Title: Relations among atypical sensory processing, maladaptive behaviour and maternal stress in Spanish children with Autism Spectrum Disorder

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Relationships between atypical sensory processing patterns, maladaptive behavior and maternal stress in Spanish children with Autism Spectrum Disorder

Abstract

Background This study investigated sensory processing in a sample of Spanish children with Autism Spectrum Disorder (ASD). Specifically, the study aimed to explore: 1) the prevalence and distribution of atypical sensory processing patterns; 2) the relationship between adaptive and maladaptive behaviour with atypical sensory processing; and 3) the possible relationship between sensory subtype and maternal stress.

Methods The Short Sensory Profile-2 (Dunn 2014) and the Vineland Adaptive Behavior Scale (Sparrow *et al.* 1984) were administered to examine the sensory processing difficulties and maladaptive behaviours of 45 children with ASD aged 3 to 14; their mothers also completed the Parenting Stress Index-Short Form (Abidin 1995).

Results Atypical sensory features were found in 86.7% of the children; *Avoider* and *Sensor* being the two most common patterns. No significant relationship was found between atypical sensory processing and adaptive behaviour. However, the analysis showed a strong relationship between sensory processing and maladaptive behaviour. Both maladaptive behaviour and sensory processing difficulties correlated significantly with maternal stress although maternal stress was predicted only by the sensory scores, and in particular by the *Avoider* pattern.

Conclusions The findings suggest that sensory features in ASD may be driving the high prevalence of parental stress in carers. They also suggest that the effect on parental stress that

has been attributed traditionally to maladaptive behaviours may be driven by sensory difficulties. The implications of these findings are discussed in relation to the development of interventions and the need to explore contextual and cultural variables as possible sources of variability.

Keywords: autism spectrum disorder, sensory processing, maladaptive behaviour, maternal stress

In recent years sensory processing difficulties with individuals with Autism Spectrum Disorder (ASD) have become the focus of many research studies (Ben-Sasson *et al.* 2009; Lane *et al.* 2010; Lidstone *et al.* 2014; O'Donnell *et al.* 2012; Tomchek *et al.* 2015). The importance of unusual sensory behaviours in individuals with ASD has also been recognised in changes in diagnostic practices as reflected in its inclusion in the DSM-5 (APA 2013) as a part of the criteria for the diagnosis of ASD.

Studies report a high prevalence of sensory processing difficulties in people with ASD although percentages vary between 65% to 95%. The discrepancy in prevalence may be explained by differences in the ages of the samples studied or the measures used such as the Short Sensory Profile (SSP; McIntosh *et al.* 1999), the DISCO interview (Leekam *et al.* 2007; Wing *et al.* 2002), the Sensory Experiences Questionnaire (SEQ; Baranek *et al.* 2006), and the Sensory Processing Measure (SPM; Fernández-Andrés *et al.* 2015; Parham *et al.*2007). Regardless of the discrepancy in the percentages reported, a meta-analysis of 14 studies, by Ben-Sasson *et al.* (2009) concluded that these symptoms are universal across the diagnostic autism spectrum and throughout the lifespan. Furthermore, these symptoms have a very early onset and are one of the early signs of ASD perceived by parents (Ben-Sasson *et al.* 2007).

Research to date has focused on trying to identify patterns of sensory dysfunction within the autism population. A large proportion of these studies are carried out using a framework developed by Dunn (1997), which is based in Ayres Sensory Integration Theory (Ayres *et al*. 1979). According to this framework, sensory processing profiles can be defined by two dimensions: neurological threshold (high - low) and behavioural response (active - passive). The cross of these dimensions results in four sensory patterns: *Seeker, Avoider, Sensor and Bystander*. Studies using this framework have yielded mixed findings in relation to what are the most frequent sensory patterns in autism. The discrepancy may be explained

