Published in final edited form as:
Am J Occup Ther. 2011 ; 65(2): 207–210.

Psychometric Validation of the Sensory Experiences Questionnaire

Lauren M. Little, MS, OTR/L[Graduate Student],
School of Allied Health Sciences, Division of Occupational Science and Occupational Therapy, University of North Carolina at Chapel Hill, CB 7122 Bondurant Hall, Chapel Hill, NC 27599-7120

Ashley C. Freuler, MS[Graduate Student],
School of Allied Health Sciences, Division of Occupational Science and Occupational Therapy, University of North Carolina at Chapel Hill

Marisa B. Houser, MS, OTR/L[Occupational Therapist],
Children's Hospital of The King's Daughters, Norfolk, VA

Lisa Guckian, MS, OTR[Director],
Alumni Affairs, Teach for America, Charlotte, NC

Kristin Carbine, MS, OTR/L[Occupational Therapist],
Constellation School Based Therapy, Norwalk, CT

Fabian J. David, MS, PT[Graduate Student], and
College of Applied Health Sciences, Department of Kinesiology and Nutrition, University of Illinois at Chicago

Grace T. Baranek, PhD, OTR/L, FAOTA[Professor and Associate Chair for Research]
Department of Allied Health Sciences, Division of Occupational Science and Occupational Therapy, University of North Carolina at Chapel Hill

Lauren M. Little: littlel@med.unc.edu

Abstract

INTRODUCTION—We evaluated the psychometric properties of the Sensory Experiences Questionnaire (Version 1; Baranek, David, Poe, Stone, & Watson 2006), a brief caregiver questionnaire for young children with autismand developmental delays used to identify sensory processing patterns in the context of daily activities.

METHOD—Caregiver questionnaires (N = 358) were analyzed to determine internal consistency. The test–retest subsample (n = 24) completed two assessments within 2–4 wk. Internal consistency and test–retest reliability were analyzed using Cronbach's coefficient α and intraclass correlation coefficients, respectively.

RESULTS—Internal consistency for the SEQ was α = .80. Test–retest reliability for the total score was excellent, with ICC = .92.

DISCUSSION—The SEQ is an internally consistent and reliable caregiver report measure of young children's sensory processing patterns of hypo- and hyperresponsiveness. The SEQ can be used as an early tool for identifying sensory patterns in young children with autism and other developmental disabilities.

Keywords

autistic disorder; developmental disabilities; psychometrics; questionnaires; sensation disorders

In addition to the three core areas of deficit among children with autism (communication; social interaction; and restricted, repetitive behavior; American Psychiatric Association, 1994), associated features of autism have been found to include unique sensory features. Current research has focused on characterizing sensory processing deficits in young children with autism (Baranek, David, Poe, Stone, & Watson, 2006; Ben-Sasson et al., 2008; Iarocci & McDonald, 2006; Rogers, Hepburn, & Wehner, 2003; Tomchek & Dunn, 2007). Research has shown that young children with autism have higher rates of sensory processing problems than both typically developing children (Kientz & Dunn, 1997; Watling, Deitz, & White, 2001) and children with other developmental disabilities (DD; Baranek et al., 2006; Rogers et al., 2003).

Unusual patterns of sensory processing have been found to be prevalent, although not universal, among young children with autism; patterns of sensory processing are commonly reported in terms of hyper- and hyporesponsiveness (Baranek, 2002). *Hyperresponsiveness* refers to an exaggerated or aversive response to sensory stimuli (e.g., a child refuses to try new foods or dislikes certain textures). *Hyporesponsiveness* refers to the absence of or a diminished response to sensory stimuli (e.g., a lack of response when his or her name is called or lack of a reaction to pain). Baranek et al. (2006) found that although hyperresponsiveness was common in both autism and DD groups, a pattern of hyporesponsiveness in social and nonsocial contexts was more characteristic in children with autism. Mixed patterns of both hyper- and hyporesponsiveness were evident in 39% of the sample. Ben-Sasson and colleagues (2007) investigated sensory modulation in toddlers and confirmed that the most prevalent pattern among these children was hyporesponsiveness.

