

CRITICALLY APPRAISED TOPIC

TITLE

Does the Sensory Profile or Sensory Processing Measure – Home form have stronger reliability, validity and clinical utility in identifying children with sensory processing difficulties?

AUTHOR

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Review date	May 2016		

CLINIAL SCENARIO

The Sensory Profile (SP) and Sensory Processing Measure – Home Form (SPM-H) are parent-report tools to assist in identifying patterns of sensory processing status and provide direction for intervention with children, with a variety of diagnoses including Autism Spectrum Disorder and Attention Deficit Hyperactivity Disorder. The SP covers children aged between 3-10years and the SPM-H covers children aged between 5-12years. These tools have similarities and differences. We completed this CAT in order to select the preferred tool for clinical practice based on consideration of psychometric properties and clinical utility.

FOCUSSED CLINICAL QUESTION

Does the SP or SMPH have stronger reliability, validity and clinical utility in identifying children with sensory processing difficulties?

Important note on the limitation of this CAT

This critically appraised paper (or topic) has /has not been peer-reviewed by one other independent person/lecturer

SEARCH STRATEGY

Terms used to guide the search strategy

- **P**atient/Client Group: No terms entered as we were interested in the use of these assessments in any diagnostic group
- **I**ntervention (or Assessment): Separate searches were conducting using the terms: "Sensory Profile" and "Sensory Processing Measure"
- **C**omparison: Not required
- **O**utcome(s): No terms were used in this category due to the specific nature of the search for the two assessments

Databases Searched	Date search completed
CINAHL	June 28 2013
Medline	June 28 2013
Embase	June 28 2013
PsychInfo	June 28 2013

INCLUSION and EXCLUSION CRITERIA

Inclusion Criteria

1. Articles that evaluated any aspects of the reliability, validity or clinical utility of the Sensory Profile (SP) and/or Sensory Processing Measure- Home form (SPM-H)
2. Articles using SP and/or SPM-H to explore sensory patterns in particular diagnostic groups (but not necessarily exploring the psychometric properties of either tool), where information regarding the discriminative ability of either measure is provided.

Exclusion Criteria

1. Articles using the SP or SPM-H in intervention studies or as a tool to identify sensory processing disorders to plan intervention but not exploring the psychometric properties of either tool.
2. Articles exploring psychometric properties of the SP or SPM-H in languages other than English
3. Articles exploring psychometric properties of other forms of either the SP or SPM-H (for example Infants/Toddler forms, teacher/school forms or adolescent/adult forms).

RESULTS OF SEARCH

Ten references were located to include in this CAT. These included the test manuals for each tool which contain the majority of information about psychometric properties, particularly of the SPM-H. Four studies examining the SP and one additional study comparing the convergent validity of the tools were included.

Other articles were identified but not included as they reported the same information about the SP contained in the included studies. Examples were Watling et al. (2001) and Kern et al. (2006). A study by Miller-Kuhaneck and colleagues (2007) was not included as it evaluated the school version rather than Home version of the SPM-H. A study by Kientz and Dunn (1997) was also excluded as it examined an early version of the SP. One article used the SP as an outcome measure (Hall & Case-Smith, 2007). As it was not specifically addressing the sensitivity to change of the SP, the article has been mentioned in the discussion and included in the table comparing features of the SP and SPM-H but a detailed summary and appraisal has not been completed. One article was included that used the Sensory Profile Short form. This was included in the CAT as it was specifically looking at one sense (auditory) and these items are exactly the same in both the Short Sensory Profile and SP forms.

Finally, many studies used the SP to explore sensory processing issues in clinical populations compared with typically developing children. Each of these studies provided support for the discriminative validity of the SP. Only 4 of these studies have been included as exemplars, the remainder have not. These exclude articles compared typically developing children with other rarer conditions such as Duchenne Muscular Dystrophy and Smith-Magenis syndrome.

SUMMARY OF BEST EVIDENCE

Table 1: Description and appraisal of Dunn, W. (1999). *Sensory Profile. User's Manual*. Minneapolis, MN.: NCS Pearson.

NB: The following information is extracted from the user's manual for the Sensory Profile (SP). Dunn, W. (1999)

Assessment investigated:

Sensory Profile (SP)

Objective of the Study:

Description of the development, administration, scoring and interpretation of the SP.

Sample:

The normative sample consisted of 1037 children from the US, 91% were white with a small percentage from other ethnic groups. Ages were 3 to 10 years, girls = 51%, boys = 49%, with data collected from 1993 to 1999. There were 110 to 140 children in each age band. Children were excluded from the normative sample if receiving special education services or were on regular prescription medication.

Methods of the study:

Items for the SP were identified from a review of literature, followed by pilot testing. Then, 155 therapists participated in a study to place items in sensory or behavioural categories, resulting in the current items and groupings.

Normative data were collected by 166 OTs around USA

Results related to psychometric properties:

Internal consistency – Cronbach's alpha for various sections ranged from .47 to .91 - most items possessed adequate to good internal consistency.

Content validity – established as part of test development using literature review, expert review and factor analysis (Dunn, 1999).

Construct validity. Dunn compared aspects of the SP with selected aspects of the School Function Assessment to evaluate convergent and discriminant validity with 16 children in Special Education programmes.

Convergent validity – as hypothesised, selected SP items correlated to expected levels with appropriate SFA items.

Discriminant validity – SP scores of children with ASD (n=32) and ADHD (n=61) were sufficiently different from the normative sample to provide evidence of discriminant validity. That is, children in the clinical samples engaged in the behaviours listed on the Sensory Profile more frequently than the normative sample. For the children with ASD, items that were most different were scattered across all factors on the Sensory Profile, evidence for the pervasive nature of ASD. Items most different for the children with ADHD clustered into particular factors.

