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Predictors of Daily Activity Performance of Children with Autism and its Association to Autism Characteristics

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Predictors of Daily Activity Performance of Children with Autism and its Association to Autism Characteristics

Abstract

Background: The daily activity performance of children with autism spectrum disorder (ASD) is a central focus of occupational therapists. Yet, the existing performance-based assessments of basic and instrumental daily activities in children are limited and their application on children with ASD is scarce. The purpose of this study is to examine if daily activity performance of children with ASD is impaired as compared to children with typical development (TD), and to examine possible predictors of daily activity performance in children with ASD.

Method: The participants included 39 children with ASD and 40 children with TD, 6–10 years of age, who performed the Do-Eat, a performance based assessment of daily activities. The parents of children with ASD completed the Childhood Autism Spectrum Test (CAST), the Repetitive Behavior Scale-Revised (RBS-R), and the Sensory Experience Questionnaire (SEQ).

Results: Differences were found between activity performance of children with ASD and children with TD, who achieved significantly better ($t(40.3) = -8.92, p < .001$).

Conclusion: Children with ASD present difficulties in performance of daily activities and may benefit from occupational therapists' input concerning the impact of sensory features, specifically hyper-responsiveness, on daily function.

Comments

The authors declare that they have no competing financial, professional, or personal interest that might have influenced the performance or presentation of the work described in this manuscript.

Keywords

ASD, assessment, hyper-responsiveness, instrumental daily activity performance, sensory features

Credentials Display

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The current autism spectrum disorder (ASD) diagnosis (DSM–5; American Psychiatric Association [APA], 2013) specifies that the severity of ASD is related to the functional performance of each individual and the amount of support required. This functional performance is impacted by core symptoms in ASD, which are defined by two major developmental deficits: impairments in social-communication skills and restricted, repetitive patterns of behavior, interests, or activities (RRBIs). Social-communication deficits of children with ASD may include inadequate use of eye contact, problems initiating social interactions, difficulty interpreting verbal and nonverbal social cues, difficulty interpreting humor or the social context of language, and inappropriate emotional response (APA, 2013). In turn, social deficits can lead these children to social isolation, loneliness, and difficulty establishing satisfying peer and familial relationships, although they might be interested in them (Locke et al., 2010).

Other than social-communication symptoms, children with ASD also demonstrate RRBIs, referring to a group of heterogeneous behaviors marked by repetition, rigidity, invariance, and inappropriateness to the place and context of the behavior (Bodfish et al., 2000; Gal & Yirmiya, 2021). The DSM-5 definition of ASD categorizes RRBIs into four domains: (a) stereotyped or repetitive speech, motor movements, or use of objects; (b) excessive adherence to routines, ritualized patterns of verbal or nonverbal behaviors, or excessive resistance to change; (c) highly restricted, fixated interests that are abnormal in intensity or focus; and (d) hyper-responsiveness (an overreaction to sensory stimuli), hypo-responsiveness (a decreased response to sensory stimuli), or unusual interest in sensory aspects of their environment, such as excessive smelling or touching of objects, and fascination with lights or spinning objects (often referred to as sensory seeking) (APA, 2013; Baranek et al., 2014). These distinct sensory features of children with ASD, which are also referred to as sensory reactivity patterns, often interfere with learning skills, self-care, and play activities and are considered to be a serious concern for family members and educators (Baranek et al., 2014).

Compared to core symptoms of individuals with ASD in communication, socialization, and RRBIs that are commonly investigated, potential deficits in daily activity performance in this population remain less explored. As independence in the performance of daily activities plays a key role in the child's ability to function across settings and environments and contributes to the development of feelings of competence, safety, and satisfaction (Drahota et al., 2013), it should receive greater attention. Several studies among children with ASD reveal problems in basic activities of daily living (ADLs), such as dressing, grooming, sleeping, and other self-care activities (Ahmed et al., 2021; Bal et al., 2015; Jasmin et al., 2009; Ricon et al., 2017). However, data concerning possible deficits in the performance of instrumental daily activities (IADLs) among individuals with ASD, such as preparing simple meals or bed making, are scarce and often focus on adolescents and young adults only (Bal et al., 2015).

