JRSR 8 (2021) 139-143

Journal of Rehabilitation Sciences and Research

Journal Home Page: jrsr.sums.ac.ir

Original Article

Use of Evidence to Reduce the Load of Therapy: Occupational Therapy for Cerebral Palsy

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ARTICLE INFO

Article History:
Received: 07/02/2021
Revised: 18/05/2021
Accepted: 28/07/2021

Keywords:
Cerebral palsy
Gross motor function
Longitudinal studies
Prognosis

Please cite this article as:
Pourahmad S, Balvardi M, KavousiPour S. Use of Evidence to Reduce the Load of Therapy: Occupational Therapy for Cerebral Palsy. JRSR. 2021;8(3):139-143.

ABSTRACT

Background: Occupational therapy outcomes for motor improvement are different among the children with cerebral palsy to determine the effective factors related to gross motor achievement in the children with Cerebral palsy (CP), the present project was designed.

Methods: In a quasi-experimental study, 59 CP patients with Gross Motor Function Classification System (GMFCS) 1-4 were evaluated by Gross Motor Function Measure (GMFM). They were referred to four centers in Shiraz, Iran, in 2015. Results of therapy were monitoring five times during six months for each participant, according to achievement to stages of GMFM, and marginal modeling method was utilized.

Results: The results revealed the significance of some factors including, age at starting occupational therapy services, number of sessions per week, type of spastic, level four of socio economic status (SES), grade two of GMFCS, and time effect on the outcome (upgrade to a higher level on each occasion) ($P<0.05$).

Conclusion: Based on the odds ratio (OR) values, the number of occupational therapy sessions per week had the most positive effect on gross motor function upgrade for at least two half times. Age at starting occupational therapy service was the second important factor in the outcome. However, spending more time for therapy and early starting relates to family characteristics and also financial support.

Introduction

Cerebral palsy (CP) is a complex condition resulting from damage to the immature brain with the primary features of movement limitations and impairments of postural control [1]. A fundamental goal of early intervention for children with CP is to optimize gross motor function [2]. Many determinant factors contribute to motor function improvement, in children with CP; they include family characteristics, service delivery and the grade of Gross Motor Function Classification System (GMFCS) [3]. Some evidence indicated the role of GMFCS level and movement ability in children's interest and motivation in performing activities [4].

Regarding the severity of impairments [5, 6], As Brtlett mentioned in a research, primary impairments, secondary impairments, child personality characteristics' and family factors are four major essential factors for making prognosis of motor improvement by physical therapy services [7]. Furthermoe, body function, body structure, and related impairments are significant indicators for motor function development by GMFM in all developmental disabilities [3, 8].

Spasticity, distribution of impairments, mental and behavioral problems and family supports and characteristics, could determine the child outcome from

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occupational therapy and physical therapy services; we considered these variables to model service delivery for motor improvement.

In the literature, timing, and dosage of rehabilitation [9], continuity of therapy sessions, family supports, therapist experiences for coaching the therapy [10], Mother and father motivation [7] consider as contextual factors related to prognosis. Moreover, body function and structure, the severity of impairments, and GMFCS level are biological factors related to prognosis outcome.

As the evidence showed, more time spending on the repetition of movement leads to more learning; for example, constraint-induced movement therapy (CIMT) developed for the improvement of hand function in the children with hemi plegia as a home base program with at least 3 hours of exercise per day. Moreover, making home as a treatment environment is the optimal goal of occupational therapy for children [11]. Occupational therapy with children literature showed that home exercise and family education make the child home as a 24 hours therapy context. But, in Persian culture, families like to make the therapist and therapy sessions bold because of family beliefs and desires for optimal outcomes. It seems that more therapy session is a value for the family regards to determining predictive factor. Hence, there is a dilemma for rehabilitation practitioners working with children with CP and their families in our country [12], So determining the most effective factors on gross motor improvement during occupational therapy intervention and use them to predict the therapy trend in our society may be useful for therapists, children's families and health policymaker. There are a few studies about therapy dosage in relation to GMFCS level, so to define the motor outcome of children with cerebral palsy in regards to biological, contextual factors and amount of therapy session they perceived, a longitudinal study and appropriate statistical methods were designed.

