Activity Participation Among Children With Autism Spectrum Disorder

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OBJECTIVE. The purpose of this study was to empirically derive dimensions of activity participation among a sample of school-age children with autism spectrum disorder (ASD; $n = 713$). Additionally, we examined the associations between dimensions of activity participation and child characteristics (i.e., chronological age, autism severity, gender) and family demographics (i.e., maternal education).

METHOD. Exploratory factor analysis was used to determine the factors on the Home and Community Activities Scale (HCAS). Multiple regression was used to examine the extent to which child characteristics and family demographics were related to HCAS dimensions.

RESULTS. A six-factor model best characterized activity participation among the school-age children with ASD, and child characteristics and family demographics were differentially associated with HCAS dimensions.

CONCLUSION. The findings have implications for how activities may be categorized for children with ASD and suggest that the frequency of specific activities is affected by child characteristics and maternal education.

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Recent estimates suggest that 1 in 88 children will be diagnosed with autism spectrum disorder (ASD) by age 8 yr (Baio, 2012). Participation in activities in the home and community (e.g., helping prepare meals, attending school clubs, visiting neighbors) structures the everyday lives of children and promotes development and learning (Dunst, Bruder, Trivette, Raab, & Mclean, 2001; Humphry & Wakeford, 2006). Children with ASD are particularly at risk for limited activity participation, and several studies have shown that children with ASD participate in activities less frequently and with less variety than do children with other developmental disabilities (DD) and typical development (e.g., LeVesser & Berg, 2011; Rodger & Umaibalan, 2011). However, research has not yet addressed the extent to which children with ASD participate in particular activities across contexts, partially because of a lack of a validated measure of activity participation for use among this population. Therefore, we investigated the factor structure of the Home and Community Activities Scale (HCAS; adapted from Dunst, Hamby, Trivette, Raab, & Bruder, 2000) in a large sample of children with ASD ($n = 713$) and examined the extent to which child characteristics and family demographics were associated with specific activity dimensions.

Literature Review

Research suggests that children with ASD participate less frequently and with less variety in activities than do typically developing children (LeVesser & Berg, 2011; Rodger & Umaibalan, 2011) and those with DD (Marquenie, Rodger, Mangohig, & Cronin, 2011). Preschoolers with ASD have been found to

participate less frequently in self-care, community mobility, vigorous leisure, and sedentary leisure than do children with typical development (LeVesser & Berg, 2011). Caregivers of preschool children with ASD report less frequent and less diverse activity participation (Lam, Wong, Leung, Ho, & Au-Yeung, 2010). Special event activities, such as birthday parties and family vacations, have also been reported as less frequent among preschool and school-age children with ASD (Rodger & Umaibalan, 2011).

High-functioning school-age children with ASD have self-reported that they participate in fewer activities, in less varied environments, and with less diversity of peers than typically developing peers (Hilton, Crouch, & Israel, 2008). Specifically, the participation of school-age children with ASD appears to occur less frequently than that of typically developing children in unstructured activities; social activities; and hobbies, such as recreational and after-school activities (Hochhauser & Engel-Yeger, 2010; Reynolds, Bendixen, Lawrence, & Lane, 2011). Similarly, adolescents with ASD have been found to participate less frequently in recreational activities and community activities such as after-school clubs and organizations (e.g., Scouting, 4H) than typically developing children and those with other DD (Lee, Harrington, Louie, & Newschaffer, 2008; Orsmond, Krauss, & Seltzer, 2004; Solish, Perry, & Minnes; 2010).