Original Authors' conclusions:

Nil

Limitations listed by authors:

Nil

Reviewer Appraisal

The test manual reports detailed and appropriate test development procedures

A large normative sample was used.

The manual provides good evidence for content and construct validity.

Summary/Conclusion

This manual provides useful background to the development, administration and interpretation of the SP.

Table 2: Description and appraisal of Parham, D & Ecker, C. (2007). Sensory Processing Measure Manual. Western Psychological Services, Los Angeles, CA.

Assessment investigated:
Sensory Processing Measure. NB: This information is from the test manual and only information relevant to the Home form is presented.
Objective of the Study:
Describe test development, standardisation, administration, scoring and interpretation.
Sample:
The Sensory Processing Measure Home and School forms were standardized on 1,051 typically developing children in grades K through to Year 6 (5 to 12 years) recruited from "regular" elementary school classrooms in the USA during 2005 and 2006 by 67 SPM-H study coordinators. In addition, a clinical sample of 345 children aged between 5-13years and being treated by an occupational therapist in USA or Canada were recruited. It was not mentioned specifically why the children were being treated by an occupational therapist. Beyond sampling from regular education classroom, no exclusions were made for children with mild academic or behavioural difficulties Distribution of males vs females paralleled US census figures, there was "fairly close" approximation of the sample with respect to ethnic background, geographic distribution and socioeconomic status. Further evaluation concluded that a single set of norms (independent of age, gender, ethnicity or SES) was appropriate.
Methods of the study:
Sensory Processing Measure – Home form (SPM-H) was developed from combining two pre-existing sensory based questionnaires, the "Evaluation of Sensory Processing" and the "School Assessment of Sensory Integration". SPM-H was completed for students in the normative sample twice, 2 weeks apart, to evaluate test retest reliability.
Results:
<i>Test-retest reliability (standardisation sample only, 2 week retest period:</i> Home form – estimates ranged from 0.94 to 0.98 (median = 0.97). It is not reported what test was used. <i>Internal consistency (Cronbach's alpha for 7 scales and total score):</i> Standardisation sample – estimates ranged from 0.77 to 0.95 (median = 0.85) Clinical sample – estimates ranged from 0.78 to 0.94 (median = 0.80) <i>Face and content validity:</i> Items were written to reflect principles of Jean Ayres's sensory integration theory. Both item sets were subject to several rounds of expert review. Items were only retained if they were judged to adequately represent function of the sensory systems, praxis and social participation <i>Structural validity:</i> Each SPM-H scale represents a theoretical construct that is defined by its item content. This was supported by a factor analysis. Other evidence for structural validity: internal consistency of each scale is higher than interscale consistency, most items correlate higher with its own scale than other scales and rating scale structure was sound. <i>Convergent validity:</i> 182 children from the clinical sample also completed the SP to evaluate convergent validity of appropriate SP items with SPM-H items. Stronger correlations were found between items measuring similar content than dissimilar content. <i>Discriminant validity:</i> Scores from the standardisation sample and clinical sample were compared. All scale means were significantly higher in the clinical sample with differences more evident, as expected, in the sensory processing disorders and ASD subgroups of the clinical sample.
Original Authors' conclusions:
Adequate to good internal consistency Excellent test retest reliability.
Limitations listed by authors:

Nil

Reviewer Appraisal

Standard error of measurement is provided for each scale of the SPM-H to assist in accurate interpretation of T-scores.

Statistic used to evaluate test retest reliability not specified.

Strong test development process.

Summary/Conclusion

Test development and psychometric evaluation provides good preliminary evidence for internal consistency, validity and test retest reliability.

Table 3: Description and appraisal of Ermer, J. & Dunn, W. (1997). The Sensory Profile: A discriminant analysis of children with and without disabilities. *American Journal of Occupational Therapy*, 52(4), 283-290.

NB: Some, but not all, aspects of the results of this study are reported in the Sensory Profile user's manual. Dunn, W. (1999)

Assessment investigated:

Sensory Profile (SP)

Objective of the Study:

To investigate the factors of the SP which discriminated between children with Autistic Spectrum Disorder/Pervasive Developmental Disorder, children with Attention Deficit Hyperactivity Disorder and children without disabilities.

Sample:

Data from 769 children were analysed. Data were accessed from a larger database assembled from previous studies of the SP and added to by the first author.

- Children with ASD/PDD: 38 children 3 to 13 years recruited by Kientz and Dunn (1997) from a Child Development Unit in Kansas
- Children with ADHD: 61 children aged 3 to 15 years recruited by Bennett and Dunn (date and reference not provided)
- Children without disabilities: 671 aged 3 to 10 years recruited by Dunn and Westman (1997) in the national standardisation study

Methods of the study:

Sensory Profiles were completed by parents by mail or during clinic visits, depending on the study with which they were involved.

Results:

Discriminant analysis identified that the SP could discriminate:

Children with and without disabilities. Factor 5 – Inattention/Distractibility was a significant discriminator; children without disabilities had relatively few behaviours in this factor.

Children with ASD/PDD from children with ADHD. Factor 1 (Sensory Seeking), Factor 4 (Oral Sensory Sensitivity) and Factor 9 (Fine Motor/Perceptual) were significant discriminators. Specifically, children with ASD/PDD had a high incidence of behaviours in Factors 4, 5, and 9 and low incidence of behaviours in Factor 1. Children with ADHD had a high incidence of behaviours in Factor 1 and low incidence of behaviours in Factors 4 and 9.

