


Factors Affecting the Independence Level of 4-6-Year-Old Children with Cerebral Palsy in Activities of Daily Living

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Abstract

Objectives

Enhancing the independence of children with cerebral palsy in their daily activities can significantly alleviate caregiver stress and challenges, thereby improving the quality of life for caregivers.. This study aimed to identify the influential factors in the independence level of children with CP in Activities of Daily Living (ADL) (self-care) and Instrumental Activities of Daily Living (IADL) (home participation).

Materials & Methods

In this cross-sectional study, 116 children with different types of CP (61 boys and 55 girls) in the 4-6 age range and their parents were non-randomly selected through convenience sampling. The Iranian-Children Participation Questionnaire was used to measure the children's independence level in self-care activities and home participation. Several instruments, along with a demographic questionnaire, were used to assess personal factors, such as the Gross Motor Function Classification System, Manual Ability Classification System, Communication Function Classification System, SPARCLE (for determining children's cognitive level), and Eating and Drinking Ability Classification System. Eventually, the collected data were analyzed using stepwise linear regression.

Results

The results showed that the level of Gross Motor Function Classification System (GMFCS) and Communication Function Classification System (CFCS) and the child's age had the most correlation with the independence level in self-care activities. Moreover, GMFCS,

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Manual Ability Classification System (MACS), cognitive level, and child's age were most associated with home participation.

Conclusion

Personal factors are more effective than environmental factors in determining the independence of children with CP.

Keywords: Cerebral Palsy, Activities of Daily Living, Instrumental Activities of Daily Living, Participation, Self-care, Occupations.

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Introduction

Cerebral palsy (CP) is the impairment of motor function occurring due to damage to or the dysfunction of the developing brain (1). This brain disorder is not progressive, arising in the early stages of brain development (2). The prevalence of CP is 2.11 per 1000 live births (3). According to the International Classification of Functioning, Disability and Health (ICF), assessing children with CP and their therapeutic interventions includes four components: 1) body structure, 2) body function, 3) participation, and 4) environmental factors (4). According to the World Health Organization (WHO), 'participation' is a comprehensive term encompassing various personal and social aspects. It signifies an individual's active engagement in various life situations. (4). Participation is a critical factor in human life, giving a sense of competence and satisfaction to individuals, playing a significant role in their mental and emotional health, and developing their skills (5, 6). Physical disabilities can significantly impact an individual's health, often leading to emotional and social challenges. These combined factors may result in decreased participation in various activities (6). Among those who are involved in providing services to children

with CP, occupational therapists have a crucial role. The ultimate goal of occupational therapists is to promote individuals' participation in all occupational areas (7, 8).

Based on the Occupational Therapy Framework Practice (OTPF), participation domains or occupational performance areas include eight categories: Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL), work, play, leisure, education, rest/sleep, and social participation. ADL refers to the activities mainly relating to individuals' care for their bodies. These activities are essential to social life and contribute to one's survival and health. IADLs, often more complex than basic ADLs, encompass tasks that support independent living at home and in the community. (9). Studies show that the participation of children with CP in different areas of life is lower than that of normal children (10, 11). The participation restrictions of children with CP are induced by their physical, communicational, and cognitive problems (12).

Previous studies related to identifying the impact of various factors on the independence of children with CP have been conducted in various areas. For example, Pashmdarfard et al., in 2017, investigated

the effect of various factors on social participation, and the results showed that the most predictive factors on social participation of children with CP, including the type of cerebral palsy, manual abilities, and cognitive level of the child (13). Rosenberg et al., in 2013, conducted a study to investigate the factors predicting the participation of children with and without developmental disabilities. The results showed that the process skills and residential areas had the greatest contribution in affecting the participation of disabled children (14). In another study, Hammal et al. studied the impact of factors related to the living environment on the participation of children with CP. The results of this study indicated that communication problems have a significant impact on children's participation (15).

Many studies have revealed that when taking care of children with physical disabilities, caregivers experience fatigue and stress, and this sense of exhaustion decreases the quality of their lives. Besides, the more the children need help with their daily living activities and the more demanding they become, the more their caregivers feel burdened and have difficulties (15, 16). Hence, the independence of children with CP in doing their daily living activities can reduce caregiver burden and difficulties and improve the quality of caregivers' lives. Determining the factors affecting the independence level of children in performing their daily living activities assists rehabilitation experts substantially, specifically occupational therapists, in setting their therapeutic goals, making treatment plans, and implementing their plans. In this way, it is possible to promote the participation of children with CP and reduce the burden and difficulties of caregivers. Therefore, this study aimed to identify the factors influencing

the independence level of children with CP in self-care activities and home participation.

