# Correlation of gross motor functions with quality of life in children with cerebral palsy of Ahmedabad, Gujarat

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## Abstract

**Introduction:** Cerebral Palsy (CP) is the most common physical disability in children and it represents the most frequent diagnosis of children who receive physical therapy. Quality of Life (QoL) in children with CP is a complex construct that is influenced by many factors. Gross motor function is one of them. Cerebral palsy can have a tremendous impact on the child's capacity to carry out ADL; hence the impact on the QoL of the child and also his/her family.

**Purpose:** To correlate the Quality of Life of children with CP of different clinical types and Gross Motor Function Classification System (GMFCS) levels with their gross motor functions.

**Materials and Methods:** A cross sectional analytical study was conducted on 52 children with cerebral palsy of all GMFCS levels and all clinical types with mean age 9.11 ± 3.31 years (5-18 years).Children were analyzed for their QoL using Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD) questionnaire with respect to their gross motor functions measured using Gross Motor Functional Measure 88.

**Result:** The mean GMFM score was71.99 ± 32.08 and mean PBS score was 33.09 ± 21.25. Results showed moderate to strong positive correlation between gross motor functions and the quality of life between 5 subsection domains of CPCHILD with r value 0.80, 0.909, 0.563, 0.792 and 0.504 respectively. Ambulatory children with GMFCS I, II, III were having higher scores in comparison to non-ambulatory children.

**Conclusion:** Present study concludes that better gross motor functions reflects better quality of life of children with CP.

**Keywords:** Quality of life, Cerebral palsy, Gross motor function.

## Introduction

Cerebral Palsy (CP) is the most common physical disability in children[1] and represents the most frequent child referral to physiotherapy.[2] Cerebral palsy describes a group of disorders of the development of movement and posture, causing activity limitation, that are attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. The motor disorders of cerebral palsy are often accompanied by disturbances of sensation, cognition, communication, perception, and/or behavior, and/or by a seizure disorder.[3]

A total of 2-2.5 of every 1000 live born children in the Western world have the condition;[4] incidence being higher in premature infants and in twin births.[5,6] The severity of impairments varies greatly and the children's mobility ranges from independent walking to totally dependent wheel-chair mobility whilst almost one third are non-ambulant.[7] Although the primary lesion in the brain is non-progressive (static encephalopathy), the pathology is permanent and many of the clinical manifestations including the musculoskeletal consequences, are acquired and progressive over time. Between 25% and 35% of these children are severely involved and experience difficulties with their activities of daily living (ADL), communication, mobility and their health, and are dependent on their caregivers for most of their needs. These conditions have a significant and lifelong impact on the children, their caregivers and families, and to the agencies responsible for their well-being.[8-10] Ability to execute ADL needs combination of gross motor functions, functional balance and hand functions.

The World Health Organization (WHO) defines Quality of Life (QoL) as 'an individual's perception of their position in life in the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards and concerns'.[11]

QoL in children with CP is a complex construct that is influenced by many factors. Cerebral palsy can have a tremendous impact on the child's capacity to carry out ADL; hence the impact on the QoL of the child and also his family.

The traditional focus of health care services for CP has been primarily directed at rehabilitation interventions that address the underlying motor and other developmental impairments such as abnormal muscle tone, decreased attention span, poor dexterity or difficulties with perceptual concepts as well as limitations in essential daily self-care skills and mobility.

In recent years, there has been increasing interest in research on the QoL of children with CP.[12] In a recent review of the QoL and CP literature,[13] it was noted that measuring the QoL construct in children with CP was difficult due to the heterogeneity of the population, including a variety of physical, communicative and intellectual impairments. It is logical to have better QoL with better gross motor functions. Indian studies[14-17] done so far exploring QoL in children with CP of different age groups using different questionnaires but exploration with reference to different clinical types and Gross Motor Functional Classification Scale levels has not been done.

Hence the objective of present study was to correlate the Quality of Life of children with CP of different clinical types and GMFCS levels with their gross motor functions.

## Materials and Methods

Study was approved by the Institutional Ethics Committee with IEC approval letter no. PTC/IEC/93/2012-13 dated 1/3/2013.

A Cross sectional analytical study was conducted on children with cerebral palsy visiting the neuro rehabilitation department of SBB college of physiotherapy, V S General Hospital. Children with confirmed diagnosis of CP of all GMFCS levels and all clinical types, aged 5-18 years, evaluated by pediatric neurologist and pediatric physiotherapist based on abnormal neuro-motor signs consistent with the disorder, such as muscle spasticity, postural abnormalities or developmental reflex problems, delayed developmental milestones were included in the study.

Children presenting with progressive disorders, disorders of non-cerebral origin and specific syndromes which may affect mobility, moderate to severe mental retardation or uncontrolled epilepsy, previous orthopedic surgery in lower extremity, serial casting or BOTOX injection within last 6 months patients with acute fever or respiratory infections or any debilitating illness were excluded.

Children with CP were recruited as per the selection criteria. Nature and purpose of the study was explained to the parent or legal caregiver of the child. Written informed consent for participation in the study was taken from parent or legal caregiver of the child and an oral consent of child was taken if the child was able to understand and give assent.