Methods

A quasi-experimental study was designed. All children who received routine occupational therapy services according to Bobath concept, in private centers and welfare organizations of Shiraz (southern Iran) were admitted to the study. They were children with cerebral palsy in GMFCS level 1 to 4, in both genders during six months (over 1 month intervals). Fifty nine children were qualified and enrolled in the study. Participants were received various numbers of occupational therapy services in a week. The therapists determined the number of therapy sessions, but those were optional for families and caregivers. Accordingly, one assessor who was a master of science student in the biostatistics field, without any information related to cerebral palsy and occupational therapy services, filled out the form of child information with the cooperation of the therapist responsible to the child. All participants confirmed their participation by signing the consent form approved by the Shiraz University of Medical Sciences ethic committee. The ethics code was IR.SUMS.REC.1392.S6696. Therefore, the data gathering process was blind. Investigated factors included age at diagnosis, state of birth, etiology, type of delivery, currently seizure status of child, sequence, and order of treatment, taking drugs, gender, mother workout, the experience of the therapist, age at starting occupational therapy services, socio economic status (SES), positive look and belief of therapist, mental and behavioral problems, number of sessions per week and type of spastic. Moreover, the level of gross motor function was repeatedly evaluated by the month. For this, the items of GMFM were used.

GMFM is a criterion reference observational measurement use to evaluate gross motor function in children with cerebral palsy. There are two related versions of GMFM including, GMFM-88 and the new recent version GMFM-66. This tool categorises gross movements into 6 groups [13]. For example, item A (lying and rolling) in the original version of GMFM, the ability of the child to lift head 45 degrees in supine, is rating as 0 (dose not initiate), 1 (initiate), 2 (partially complete), 3 (complete). But, in this study we define the outcomes as 0 (don't achieve during 6 months of follow-up) and 1 (achieved during 6 months of follow-up). Hence, the upgrade to a higher improvement stage at each visit (yes/no) was treated as the dichotomous outcome.

Marginal model (or models of medium), which developed from generalized linear models, is a known approach to the analysis of longitudinal data [14]. This method does not require any theoretical assumptions for the outcome. The Generalized Estimating Equations (GEE) method was used to estimate the parameters in this method. GEE is based on a quasi-likelihood method. The outcome can be continuous, ordinal or dichotomous in this method. Besides, it is not necessary to have the same number of repeated measurements for each person. Therefore, this method can handle the problem of missing data well. However, the missing data should have occurred quite randomly [15].

To evaluate the performance of marginal model in our data set, validity indexes including sensitivity, specificity (both with cut-off point of 0.3), and the area under the receiver operating characteristics (ROC) curve were utilized.

Results

At starting the therapy, fifty-nine children aged 0 to 7 years old were enrolled in the present study.The age of diagnosis was under 2 years old. The majority were males (59.3%). According to the type of spastic, the patients were divided into three categories: 39 percent diplegia, 22 percent hemiplegia, and 39 percent quadriplegia. Table 1 describes the patients' attributes used in the modelling process. The investigated variables were all categorized to use in this model.

Children were evaluated five times during six months for whether they had obtained the motor skills of the previous session. The answer to this question (yes/no) makes the dichotomous outcome observations for each individual on each occasion.

The results of the marginal model are summarized in Table 2. Each variable with a significant coefficient

Table 1: Descriptive Attributes of children with the cerebral palsy problem in the present study, N=59.

Attribute	Total	Attribute	Total
Age of diagnosis, N (%)		Child age at starting occupational therapy services, N (%)	
0-1 years	48 (81.4)	0-2 years	31 (52.5)
1-2 years	11 (18.6)	2-5 years	13 (22.0)
State of birth, n/N (%)		5-7 years	15 (25.5)
all natural childbirth	38/55 (69.1)	Social Economic Status (SES), N (%)	
Premature and weighing > 2500 gr	17/55 (30.9)	SES, level 4	15 (25.4)
Etiology, N (%)		SES, level 3	11 (18.6)
genetic disorder	5 (8.5)	SES, level 2	8 (13.6)
problems during labor	32 (54.2)	SES, level 1	25 (42.4)
mother's disease	3 (5.1)	Positive look and belief of parents, n/N (%)	
no awareness of etiology	19 (32.2)	very much	20/55 (36.4)
Type of delivery, n/N (%)		High	21/55 (38.2)
caesarean section	29/55 (52.7)	Medium	13/55 (23.6)
normal vaginal delivery	23/55 (41.8)	Low	1/55 (1.8)
long normal vaginal delivery	3/55 (5.5)	Positive look and belief of Therapist, N (%)	
Currently seizure status of child, N (%)		very much	18 (30.5)
no seizures	40 (67.8)	High	21 (35.6)
seizure and resolved	6 (10.2)	Medium	17 (28.8)
seizure with taking medications to control	13 (22.0)	Low	3 (5.1)
Sequence and order of treatment, N (%)		Mental and behavior all problems, N (%)	
Regularly	54 (91.5)	no mental - no behavioral	22 (37.3)
Irregularly	5 (8.5)	mental - behavioral	6 (10.2)
Taking drugs, N (%)		no mental - behavioral	8 (13.6)
Yes	13 (22.0)	mental - no behavioral	23 (39.0)
No	46 (78.0)	Number of sessions per week, N (%)	
Gender, N (%)		more than 10 sessions	14 (23.7)
Female	24 (40.7)	5-10 sessions	19 (32.2)
Male	35 (59.3)	Less than 5 sessions	26 (44.1)
Mothers workouts, N (%)		Type of Spastic, N (%)	
no workout	31 (52.5)	diplegia	23 (39.0)
having workout	28 (47.5)	quadriplegia	23 (39.0)
Experience of therapist, N (%)		hemiplegia	13 (22.0)
more than 10 years	7 (11.9)	Gross Motor Function Classification System (GMFCS), n/N (%)	
5-10 years	19 (32.2)	GMFCS 1	10/53 (18.9)
less than 5 years	33 (55.9)	GMFCS 2	17/53 (32.1)
		GMFCS 3	13/53 (24.5)
		GMFCS 4	13/53 (24.5)