Although the studies described have investigated activity participation among children with ASD, the measures used to characterize participation have not yet been validated on a large sample of children with ASD. Measures have used self-report formats (e.g., Child Assessment of Participation and Enjoyment; King et al., 2006), which may be problematic for children with ASD because of social communication limitations. Some tools measure participation in a limited number of activities (e.g., Participation in Childhood Occupations Questionnaire; Bar-Shalita, Yochman, Shapiro-Rihtman, Vatine, & Parush, 2009) or assess activities that occur in one context (e.g., Child Routines Inventory, Sytsma, Kelley, & Wymer, 2001; Children Helping Out: Responsibilities, Expectations, and Supports, Dunn, 2004). Additionally, measures that require an interview with a caregiver (e.g., Preschool Activity Card Sort, Berg & LaVesser, 2006) may not be feasible for large sample research.

Given the importance of activity participation and its link with children's health and well-being (Law, 2002), a reliable parent-report measure that characterizes the frequency of participation across contexts for children with ASD is needed. With the increase in the number of children diagnosed with ASD, a psychometrically sound

measure for use among occupational therapy practitioners working with families of children with ASD is needed. Although previous studies have investigated the extent to which activity participation is limited among children with ASD, the frequency with which this group of children participates in activities across contexts is unknown. Therefore, in this study we investigated the factor structure of a parent-report measure among a large sample of children with ASD, the Home and Community Activities Scale (adapted from Dunst et al., 2000).

To address the complexities associated with children's participation, both child and family factors should be considered (King et al., 2003; Law et al., 2006). Research suggests that child factors such as functional ability, communication, cognition, and physical functioning are associated with activity participation (e.g., Lepage, Noreau, & Bernard, 1998; Sloper, Turner, Knussen, & Cunningham, 1990). Consequently, we examined how specific child and family factors were related to the frequency of participation in home and community activities. Specifically, we addressed the following research questions:

1. What empirically derived dimensions characterize the participation of school-age children with ASD on the HCAS?
2. To what extent do child characteristics (i.e., child chronological age, child gender, autism severity) and family demographics (i.e., family income, maternal college education) predict dimensions of participation (as identified on the HCAS)?

Method

Research Design

Participants for this study were drawn from a larger federally funded longitudinal online survey study. As part of the larger, longitudinal study, caregivers of children with ASD consented online to participate in the study and completed electronic questionnaires regarding various aspects of their child's development through Qualtrics online survey software (Qualtrics Labs, 2011). Data on the large sample were collected at two time points 1 yr apart. Measures for the current analysis were drawn from the second point of data collection, with the exception of the measure of autism severity. This study was approved by the institutional review board at the University of North Carolina at Chapel Hill.

Participants

As part of the larger study, participants were recruited online through various autism organizations, including the Interactive Autism Network, an online research registry for

caregivers of children with ASD, which recently authenticated the parent-report ASD diagnosis in their registry (Daniels et al., 2012). Children included in this study had a caregiver-reported diagnosis of an ASD, including autism or autistic disorder, Asperger's disorder, and pervasive developmental disorder–not otherwise specified (American Psychiatric Association, 2000). Exclusionary criteria were as follows: comorbid conditions of ASD, such as fragile X syndrome; considerable visual or hearing impairments; DD because of a genetic disorder or syndrome; physical impairments; psychiatric conditions such as schizophrenia; or seizure activity within the previous 12 mo.

Measures

Home and Community Activities Scale. The HCAS is based on research by Dunst and colleagues (2000), in which 3,300 children with or at risk for DD were surveyed to determine the settings of naturally occurring learning opportunities. A previous confirmatory factor analytic study on the HCAS with young children aged birth–6 yr at risk for and diagnosed with DD resulted in 10 home and 10 community factors (Dunst et al., 2000). The factor structure of the HCAS among a sample of school-age children with ASD remained unknown. The original version of the HCAS included a Likert response scale (1 = *not at all* to 5 = *always*) of how each activity was a setting in which a child learned or displayed a desired behavior. Although we used the original activity items, we adapted the response scale to measure the frequency of participation in each activity. Caregivers rated the frequency of the child's participation in each activity on a scale of 0 (*never*), 1 (*monthly*), 2 (*weekly*), or 3 (*daily*). In summary, the HCAS is an 83-item parent-report instrument used to characterize the frequency with which children participate in activities of daily life in the home and community.