Materials & Methods

Study design

This study was a cross-sectional conducted from September 2019 to February 2020.

Participants

In this study, 116 children with different types of CP in the age group of four to six years (average age = 4.8 years, standard deviation = ± 0.83) and their parents participated. The children participating in the study suffered from various types of CP (Spastic hemiplegia, Spastic diplegia, Spastic quadriplegia, Athetoid, Ataxic, and Dystonic).

The inclusion criteria were children with CP at four to six years of age, and their parents should have the ability to read and write. The exclusion criterion was the failure to complete the questionnaires by the parents.

Sample size

Sampling was performed by non-probability sampling method (convenience sampling). In addition, the sample size was calculated according to previous studies. Out of 123 participants, seven participants were excluded from the study due to needing to complete the questionnaires. Thus, in this study, 116 children with different types of CP in the age group of 4 to 6 years (average age = 4.8 years, standard deviation = ± 0.83) and their parents participated.

Tools

The parents participating in the study ($n=119$) responded to the questionnaires associated with personal factors (GMFCS, MACS, EDCS,

CFCS, SPARCLE), I-CPQ, and the demographic questionnaire containing questions about socioeconomic conditions and other personal information of their child.

Iranian-Children Participation Questionnaire (I-CPQ)

To collect information on involving children with CP in activities related to self-care and home participation, the I-CPQ was used (1). This questionnaire assesses the participation of preschool children with CP over four months. In this questionnaire, the parents of these children rate the level of their children participation based on diversity (0-1), intensity (0-5), independence level (1-6), enjoyment (1-6), and report on their satisfaction with their child's carrying out various activities, including participation in ADL (self-care), IADL (home participation), play, leisure, social participation, and educational environment. In the current study, only two areas, i.e., self-care and home participation, were investigated. The parents rated these areas from 0 (this item does not apply to my child) to 6 (my child has the maximum independence in this item). Additionally, the I-CPQ has acceptable psychometric characteristics to assess children with CP (ICC = 0.98-.0.99 and $\alpha=0.66-0.85$) (1).

Gross motor function classification system (GM FCS)

To gather information on the gross motor skills level of children with CP, the GMFCS was utilized. The GMFCS evaluates children's gross motor abilities using a five-level scale. On this scale, parents score from 1 (complete independence in performing the activity) to 5 (complete dependence in performing the activity). The validity and reliability of this

instrument were at an acceptable level (ICC = 0.92 and weighted kappa coefficient = .685) (2).

Manual Ability Classification System (MACS)

The MACS with five levels was used to collect data on the upper extremity ability of children with CP. In this questionnaire, level 1 represents the child's maximum independence in manual activities, and level 5 reflects their total dependence. The validity and reliability of the Persian version of this instrument were acceptable (ICC = 0.96, spearman's correlation coefficient = 0.94, and weighted kappa coefficient = 0.75) (3).

Communication function classification system (CFCS)

To determine the communication skills of children with CP, the CFCS with five levels was used. In the CFCS, levels 1 and 5 show maximum and minimum communication efficiency, respectively. Minimum communication efficiency is given to people who can hardly express themselves or understand others' talk. The test-retest reliability of CFCS was reported to be 0.96, and the inter-rater reliability was 0.74 (4).

Eating and drinking ability classification system (EDACS)

To gather information about the ability of children with CP to eat and drink, the EDACS was used. This classification system describes children's eating and drinking ability with CP at five levels (5). In this instrument, level 1 indicates the child's perfect ability to eat and drink safely and efficiently, and level 5 reflects the child's inability to eat and drink safely and efficiently. This instrument has an acceptable level of validity and reliability (ICC was reported to be higher than 0.97, and CVR for

all the items was more significant than 0.42. CVI for all items was in the range of 0.78 to 1) (6).

Cognitive level assessment

In this study, to determine children's cognitive level, the index of SPARCLE developed in the SPARCLE project was used (7). In this form, based on the ICD10 scale, children with mild intellectual impairment and an IQ score of 50 to 70 are considered as children with learning disabilities, and children with severe intellectual impairment and an IQ score below 50 are deemed as children with mental disabilities (8).

Demographic questionnaire

The demographic questionnaire includes questions about the child's gender, age, type of CP, parents' age, parents' educational level, parents' job, general information about the location and type of family residence, and the assistive devices used by the child.

Procedure

Firstly, the ethics committee of Zanjan University of Medical Sciences approved the study protocol (Approval ID: ZUMS.REC.1398.106). An occupational therapist visited clinical centers (including hospitals and private clinics) for data gathering. Parents provided written consent and completed the demographic questionnaire. Afterward, the parents were explained how to respond to questionnaires, and they were given a package containing all of the measures (the MACS, GMFCS, I-CPQ, EDCS, and the SPARCLE). They were asked to read each scale's items carefully, answer them, and then return the package to the therapist. Then, the researchers excluded the packages containing incomplete information. Zanjan University of Medical Sciences (ZUMS)

provided financial resources.