In addition, although daily activity performance is critical for the participation and quality of life of children with ASD, clinical evaluations of daily performance seem to be lacking and most often rely on parents' questionnaires as measures for daily activity performance (Ahmed et al., 2021; Jasmin et al., 2009). These proxy reports might be biased, and their ecological validity, the degree to which the assessment can be related to performance in the context of everyday activity, is questionable (Missiuna et al., 2006). Furthermore, it has been suggested that children's actual experience performing a task is the most powerful contributor to their self-efficacy beliefs regarding task performance (Missiuna et al., 2006). This is extremely important because of the tendency of parents of children with ASD to present over-involvement in basic self-care tasks of their children, a tendency that has been suggested as a limiting

factor of their children's mastery of these tasks and a cause for parental stress (Drahota et al., 2011; Green & Carter, 2014; Marsack-Topolewski, 2021). Thus, occupational therapists may be advised to use standardized ecological assessments designed for children, which are held in the natural environment and enable collecting evidence on daily activity performance directly from the child.

The Do-Eat (Josman et al., 2010) is a standardized ecological performance-based assessment of daily activities designed for children. It enables the direct evaluation of the children while they perform daily activities that characterize their age group in their real-life context (Josman et al., 2010). The Do-Eat has been applied to examine the daily activity performance of children with typical development (TD) as well as children with disabilities, such as Developmental Coordination Disorder (DCD) and children with Attention Deficits and Hyperactivity Disorder (ADHD) (Frisch et al., 2009; Josman et al., 2010; Rosenblum et al., 2015). Although the Do-Eat has not been applied to children with ASD yet, its properties are relevant to their characteristics, including diagnostic criteria (e.g., sensory features) and related participation in everyday life.

Therefore, the aims of the present study were (a) to examine the application of the Do-Eat among children with ASD, (b) to examine the performance of IADLs in the real-life context of children with ASD in comparison to children with TD, and (c) to investigate whether ASD characteristics, including social-communication symptoms, RRBI, and sensory features, will predict activity performance among children with ASD.

Method

Participants

Participants included 79 children in the age range of 6–10 years. The study group included 39 participants, who were recruited through the education system in northern Israel. The inclusion criteria for the study group were:

1. A diagnosis of ASD, which was determined by a physician or a psychologist according to the DSM-5 criteria and the Autism Diagnostic Observation Schedule (ADOS-2; Lord et al., 2000) or the ADI-R (Lord et al., 1994). ASD past diagnosis was confirmed at the time of the study using the Childhood Autism Spectrum Test (CAST; Scott et al., 2002). Only children who scored below 15 (the cut-off score for potential ASD diagnosis) in the CAST participated in the current study.
2. Classified with receptive language (as a proxy for IQ) greater than 75, as confirmed by the Peabody Picture Vocabulary Test, Third Edition (PPVT-III) (Dunn & Dunn, 1997) to ensure the ability to perform complex daily tasks and follow instructions in the study.
3. Absence of seizure disorder or acute medical or genetic condition.

The control group consisted of 40 children with TD, all without a remarkable medical history, psychiatric disorders, or developmental disabilities. No significant differences were found between groups concerning chronological age, gender, and socio-economic status. Table 1 describes the sociodemographic information for this study.

Table 1
Sociodemographic Data of Participants

		<u>ASD (n = 41)</u>	<u>TD (n = 40)</u>	
		<u>Mean (SD)</u>	<u>Mean (SD)</u>	
Gender	Boy	34	34	$\chi^2 = 0.78$
	Girl	5	6	
Chronological age (years)		7.97 (1.13)	7.55 (1.09)	t = 1.68
Socio-economic status	Low	3	3	$\chi^2 = 0.001$
	Average and above	36	37	

Note. ASD = autism spectrum disorder; TD = typical development.

Measures

A Socio-Demographic Questionnaire

The researchers composed a questionnaire that included questions related to personal information about the child and their family, such as age, gender, socio-economic status, place of residence, and health condition of the child.