Social Responsiveness Scale. The Social Responsiveness Scale (SRS; Constantino & Gruber, 2005) is a 64-item caregiver-report quantitative measure of autistic traits in children. The SRS has been found to have a single factor structure (Constantino et al., 2004) and convergent validity with the Autism Diagnostic Interview–Revised (Lord, Rutter, & Le Couteur, 1994). The SRS data used for this study were drawn from the first point of data collection, approximately 1 yr prior to the collection of other measures. The SRS has demonstrated excellent test–retest reliability (.88 over 3 mo; .83 over 27 mo; Constantino et al., 2003), providing strong evidence of the stability of the SRS score. Autism severity was used as a continuous variable as the total raw score on the SRS.

Background Information Questionnaire. The Background Information Questionnaire (unpublished questionnaire) is a caregiver report measure designed to gain family demographic and child's characteristic information. Covariates included in analyses were child chronological age and maternal college education. Children were grouped into three age categories: 5–6 yr, 7–9 yr, and 10–12 yr (Table 1). Because the majority of mothers in the sample reported completing a 4-yr college degree (n = 438; 61.4%), maternal college education was treated as a dichotomous variable indicating whether the child's mother completed a bachelor's degree.

Data Analysis

To determine the structure of activity participation among school-age children with ASD on the HCAS, we used *exploratory factor analysis* (EFA), which is a method to explain the variation and covariation in a set of variables (Preacher & MacCallum, 2003). Mplus Version 6.1 (Muthén & Muthén, 2010) was used to analyze data for the first research question. Because the HCAS measures frequency of participation on an ordinal scale (i.e., *never* to *daily*), categorical EFA with weighted least squares

Table 1. Participant Demographics

Variable	n (%)
Child gender	
Male	593 (83.2)
Female	120 (16.8)
Child race–ethnicity	
White	608 (85.3)
African American	16 (2.2)
Hispanic	60 (8.4)
Asian	9 (1.3)
Other	25 (11.1)
Unknown	1 (0.1)
Diagnostic category	
Autism–autistic disorder	365 (51.2)
Asperger syndrome	157 (22.0)
PDD–NOS	127 (17.8)
Multiple ASD diagnoses	64 (9.0)
Respondent	
Mother	684 (95.9)
Father	23 (3.2)
Grandmother	3 (0.4)
Other primary	3 (0.4)
Maternal education	
College	438 (61.4)
No college	268 (37.6)
Unknown	7 (1.0)
Age groups	
5–7 yr	167 (23.4)
8–10 yr	301 (42.2)
11–13 yr	245 (34.4)

Note. Race/ethnicity are not exclusive categories, and respondents may have chosen more than one category. ASD = autism spectrum disorder; PDD–NOS = pervasive developmental disorder–not otherwise specified.

with mean and variance adjustment (WLSMV; Muthén, DuToit, & Spisic, 1997) was used. The WLSMV approach is recommended for sample sizes 200 or greater and uses polychoric correlations, which estimate the linear relationship within ordinal data (Muthén et al., 1997). Oblique rotation was used, which allows for correlation between factors. Specifically, geomin rotation was used because it yields superior results compared with other oblique rotation methods (Browne, 2001; Costello & Osborne, 2005).

To address the second research question, multivariate regression in SPSS Version 18.0 (SPSS, Inc., Chicago) was used. Specifically, the extent to which child characteristics (i.e., chronological age, gender, autism severity) and family demographics (i.e., maternal college education) predicted mean scores on each HCAS factor was tested. Independent variables included child characteristics and family demographics, and dependent variables included the mean scores on each of the six HCAS factors.

Results

Our study included 713 caregivers of children with ASD aged 5–12 yr (mean = 105.93 mo; standard deviation = 26.02 mo; range = 60–155 mo). Demographic information on the sample is shown in Table 1.