appeared in the final model. Therefore, age at starting occupational therapy services below two years, number of sessions per week, type of spastic, level four of SES, grade two of GMFCS, and time effect were significant factors on the outcome (upgrade to a higher level on each occasion) ($P<0.05$).

Odds ratio (OR) values are interpreted according to the reference category in each factor. The values far from 1 may be significant. Moreover, the values less than 1 show the decrease, and the ones more than 1 result an increase in the odds of upgrade. According to the values in Table 2 (rounded to one decimal), starting the therapy below the age of two increases the odds of upgrading about two times, comparing to the reference category (children aged 5-7 years). Moreover, more than five sessions per week of occupational therapy increase odds of outcome for at least two half times. Besides, the odds of upgrade are less for diplegia and quadriplegia types of spastic than hemiplegia (0.6 and 0.3 times, respectively). For SES, only the forth level (highest level) is significant in outcome (1.6 times compared to the first level). Furthermore, children with grade two of GMFCS have significant odds to upgrade their level on each occasion ($P=0.006$). The time effect is also significant on outcome passing time naturally leads to an increase in odds of upgrading (1.3 times).

Discussion

The results revealed that the children with CP who attended more than five therapy sessions per week and also started the therapy at an early age have more chances to upgrade (two times or more). Besides, diplegia or hemiplegia types of spastic showed more development on the gross motor improvement during a six months period ($P<0.01$). The high SES of the child's family and low grade of GMFCS (grade two) was the other significant factors on the outcome ($P<0.05$). And naturally, passing the time had a postive effect on the upgrade ($P=0.008$).

At first, it is mentioned that according to evidence,

Table 2: The coefficients and standard error values of attributes in the marginal model for gross motor improvement of children with the cerebral palsy problem.

Attribute	Coefficients (SE)	OR (95% CI for OR)	P value
Intercept	-1.696 (0.439)	0.183 (0.078-0.434)	<0.001
Age at starting occupational therapy services			
0-2 years	0.691 (0.272)	1.996 (1.170-3.406)	0.011
2-5 years	0.028 (0.296)	1.028 (0.576-1.836)	0.925
5-7 years	Ref.[a]		
The number of sessions per week			
more than 10 sessions	0.691 (0.272)	3.817 (2.142-6.799)	<0.001
5-10 sessions	0.028 (0.296)	2.507 (1.532-4.102)	<0.001
Less than 5 sessions	Ref.[a]		
Type of Spastic			
Diplegi	-0.571 (0.193)	0.565 (0.387-0.825)	0.003
Quadriplegia	-1.274 (0.285)	0.280 (0.160-0.489)	<0.001
Hemiplegia	Ref.[a]		
Social Economic Status (SES)[b]			
SES, level 4	0.486 (0.230)	1.626 (1.035-2.554)	0.035
SES, level 3	-0.372 (0.236)	0.689 (0.434-1.095)	0.115
SES, level 2	0.514 (0.333)	1.673 (0.871-3.213)	0.123
SES, level 1	Ref.[a]		
Gross Motor Function Classification System (GMFCS)			
GMFCS 1	0.479 (0.340)	1.615 (0.830-3.143)	0.158
GMFCS 2	-0.677 (0.248)	0.508 (0.312-0.826)	0.006
GMFCS 3	0.043 (0.193)	1.044 (0.715-1.525)	0.822
GMFCS 4	Ref.[a]		
Time	0.289 (0.108)	1.335 (1.08-1.65)	0.008

[a]Refrence category; [b]Level 4 is the highest level

cerebral palsy children such as other neuromotor deficit displayed astonishing ability from early brain injury because of time and the process of brain development with neuroplasticity [16]. Recovery likely results from changes in structure and function of undamaged neurons, and this plasticity is a target for rehabilitative strategies [17]. Our results also showed that the passing of time is influential factor.