Measures that Assess ASD Characteristics

CAST (Scott et al., 2002). This 37-item parental screening questionnaire for autism includes 31 scoring items for autism confirmation and six general development items (each item is answered by a yes or no reply). The cut-point for concerns of possible autism-spectrum condition is 15 or higher. At that cut-point, sensitivity has been shown to be 100%, specificity 97%, and positive predictive value 50% using research diagnostic assessments (ADOS, ADIR) (Williams et al., 2005). The CAST was used in this study to confirm ASD diagnosis and assess social-communication symptoms in ASD and their correlation to daily activity performance. To examine social-communication symptoms, 24 relevant items from the CAST were summed up to a social-communication score. Internal reliability of the CAST social-communication score was high ($\alpha = .79$). As RBS-R was used in this study to assess repetitive behaviors. The CAST items that address RRBI were excluded from the social-communication score.

The Repetitive Behaviors Scale – Revised (RBS-R) (Bodfish et al., 1999; Lam & Aman, 2007). This a 43-item caregiver questionnaire containing six subscales of RRBI: stereotyped behavior, self-injurious behavior, compulsive behavior, routine behavior, sameness behavior, and restricted interests. Items are rated on a scale of 0–3 (0 = *behavior does not occur*, 3 = *behavior occurs and is a severe problem*). Factor loading ranged from 0.51–0.66 and accounted for 47.5% of the variance (Lam & Aman, 2007). Internal consistency of the subscales ranged from 0.78–0.91, inter-rater reliability ranged from 0.57–0.73, and strong discriminant validity between adults with mental retardation with and without autism was found (Bodfish et al., 2000).

The Sensory Experience Questionnaire (SEQ V 2.1, Version 2.1) (Baranek et al., 2006). As RBS-R was not updated following the DSM-5's ASD criteria, it does not thoroughly address the 4th RRBI criterion, namely sensory features. In this study, therefore, SEQ was used to identify sensory features. SEQ is a 43-item caregiver questionnaire that examines sensory features in young children with ASD and other developmental disabilities. It is a revised version of the original SEQ V 2.1 adapted in line with the evolving conceptual model of sensory processing among children with ASD. The quantitative SEQ V 2.1 items focus on three patterns of sensory response (i.e., categories of hyper-responsiveness, hypo-responsiveness, and sensory seeking), in both social and non-social contexts. The items can also be grouped by modality (auditory, tactile, visual, vestibular/proprioceptive and gustatory/olfactory). Items are graded on a 5-point Likert scale, such that 1 = *almost never*, 2 = *once in a while*, 3 = *sometimes*, 4 =

frequently, and 5 = *almost always*. This instrument has well-established reliability and validity (e.g., Baranek et al., 2006). The internal consistency of the SEQ V 2.1 subscales were reported to be as follows: hyper-responsiveness $\alpha = 0.73$, hypo-responsiveness $\alpha = 0.75$, sensory seeking $\alpha = 0.80$, social $\alpha = 0.69$, and non-social $\alpha = 0.78$. In this study, the SEQ V 2.1 was used to measure the level of sensory features in children with ASD.

Do-Eat: Performance-Based Assessment Tool for Children (Goffer et al., 2010)

This ecological test is administered in the child's natural surroundings and examines areas of strengths and difficulties in ADLs. The child is asked to perform three tasks: (a) make a sandwich, (b) prepare chocolate milk, and (c) fill out a certificate of outstanding performance for themselves. These tasks were designed based on the rich clinical experience of the tool's developers and on observations of the daily functioning of children (aged ≥ 5 years) in their homes, kindergartens, and schools.

Administration of the Do-Eat. After the evaluator introduces the three tasks to the child, they provide the necessary materials and demonstrate and explain each phase of each task before asking the child to perform it. For the "making a sandwich" task, the child is asked to wear an apron, choose a sandwich filling, and spread a thin layer of the filling on a slice of bread with a plastic knife. The child completes the task by cutting the bread in half to form a sandwich. To perform the "chocolate milk" task, the child is asked to put two full spoons of chocolate powder into a cup, add a bit of milk, stir until there are no lumps, and then fill the cup with milk and stir again until the drink is ready. The last task involves having the child write their name on a paper designed to look like a certificate, cut a circle drawn on another piece of paper, glue the circle onto the certificate, and draw a picture of themselves (or something else that the child wishes to draw). Then the child is asked to score themselves (from 5 = *well*, to 1 = *poorly*) on their performance of the sandwich and the chocolate milk tasks and sign the certificate.