Data analysis

The statistical data analysis was done via SPSS software, version 22. Stepwise regression was run to determine the factors influencing children's participation in self-care activities and home participation. Due to a large number of independent variables, initially, their correlation with the dependent variables was measured using the Pearson Correlation Coefficient, and then, those variables whose correlation with the dependent variables (self-care and home participation) were not significant were screened and excluded from the subsequent analysis. In the next step, only those variables that had significant correlations with the dependent variables (self-care and home participation) were entered into the stepwise linear regression model. Multiple linear regression with stepwise selection was used to estimate the relationship between dependent and the independent variables.

Results

In this study, 61 boys (52.6%) and 55 girls with CP (47.4%) with the age range of 4 to 6 years (mean: 4.8 years and SD: 0.83) participated. The mean age of fathers was 37.23. The mean age of mothers was 32.67. The frequency and percentage of each personal and environmental variable are reported in Table 1.

The results of the stepwise linear regression analysis showed that GMFCS, child's age, and CFCS had the most correlation with self-care and GMFCS, child's age, MACS, and cognitive level were the most associated factors with home participation (Tables 2, 3).

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Table 1. The frequency and percent of qualitative variables.

		Frequency	Percent
Gender	Male	61	52.6
	Female	55	47.4
CP type	Spastic hemiplegia	30	25.9
	Spastic Diplegia	50	43.1
	Spastic quadriplegia	21	18.1
	Athetoid	3	2.6
	Ataxia	7	6
	Dystonic	5	4.3
Walking ability	Yes	55	47.4
	No	61	52.6
Cognitive level	>70	49	42.2
	50-70	47	40.5
	<50	20	17.2
GMFCS	Level 1	19	16.4
	Level 2	43	37.1
	Level 3	13	11.2
	Level 4	24	20.7
	Level 5	17	14.7
MACS	Level 1	29	25
	Level 2	35	30.2
	Level 3	24	20.7
	Level 4	8	6.9
	Level 5	20	17.2
CFCS	Level 1	38	32.8
	Level 2	29	25
	Level 3	24	20.7
	Level 4	13	11.2
	Level 5	12	10.3
EDACS	Level 1	69	59.5
	Level 2	25	21.6
	Level 3	16	13.8
	Level 4	5	4.3
	Level 5	1	0.9

GMFCS: Gross Motor Function Classification System, MACS: Manual Ability Classification System, CFCS: Communication Function Classification System, EDACS: Eating and Drinking Ability Classification System

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Table 2. Stepwise linear regression for predicting participation in self-care.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.711	1.187		.599	.550
	GMFCS	3.847	.389	.688	9.893	.000
2	(Constant)	-11.197	2.176		-5.145	.000
	GMFCS	3.285	.347	.587	9.456	.000
	Age	2.757	.445	.385	6.201	.000
3	(Constant)	-8.394	2.284		-3.676	.000
	GMFCS	3.005	.347	.537	8.667	.000
	Age	2.844	.429	.397	6.631	.000
	CFCS	-1.021	.331	-.185	-3.085	.003

Dependent Variable: self-care, GMFCS: Gross Motor Function Classification System, CFCS: Communication Function Classification System.

Table 3. Stepwise linear regression for predicting home participation.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-1.403	1.149		-1.221	.225
	GMFCS	3.087	.376	.618	8.204	.000
2	(Constant)	-9.446	2.290		-4.124	.000
	GMFCS	2.708	.366	.542	7.406	.000
	age	1.862	.468	.291	3.980	.000
3	(Constant)	-6.026	2.491		-2.419	.017
	GMFCS	2.480	.361	.496	6.863	.000
	age	1.822	.452	.285	4.031	.000
	MACS	-.993	.333	-.209	-2.979	.004
4	(Constant)	-4.408	2.578		-1.710	.090
	GMFCS	2.190	.383	.438	5.722	.000
	age	2.070	.461	.324	4.487	.000
	MACS	-.848	.336	-.178	-2.527	.013
	IQ	-1.377	.670	-.156	-2.057	.042

a. Dependent Variable: home participation, GMFCS: Gross Motor Function Classification System, MACS: Manual Ability Classification System.

CS: Eating and Drinking Ability Classification System.