On the basis of the discriminating factors, 90% of children were correctly classified into the 3 groups.

Original Authors' conclusions:

The SP has the capacity to discriminate children with disabilities from those without disabilities and also to discriminate between groups of children with disabilities.

Limitations listed by authors:

Convenience samples of children with disabilities from different studies may have introduced bias.

Imbalance of sample size between small numbers of children with disabilities and large sample of children without disabilities.

The variance associated with each group was quite disparate so the results of the discriminant analysis should be cautiously interpreted.

Results regarding the capacity of the SP to discriminate between children with and without disabilities should not be generalised to other groups of children with disabilities.

Reviewer Appraisal

Nil in addition to author-identified limitations

Summary/Conclusion

The capacity to discriminate children with ASD/PDD and ADHD from each other and from children without a

disability is evidence of construct (discriminative) validity. This article supports the use of the SP in clinical practice.

Table 4: Description and appraisal of Dunn, W. & Bennett, D. (2002). Patterns of sensory processing in children with Attention Deficit Hyperactivity Disorder. *The Occupational Therapy Journal of Research*, 22(1): 4-15.

Assessment investigated:

Sensory Profile

Objective of the Study:

To compare the sensory responses (using the Sensory Profile) of children with ADHD and children without disabilities.

Sample:

Children with ADHD, N=70 children, aged 3 to 15 years diagnosed with ADHD (using the DSM-IV criteria) presenting to a community ADHD clinic in Kansas (USA). Half of the children had a second diagnoses (e.g. Oppositional Defiance Disorder, learning disorders).

Children without disabilities, N=70 children, age and sex matched children randomly selected from the national standardisation sample (Dunn & Westman, 1997). These children were not taking medications regularly or receiving special education services.

Methods of the study:

Sensory Profiles (SP) were completed by parents of:

- Children with ADHD during clinic visits
- Children without disabilities by mail

Analysis was by MANOVA with post hoc testing.

Results:

Children with ADHD demonstrated significantly more behaviours than children without disabilities for all 14 sections of the Sensory Profile.

Significant differences existed for 118 of the 125 items. There was >1 raw score point difference between group means (the amount of difference considered meaningful) for 57 of these 118 items. These 57 items were distributed across all 14 sections of the Sensory Profile.

Thirty-four of these 57 items clustered into 4 factors: Factor 1 (Sensory Seeking), Factor 2 (Emotionally Reactive), Factor 5 (Inattention/Distractibility) and Factor 9 (Fine Motor/Perceptual).

Original Authors' conclusions:

The SP discriminates between children with ADHD and those without disabilities and may identify a unique pattern of sensory responses in children with ADHD.

Limitations listed by authors:

Children with ADHD were recruited from a single centre in Kansas whereas matched sample was drawn from a nationally derived sample. It is possible these samples are temporally disparate and that the ADHD group may not to be a representative sample.

Study unable to address any possible effects of medication on sensory processing. At least 74% of children with ADHD in this study were taking medication to manage their ADHD.

Half of the children with ADHD had an additional diagnosis. Although this is typical of ADHD, it is unclear how the additional diagnoses may have influenced sensory responses.

There were few girls in the samples and the data for boys and girls were pooled. Although the proportion of boys to girls is generally much higher in children with ADHD, the clustering of sensory responses may differ for boys and girls.

Reviewer Appraisal

The study covered children up to the age of 15 years, however the SP caregiver questionnaire only covers children aged 3-10years

Summary/Conclusion

The capacity to discriminate children with ADHD from those without a disability is evidence of construct (discriminative) validity. This article supports the use of the SP in clinical practice.

Table 5: Description and appraisal of Brown , T., Leo, M., & Austin, D.W. (2008). Discriminant validity of the Sensory Profile in Australian children with Autism Spectrum Disorder. *Physical and Occupational Therapy in Pediatrics*, 28(3), 253-266.

Assessment investigated:

Sensory Profile

Objective of the Study:

To examine the discriminant validity of the sensory processing category, factor, and quadrant scores of the Sensory Profile (SP) in Australian children aged 5 to 8 years, with and without ASD.

Sample:

ASD: Mothers of 26 children aged 5 to 8 years with ASD – recruited from specialist schools, early intervention programmes and paediatric therapy clinics in Melbourne, Australia. Mean age: 72.1 months (SD=9.1 months), 21 boys, 5 girls.

Matched controls (matched for age and sex): Mothers of 26 children, aged 5 to 8 years, without developmental delay, intellectual or physical impairments, or siblings diagnosed with ASD. Recruited from public schools in Melbourne, Australia. Mean age: 75.1 months (SD=9.4 months), 18 boys, 6 girls (N=24, query matching for sex).

Methods of the study:

Method of completion of SP not mentioned (e.g., mailed or in person).

Separate multivariate analyses of variance (data exhibited univariate and multivariate normality) were used to identify group differences in category, factor and quadrant scores on the Sensory Profile. *P*-value set at <0.017 using Bonferroni's adjustment for multiple comparisons.

Results:

Category scores: Children with ASD scored significantly lower than matched control group on all 14 sensory processing categories.

Factor scores: Children with ASD scored significantly lower than matched control group on 8 of 9 factors. There was no difference between groups on the sensory sensitivity factor.

Quadrant scores: Children with ASD scored significantly lower than matched control group on all four sensory processing quadrants.

Original Authors' conclusions:

Results supported discriminant validity of the SP (ability to discriminate between children with and without ASD). Results support validity of using SP in the Australian context for children with ASD.