Gross motor function was measured using Gross Motor Functional Measure 88.[18] Functional balance was tested using Pediatric Balance Scale.[19] Hand function was classified using Manual Ability Classification System (MACS). QoL was measured by Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD)[20] questionnaire based on semi structured interview with primary caregiver. Standardized scores of domains of CPCHILD questionnaire was calculated instead of the total score of the all domains as per scoring guideline of the questionnaire because number of items in each domain is not consistent and summing up all domains to get the total survey score may cause false section weighting.[20]

The CPCHILD© consists of 37 items distributed over among 6 sections representing the following domains:

1. Activities of daily living/ personal care (9 items)
2. Positioning, Transferring and mobility (8 items)
3. Comfort and Emotions (9 items)
4. Communication and Social Interaction (7 items)
5. Health (3 items)
6. Overall Quality of Life (1 Item)

## Results

Present study shows moderate to strong positive correlation between gross motor functions and the quality of life in children with cerebral palsy. Table 1, 2 and Fig 1, 2 display demographic details of all children with CP.

In the present study n=52 children with CP with mean age 9.11 years ± 3.31 years (5-18 years; M: F-59.61: 40.38) were analyzed for their QoL with respect to their gross motor functions.

The mean GMFM score was 71.99 ± 32.08 and mean PBS score was 33.09 ± 21.25 (Table 1).

**Table 1: Demographic details of 52 children with CP analyzed for GMFCS level and MACS level**

| Characteristics | Number(%) |
|---|---|
| Age (years) | |
| Mean ± SD | 9.11 ± 3.31 |
| Range | 5-18 |
| Gender | |
| Male | 31 (59.61) |
| Female | 21 (40.38) |
| Clinical type of CP | |
| Hemiplegic | 17 (32.69) |
| Diplegic | 13 (25.00) |
| Triplegic | 0 |
| Quadriplegic | 9 (17.30) |
| Dystonics | 9 (17.30) |
| Ataxic | 1 (1.92) |
| Athetoid | 3 (5.76) |
| GMFCS Level | |
| I | 22 (42.30) |
| II | 10 (19.23) |
| III | 7 (13.46) |
| IV | 6 (11.53) |
| V | 7 (13.46) |
| MACS Level | |
| I | 10 (19.23) |
| II | 16 (30.76) |
| III | 10 (19.23) |
| IV | 7 (13.46) |
| V | 9 (17.30) |

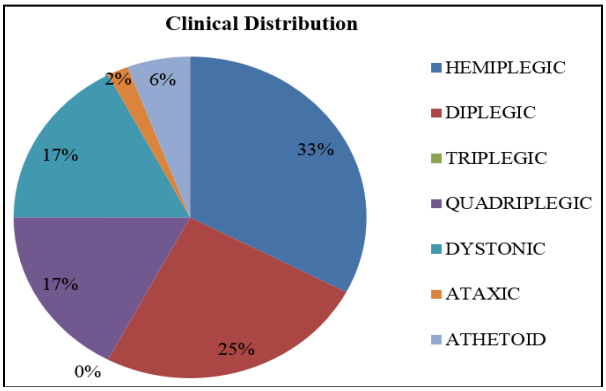


**Fig. 1: Percentage distribution of clinical types of children with CP**

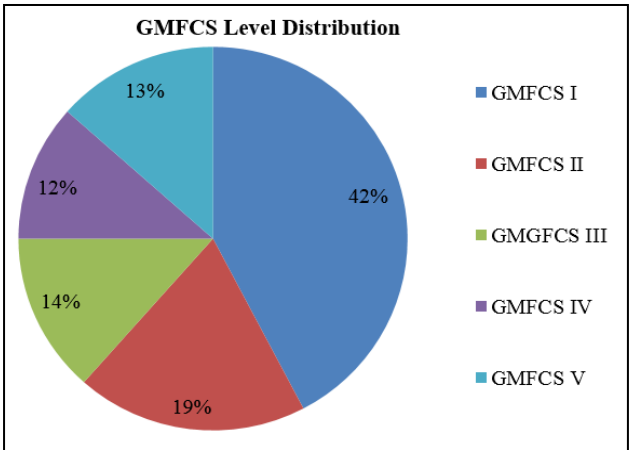


**Fig.2: Percentage distribution of GMFCS levels of children with CP**

**Table 2: Mean of standardized scores of domains (SSD) of CPCHILD questionnaire and other variables**

| Variable | Mean | SD | Median |
|---|---|---|---|
| Age of child | 9.11 year | 3.31 | |
| SSD 1 | 54.46 | 30.18 | |
| SSD 2 | 66.96 | 31.44 | |
| SSD 3 | 74.97 | 22.12 | |
| SSD 4 | 68.68 | 23.69 | |
| SSD 5 | 76.53 | 17.73 | |
| GMFM Total | 71.99 | 32.08 | |
| PBS | 33.09 | 21.25 | |
| BMI | 14.20 | 3.45 | |
| Maternal age | 33.90 | 4.51 | |
| Diagnosis | | | 2 (Diplegic CP) |
| GMFCS | | | 2 |
| MACS | | | 2.5 |

