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

Saeedeh Pourahmad1, PhD; Mohadeseh Balvardi1,2, MSc; Somaye KavousiPour3*, PhD

1Biostatistics Department, Shiraz University of Medical Sciences, Shiraz, Iran
2Instructor of Biostatistics, Sirjan School of Medical Sciences, Sirjan, Iran
3Department of Occupational Therapy, Shiraz University of Medical Sciences, Shiraz, Iran

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.

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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]. Furthermore, 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
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 hemiplegia 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
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 upgrading. 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 positive effect on the upgrade (P=0.008).

At first, it is mentioned that according to evidence,
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

### 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.

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

*Reference category; Level 4 is the highest level*
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’s functions are considered.

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Conflict of Interest: None declared.

References