Limitations listed by authors:

Sample included children aged 5 to 8 years rather than entire range suitable for the SP (3 to 10 years).

Sample from one geographical region

Small sample size

Inclusion of only one diagnostic group.

Reviewer Appraisal

Criteria for matching of age (i.e., +/- number of months) was not provided. No significant differences were identified for age and sex between groups, however.

Participant numbers given for sex of matched controls indicates sample size of 24 (rather than otherwise noted 26 – in Participants section and tables 1, 2 and 3) and matching for sex was not accurate (e.g., girls: ASD=6, controls=5)

Classification/description of sensory difficulties for each group was not provided nor discussed. It is not possible to ascertain whether the children with ASD in this study had sensory processing difficulties according to the SP, that is, the scores between groups were significantly different, but it is unknown as to whether the children with ASD were in the impaired range.

No discussion as to whether the difference between groups was considered clinically meaningful. Bonferroni adjustment of p -value lends confidence to the conclusions.

Summary/Conclusion

Results indicate, as study authors conclude, that the SP has discriminant validity for children with ASD, and provides some evidence that the SP is appropriate for use with Australian children. Comparison of SP normative values with typically developing children in Australia would add further knowledge to use of SP in Australian children.

Table 6: Description and appraisal of Dunn, W., Smith Myles, B., & Orr, S. (2002). Sensory Processing Issues Associated with Asperger Syndrome: A Preliminary Investigation. *American Journal of Occupational Therapy*, 56(1), 97-102.

Assessment investigated:

Sensory Profile (SP)

Objective of the Study:

To identify the sensory processing patterns of children with Asperger Syndrome compared with children without disability.

Sample:

42 children (39 boys and 3 girls) with Asperger Syndrome aged 8-14yrs (mean age = 11.3yrs). Convenience sample obtained from expression of interest at a large Midwestern university in USA.

42 children without disabilities aged 8-14yrs (mean age = 9.6yrs). Sample randomly selected from the SP standardisation sample developed in 1999. Numbers of boys and girls were not specified.

Methods of the study:

Group comparison to identify any differences in sensory processing between children with and without Asperger Syndrome on the SP.

Results:

Of 23 possible comparisons, 22 were statistically significantly different ($p < 0.5$, confidence intervals not overlapping). Children having Asperger Syndrome performed more poorly than children without disabilities.

No difference between groups on "modulation of visual input affecting emotional responses and activity level"

On examination of factor scores children with Asperger Syndrome experienced difficulty with factors associated with both hypo responsiveness and hyper responsiveness. This pattern suggests that the children in this study with Asperger Syndrome may have poor ability to regulate their responses rather than only one way of responding.

Original Authors' conclusions:

The SP identifies dramatic differences in sensory processing patterns between children with Asperger Syndrome and children without disabilities.

The dramatic difference between the two groups suggest that further study about the nature of sensory processing challenges for children with Asperger Syndrome would be beneficial.

Further studies about the impact of sensory processing difficulties on performance of children with Asperger Syndrome are needed to validate the observations that professionals and families make about children's behaviours and responses during everyday tasks.

Limitations listed by authors:

Study used convenience sample for both the children with Asperger Syndrome and children without disabilities. Study didn't evaluate the impact of sensory processing differences on children's/families' daily routines.

Reviewer Appraisal

Nil in addition to those identified by authors

Summary/Conclusion

The capacity to discriminate children with Asperger Syndrome and children without a disability is further evidence of construct (discriminative) validity.

Table 7: Description and appraisal of Ohl, A., Butler, C., Carney, C., Jarmel, E., Palmieri, M., Pottheiser, D., & Smith, T. (2012). Test-retest reliability of the Sensory Profile Caregiver Questionnaire. *American Journal of Occupational Therapy*, 66, 483-487. (Ohl et al., 2012)

Assessment investigated:

Sensory Profile (SP)

Objective of the Study:

Examine test-retest reliability of section, factor and quadrant scores after 7-14 day retest period. SP has infrequently been used as an outcome measure possibly because test stability is unknown.

Compare internal consistency with that documented as part of test development/normative sample.

Sample:

Fifty-five primary caregivers of children aged 3year to 6years (mean = 49months, SD=6.5) recruited from nursery schools and child care centres in New York metropolitan area. No diagnoses were identified in the article.

Methods of the study:

Two SP questionnaires were sent home to participants from the recruitment sites. Caregivers were invited to participate and complete questionnaires 7 to 14 days apart and return to recruitment site.

Results:

Test retest reliability – using intraclass correlational coefficients.

Quadrants: ICCs ranged from 0.80 to 0.90 (good)

Factors: ICCs ranged from 0.69 to 0.88 (moderate to good)

Sections: ICC ranged from 0.50 to 0.87 (moderate to good)

Lowest, but still moderate test retest reliability for:

- Visual processing section
- Auditory processing section
- Sedentary factor

Internal consistency – using Cronbach’s alpha α coefficients.

Quadrants: α ranged from 0.89 to 0.95 (high)

Factors: α ranged from 0.82 to 0.93 (high)

Sections: α ranged from 0.67 to 0.93 (moderate to high)

Original Authors’ conclusions:

Quadrant scores capture sensory processing more consistently than factor or section scores.

Internal consistency was higher in this study than in normative sample possibly as this sample was smaller and in a narrower age range.

Test retest reliability results give some confidence that changes following intervention are more likely to be a result of intervention than of measurement error.

Limitations listed by authors:

Small sample size from a geographically convenient area, therefore unlikely to be representative.