Discussion

This study aimed to determine the factors affecting the independence level of 4- to 6-year-old children with CP in self-care activities and home participation. Based on the results obtained from the initial analysis, it was found that some environmental and personal factors impacted the ability of children with CP to perform activities related to self-care and home participation independently. For example, a child's age, type of CP, cognitive level (IQ), GMFCS, MACS, EDACS, CFCS, and walking ability are the influential factors in self-care skills. The child's age, mother's age, hearing impairment, cognitive level (IQ), GMFCS, MACS, EDACS, CFCS, and walking ability affect the child's degree of independence in home participation. As the results of this study revealed, personal factors had a more significant effect on the independence level of children with CP in self-care and home participation activities. Similarly, among the personal factors, GMFCS, Child's age, and CFCS had the most impact on self-care skills, and GMFCS, child's age, MACS, and IQ exerted the most influence on home participation.

The age of children was one of the most influential factors in the degree of their independence in performing self-care activities and home participation; in other words, older children had more participation in these activities. Dunn et al. (2013) showed that younger children participated less and needed more help with household tasks (9). Moreover, the results of the present study confirmed that children's age plays a critical role in their participation in the activities of self-care and home participation; to put it in other terms, the older the children with CP are, the more independent they are in the self-care and home participation, which can be due to the development

of children's skills with age.

The impact of cognitive impairment on the participation of children with CP has been proven by many studies (9-12). The present study results are consistent with those of these studies. In this study, the results showed that the more the cognitive disabilities were, the less independent the children were in their participation in self-care and home participation activities.

This study's results indicated that the more independent the children were in their gross motor function, the more they participated in self-care and home participation activities, the more independent they were. The results of this study are in agreement with the study undertaken by Beckung et al. (16) revealed that motor function is an essential factor restricting children's participation with CP. Activity limitations were measured through the gross motor function classification system (GMFCS). Tan et al. indicated that the GMFCS score of 5 could contribute to the social participation of children with CP, while the GMFCS score of 1 to 4 had little impact on their participation (12). Livingston et al. demonstrated that children with CP had less activity participation due to poor mobility, endurance, and balance (17).

The obtained results revealed that children's ability in fine movements and manual skills influenced their independent participation in self-care activities and home participation. However, the impact of this factor on independent home participation was stronger. These findings are in agreement with the previous findings (10). Fauconnier et al. confirmed the positive role of children's fine motor skills in their participation in different life situations (12). Zelst et al. showed that upper limb impairment of children with hemiplegic CP could affect their ability to participate in the ADL (18).

In the present study, the results verified the effects of communication skills on children's participation in self-care and home participation. This impact was more substantial on the home participation. These results align with the findings of Fauconnier et al. (12). Similarly, the results of some previous studies have proved the influence of relationships with others and communication skills on the participation of children and adolescents with CP (10, 17). Hammal et al. reported that communication problems were hindered children's participation (15).

The present study and previous research results indicated that personal factors are more robust predictors of the participation of children with CP (14, 19).

Based on this study's results, children with CP's capability to communicate with others and perform gross movements have a substantial relationship with their level of independence in self-care abilities. In addition, the ability of children with CP to use their upper extremities effectively and their gross motor skills had a critical relationship with the level of independence in home participation. Given that some personal factors, such as type of CP, child's age, or cognitive level, are either permanent or barely changeable, promoting children's ability level is likely an influential factor in their participation, their independence in performing the activities of self-care, and home participation increases. Based on this study, children can be more independent in the activities of self-care and home participation by improving their fine motor function (specifically upper-extremity and hand movements), gross motor function, communication skills, ability to walk, and ability to eat and drink safely and efficiently, which is feasible via using rehabilitation interventions.

Limitations

The major limitation of this study was the use of many questionnaires. It took the parents a long time to fill them out. However, the main reason for using all these questionnaires was that the authors intended to investigate all the factors likely to influence children's participation in ADL and IADL.

In conclusion

The participation of children in daily living activities, including self-care and home participation, regardless of their being healthy or sick, is one of the factors affecting their quality of life and predicting their independence in adulthood. Studies indicate that children with CP show less participation in all areas compared to healthy children. This study proved the effect of several factors, such as the child's age, type of CP, cognitive level, gross motor skills, fine motor skills (or manual dexterities), and communication skills, on children's independence and participation in self-care and home participation activities. Considering that some of these factors are stable, improving children's ability in some skills would make them more independent in ADL and IADL.

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Authors' Contribution

Faeze Alvandi was the corresponding author who led the study's monitoring and implementation and wrote the manuscript's first draft. Dr. Malek

Amini designed and conceptualized this research, analyzed the data, and wrote the results section. Narges Ghafarzadeh Namazi collaborated in the implementation of the study. All authors cooperated in the executive steps of the study and approved the final manuscript as submitted.

Conflict of interest

The authors have no conflict of interest to declare.

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