by differences in either the age or culture of the samples studied. For instance, in young children, the most frequent patterns identified have been either *Bystander* in Taiwanese children (Tseng *et al.* 2011) or *Seeker* and *Sensor* (Jasmin *et al.* 2009) in a sample of Canadian children. In a meta-analysis of 14 studies, Ben-Sasson *et al.* (2009) concluded that *Seeker* is the most frequent pattern in older children while it is the least common pattern in adults (Crane *et al.* 2009). The high heterogeneity across studies is further complicated by the use of different classification systems of sensory patterns in the literature. For instance, Ausderau *et al.* (2014a) using the SEQ (Baranek *et al.* 2006) found four sensory response patters: *Hypo-reactivity, Hiper-reactivity, Sensory interests* and *Enhanced perception.* Next Ausderau *et al.* (2014b) carried out a latent profile analysis which identified four distinct profiles: *Mild, Sensitive-Distressed, Attenuated-Preoccupied* and *Extreme-Mixed.* Lane *et al.* (2010, 2011, 2014) used a cluster analysis and the Short Sensory Profile (McIntosh et al. 1999) and identified four alternative distinct sensory subtypes: *Sensory Adaptive, Taste/Smell Sensitive, Postural Inattentive* and *Generalized Sensory Difference.*

Sensory processing difficulties have been shown to have an impact in other domains such as stress and anxiety (Baker *et al.* 2008; Lidstone *et al.* 2014; Grandin & Scariano 1986; Williams 1992), family life (Schaaf *et al.* 2011), perceived children's social participation (Koenig & Kinealey 2008), and, more recently, have been shown to contribute to maternal stress (Ben-Sasson *et al.* 2013; Ausderau *et al.* 2016). Thus, the study of how subtypes of atypical sensory processing impact others has important implications for the development of appropriate support interventions and the quality of life of people with ASD and their families.

One area that has received special attention is the relationship between sensory processing and adaptive behaviour but, again, studies have found mixed results. Many of these studies use the Vineland Adaptive Behavior Scales (VABS: Sparrow *et al.* 1984;

VABS-II: Sparrow *et al.* 2005) to assess adaptive behaviour and the Sensory Profile (extended version, SP or short version, SSP) to assess sensory processing (see Table 1). This research has found positive correlations between *Daily Living Skills* and either *SSP Total Scores* or specific patterns of the SP (Jasmin *et al.* 2009; Baker *et al.* 2008). Studies using the SEQ have also found a correlation between both *Daily Living Skills* or *Adaptive Behavior Composite* scores and specific sensory domains (Liss *et al.* 2006; Roger *et al.* 2003). However, other studies have failed to confirm this relationship (Baker *et al.* 2008; Lane *et al.* 2010; McCormick *et al.* 2016; O'Donnell *et al.* 2012; Robinson & Magill-Evans 2009). In contrast, there seems to be a more consistent relationship between maladaptive behaviour and atypical sensory processing across different studies (Baker *et al.* 2008; Lane *et al.* 2010; O'Donnell *et al.* 2012; Tseng *et al.* 2011).

Maladaptive behaviour has been widely related with parental stress. Many studies carried out with parents of people with ASD show this relationship (Lecavalier *et al.* 2006; Pozo & Sarriá 2014; Pozo *et al.* 2014). However, there are still few studies that have directly analysed the relationship between atypical sensory processing patterns and parental stress. Specifically, using the Parental Stress Index-Short Form (PSI-SFl; Abidin 1995) several studies find that some specific sensory patterns are better at predicting parental stress than others (Abidin, 1995; Ausderau *et al.* 2016; Baranek, 1999; Ben-Sasson *et al.* ,2013; Kirby *et al*., 2015) although the different scales used in these studies preclude any conclusion regarding which pattern may be the best predictor of parental stress.

In summary, sensory processing difficulties have been widely reported in the literature. It seems that atypical sensory functioning is present in a very high percentage of people with ASD but the profile distribution and its relationship with adaptive functioning are still unclear. More consistent is the relationship between atypical sensory processing and maladaptive behaviour. However, although maladaptive behaviour has been traditionally

associated with family stress, few studies have evaluated the three-way relationship between atypical sensory processing, maladaptive behaviour and family stress. Therefore, this study aimed to: analyse the prevalence and, specially, describe the distribution of the different profiles of sensory processing in a sample of Spanish children with ASD using the SSP-2 Spanish version (Dunn 2014); and investigate the relationship between atypical sensory processing and adaptive functioning (*Communication*, *Socialization*, *Daily Living Skills* and *Maladaptive Behavior*). Based on previous results, a significant positive correlation is expected between maladaptive behaviour and atypical sensory processing but we did not have a clear prediction regarding the other three domains as few correlations have been found in previous studies (see Table 1). Finally, we plan to explore the predictive value of maladaptive behaviour and atypical sensory processing in maternal stress. Regarding this last aim and, in contrasts to Ben-Sasson *et al.* (2013), we worked with the four subtypes of the SSP-2, not only with SOR. The measure of maternal stress we used was the *PSI-SF Total Score* but, following the Zaidman-Zait *et al.* (2001) recommendation, we used also the *Parent Distress (PD)* subscale. The other two subscales of this instrument have been suggested to mask characteristics of ASD as erroneous indicators of parental stress.