Throughout the child's performance, they receive a raw score for performing the task (such as "washing hands"). Raw test scores range from 1 (*unsatisfactory performance*) to 5 (*very good performance*). The Do-Eat also provides a summary test score that incorporates the average of the three scores: task performance score, sensory-motor score, and EF score.

The Do-Eat has inter-rater reliability ranges between 0.92–1 (Josman et al., 2010). A high internal consistency was found for each of the test's groups of items ($\alpha = .89-.93$). In addition, Do-Eat established good content validity and discriminant validity between gender and age groups, as well as between children with developmental coordination disorder and children with TD ages 5–6.5 years of age ($t(57) = -11.94, p < 0.01$), and predictive validity of group membership of children with ADHD versus controls (Frisch et al., 2009; Josman et al., 2010; Rosenblum et al., 2015).

Procedure

The university of Haifa ethical committee approved the study. The general scientific department in the Ministry of Education of Israel also granted the study ethics approval. Children and parents were recruited via letters sent by teachers in the special and regular education system, explaining the purpose and procedure of this study. Before participating in the study, all of the parents supplied written consent and assent. In addition, the children's parents completed the socio-demographic questionnaire, and parents of children with ASD also completed the SEQ (V 2.1) (Baranek et al., 2006), the RBS-R (Bodfish et al., 1999; Lam & Aman, 2007), and the CAST (Scott et al., 2002). Following initial screening of these questionnaires, the children of the clinical and control groups performed the Do-Eat assessment, which was administered by two assessment-trained occupational therapists. Assessment took place in a quiet room at the children's school surroundings and was administered separately for each child.

Data Analysis

The results of this study were analyzed using Statistical Package for the Social Sciences (SPSS) version 23 software. Demographic characteristics were described by descriptive statistics. Internal consistency for each of the three components of the Do-Eat was calculated. T-tests were performed to analyze differences in the total score of the Do-Eat in each group. To examine group differences in the Do-Eat subscales, a multivariate analysis of variance (MANOVA) was conducted. Furthermore, a hierarchical regression analysis was carried out to examine whether clinical symptoms, including social-communication symptoms, sensory features, and RRBI (as measured by the CAST social-communication score, SEQ, and RBS-R total scores) contributed to the daily activity performance of children with ASD. The significance level for all statistical analyses was set at $p < .05$.

Results

Differences Between Groups in Daily Activity Performance

Cronbach's alpha test revealed high internal consistency for the total score of task performance across the three tasks ($\alpha = .93$) and in the sub-categories of the Do-Eat among children with ASD ($\alpha = .78-.97$, see Table 2).

Table 2

α Cronbach Values of the Do-Eat Scores Among Children with ASD ($n = 41$)

Do-Eat scale	Number of items	α Cronbach
Total task score	20	.93
Sandwich task score	8	.88
Drink task score	7	.88
Certificate task score	5	.78
Total sensory-motor score	18	.95
Sandwich sensory-motor score	6	.85
Drink sensory-motor score	6	.88
Certificate sensory-motor score	6	.86
Total EF score	27	.97
Sandwich EF score	9	.90
Drink EF score	9	.91
Certificate EF score	9	.94

Note. EF = executive functions.

Furthermore, children with ASD performed significantly worse than children with TD as seen in the total raw scores of the Do-Eat and across each of the daily activities: making a sandwich, preparing a drink, and filling out a self-certificate ($F(9,69) = 15.30, p < .001, \eta^2 = .66$) (see Table 3).

A hierarchical regression analysis was conducted to examine whether clinical symptoms, including social-communication, repetitive symptoms, and sensory features (as measured by the CAST, the RBS-R, and the SEQ V 2.1) predict daily activity performance among children with ASD.

Sensory features as measured by the SEQ total score were found to predict 22% of the variance. Further examination of the possible effect of sensory patterns, including sensory hyper-responsiveness, hypo-responsiveness, and sensory seeking, revealed that sensory hyper-responsiveness predicted 15% of the daily activity performance of children with ASD. Social-communication symptoms as measured by the CAST social-communication score were found to predict 12% more, and RRBI, as measured by the RBS-R total score, were not found to significantly predict the Do-Eat total score (see Table 4).