Sample demographics unknown except for age.

Reviewer Appraisal

Nil, other than those identified by authors.

Summary/Conclusion

First study of the test retest reliability of the SP providing preliminary evidence that quadrant scores, in particular, may allow responsible use of the SP as an outcome measure.

Further work is required, using larger more representative samples, samples in other countries and clinical samples in addition to samples of typically developing children.

Table 8: Description and appraisal of Brown, T., Morrison, I. C., & Stagnitti, K. (2010). The convergent validity of two sensory processing scales used with school-age children: Comparing the Sensory Profile and the Sensory Processing Measure. *New Zealand Journal of Occupational Therapy*, 57(2), 56-65.

Assessments investigated:

Sensory Profile and Sensory Processing Measure – Home (SPM-H).

NB: This is the only study located which evaluates the SPM-H apart from the test manual.

Objective of the Study:

To investigate the convergent validity of:

- i) Sensory Profile (SP) and Sensory Processing Measure – Home (SPM-H)
- ii) Sensory Profile School Companion and Sensory Processing Measure – Main Classroom
- iii) Mothers and teachers ratings of the respective assessments. No statistical analyses were presented for this objective.

To demonstrate convergent validity, an aspect of construct validity, assessments of similar theoretical constructs should be highly correlated

NB: Only information regarding point i) the topics of interest in this CAT, will be summarised.

Sample:

Two groups of participants were recruited via convenience sampling in local school districts in Victoria, Australia.

- i) Mothers of typically developing children (without known or suspected sensory processing problems) aged 5 to 10 years, n=30.
- ii) Teachers of the same group of children (to enable comparison of home and school versions), n=19.

Children were 47% boys and 53% girls, reasonably spread over ages 5 to 9 years (n=4-7 in each year group), but only 2 children were 10 years.

Methods of the study:

Consenting mothers and teachers were posted questionnaires for completion.

Spearman's rho correlation coefficients were used to examine relationship between the scales, as the data elicited were ordinal level. Correlation coefficients between 0.4 and 0.8 were considered to indicate adequate correlation.

Results:

Convergent validity of the SP and SPM-H.

Total scores correlated strongly – rho= 0.86 (P<0.01).

The total score of both the SP and SPM-H correlated at ≥ 0.4 with each item of both measures.

Eighty-percent of correlations between the 14 items of the SP and 8 items of the SPM-H correlated ≥ 0.4 .

Scales with fewer numbers of correlations were SPM-H – Social participation, Hearing, Taste and Smell, Balance and Motion.

Original Authors' conclusions:

The SP and SPM-H were moderately correlated, suggesting that the scales are measuring comparable sensory processing constructs.

Further research is required using larger, more culturally diverse and clinical populations.

Limitations listed by authors:

Small sample size

Sample included solely typically developing children

Convenience sample potentially biasing sensory status of children

Both assessments normed in USA

Reviewer Appraisal

Sample consisted of typically developing children only, so caution would need to be exercised in generalising the findings to clinical samples. Furthermore, inclusion of typically developing children precluded the capacity to classify children according to normative data as to the degree of sensory difficulties and compare classifications between assessments.

Summary/Conclusion

This study provides preliminary evidence for the equivalency of the SP and SPM-H in typically developing children without sensory processing difficulties.

Table 9: Description and appraisal of Hansen, K. and Jirikowic, T. (2012) A Comparison of the Sensory Profile and Sensory Processing Measure Home Form for Children with Fetal Alcohol Spectrum Disorders. Physical and Occupational Therapy in Paediatrics, Early Online, 1-13, 2013.

Assessments investigated:

Short Sensory Profile (SSP) and Sensory Processing Measure – Home (SPM-H).

Objective of the Study:

- Exploratory study to describe the performance of children with Fetal Alcohol Spectrum Disorder (FASD) compared with typically developing children without FASD.
- To determine if the scores differed between the SPM-H and SSP for each group.
- Explore the concurrent validity of the two measures.

Sample:

Children aged between 5-11years
 11 children FASD from database registry through University of Washington Fetal Alcohol Syndrome Diagnostic and Prevention Network
 12 children typically developing - convenience sample recruited through a university research participant pool & word of mouth

Methods of the study:

Descriptive substudy completed with data collected from a pilot study exploring sensory processing and physiological stress reactivity in children with FASD.

Primary caregiver completed SSP and SPM-H home form in university laboratory prior to child’s participation in a laboratory study. (Assessments were part of larger assessment investigating sensory processing and physiological stress reactivity).

Data was analysed using SPSS (version 19.0).

Chi-squares were used to examine group differences on socio-demographic variables.

Percent agreement was calculated to compare classification categories for outcomes on the SSP and SPM-H Home Form total scores.

Pearson product correlation coefficient was used to examine relationship between SSP and SPM-H Home Form total scores.