Methods

Participants

Forty-five Spanish children with ASD and their mothers participated in this study. Participants were recruited through the Association of Parents of Persons with Autism (APNA) and the Association of Families of People with Autism Spectrum Disorder (ASTEA-Henares). Inclusion criteria mandated that participants were between 3 years to 14 years, 11 months and met criteria for ASD on: Autism Diagnostic Interview-Revised (Lord *et al.* 1994), Autism Diagnostic Observation Schedule-Generic (ADOS-G; Lord *et al.* 2000) and Diagnostic and Statistical Manual of Mental Disorders (4^{th} ed., text rev; DSM-IV-TR criteria

(American Psychiatric Association [APA] 2000) or Diagnostic and Statistical Manual of Mental Disorders (5th ed., DSM-5) criteria (American Psychiatric Association [APA] 2013). Children who met the criteria for ASD but who presented with a co-morbid diagnosis, i.e. additional disorders such as attention deficit hyperactivity disorder, genetic condition (Rett Syndrome), brain injury or blindness were excluded. Participating children had a mean chronological age of 95.4 months (SD= 34.5, range = 42-168 months of ages) and 77.8 % were boys. The VABS has been widely used with samples of children with ASD and has been considered a more appropriate measure of ability and functioning in this group than more traditional psychometric tests such as those measuring IQ (Bölte & Poustka 2002; Freeman *et al.* 1999; Kraijer 2000). Therefore, cognitive level was estimated by the Adaptive Behavior Composite (ABC) Standard Score of the Vineland Adaptive Behavior Scale (VABS; Sparrow *et al.* 1984). A power analysis indicated that with our sample size the statistical power to detect a small effect of f^2=0.15 with α = 5% and β = 80% was 0.68.

The average age of mothers was 42.36 years (SD= 5.78, range= 32-59). Most mothers reported middle to upper class household incomes (95.2%) and medium-high levels of study (97.6%). The majority of mothers were married or cohabiting (78.6%); fewer mothers were separated/divorced (19.0%), or widowed (2.4%).

Measures

Short Sensory Profile-2 (SSP-2), Spanish version.

The SSP-2 is a 34-item parent questionnaire designed to measure behaviours associated with abnormal responses to sensory stimuli in children aged 3-14;11 (Dunn 2014). The SSP-2, unlike the previous short version of the Sensory Profile (McIntosh *et al.* 1999), offers a clustering of scores in the four patterns: *Seeker, Avoider, Sensor* and *Bystander.* Besides, it provides two summary measures, a *Sensory* subscale and a *Behavioral* subscale (behavioural responses associated with sensory processing). Items are scored on a Likert

scale ranging from 1 (*always*) to 5 (*never*). The scale provides a classification system for interpreting the results based on the normal distribution.

Vineland Adaptive Behavior Scale (VABS), Interview Edition, Spanish version.

The VABS is a semi-structured interview administered to caregivers to assess the current adaptive behaviour of the child (Sparrow *et al*. 1984). The VABS assesses adaptive behaviour by obtaining standard scores in the domains of *Communication, Daily Living, Socialization, Motor Skills and Maladaptive Behavior*. The latter measure has been used in several previous studies whose main objective was analyses of the relationship between patterns of sensory processing and adaptive and maladaptive behaviour (Baker *et al.* 2008; Jasmin *et al.* 2009; Lane *et al.* 2010) (see Table 1). Items in each domain are scored from 0 to 2, with decreasing scores indicating skills/behaviours that are sometimes or never performed. The raw scores are then converted to standard scores, except for the *Maladaptive Behavior* scale that is comprised of 32 items. The sum of standard scores for each domain yields an *Adaptive Behavior Composite (ABC)* score reflecting the overall ability of the person to live independently.