The results obtained from the previous study showed that the motor function of children with CP is commensurate with their mental performance [18]. Furthermore, the continuous presence of parents in therapy sessions and their awareness of the process have significant effects on therapy [19, 20]. Our study didn't confirm the mentioned results. The differences in the sample size of studies may influence the results.

According to this study's results, receiving more occupational therapy sessions per week upgrades the children's improvement of motion. Besides, starting the therapy at an early age was the other significant factor. High-quality evidence showed that intensive and extended therapy with early initiation, when commenced in the first 2 years of life, is an effective therapy to improve motor function [21]. Palisano found that Mean minutes per month of Physical Therapy and Occupational Therapy were greater for children in levels IV–V than children in level I and greater for children in the United States than children in Canada because of the severity of impairments and insurance coverage [22]. However, occupational therapy services are not covered by insurance in Iran. Therefore, all economic burden of rehabilitation, covered by the family. This burden may lead to depriving children of treatment [23]. Besides, clients and their families depend on therapists. Hence, they like to receive services from specialists rather than learn and do it in the home by themselves. Thus, for more sessions per week, the family should pay more, and it leads to more burden. Therefore, it is necessary that child family and therapists be aware of the child prognosis and related important factors to select the best patient for the best treatment; for example, the results showed that cerebral palsy at level 2 of GMFCS could benefit more from occupational therapy service according to Bobath approach, but children with level 3 or 4 may need to other therapy services as adaptation technique [24].

There is no significant relationship among demographic variables (age, gender, family SES, type of child delivery, mother education) and motor improvement. It seems that gross movements are more influenced by body function and the frequency of exercise and learning than other contextual factors. Evidence showed that mastery motivation could be effective in gross motor function, is influenced by a few contextual factors such as caregiver and therapist perception about child ability [25]. Hence, human and physical context have to be motivated for burst mastery motivation and explore the environment.

The current study is not without limitations. The first is the equal distribution of samples in the different groups of GMFCS level. Future studies should recruit large sample in one of the GMFCS level groups to be the focus on the characteristics of that level and study the other groups in different research phases. It means to design a large comprehensive study with detailed phases according to GMFCS level, According to the importance of GMFCS level to identify motor ability. The second is the lack of a long-term follow-up assessment which limited the generalization of the results. Future studies should recruit a larger sample size and include long-term

follow-ups to examine potential long-term benefits of corrective exercises.

Conclusion

It is necessary that therapists categorize the cerebral palsy children according to GMFCS, SES of family, the age which starts therapy, and the type of cerebral palsy to determine the time spending in the therapy session. Some children need to receive therapy by a therapist directly and intensively, and the others need to conduct by parents and other types of therapy, including modification and use of some kinds of assistive device. It is useful to consider the results of the present study for more accurate clinical reasoning**.** Besides, designing a longer longitudinal study with a larger sample size may provide the required conditions to try other modeling methods in which the differences of individual'sfunctions are considered.

Acknowledgements

The authors are thankful to Ghadir rehabilitation service, Shiraz occupational therapy center, Mehregan occupational therapy center, and Foroghe Asr rehabilitation center for their help in data gathering. Furthermore, we would like to thank Dr. N. Shoukrpour from Research Consultant Center (RCC) for editing this manuscript.

Conflict of Interest: None declared.