Table 3*Average Scores, SD, F Values and η^2 of the Do-Eat Raw Scores on Each Task, SM Score and EF Score*

	TD (n = 40) Mean (SD)	ASD (n = 41) Mean (SD)	F	p	η^2
Daily activity performance					
Making a sandwich (8)	4.84 (.23)	3.71 (.89)	60.12	< 0.001	.44
Preparing a drink (8)	4.94 (.09)	4.08 (.73)	53.40	< 0.001	.41
Filling out self-certificate (3)	4.86 (.25)	3.97 (.80)	44.64	< 0.001	.37
Sensory-motor score					
Making a sandwich (7)	4.94 (.15)	4.01 (.68)	69.31	< 0.001	.47
Preparing a drink (8)	4.95 (.14)	4.18 (.65)	53.96	< 0.001	.41
Filling out self-certificate (7)	4.96 (.09)	4.33 (.56)	47.78	< 0.001	.38
Executive functions					
Making a sandwich (9)	4.90 (.15)	3.90 (.62)	98.10	< 0.001	.56
Preparing a drink (9)	4.93 (.14)	4.01 (.66)	74.62	< 0.001	.49
Filling out self-certificate (9)	4.96 (.09)	4.35 (.73)	27.65	< 0.001	.26

Note. TD = typical development; ASD = autism spectrum disorder.

Table 4*Hierarchical Regression Analysis of the CAST Social-Communication Score, RBS-R Total Score, and SEQ Total Score on Do-Eat Total Score (N = 39)*

	Model 1			Model 2			Model 3		
	B	SEB	β	B	SEB	β	B	SEB	β
CAST-social communication score	-.34	.15	-.35	-.41	.19	-.42	-.58	.17	-.60
RBS-R total score				.01	.02	.12	-.04	.02	-.47
SEQ total score							.07	.02	.85
R²	.12			.01			.22		
F for change	5.00*			.38			11.46**		

Note. * ≤ 0.05 ; ** $p \leq .01$.

Discussion

This study aimed to examine the differences between school-aged children with ASD and typical peers in the performance of IADLs. The results revealed significant differences between children with ASD and typical peers in performing daily activities, including preparing a simple meal and filling out a self-certificate. Our findings support previous data concerning difficulties of children with ASD in performing basic ADLs, such as dressing, eating, or bathing, which characterize individuals with ASD from early childhood through adolescence and adulthood (Ahmed et al., 2021; Bal et al., 2015; Jasmin et al., 2009). This data concerning difficulties of children with ASD in the performance of ADLs and IADLs is important, as daily activities impact the child's participation in social events, such as playdates and overnight camps, and are essential for learning life skills that later on create pathways for being independent and active members of a community (Drahota et al., 2013).

In comparison to past studies that rely mainly on proxy reports of parents of children with ASD concerning their general daily skills, the current study emphasizes the importance of using a performance-based assessment of daily activity performance among children with ASD. Ecologically valid assessments, such as the Do-Eat, provide clinical utility beyond diagnostic utility because of the fact that situations experienced in the assessment correspond with the everyday life situations of children (Wallisch

et al., 2018). Thus, taking into account both performance-based assessments and parent questionnaires may provide more applicable information concerning children with ASD's daily skills. As mentioned in previous studies concerning children's self-efficacy beliefs (Missiuna et al., 2006), by independently performing the daily tasks in the Do-Eat, children with ASD experienced feelings of satisfaction and pride. These experiences can be mediated to their parents, prompting them to minimize their involvement in the basic ADLs and IADLs of their children and reducing parental stress (Drahota et al., 2011; Marsack-Topolewski, 2021). As demonstrated among the participants in the current study, children with ASD without cognitive disabilities are most often integrated into public education systems, thus emphasizing even more their need to independently perform IADLs, such as preparing a school satchel or using public transportation.