Parenting Stress Index-Short Form (*PSI-SF).*

The PSI-SF (Abidin 1995) is a self-report measure designed to assess parenting stress. It includes 36 items that fall into three scales: *Parental Distress*, *Parent-Child Dysfunctional Interaction* and *Difficult Child Characteristics*. Parents rated each item on a 5-point Likert scale. According to Zaidman-Zait *et al.* (2010), items in the *Parental Distress* subscale are useful to assess the severity of distress among parents of individuals with ASD, however, items in the *Parent–Child Dysfunctional Interactions* and *Difficult Child* subscales are less informative in this population. Following their recommendation, we used the *Parent Distress* subscale score as a measure of maternal stress, which showed good internal consistency (α= .87). We also provide, where appropriate, results with *PSI-SF Total Score* as several studies

also use this measure (e.g. Ausderau *et al.* 2016; Ben-Sasson *et al.* 2013; Pozo & Sarriá 2014; Rao & Beidel 2009) and the comparison between the two scores could provide valuable information.

Procedures

Ethical approval for this study was granted by the Ethics Committee at the Universidad Autónoma de Madrid- Spain. The diagnostic services of the associations that helped with the recruitment of participants provided the ADI-R and ADOS-G scores. The most recent scores available were taken from the ADOS-G since this is an instrument given routinely in review assessments. Assessments were conducted by three psychologists trained in the administration of these scales. Most families (n=39) completed the VABS and the SSP-2 as part of an interview for the review assessment of their child. During this same visit the mother independently completed the PSI-SF. A typical assessment session lasted between 50 and 60 minutes. The remaining five families completed the VABS and the SSP-2 via a telephone interview and the PSI-SF was sent by post.

Results

Data analyses were completed using the Statistical Package for the Social Sciences (SPSS) (v. 22.0). Descriptive statistics were calculated for the raw scores of the key variables of the SSP-2 and the standard scores of the adaptive behaviour domains except for the *Maladaptive Behavior* subscale. As it was noted on the Measures section, the VABS does not provide a standard score for this subscale, so the raw scores were used. Pearson's Correlation Coefficient method was used to examine the relationship both between atypical SP (SSP-2) and adaptive behaviour (VABS) and also between atypical SP, maladaptive behaviour and maternal stress. Significant results those with a probability a value of $p<.05$. Finally, to study the predictive value of the variables atypical SP and maladaptive behaviour in maternal

stress, multiple regression analysis and a forward stepwise regression analysis were performed.

Atypical sensory processing

Table 2 shows the means and standard deviations for the sample on the SSP-2 across the four patterns and the two subscales *(Sensory* and *Behavior*) and the percentages in each range. As can be seen the most frequent patterns were *Sensor* and *Avoider*, followed by *Seeker* and *Bystander*.

Atypical sensory processing and adaptive functioning

Table 3 shows the means, standard deviations (SD), range, and frequency distribution of adaptive functioning level for each domain. As in previous studies, a high prevalence of adaptive behaviour difficulties was observed (Baker et al. 2008; O'Donnell et al. 2010). Specifically, the *ABC-standard scores* indicated an overall low level of adaptive behaviour for the participants.

Table 4 shows the correlations between the SSP-2 scores and the different domains of the VABS. As it can be observed, no significant correlations were found between the SSP-2 scores and any of the VABS scores with the exception of *Maladaptive Behavior*, which correlated significantly with all the SSP-2 scores.

Maternal stress, maladaptive behaviour and atypical sensory processing

Table 5 shows the correlations between the SSP-2 scores (four patterns and the *Total* score), *Maladaptive Behavior* and the two measures of maternal stress used: the *PSI-SF: Total* score, and the *Parental Distress* subscale (*PSI-SF: PD*). The *PSI-SF: Total* score correlated with all the SSP-2 scores and with *Maladaptive Behavior*; however, the *PSI-SF: PD* only showed significant correlations with three of the four patterns and with the *Total* score of the SSP-2.