References

1. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, Damiano D, et al. A report: the definition and classification of cerebral palsy April 2006. Dev Med Child Neurol Suppl. 2007;109(suppl 109):8-14.
2. Chiarello LA, Palisano RJ, Bartlett DJ, McCoy SW. A multivariate model of determinants of change in gross-motor abilities and engagement in self-care and play of young children with cerebral palsy. Phys Occup Ther Pediatr. 2011;31(2):150-68.
3. Palisano RJ, Walter SD, Russell DJ, Rosenbaum PL, Gémus M, Galuppi BE, et al. Gross motor function of children with Down syndrome: creation of motor growth curves. Arch Phys Med Rehabil. 2001;82(4):494-500.
4. Dehghanizadeh M, Akbarfahimi M, Zareiyan A, Yazdani F, Khalafbeigi M, Soleimani F. Predictors of Interest in Performing Activities Among Iranian Adolescents With Cerebral Palsy. Iran Rehabil J. 2020;18(4):377-86.
5. Alotaibi M, Long T, Kennedy E, Bavishi S. The efficacy of GMFM-88 and GMFM-66 to detect changes in gross motor function in children with cerebral palsy (CP): a literature review. Disabil Rehabil. 2014;36(8):617-27.
6. Bartlett DJ, Chiarello LA, Mccoy SW, Palisano RJ, Jeffries L, Fiss AL, et al. Determinants of gross motor function of young children with cerebral palsy: a prospective cohort study. Dev Med Child Neurol. 2014;56(3):275-82.
7. Bartlett DJ, Palisano RJ. A multivariate model of determinants of motor change for children with cerebral palsy. Phys Ther. 2000;80(6):598-614.
8. Park E-Y, Kim W-H. Structural equation modeling of motor impairment, gross motor function, and the functional outcome in children with cerebral palsy. Res Dev Disabil. 2013;34(5):1731-9.
9. Huang H-C, Chung K-C, Lai D-C, Sung S-F. The impact of timing and dose of rehabilitation delivery on functional recovery of stroke patients. Chin Med J (Engl). 2009;72(5):257-64.
10. Taylor NF, Dodd KJ, McBurney H, Graham HK. Factors influencing adherence to a home-based strength-training programme for young people with cerebral palsy. Physiotherapy. 2004;90(2):57-63.
11. Charles JR, Wolf SL, Schneider JA, Gordon AM. Efficacy of a child-friendly form of constraint-induced movement therapy in hemiplegic cerebral palsy: a randomized control trial. Dev Med Child Neurol. 2006;48(8):635-42.
12. Dehghanizadeh M, Khalafbeigi M, Akbarfahimi M, Yazdani F, Zareiyan A. Exploring the contributing factors that influence the volition of adolescents with cerebral palsy: A directed content analysis. Scand J Occup Ther. 2020:1-11.
13. Russell DJ, Rosenbaum PL, Cadman DT, Gowland C, Hardy S, Jarvis S. The gross motor function measure: a means to evaluate the effects of physical therapy. Dev Med Child Neurol. 1989;31(3):341-52.
14. Carrière I, Bouyer J. Choosing marginal or random-effects models for longitudinal binary responses: application to self-reported disability among older persons. BMC Med Res Methodol. 2002;2(1):1-10.
15. Twisk JW. Longitudinal data analysis. A comparison between generalized estimating equations and random coefficient analysis. Eur J Epidemiol. 2004;19(8):769-76.
16. Pollard V. Neuromotor and Cognitive Development in Children with Cerebral Palsy in Relation to Neural Plasticity. McCabe Thesis Collection. 2001:34.
17. Wittenberg GF. Experience, cortical remapping, and recovery in brain disease. Neurobiol Dis. 2010;37(2):252-8.
18. Dalvand H, Dehghan L, Hadian MR, Feizy A, Hosseini SA. Relationship between gross motor and intellectual function in children with cerebral palsy: a cross-sectional study. Arch Phys Med Rehabil. 2012;93(3):480-4.
19. Hess CR, Teti DM, Hussey-Gardner B. Self-efficacy and parenting of high-risk infants: The moderating role of parent knowledge of infant development. J Appl Dev Psychol. 2004;25(4):423-37.
20. Huang K-Y, Caughy MOB, Genevro JL, Miller TL. Maternal knowledge of child development and quality of parenting among White, African-American and Hispanic mothers. J Appl Dev Psychol. 2005;26(2):149-70.
21. Buitrago JA, Bolaños AM, Caicedo Bravo E. A motor learning therapeutic intervention for a child with cerebral palsy through a social assistive robot. Disabil Rehabil Assist Technol. 2020;15(3):357-62.
22. Palisano RJ, Begnoche DM, Chiarello LA, Bartlett DJ, McCoy SW, Chang H-J. Amount and focus of physical therapy and occupational therapy for young children with cerebral palsy. Phys Occup Ther Pediatr. 2012;32(4):368-82.
23. Raina P, O'donnell M, Rosenbaum P, Brehaut J, Walter SD, Russell D, et al. The health and well-being of caregivers of children with cerebral palsy. Pediatrics. 2005;115(6):e626-e36.
24. Damiano D, Abel M, Romness M, Oeffinger D, Tylkowski C, Gorton G, et al. Comparing functional profiles of children with hemiplegic and diplegic cerebral palsy in GMFCS Levels I and II: Are separate classifications needed? Dev Med Child Neurol. 2006;48(10):797-803.
25. Huang H-H, Sun T-H, Lin C-I, Chen Y-R. Contextual Factors and mastery motivation in young children with and without cerebral Palsy: a Systematic Review. Front Pediatr. 2017;5:224.