Although hyporesponsiveness may be more characteristic of autism, studies have shown that caregivers are more likely to attribute problems in performance and participation to hyperresponsiveness (e.g., Dickie, Baranek, Schultz, Watson, & McComish, 2009); thus, both sensory patterns should be considered in assessment and intervention.

An evaluation of sensory processing may be an important component of a comprehensive occupational therapy assessment, especially in a diagnostic clinic. Caregiver reports of autistic features among young children are invaluable in this assessment process, because they provide perceptions of the child's behavior over time and contexts (Stone & Hogan, 1993). Occupational therapists commonly use caregiver interviews or questionnaires, in addition to clinical observations, to describe a child's sensory profile. The Sensory Profile (Kientz & Dunn, 1997) consists of a series of questions concerning the child's sensory experiences in natural contexts. Such reports also allow caregivers an opportunity to share information regarding the meaning of sensory experiences for their nonverbal children (Dickie et al., 2009).

Few sensory processing assessment tools exist specifically for very young children with autism. Sensory processing questionnaires used in research with children with autism include the Sensory Processing Measure (SPM; Parham & Ecker, 2007), formerly known as the Evaluation of Sensory Processing (Johnson-Ecker & Parham, 2000), Sensory Sensitivity Questionnaire–Revised (Talay-Ongan & Wood, 2000), and the Sensory Profile (Dunn, 1999). The Sensory Sensitivity Questionnaire–Revised (Talay-Ongan & Wood, 2000) was designed to tap sensory features in autism specifically; however, it was designed primarily for a school-age population. Although each of these tools addresses elements of sensory processing, an evaluation tool that measures the full range of sensory processing problems specific to autism in both social and nonsocial contexts and that can be used with a wider age range is needed. The Sensory Experiences Questionnaire (SEQ) was designed

specifically for this purpose and demonstrated excellent reliability and discriminative validity in a previous study of young children with autism (Baranek et al., 2006).

The purpose of the current study was to further investigate the psychometric properties of the SEQ. Specifically, we aimed to examine the internal consistency of the SEQ with a larger, more inclusive sample and item-level statistics. In addition, we sought to establish the test–retest reliability of the SEQ at the scale, subscale, and item levels.

Method

Description of the SEQ

The SEQ (Version 1) is a brief (10–15 min) caregiver report instrument designed to evaluate sensory processing problems in young children (ages 5–72 mo) with autism and related DD. The SEQ is designed to be used as a supplement to diagnostic developmental assessments. The SEQ measures hyper- and hyporesponsive patterns across social and nonsocial contexts; it yields four-dimensional subscale scores as well as a total score. The items reflect five sensory domains (Tactile, Auditory, Visual, Vestibular–Proprioceptive, and Gustatory–Olfactory). Caregiver responses are based on a 5-point Likert scale, ranging from 1 (*almost never*) to 5 (*almost always.*) Higher scores are indicative of more sensory processing problems. In addition to the quantitative responses of child behaviors, the questionnaire includes qualitative questions regarding parent compensatory strategies used in response to the sensory processing problems experienced by the child.

Participants

Participants were parents of children ages 6–72 mo belonging to one of three groups: (1) children with autism, (2) children with developmental delay, or (3) typically developing children. SEQ data were collected using convenience sampling methods and as part of a larger grant-funded study. Participants were recruited through the distribution of a letter and SEQ form to caregivers by a designated contact person at preschools, early intervention programs, day care centers, or diagnostic and evaluation centers throughout rural and metropolitan areas in North Carolina, as well as through a university-based research registry. All caregivers gave written informed consent as approved by the Institutional Review Board. The final internal consistency sample consisted of 358 participants who filled out the SEQ. The test–retest reliability subsample consisted of 24 caregivers, each of whom completed a second questionnaire within 2–4 wk of the first questionnaire. Table 1 provides demographic data on each sample.