In order to analyse which variables (maladaptive behaviour and atypical sensory processing) would better predict the level of maternal stress, two multiple regression analyses were performed with PSI-SF: Total and PSI-SF: PD as dependent variables. The percentage variance explained was greater using the *PSI-SF: Total* score (R^2 = .41, $F(2,41) = 13.961$, p <.001) than the *PD* subscale (R^2 = .16, $F(2,42) = 3.88$, p <.05). However, in both analyses the only significant predictor was the sensory variable, *SSP-2*: *Total* (β = .471, $t(42) = 3.44$, p<.001 and (β = .39, $t(42) = 2.4$, p<.05, respectively). To determine whether specific sensory patterns particularly affect maternal stress, a forward stepwise regression analysis was carried out, introducing each pattern sequentially, based on weight of correlations starting with *Avoider,* then *Sensor* and, finally, *Bystander*. The results clearly show that the pattern that explained most of the variance of maternal stress (*PSI-SF: PD*) was *Avoider* (R^2 = .19, $F(1,43) = 10.32$, p <.01). The input of the two others patterns (*Sensor* and *Bystander*) barely had an effect on the percentage of variance explained (Avoider and Sensitive: R^2 = .20, $F(2,42) = 5.29$, p <.01; All three predictors: (R^2 = .20, $F(3,41) = 3.45$, p <.05) .

Discussion

As expected, a high prevalence of atypical sensory processing was observed with 86.7% of participants showing scores outside of the normotypical range of at least one of the sensory processing patterns. This percentage is somewhat higher than that found in other studies (O'Donnell *et al.* 2012; Tseng *et al.* 2009) but similar to the 90% found by Lane *et al.* (2010). That there is a high percentage of atypical sensory processing in people with ASD is not contested, although identifying the sources of heterogeneity is one of the current challenges in atypical sensory processing research in ASD. However, finding a clear distribution of the characteristic sensory processing patterns is proving far more complex. In our study, the most frequent patterns were *Sensor* and *Avoider*, a result that is different from other studies. The two previous studies using the Sensory Profile found that the most frequent

patterns were *Seeker* and *Sensor* (both with a percentage of 54.4%) and the least observed was *Avoider* (Jasmin *et al*. 2009) or that the most frequent pattern was *Bystander* (62.7%) and the least common was *Sensor* (35.8%) (Tseng *et al.* 2011). The only concordance found between the study by Jasmin *et al.* (2009) and ours, was that the highest percentage was among both fractions of the *Sensor* pattern. Some are suggesting that age, even if not affecting prevalence, is affecting the atypical profile processing patterns. As mentioned, Ben-Sasson *et al.* (2009) suggested that the *Seeker* pattern increases as a function of chronological age. Unfortunately, due to the small sample size we could not explore this possibility, however, other studies do not confirm this hypothesis (Crane *et al.* 2009; McCormick *et al.* 2016).

An alternative explanation may relate to the interplay between the kind of sensory modulation difficulties faced by the child and the specific behavioural reactions and coping strategies a child develops, which may be a direct response to some of the features of the environment in which they live. In our study for instance, children showed a higher percentage of difficulties related with the presence of low sensory thresholds (*Avoider* or *Sensor*) but avoiding or seeking strategies may depend on the environment of the child. Perhaps it is time to consider the importance of studying these sensory thresholds in relation with the sensory environment in which individuals live at both the micro level, such as family routines (Schaff *et al.* 2011) and at the macro level (i.e., cultural environment).

In relation to cultural factors, research on sensory processing has largely been conducted using parental reports, which are particularly prone to cultural variations regarding the perception of what is considered "atypical". Matson *et al.* (2011) found extensive cultural differences in the perception of sensory difficulties by parents of children with ASD. In particular, they found that while 42% parents of South Korean children with ASD reported sensory difficulties, this percentage increased to 85% in a sample of parents of UK children.

The cultural environment has been shown to influence perceptual development as well. For instance, culture has been shown to influence the perception of visual illusions and visual scanning of scenes at both brain and behavioural levels (Chua *et al.* 2005; Davidoff *et al.* 2008; de Fockert *et al.* 2007). We are bringing up the importance of opening the perspective not only to the need to study developmental profiles but also the importance of considering the broader environment in which a child develops as cultural practices may influence parental perceptions and even the development of the expression of some symptoms associated with ASD such as sensory processing. As argued elsewhere, the strong genetic basis of ASD has led to conceptualise this condition as static and impervious to environmental influence however, ASD is classified as a developmental disorder and as such, its development is influenced by environmental factors (López 2015).