Exploratory Factor Analysis

A six-factor solution was determined to most succinctly characterize the data based on empirical and theoretical evidence, although a two-factor solution was also investigated. Research suggests that retaining eigenvalues over 1.00 is an inaccurate method of determining the number of factors (Fabrigar, Wegener, MacCallum, & Strahan, 1999); therefore, the results of the scree plot were investigated, which has been suggested as the most accurate method for determining the number of factors to retain (Costello & Osborne, 2005; Velicer & Jackson, 1990). This method allows the researcher to visually examine the plot of eigenvalues and retain the number of factors above the bend or "break" in the data points. The break in the eigenvalues was from the sixth to seventh factor (2.88–2.47). The scree plot is shown in Figure 1.

The interfactor correlations provided further evidence for the six-factor solution because they offered an estimate of the unique contribution of each factor to the model and were found to be minimally correlated (Table 2; Tabachnick & Fidell, 2007). Next, fit statistics provided support for the six-factor solution: root-mean-square error of approximation = .040 (.038–.042), comparative fit index = .907, standardized root-mean-square residual = .07. Because of the categorical nature of the data and the WLSMV approach to analysis, a value for the total variance explained by the solutions is unavailable.

Items with loadings greater than .32 were examined (Tabachnick & Fidell, 2007). Cross-loading of items may be problematic because they suggest that the variance associated with one item is not necessarily attributable to one factor (Ferguson & Cox, 1993). Items that loaded on two factors within 0.10 of one another were deleted (Worthington & Whittaker, 2006). Cross-loading and low-loading items resulted in 28 items being deleted from the solution and 55 items kept in subsequent analyses. Item loadings on the six-factor solution resulted in the following ranges and number of items on each factor: Factor 1 (14 items), .34–.71; Factor 2 (21 items), .33–.82; Factor 3 (4 items), .39–.65; Factor 4 (7 items), .33–.83; Factor 5 (5 items), .39–.63; and Factor 6 (4 items), .41–.91.
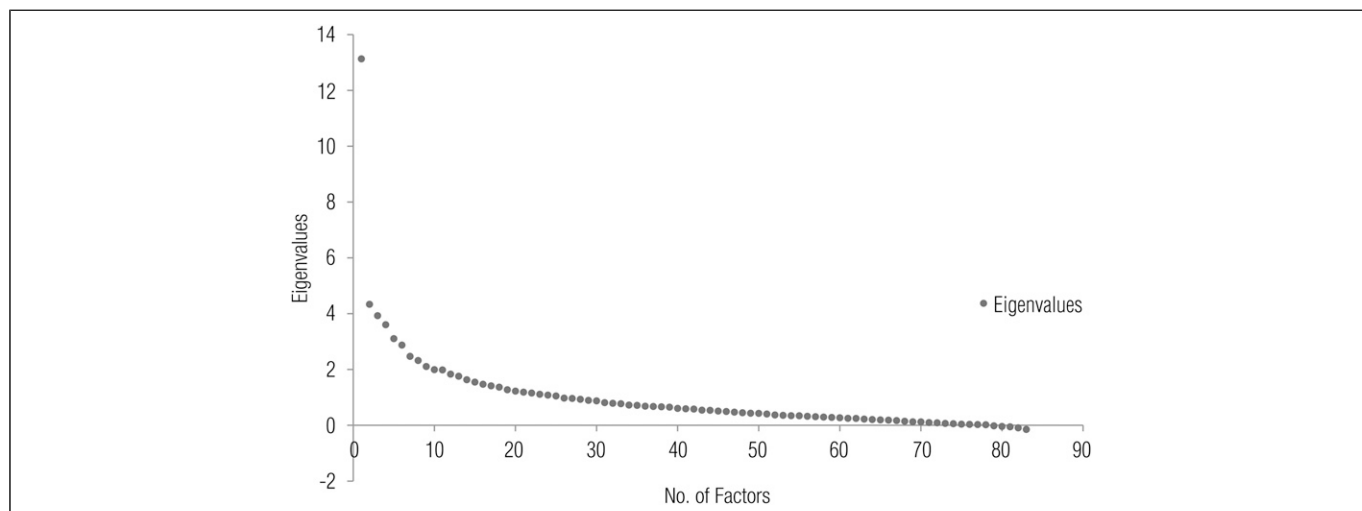

Figure 1. Home and Community Activities Scale (HCAS) scree plot.