Our study further delves into the investigation of key factors that may influence the participation of children with ASD in daily activity performance. Its results support previous research concerning the association of sensory integration skills in ASD with daily activity performance (Ricon et al., 2017; Schaaf et al., 2015). Indeed, Ahmed and colleagues (2021) revealed that deficits in tactile and auditory processing among children with ASD aged 5–12 years were associated with poor performance and independence in daily tasks. Ricon and colleagues (2017) found that worse modulation of tactile, vestibular, and visual/auditory input correlated with less independence when performing routine daily activities among children with ASD without cognitive disabilities ages 5 to 7 years of age. Our study further supports this notion, indicating that sensory features, mainly sensory hyper-responsiveness, significantly predicted daily activity performance of children with ASD. Similarly, Jasmin and colleagues (2009) revealed that avoidance of sensory stimuli (which relates to sensory hyper-responsiveness) among preschoolers with ASD was correlated with daily activity performance, such as dressing, grooming, and bathing. Schaaf and colleagues (2015) found that parent-identified goals for children with ASD often relate to performance challenges that are correlated with sensory hyper-responsiveness, such as oral-tactile hyper-responsiveness of children with ASD interfering with the ability to brush teeth or auditory and tactile hyper-responsiveness that influence duration of sleep. However, other researchers found no links between sensory features and adaptive daily functioning among children with ASD between the ages of 2 to 8 years of age (McCormick et al., 2015). Possible explanations for the contrasting results concerning the association between sensory features and daily activity performance in ASD may relate to the variety of sensory and daily function measures, including both proxy reports and performance-based measures, as well as to the heterogeneity of samples of children with ASD in different cognitive levels and age bands.

Finally, the current study demonstrated that social-communication symptoms, though not RRBI, of children with ASD also contributed to their difficulties in daily activity performance. Green and Carter (2014) found that ASD symptom severity (relating both to social-communication symptoms and RRBI) predicted daily living skills of young children with ASD above and beyond IQ. In another longitudinal study, Bal and colleagues (2015) revealed that receptive language and social-communication impairment of children with ASD at 2 years of age predicted the level of performance of daily living skills as they reached adulthood. Possible explanations for this may be that communication and social deficits of children with ASD may prevent them from understanding what is being asked of them in performing daily tasks and reduce their desire to perform skills to please their parents or receive social reinforcement (Green & Carter, 2014). In the current study, performance of the tasks in the Do-Eat involved understanding a sequence of verbal instructions concerning the preparation of the sandwich, the drink, and the certificate. Although children with ASD who participated in the current study obtained above-average receptive

language, these verbal instructions may have been challenging for some of them, thus impeding their ability to perform these tasks according to demands.

Further investigation is needed concerning the involvement of clinical symptoms in the performance of daily activities of children with ASD, with a focus on unique sensory reactivity patterns and social-communication symptoms. A comprehensive understanding of the association between ASD characteristics and daily activity performance of children with ASD can assist in developing interdisciplinary interventions, which guide caregivers concerning the sensory features of their children with ASD and their association with ADLs and IADLs, such as preparing food. Furthermore, therapists may suggest possible modifications to the environment and daily routine to promote independence and participation in daily activities. Therapists are advised to use performance-based measures focusing on real-life daily tasks that may lay the foundation for ecological targets for intervention, matched to children with ASD and their families' daily routines in natural contexts.

Limitations and Implications for Future Research

Results must be considered with caution as this study's sample consisted of a limited number and character of children (children with ASD without cognitive disabilities or language delays); thus, their generalization to other groups of individuals with ASD across cognitive levels and along the life span is limited. In addition, preliminary associations that were found between daily activity performance and other ASD clinical symptoms were measured by a modification of the CAST questionnaire, which also might potentially affect the results. Furthermore, a comparison of daily activity performance as measured by an ecological assessment to similar proxy reports is warranted to provide a more profound understanding of daily activity performance in real-life contexts among children with ASD. In addition, caution is advisable while implying possible generalizations of the current study's conclusions to other areas of basic and instrumental daily activity performance of children with ASD (other than the specific tasks conducted in the Do-Eat). This data is important to the work of therapists with children with ASD as the ability to acquire, maintain, and generalize daily living skills is crucial, allowing them to achieve a self-sufficient life (Drahota et al., 2013).

Conclusion

The current study expands knowledge concerning impaired IADL performance of children with ASD as compared to TD peers. In addition, the study emphasizes the importance of using ecologically valid performance-based measures of daily activity among children with ASD in research and practice. Our study further explores the possible involvement of sensory features that may influence the participation of children with ASD in daily activity performance. Thus, the evaluation of daily activity performance of children with ASD and its relation to sensory features could assist clinicians in tailoring the optimal intervention, based on the child's specific profiles and needs, in real life. This approach may enhance self-esteem and motivation to participate in daily activities.

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