Regarding adaptive functioning, no relationships were found between atypical sensory processing and *Communication*, *Daily Living Skills* and *Socialization* scores on the VABS. Many studies have investigated the extent to which specific sensory processing patterns are related to adaptive behaviour (Baker *et al.* 2008; Lane *et al.* 2010; O'Donnell *et al.* 2012; Tomcket *et al.* 2015). The hypothesis that there could be relationship between the sensory processing features and the individual's ability to respond to the environmental demands has a strong theoretical support (Dunn 1997). However, results obtained so far do not support this hypothesis. This may be because adaptive functioning skills such as *Communication*, *Daily Living Skills* and *Socialization* are the product of neurodevelopmental processes that are enormously complex. It is still worth continuing research to find how specific sensory patterns might be influencing functioning in other domains such as communication introducing more objective instruments.

In contrast, as in previous studies a strong relationship was found between atypical sensory processing and maladaptive behaviour (see Table 1), and with the *Sensory* subscale

on the VABS. Our findings also indicate that while both *Maladaptive Behavior* and atypical sensory processing correlated significantly with maternal stress, particularly the Avoider profile. It is difficult to compare these results to previous studies due to the way that sensory processing was measured. Alternatively, the fact that the *PSI-SF: Total* score can be masking stress indicators characteristics of ASD (Zaidman-Zait *et al.* 2010), could explain the high percentage of variance explained by the *Maladaptive Behavior* variable in previous studies.

Limitations

This study had several limitations. First, all the data collection was through parental reports. Parent's perceptions are crucial to study some of these variables, especially when analysing the possible relationship with perceived stress. Hence, it would be useful in future research to use direct observational methods to complement their reports. Second, the sample size was insufficient to investigate subgroups adequately or explore developmental trajectories of sensory symptoms. Future research should endeavour to conduct longitudinal studies with larger samples to explore these issues. Finally, research on this topic favours the use of the SSP, the SP or the SEQ as measures of sensory patterns. An alternative measure used in the literature is the SPM (Parham & Ecker 2007). This measure not only includes sensory issues but also social participation and praxis. The latter component has been shown to significantly affect adaptive behavior (Roley *et al*. 2014). Therefore, future studies may need to consider a broader conceptualisation of sensory issues that includes aspects such as praxis in order to elucidate their relationship to maladaptive behavior and parental stress.

Conclusions

The atypical sensory features in people with ASD is difficult to characterise and has a potential impact on other areas of functioning. However, the heterogeneous distribution of sensory profiles across different studies presents a challenge to our understanding of their nature as well as to the identification of the sources for this heterogeneity. Variables as age,

adaptive functioning and severity of symptoms seem to be insufficient to account for the large variability found. Our proposal is that it may be worth broadening the focus to study how these sensory features relate to the interplay between the nature of specific difficulties faced (i.e., stimuli) and the context in which a child is raised (i.e., family and cultural environment).

In contrast, there is consensus that sensory processing difficulties and maladaptive behaviours are strongly linked. What remains to be determined is how sensory difficulties are affecting other domains such as communication, socialisation and daily life activities. The close relationship between maladaptive behaviours and sensory difficulties has been used to explain the presence of parental stress, however the findings from this study suggest that atypical sensory processing may be the real driver of parental stress, particularly if the child is an *Avoider*. Therefore, it is worth dedicating efforts towards a better understanding of the sensory characteristics of people with ASD. Only from a better knowledge of sensory functioning will we be able to improve individual-environment interaction and to develop more effective supports to people with ASD and their families.

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Table 1. Correlations between atypical sensory processing and adaptive (and maladaptive) behaviour found in previous studies carried out with children with ASD, using the Sensory Profile (extended version, SP; or short version, SSP) and the VABS (or VABS-2)

	Baker *et al*. (2008)	Lane *et al*. (2010)	Jasmin *et al*. (2009)	O'Donnell *et al*. (2012)	Tseng *et al*. (2011)
N	22	54	35	42	67
Mean chronological age (SD)	64.86 months (20.70)	79.02 months (19.22)	44.1 months (5.9)	45.5 months	64.04 months (10.48)
Range	33-101 months	33-115 months	36-56 months	36-59 months	48-84 months
Nationality	Australian	Australian	Canadian	US	Taiwanese
Instruments	SSP VABS	SSP VABS	SP VABS-2	SSP VABS ABC-C (Aman & Singh 1994)	SP-C Chinese version (Tseng & Cheng 2008); CBCL-C (Huang *et al*. 1994)
Communication (VABS)	ns	Low energy/weak p<.05	-	-	
Daily Living Skills (VABS)	SSP Total .044	ns	Avoider .033	-	
Socialization (VABS)	ns	ns	-	-	
Adaptive Behaviour Composite (VABS)	ns	ns	-	SSP Total .062	
Maladaptive Behavior (VABS)	SSP Total .000 Movement Sensitivity .022 Under-resp./seeks sens .023 Auditory filtering .042 Low energy/weak .003	Tactile sens. p<.001 Taste/Smell sens. p<.001 Under-resp./seeks sens p<.001 Auditory filtering p<.001 Visual/Auditory sens. p<.001	-	-	
Maladaptive Behavior (ABC-C)				SSP Total p<.01	
Maladaptive Behavior (CBCL-C)					
CBCL-Internal					Bystander .02 Sensor .047 Avoider p<.001
CBCL-External					Seeker .028 Sensor .013 Avoider .016