Children included in the autism group had been diagnosed with an autism spectrum disorder (i.e., autistic disorder; pervasive developmental disorder, not otherwise specified; Asperger disorder). The DD group consisted of children with diagnosed DD associated with intellectual disability (e.g., Down syndrome) as well as other developmental delays of nonspecific origin (e.g., physical impairment, speech–language disorder) but excluded children with conditions that are often comorbid with autism, such as fragile X syndrome, so as to not conflate groups for the purposes of the larger grant-funded study. The typically developing group consisted of children without a diagnosis of DD and not receiving special services (e.g., occupational therapy, speech therapy, physical therapy). Exclusionary criteria for all groups included children with significant visual or hearing impairments and children receiving psychotropic medications.

Data Analysis

Internal consistency was evaluated at the scale, subscale, and item levels using Cronbach's coefficient α. Test–retest reliability was analyzed using intraclass correlation coefficients

(ICCs; Shrout & Fleiss, 1979) at the scale, subscale, and item levels using a two-way random effects model with a 95% confidence interval. When using a small sample size, ICCs are considered appropriate for ordinal data when unendorsed categories are present (Maclure & Willet, 1987). ICCs ranging from .4 to .6 were considered fair, those >.6 were considered good, and those >.75 were considered excellent (Fleiss, 1986). All data were analyzed using Statistical Package for the Social Sciences Version 16.0 (SPSS, Inc., Chicago).

Results

Table 2 shows the scale reliability as well as the SEQ internal consistency and test–retest reliability of the total score and subscale scores. The overall internal consistency of the SEQ yielded α = .80. Subscale reliability in the internal consistency sample ranged from α= .64 to α= .74. In addition, the contribution of each item to the scale's internal consistency was evaluated, yielding (α if item deleted) coefficients ranging from .79 to .80 (Table 3).

The test–retest reliability of the SEQ was ICC = .92. The test–retest subscale scores ranged from ICC = .68 to ICC = .86. Although most items were very high on test–retest reliability, three items in the nonsocial subscale were below the acceptable range: (1) avoids textures, (2) ignores loud noises, and (3) smells objects. Analysis of the response distributions of these items revealed limited variability (i.e., items were seldom endorsed) in this small sample. Including all items that met reasonable cut-off for reliability, the item reliability ranged from ICC = .63 to ICC = .99.

Discussion

This study examined the psychometric properties of the SEQ Version 1.0 through an evaluation of the internal consistency and test–retest reliability at the item, subscale, and scale level. Internal consistency and test–retest analysis of the SEQ total score revealed excellent psychometric indexes (α = .80, ICC = .92), suggesting that the tool reliably captures young children's sensory processing patterns. Individual subscales of the SEQ revealed good test–retest reliability (.68–.86), although individual items within the non-social subscale may have weakened overall scale reliability. The current results confirm excellent internal consistency and extend previous findings (Baranek et al., 2006) using a larger, more diverse sample. Item-level analyses suggested retention of most items, although three individual items may require revision or reexamination with larger samples. Although the subscales may be used separately to characterize sensory processing patterns, the total score provides the most reliable estimate of level of sensory features.

The SEQ's test–retest reliability of individual items varied from fair to excellent, suggesting that certain behaviors may be observed or conceptualized differently by the same caregiver over time or perhaps in different contexts. For example, caregivers consistently reported the rate at which children showed distress during grooming (ICC = .99); however, the reliability of parent report regarding frequency of smelling objects (ICC = .25) was weak. Thus, parents may be apt to reliably report sensory experiences that are more frequent, more intense, or particularly disruptive to daily activities. Test–retest reliability of the SEQ total score was excellent, supporting the tool's ability to measure stability in scores over a relatively short period of time.

Implications for Practice

The SEQ offers researchers and clinicians a quick and reliable parent-report tool to identify sensory processing patterns in children with autism and related DD between the ages of 6

and 72 mo. The SEQ's subscales capture a representation of a child's hypo- and hyperresponsiveness in both social and nonsocial contexts that may be useful for assessment or intervention planning. The unique conceptual model of this tool may be particularly important for children with autism, whose core deficits in social communication are likely to interact with their sensory experiences. Thus, demands for processing sensory information may differ considerably in social and nonsocial contexts, and practitioners may use this tool to measure such aspects separately and reliably with the SEQ subscale scores.