Results:

On SSP

- For total score on SSP 81.8% children with FASD classified in “definite difference” category
- 63.6-90.0% children FASD scored “probable difference” or “definite difference” for tactile sensitivity, under responsive/seeks attention, auditory filtering and visual/auditory sensitivity
- 54.5-63.6% children FASD scored “typical” category for Taste Smell and Movement and Low Energy/Weak

On SPM-H Home Form

- Total score 18.2% children FASD scored “definite dysfunction” and 63.6% scored “some problems”
- More than 50% children FASD categorised as having “some problems” or “definite dysfunction” in every scale exception Balance and Motion
- 63.6% children FASD scored “typical” category for Balance and Motion and no children scored in “definite dysfunction”
- 54.5% children FASD scored “definite dysfunction” for Planning and only one child scored “typical”
- No children FASD scored in the typical category for Touch sensory system scale

Typically developing (TD) children

- All total scores classified in the “typical” category on both measures
- SSP only one child scored in “definite difference” for Visual and Auditory Sensitivity

- On SPM-H Home Form none classified in "definite dysfunction" for any category.
- Only one child was classified as "some problems" for the Vision and Touch scales

Agreement between Classifications on SSP and SPM-H Home Form

- Children FASD percent agreement between classifications on total scores was 36.6%
- TD Children percent agreement between classifications on total scores was 100%
- Combining children who scored in "probable/some difference" with "definite difference" and comparing those with "typical" scores these were analysed and then divided into 2 categories typical or clinical (children with any difference in sensory processing). Using these categories the percent agreement between SSP and SPM-H Home Form for children FASD was 90.9%
- Relationship between total raw scores on SSP and total T-score on SPM-H Home Form for total sample (23 children) was explored using Pearson product moment correlation. Results indicating there was a strong negative correlation between the performance on SSP and SPM-H Home Form

Original Authors' conclusions:

- Both measures assess similar sensory processing behaviours
- Both measures discriminate between children without sensory processing difficulties and children with neurodevelopmental disorders who have sensory processing difficulties
- Section and scale scores for each measure provided different clinical information that was specific to inform intervention or further assessment for children with FASD
- SPM-H gives unique information regarding body awareness and motor planning that is not assessed in SSP
- Findings contribute to evidence of concurrent validity between the SSP and SPM-H Home Form
- Both measures identify children with FASD who may have sensory processing difficulties
- SSP may be more sensitive screen for identifying sensory seeking behaviours in children with FASD
- SPM-H may better identify praxis difficulties
- Follow up using SP after the SSP has identified particular tendencies (e.g. sensory seeking behaviours) is recommended

Limitations listed by authors:

- Small sample size limits generalisation of findings for children who are typically developing and those children with FASD
- Discrepancy in classification of severity of sensory processing problems among children with FASD (and other developmental difficulties) should be considered
- Only investigated parent reported behaviours. Children's behaviours in school not assessed or reported.

Reviewer Appraisal

Summary/Conclusion

Both SSP and SPM-H are able to identify sensory processing difficulties in children with Fetal Alcohol Spectrum Disorder.

SSP is more sensitive in screening sensory seeking behaviours and the SPM-H is more sensitive in screening for difficulties with praxis in children with FASD.

The findings of the research are further evidence of concurrent validity between the SSP and SPM-H Home Form.

Table 10: Description and appraisal of Chang, M.C., Parham, D., Blanche, E. I., Schell, A., Chou, C., Dawson, M., Clark, C. (2012). Autonomic and Behavioural responses of children with autism to auditory stimuli. *American Journal of Occupational Therapy*, 66, 567-576.

Assessments investigated:

Sensory Processing Measure Home Form(SPM-H)

Objective of the Study:

Whether children with Autism Spectrum Disorder (ASD) and children without ASD differ in autonomic activity at rest and in response to auditory information.

Whether behavioural problems related to sounds in everyday life are associated with autonomic responses to auditory stimuli.

Sample:

- 25 children with ASD aged 5-12years
- 25 typically developing (TD) children aged 5-12years

Methods of the study:

- Case control research design comparing children with ASD and TD children
- Measured skin conductance (SC) at rest
- Measured skin conductance after auditory stimuli
- Measured behavioural responses using SPM-H Home Form
- Data collected for each child in one visit in the laboratory
- Parents completed SPM-H Home Form whilst the child had skin conductance

Results:

- Both of the tonic SC measures differed significantly between study groups
- ASD group demonstrated significantly higher SC at baseline and recovery compared with TD group
- ASD group demonstrated higher amplitude than TD group
- Girls tended to have higher SC values than boys but T tests indicated no significant gender differences within the TD group
- Number of girls in ASD group was too small to measure gender differences
- No significant age study group interaction was found however younger children tended to have higher SC and more reactive than older children
- For same age groups ASD children showed higher SC and SCRs than TD children
- Ethnicity was significantly unbalanced – more white than Asian children in ASD group and the inverse for TD group
- No significant main effect or interaction effect on SC for ethnicity
- Correlation of under responsiveness subscale with SCR magnitude was significant in children with ASD. These behaviours reflecting under responsiveness were associated with higher sympathetic responses to the tone in the lab
- Children with ASD who have strong sympathetic reactivity may demonstrate under responsive as well as over responsive behaviours and reflecting general dysregulation in sensory modulation processes
- Children in TD group all had “typical” SPM-H scores
- 88% Children in ASD group had at least 1 standard deviation below normative mean on Hearing Scale of SPM-H
- 96% ASD group fell above 1 standard deviation on the total scale score of SPM-H

Original Authors’ conclusions:

- Study showed that children with ASD who demonstrate strong behavioural over reactivity to sound on SPM-H are likely to have high sympathetic reactivity to sound
- Children with ASD who demonstrated general sensory processing difficulties as measured by SPM-H may have elevated sympathetic activation at rest and strong sympathetic reactivity
- Children who demonstrate both behavioural under and over responsiveness to sounds in everyday life may present strong sympathetic reactivity to sound
- Implications/considerations for treating occupational therapists include addressing modifications of daily routines and environments, self-regulation strategies, facilitate development of sensory modulation and self-regulation across multiple sensory systems, to create predictable daily environments and routines, plan for anticipated changes in routine.
- OTs should carefully assess the context, situation and types of stimuli involved when sensory questionnaire items indicate that children are both under and over reactive to auditory stimuli

Limitations listed by authors:

- 80% of the children with ASD were receiving OT therefore a possibility of clinical bias
- The children with ASD who were over reactive to auditory stimuli tended to be selectively referred to OT's within the geographical area in which the study was conducted
- It's possible that the parents who volunteered to participate in this kind of study are more likely to have children with over-responsive behaviours.
- Group imbalances in gender, age and ethnicity

Reviewer Appraisal

Summary/Conclusion

Findings indicate the discriminative ability of the SPM-H.
 SPM-H can be used to identify difficulties in processing auditory information in children with ASD.
 SPM-H identifies more over responsive behaviours than under responsive behaviours.
 SPM-H can be used to identify general difficulties in processing sensory input in children with ASD.