Table 2. Participants' performance on SSP-2 (Dunn, 2014)

SSP-2	Raw Score Mean (SD)	Normotypical Range	Within norm % (*n*)	1-2 SDs above % / below%	+2 SDs above % / below %
Patterns:					
Seeker	16.91 (6.46)	6 - 17	48.9% (22)	2.2% (1) / 33.3% (15)	- / 15.6% (7)
Avoider	25.22 (7.62)	9 – 22	28.9% (*13*)	4.4% (2) / 35.6% (16)	- / 31.1% (14)
Sensor	28.98 (8.82)	10 - 24	28.9% (13)	- / 33.3% (15)	- / 37.8% (17)
Bystander	15.69 (6.68)	6 - 16	53.3% *24*)	2.2% (1) / 26.7% (12)	- / 17.8% (8)
Subscales:					
Sensory	33.00 (11.41)	14 - 31	42.3%(19)	2.2% (1) / 31.1% (14)	- / 24.4% (11)
Behavioral	54.20 (14.86)	19 - 46	26.6%(12)	2.2% (1) / 35.6% (16)	- / 35.6 % (16)

Table 3. Participants' performance on VABS (Sparrow, 1984)

VABS Domains	Standard Score Mean (SD)	Range	Adaptive Level % (n) Low	Moderately Low	Adequate
Comunication	57.29 (23.77)	19 – 108	64.4 (29)	15.6 (7)	20.0 (9)
Daily Living Skills	51.27 (22.13)	19 – 102	77.8 (35)	15.6 (7)	6.7 (3)
Socialization	55.71 (14.79)	19 – 84	82.2 (37)	17.8 (8)	-
ABC-Standard Score	50.20 (18.36)	19 – 91	77.3 (34)	18.2 (8)	4.5 (2)
Maladaptive Behavior*	19.62 (7.57)	3-36			

* Correspond to raw scores.

Table 4. Correlations between SSP-2 and VABS

r (p level)	Seeker	Avoider	Sensor	Bystander	Sensory	Behavioral	Total
Communication	-.054	.082	-.002	.188	.142	.002	.063
	(.726)	(.592)	(.992)	(.216)	(.354)	(.990)	(.683)
Daily Living Skills	-.229	-.056	-.063	.002	-.028	-.132	-.093
	(.131)	(.714)	(.683)	(.988)	(.857)	(.389)	(.545)
Socialization	-.160	.043	-.010	.128	.055	-.030	.009
	(.295)	(.781)	(.948)	(.402)	(.718)	(.844)	(.954)
Adaptive Behavior	-.145	.017	-.001	.127	.067	-.046	.002
Composite	(.348)	(.914)	(.997)	(.413)	(.665)	(.765)	(.988)
Maladaptive	.322*	.490**	.387**	.382**	.390**	.503**	.475**
Behavior	(.031)	(.001)	(.009)	(.010)	(.008)	(.001)	(.001)

* Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.

Table 5. Correlations between maternal stress, SSP-2 (patterns and total score) and maladaptive behavior

r (p level)	Maladaptive Behavior	Seeker	Avoider	Sensor	Bystander	Total SSP-2
PSI-SF: Total	.490**	.407**	.595**	.536**	.497**	.603**
	.001	.006	.001	.001	.001	.001
PSI-SF: PD	.201	.219	.440**	.332*	.320*	.395**
	.185	.149	.002	.026	.032	.007

SSP-2: short sensory profile-2; PSI-SF: parenting stress index: short form; PSI-PD: PD: parenting stress index: parenting distress.
* Correlation is significant at the 0.05 level.
** Correlation is significant at the 0.01 level.
*** Correlation is significant at the 0.001 level.