Table 2. Home and Community Activities Scale (HCAS) Factor (F) Loadings: Highest Loading Four Items

HCAS Item	F1	F2	F3	F4	F5	F6
Parent–Child Household Activities						
F1: Picking up toys	**0.711**	−0.020	−0.147	0.080	0.094	0.219
F1: Cleaning up room	**0.612**	0.023	−0.139	0.046	0.206	0.287
F1: Reading–looking at books	**0.611**	0.177	−0.103	0.028	0.034	0.096
F1: Adult–child play times	**0.565**	0.201	−0.036	0.088	−0.163	−0.100
Community Activities						
F2: Children's festivals	0.302	**0.822**	0.043	0.240	−0.052	0.269
F2: Community celebrations	0.171	**0.701**	0.104	0.323	0.037	0.242
F2: County–community fairs	0.172	**0.662**	0.041	0.222	0.049	0.184
F2: Hay rides	0.285	**0.658**	−0.099	0.030	0.075	0.198
Routine Errands						
F3: Doing errands	0.399	0.235	**0.650**	0.228	0.198	0.033
F3: Going shopping	0.314	0.321	**0.561**	0.229	−0.105	0.037
F3: Food shopping	0.350	0.238	**0.569**	0.146	0.069	0.001
F3: Eating out	0.173	0.294	**0.392**	0.246	−0.041	0.143
Neighborhood–Social Activities						
F4: Swimming	0.093	0.167	0.223	**0.828**	0.026	−0.242
F4: Water play–swimming	0.089	0.151	0.202	**0.798**	−0.039	−0.261
F4: Visiting friends	0.342	0.304	0.025	**0.637**	0.092	0.358
F4: Having friends over to play	0.278	0.193	−0.036	**0.619**	0.162	0.351
Outdoor Activities						
F5: Hiking	0.259	0.523	0.016	0.208	**0.629**	−0.162
F5: Doing yard work	0.378	0.187	−0.052	0.103	**0.537**	0.123
F5: Growing vegetable garden	0.358	0.288	−0.118	0.098	**0.450**	0.056
F5: Camping	0.091	0.295	0.024	0.248	**0.418**	0.070
Faith-Based Activities						
F6: Going to church	0.080	0.113	0.010	0.113	0.012	**0.908**
F6: Religious activities	0.116	0.211	0.018	0.100	−0.012	**0.900**
F6: Praying	0.202	0.116	−0.090	0.074	0.034	**0.793**
F6: Children's clubs (4H, scouting)	0.080	0.182	0.035	0.108	0.269	**0.413**

Note. Bold indicates the four highest loading items on each factor.

Factor Naming

The factors were named through a process adapted from Ferguson and Cox (1993). The first author (Little) drafted factor names, and the items that loaded on each factor were presented to a panel of investigators ($n = 13$) who were asked to blindly name the factors and discuss. From this process, the factors were the following: Factor 1, Parent–Child Household Activities; Factor 2, Community Activities; Factor 3, Routine Errands; Factor 4, Neighborhood–Social Activities; Factor 5, Outdoor Activities; and Factor 6, Faith-Based Activities. The four highest loading items on each factor are shown in Table 2.

Multivariate Regression

Because an EFA does not provide factor scores, mean scores on each of the six HCAS factors were used as outcomes in the multivariate regression analyses. Several variables predicted HCAS mean scores (Table 3). Boys participated less frequently than girls in Parent–Child Household Activities and Routine Errands ($p < .05$).