COMPARISON TABLE OF ASSESSMENTS

	Sensory Profile	Sensory Processing Measure
Purpose	<ul style="list-style-type: none"> Measures sensory processing and effect on daily function 	<ul style="list-style-type: none"> Social participation, praxis and sensory processing
Uses	<ul style="list-style-type: none"> Diagnostic Treatment Planning 	<ul style="list-style-type: none"> Diagnostic Treatment Planning
Ages	3-10 years	5-12 years
Clinical Utility		
Time to administer	30 mins	15-20 mins
Time to score	20-30 mins	10-15 mins
Cost	\$450	\$325
Ease of use, scoring and interpretation	<ul style="list-style-type: none"> Easy to use for therapists and parents Scoring is simple however time consuming Interpretation is time consuming and requires specialised knowledge and experience with regards to sensory processing Scoring complex and takes longer than SPM-H. 	<ul style="list-style-type: none"> Easy to use for therapists and parents Scoring is simple Interpretation somewhat time consuming and requires specialised knowledge and experience with regards to sensory processing
Domains/Sections	<ul style="list-style-type: none"> 125 items 3 sections – i) Sensory processing, ii) Modulation, iii) Behavioural and Emotional Responses. Further division of sections into 14 subscales Frequency of behaviours are rated 	<ul style="list-style-type: none"> 75 items 7 sections/subscales Frequency of behaviours are rated
Covers domains of interest	Yes, with the exception of quality of movement during motor tasks and components of praxis	Yes, with the exception of oral processing and feeding based differences
Scores generated	Each of 14 scales and total score, 9 factors, 4 quadrant scores	Each of 7 scales and total score
Normative sample – size, country, year of data collection	<ul style="list-style-type: none"> 1037 children in North America, Typically developing children with no disabilities identified Aged 3-10 years 	<ul style="list-style-type: none"> 1051 children across USA Typically developing children Aged 5-12 years
Reliability		
Interrater	No evidence	No evidence
Intrarater	No evidence	No evidence
Test retest	Seven to 14 day retest period in typically developing children: ICCs: Quadrants: 0.80 to 0.90 (good) Factors: 0.69 to 0.88 (moderate to good) Sections: 0.50 to 0.87 (moderate to good) (Ohl et al., 2012)	Two-week retest period: estimates ranged from 0.94 to 0.98 (median = 0.97) (Parham 2007)
Validity		
Internal consistency	<ul style="list-style-type: none"> Cronbach's alpha ranged from .47 to .91- most items represent adequate to good internal consistency (Dunn 1999) Cronbach's alpha (Ohl et al., 2012) Quadrants: 0.89 to 0.95 (high) Factors: 0.82 to 0.93 (high) Sections: 0.67 to 0.93 (moderate to high) 	<ul style="list-style-type: none"> Estimates ranged from 0.77 to 0.95 for standardisation and clinical samples. Supported by appropriate correlations between and within scales, and sound rating scale structure (Parham & Ecker, 2007)
Content	Sound, based on test development process (Dunn 1999)	Sound, based on test development process
Construct validity - Convergent	<ul style="list-style-type: none"> Adequate convergent validity with School Function Assessment (Dunn, 1999) Adequate convergent validity with SPMH in typically developing children (Brown et al., 2010) 	<ul style="list-style-type: none"> Adequate convergent validity with SP in typically developing children (Brown et al., 2010, Parham 2007)
Construct validity - Discriminant	<ul style="list-style-type: none"> Adequately discriminated between children without disability and children with Asperger Syndrome, ASD and ADHD in USA (Dunn, 1999, 2002; Ermer & Dunn, 1997; dunn and Bennett, 2002; Dunn et al., 2002) Adequately discriminated between children without disability and 	<ul style="list-style-type: none"> Discriminates between standardisation and clinical samples (Parham & Ecker, 2007)

	children with ASD in Australia (Brown et al., 2008)	
Sensitivity to change	One study reported a statistically significant increase in SP total score after 12 weeks of intervention (mean increase approx. 71 points), suggesting the SP may be responsive to intervention (Hall & Case-Smith, 2007)	

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

The purpose of this CAT was to investigate whether the Sensory Profile (SP) or the Sensory Processing Measure - Home Form (SPM-H) has stronger reliability, validity and clinical utility in identifying children with sensory processing difficulties. We reviewed, examined and summarised 10 articles in total and reviewed both the manuals for each tool. Interpretation has been made following consideration of the information presented in all articles reviewed.

There were other articles located and reviewed which replicated the knowledge gained from articles included in the review which support the discriminative validity for the SP in children who have a diagnosis of ASD, Asperger's Syndrome and Fragile X.