The SEQ may also be useful as a supplement to conventional developmental or diagnostic testing that does not traditionally tap sensory processing constructs. The brevity of this parent-report instrument is convenient for such settings. The test–retest reliability of the SEQ allows confidence that the scores are stable over time; thus, it provides practitioners with more confidence that change detected as a result of maturation or intervention may be less likely attributable to measurement error.

Limitations and Future Research

Future research is needed to further validate the psychometric properties of the SEQ. Although a large sample was used to test the internal consistency of the SEQ, the small sample size used for test–retest reliability was a limitation, and future research with a larger sample is needed. Revisions of the SEQ will need to consider eliminating items that are less reliable, as well as adding new items to subscales that have few items and are thus less internally consistent. Testing the factor structure, developing item sets for different age groups, and establishing the SEQ's sensitivity to change as a result of maturation or intervention are among future directions.

Acknowledgments

We thank the families who participated in this study. This research was funded by NICHD–HD042168. Preliminary analyses were reported at the Gatlinburg Conference on Research and Theory in Intellectual and Developmental Disabilities in 2009.

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Table 1

Demographic Information

Characteristics	Internal Consistency Sample (*n* = 358) *n %*	Test–Retest Sample (*n* = 24) *n %*
Male	244 (68.2)	16 (66.7)
Group		
Autism	109 (30.4)	7 (29.2)
Developmental disabilities	83 (23.2)	7 (29.2)
Typical	163 (46.0)	10 (41.2)
Race–ethnicity		
White	217 (60.6)	15 (62.5)
African-American	34 (9.5)	7 (29.2)
Hispanic	9 (2.5)	1 (4.2)
Other/unknown	98 (27.4)	1 (4.2)
Mother's education		
High school graduate	91 (25.4)	10 (41.7)
College graduate	159 (44.4)	8 (33.3)
Graduate	104 (29.1)	5 (20.8)
CA, mo	Range: 6–72	Range: 6–55
	M = 35 (*SD* = 15)	*M* = 34 (*SD* = 13)
MA, mo	Range: 4–96	Range: 11–40
	M = 28 (*SD* = 18)	*M* = 22 (*SD* = 9)

Note. CA = chronological age; MA = mental age; *M* = mean; *SD* = standard deviation.

Table 2

Sensory Experiences Questionnaire Scale Reliability

Scale	Internal Consistency (Cronbach's α)	Test–Retest (Intraclass Correlation Coefficient)
Hyperresponsiveness	.74	.71
Hyporesponsiveness	.67	.84
Social	.64	.86
Nonsocial	.71	.68
Total score	.80	.92

Table 3

Sensory Experiences Questionnaire Internal Consistency and Test–Retest Item Reliability

Item	Scale	Internal Consistency (α If Item Deleted)	Test–Retest (Intraclass Correlation Coefficients)
1. Dislikes cuddling	HY, S	.79	.94
2. Reacts sensitively to loud sounds	HY, NS	.79	.75
3. Distress during grooming	HY, S	.79	.93
4. Ignores name	HO, S	.79	.81
5. Avoids textures	HY, NS	.80	.50
6. Disturbed by light	HY, NS	.79	.63
7. Stares at lights/spinning objects	HO, NS	.79	.90
8. Flaps arms/hands	HO, NS	.79	.77
9. Slow to notice objects	HO, NS	.79	.99
10. Nonedibles in mouth	HO, NS	.80	.86
11. Reacts negatively to touch	HY, S	.79	.91
12. Avoids looking during social play	HY, S	.79	.84
13. Ignores loud noises	HO, S	.80	.55
14. Dislikes water	HY, NS	.80	.77
15. Avoids certain foods	HY, NS	.79	.75
16. Smells objects	HO, NS	.80	.25
17. Ignores new person in room	HO, S	.79	.87
18. Slow to react to pain	HO, NS	.79	.86
19. Dislikes tickling	HY, S	.80	.76
20. Likes to jump, rock, or spin	HO, NS	.79	.85
21. Seeks rough housing	HO, S	.79	.85

Note. HY = hyper; HO = hypo; S = social; NS = nonsocial.