Older children engaged more frequently in Outdoor Activities and Faith-Based Activities ($p < .05$); however, younger children participated more frequently in Parent–Child Household Activities ($p < .05$). Autism severity demonstrated a significant negative effect on Parent–Child Household Activities, Routine Errands, Neighborhood–Social Activities, and Faith-Based Activities ($p < .01$), with children with higher autism severity participating less frequently across all activities. Children of mothers with a college degree participated more frequently in Neighborhood–Social Activities ($p < .05$). Two-way interactions were not significant.

Discussion

Findings from this study suggest that the activity participation of school-age children with ASD as measured by the HCAS is characterized by Parent–Child Household Activities, Community Activities, Routine Errands, Neighborhood–Social Activities, Outdoor Activities, and Faith-Based Activities. A previous study showed that the

Table 3. Regression Results for Child and Family Characteristics Associated With Home and Community Activities Scale Dimensions

Variable	Parent–Child Household β (SE)	Community β (SE)	Routine Errands β (SE)	Neighborhood–Social β (SE)	Outdoor β (SE)	Faith-Based β (SE)
Intercept	3.43 (0.09)***	1.63 (0.05)***	2.78 (0.12)***	2.24 (0.10)***	1.56 (0.10)**	2.17 (0.16)***
Gender						
Male	−.11 (0.05)*	−.02 (0.05)	−.14 (0.06)*	−.07 (0.05)	−.03 (0.05)	.03 (0.05)
Female	0	0	0	0	0	0
Age group						
5–7 yr	0	0	0	0	0	0
8–10 yr	−.07 (0.04)	−.03 (0.03)	−.06 (0.06)	.04 (0.05)	−.09 (0.04)	.12 (0.08)
11–13 yr	−.22 (0.05)***	−.07 (0.04)*	.02 (0.06)	.01 (0.05)	.18 (0.05)***	.18 (0.08)*
Social Responsiveness Scale score	−.003 (0.001)***	−.001 (0.001)	−.003 (0.001)**	−.003 (0.001)***	−.001 (0.001)	−.004 (0.001)***
Maternal education						
No college	0	0	0	0	0	0
College	.03 (0.03)	.03 (0.02)	.07 (0.05)	.10 (0.04)**	.01 (0.04)	−.05 (0.06)

Note. SE = standard error.
***$p < .001$. **$p < .01$. *$p < .05$.

HCAS comprised 10 community and 10 home factors (Dunst et al., 2000). The results from our analysis, however, suggest that among school-age children with ASD, the HCAS measures six dimensions, and activities in the home and community are likely interrelated among children with ASD. These results offer a new perspective on activity participation among children with ASD, particularly around Neighborhood–Social and Faith-Based Activities.

The Neighborhood–Social Activities factor consisted of items that other measures divide into physical activities and social activities (e.g., King et al., 2004). The integration of these activities into one dimension suggests that the frequency of activity participation among children with ASD may reflect the activity demands as well as context; activities that may appear primarily physical in nature possess social demands that are particularly challenging for children with ASD. For instance, the activity of swimming highly loaded on the Neighborhood–Social Activities dimension; however, sleepovers and visiting friends also loaded on this factor, which suggests that physical and social activities possibly involve similar skills among children with ASD.

These findings align with literature suggesting that physical activity participation is associated with social interaction skills among children with ASD. In a study of physical activity participation among school-age children with high-functioning ASD, participants self-reported that the primary barrier to engaging in physical activity was lack of a peer partner, and the highest reported facilitator of physical activities included friends who are supportive or physically active (Obrusnikova & Cavalier, 2011). Caregivers of children with ASD have also reported that the primary barrier to their children's physical activity participation was the

child's social skills (Obrusnikova & Miccinello, 2012). Moreover, one treatment study using a swimming intervention among children with ASD demonstrated that those who participated in swimming exercises demonstrated increased social skills (Pan, 2010).

