulation (American Occupational Therapy Association, 2015).

**Clinical Implications.** The results indicate that both participants had some problems with sensory integration even though they do not have an ASD diagnosis. This shows that SPD may be present in other DSM-5 diagnoses rather than solely ASD. This information is relative to caregivers, parents, teachers, and healthcare professionals. Due to extensive training in the use of Sensory Integration theory, occupational therapists are distinctly qualified to provide therapy to all children with SPD. Bringing more awareness to SPD will help a number of different clinicians become educated on how to treat sensory dysregulation.

**Implications for Further Research.** In order to further assess the relationship between SPD and non-ASD diagnoses, this research study will be continued to gather a larger sample size and draw conclusions. Statistical significance supporting SPD as a comorbidity to other diagnoses will help gain support for coverage by insurance. Treatment for SPD will help individuals gain the ability to regulate their sensory systems and participate in their ADLs and IADLs. .

## Conclusion

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Sensory systems are complex and individualized and different for every person. Having a sensory system that is not able to regulate properly inhibits the ability for a person to participate in their daily occupations. It is becoming evident by healthcare providers that individuals with ASD are not the only ones with sensory processing issues. The purpose of this study was to bring awareness to how a vast amount of individuals with different diagnoses can have sensory system dysregulation. Creating support to treating SPD will create the ability for individuals to better engage in their ADLs and IADLs.

This study showed progress towards confirming the hypothesis that SPD is equally prevalent in children with diagnoses other than ASD. Due to the lack of participants, significant statistical findings could not be confirmed. However, continuing data collection of individuals with SPD across a multitude of diagnoses will create significance of SPD as a diagnosis. No generalizations were able to be drawn from the sample due to the lack of statistical significance and limited number of participants. Furthermore, this study started the conversation that SPD is prevalent across many different diagnoses. Continued data collection for the support of the hypothesis to define SPD as a diagnosis in the DSM-5 to seek treatment from healthcare providers.

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