The test manual for the Sensory Processing Measure outlines tool development and psychometric evaluation which provides good preliminary evidence for internal consistency, validity and test-retest reliability. Findings indicate that the SPM-H has good discriminative ability and can be used to:

- identify difficulties in processing auditory information in children with Autistic Spectrum Disorder
- identify general difficulties in processing sensory information (tactile, auditory, movement) in typically developing children and children with Autistic Spectrum Disorders and Fetal Alcohol Spectrum Disorder

It was found that the SPM-H:

- identifies more over responsive behaviours than under responsive behaviours
- is sensitive in screening children for difficulties with praxis, planning and organisational skills

The test manual for the Sensory Profile reports detailed and appropriate test development procedures from a large normative sample. It provides good evidence for content and construct validity and useful background to the development, administration and interpretation of the SP. Findings indicate that the SP has good discriminative ability and can be used to:

- Identify difficulties in sensory processing for children with ASD, and provides some evidence that the SP is appropriate for use with Australian children
- Identify difficulties with sensory processing in children with ASD and ADHD
- Discriminate between children with ASD and children with ADHD
- Discriminate between children with a disability and those without

It was found that the SP also has:

- The capacity to discriminate children with ADHD from those without a disability providing evidence of construct (discriminative) validity
- The capacity to discriminate children with Asperger Syndrome and children without a disability providing further evidence of construct (discriminative) validity
- The ability to identify difficulties in sensory processing for children with Fetal Alcohol Spectrum Disorders
- Greater sensitivity in screening sensory seeking behaviours
- Greater sensitivity in identifying difficulties with overall modulation to sensory input

The SP, first published in 1999, has been used extensively in research to identify difficulties with sensory processing in children. Comparatively fewer research articles have utilised the Sensory Processing Measure, published more recently in 2007. Both assessment tools identify a sensory processing difficulty in children with an existing sensory processing disability or any disability and those without. There is good concurrent validity between the SPM-H and the SP and there is preliminary evidence for the equivalency of the SP and SPM-H in typically developing children without sensory processing difficulties. Both the SPM-H and SP have acceptable test retest reliability. Test-retest reliability of the SP in typically developing children is acceptable. Test retest reliability results from the SP give some confidence that changes following intervention are more likely to be a result of intervention than of measurement error. There is evidence that supports use of the SP quadrant scores over factor and section scores to analyse children's sensory processing patterns.

The SP and SPM-H both assess the child's ability to process sensory information in terms of smell, touch, movement, vision and sound, however each assessment focuses on slightly differing aspects/components of sensory processing. The SP investigates the behavioural component to sensory processing and behavioural reactions with regards to multisensory processing, whereas the SPM-H focuses on identification of difficulties with processing separately. The SP is useful in identifying children with feeding difficulties and specifically identifying whether those difficulties have a sensory component. The SPM-H is useful in identifying children who experience difficulties with praxis, motor planning and organisation. It separates components of gross motor skills into greater detail e.g. separating balance skills from body awareness. The SP does not assess praxis and gross motor skills, it focuses more on assessment of movement through the vestibular system.

The majority of the literature reviewed accessed convenience samples which were generally poorly described.

Neither tool was developed for use as an outcome measure, however there is one instance of the Sensory Profile being used as such. The conclusion of the authors was that the SP has potential to be used as an outcome measure when children are using a therapeutic listening program and sensory diet over a period of 8 weeks. It was not included in the reviewed articles for this CAT as it **added little** to the topic's question.

Both assessment tools have acceptable reliability, validity and clinical utility in identifying whether children have difficulties with processing sensory information. Both have good discriminate ability in identifying children who have difficulties with sensory processing and without disability. The SP and the SPM-H assess slightly different components of sensory processing **although** were moderately correlated, suggesting that the scales are measuring comparable sensory processing constructs. Further research is required using larger, more culturally diverse **and clinical** populations. Ultimately it is thought that the decision to use either tool should be evaluated by the individual clinician based on time available, accessibility of the tools and the clinical reason for the assessment of the child.

None of the studies addressed the ease or difficulty of parent completion of questionnaires for those with English as a second language or poorer literacy levels. This is a frequent clinical observation by practicing occupational therapists.

Clinical recommendations/considerations

All articles supported the use of both tools in clinical practice. From the articles reviewed and clinical use of the assessment tools the choice of whether to use the Sensory Profile or Sensory Processing Measure should be made based on accessibility to the tool, experience of the clinician using the tool and clinical reasoning behind the need to assess a child's sensory processing abilities.

In terms of length of time to administer, the Sensory Profile takes much longer to administer and score. The anecdotal evidence suggests interpretation of the information given in the SP is more complex and requires greater clinical knowledge to interpret. Particularly as following on from interpreting the information gained from the SP the clinician then transfers the information into quadrant scores. The SP looks at the separate areas of sensory processing separately in terms of how a child reacts to each type of stimuli. It then combines how a child processes information into behavioural reactions in the later part of the questionnaire. This requires further clinical knowledge and reasoning of the clinician in order to be able to effectively use this information to inform assessment and intervention. If the clinician is short on time and requires a tool to quickly identify if sensory processing is an issue, it would be quicker to administer and interpret a child's sensory processing using the SPM-H.

If the child who requires assessment is reported to have functional difficulties within the area of planning and organisational skills, it would be more effective to use the SPM-H. If the child has reported difficulties with mealtimes and feeding, then the SP would be a more appropriate tool.

The literature reviewed did not provide definitive conclusive answers to the clinical question of this CAT. Evidence for the use of both the SP and SPM-H in clinical practice is supported. Although both assess sensory processing difficulties it is clear from the literature each tool has varied clinical applications.

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