The Faith-Based Activities factor that emerged from the EFA contributes to the gap in the literature regarding the participation of children with ASD in religious services, religious activities, praying, and structured engagement in children's clubs (e.g., scouting, 4H). Children are required to attend and follow rules in the activities that specifically loaded on the Faith-Based Activities factor (i.e., attending church, religious activities, praying, scouts, 4H); therefore, these results begin to create a descriptive understanding of how the demands of these activities may be related.

This study demonstrated specific links between child characteristics and dimensions of activity participation on the HCAS. Findings related to chronological age are of particular interest: Younger children participated more frequently in Parent–Child Household Activities and Community Activities, whereas older children participated more frequently in Outdoor and Faith-Based Activities. These findings likely reflect developmental changes in activity interests and expectations; for example, a younger child with ASD may engage in cuddling with a parent or doing a puzzle more frequently than an older child. Although a few studies have shown that the diversity of activity participation is decreased among older children with disabilities (Law et al., 2006) and ASD (Hilton et al., 2008), the findings from this cross-sectional study elucidate the lack of difference between older and younger children's participation in Neighborhood–Social Activities. These findings align with those of Orsmond et al. (2004),

which demonstrated that adolescents with ASD frequently participate in solitary activities (e.g., computer use, television) and experience limited social interaction with friends in social settings. The lack of participation in Neighborhood–Social Activities among young children likely has cascading effects on the development of social skills needed to participate in similar activities (e.g., visiting friends) as children with ASD age.

Previous qualitative research has suggested that the lives of families with ASD are centered on the child's symptoms of autism (DeGrace, 2004). Current findings suggest that autism severity affects the frequency of children's participation in Parent–Child Household Activities, Routine Errands, Neighborhood–Social Activities, and Faith-Based Activities. These activities are particularly structured, whereas unstructured activities (i.e., Community and Outdoor Activities) place fewer social demands on the child with ASD.

Maternal college education was related to Neighborhood–Social Activities, such that mothers with a college degree were more likely to engage their children in activities such as swimming, having friends over to play, or visiting neighbors. This finding aligns with that of Law et al. (2006), in which maternal education was found to be positively related to children's participation across contexts. Although this finding requires further investigation, it may be that caregivers of children with ASD with college degrees have the resources to involve their children in swimming lessons or play groups.

Limitations

In this analysis we used cross-sectional data; therefore, the effects of child and family characteristics on activity participation among this sample over time is unknown. Although this was a large sample, it was not stratified, which limits generalizability. The response scale of the HCAS may need to be expanded or differentially weighted because each response category may not be appropriate for each activity (e.g., visiting museums vs. helping prepare meals). Several HCAS items were not included in the final factor solution because of low factor loadings and cross-loadings. Many of the excluded items were solitary activities (e.g., watching television, playing video games); thus, the frequency of participation across these activities and their associations with child characteristics and family demographics were not examined.

Future Directions

Future research is needed to validate the HCAS factor structure as well as associations with child characteristics

and family demographics in an independent sample of school-age children with ASD. Moreover, the response scale of the HCAS was found to be a limitation of the scale and could be expanded to be more sensitive to a range of frequency options as well as ratings of enjoyment. In addition, studies are needed to better address with whom participation occurs and the difficulty associated with activity participation among children with ASD. Such research may help illuminate the multidimensionality associated with the activity participation of children with ASD.

Implications for Occupational Therapy Practice

The results of this study have the following implications for occupational therapy practice:

- The HCAS measures six factors of activity participation among school-age children with ASD, including Parent–Child Household Activities, Community Activities, Routine Errands, Neighborhood–Social Activities, Outdoor Activities, and Faith-Based Activities.
- Occupational therapy practitioners may use the HCAS to characterize the frequency of activity participation among school-age children with ASD.
- The dimensions that characterized the structure of activity participation may allow occupational therapy practitioners to prioritize areas of meaningful activity participation and strategize to incorporate intervention strategies that address child–family characteristics in that dimension. ▲

Acknowledgments

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