**Table 3: Correlation of GMFM and PBS with standardized scores of domains of CPCHILD questionnaire**

| | SSD 1 | SSD 2 | SSD 3 | SSD 4 | SSD 5 |
|---|---|---|---|---|---|
| GMFM Total | 0.80* Strong positive | 0.909* Strong positive | 0.563* Moderate positive | 0.792* Strong positive | 0.504 Moderate positive |
| PBS | | 0.803* Strong positive | | | |

Note: Correlations given as Pearson's r value (* $p<0.01$)

**Table 4: Mean values of standardized scores of domains of different GMFCS levels of CP**

| GMFCS level | SSD 1 | SSD 2 | SSD 3 | SSD 4 | SSD 5 |
|---|---|---|---|---|---|
| I | 69.30 | 85.29 | 81.02 | 79.43 | 79.69 |
| II | 72.34 | 85.0 | 84.60 | 81.66 | 82.66 |
| III | 54.85 | 66.07 | 82.31 | 71.08 | 86.66 |
| IV | 18.72 | 33.10 | 62.16 | 49.60 | 68.89 |
| V | 12.34 | 13.49 | 45.80 | 30.27 | 54.28 |

**Table 5: Mean values of standardized scores of domains of different clinical types of CP**

| Clinical Type | SSD 1 | SSD 2 | SSD 3 | SSD 4 | SSD 5 |
|---|---|---|---|---|---|
| Hemiplegic | 68.93 | 85.34 | 78.52 | 82.67 | 80.0 |
| Diplegic | 66.87 | 78.47 | 82.54 | 72.42 | 83.33 |
| Quadriplegic | 14.67 | 18.36 | 57.49 | 38.89 | 59.26 |
| Dystonic | 45.95 | 56.63 | 68.78 | 67.98 | 74.81 |

Table 3 shows correlation matrix between the GMFM and 5 subscales of CPCHILD questionnaire.

Subsection dimension 1 represents personal care/ ADL and subsection dimension 2 represents positioning, transferring and mobility items. In the present study, majority of patients were of hemiplegic type 32.69% and diplegic type 25% with GMFCS level I and 42.30% with level II; 19.23% were those who could score higher on positioning, transfer and mobility questions(mean SSD 2 score 66.96 ± 31.44).

On analysis of mean scores of all subsections of CPCHILD questionnaire it was seen that ambulatory children with GMFCS I, II, III had higher scores in comparison to non-ambulatory children. (Table 4)

In SSD 1 diplegic CP had higher mean score compared to hemiplegic CP while in SSD 2 i.e., positioning, transfer and mobility the mean scores of all GMFCS levels were in descending order which conveyed that higher the GMFCS level better will be the mobility. (Table 4)

## Discussions

Present study findings are supported by various authors. Narayanan et al[21] found highly significant difference in CPCHILD scores based on ambulatory status and a demonstrable gradient in CPCHILD scores across the five GMFCS levels. Level II demonstrated an unexpectedly higher mean total score than level III but still significantly lower (better) scores than levels IV and V.

Varni et al[22] reported on sensitivity of the PedsQL 3.0 measure, where children with a distribution of quadriplegia had a lower HRQOL than children with hemiplegia and diplegia. It was also reported that children with lower GMFCS scores representing a higher functioning ability (GMFCS I and II) demonstrated an increased HRQOL.

In the present study, hemiplegic CP were having highest mean SSD 1 and 2 scores followed by diplegic CP, dystonic CP and quadriplegic CP (Table 5) which is supported by Jarvis et al. who have reported that children with quadriplegia or diplegia are generally more handicapped than children with hemiplegia.[23]

Present study findings are consistent with Indian study done by Dobhal et al. 2014 who studied 100 children with cerebral palsy aged 3-10 years receiving regular rehabilitation for cerebral palsy for the previous 1 year at child developmental center. The authors assessed Health related QoL of children with CP and their families and found that 9% were good, 24% were mildly affected, 37% moderately affected and 30% had severely affected HRQOL. The HRQOL was measured using Lifestyle assessment Questionnaire and it was found that the physical independence, mobility and social integration dimensions were much more severely affected than clinical burden, economic burden and schooling dimensions.[24]

Present study findings were consistent with Liu WY et al.[25] Their cross-sectional study of relationships between gross motor functions and health-related quality of life of 90 children with CP with mean age 8.2 ± 2.4 years examined gross motor functions using GMFM 66 and quality of life using Child Health Questionnaire- Parent Form 50. A significant moderate positive correlation ($r=0.73$, $p<0.01$) was found between the physical summary scores of CHQ-Parent Form 50 and GMFM 66 while no significant correlation was found between the psychosocial summary scores of the same outcome measures with $r=-0.13$, $p<0.23$.[25]

Vinson et al[26] 2010 reported that their study population were children with various gross motor functioning which provides additional evidence that difficulties with gross motor functioning are not related to an overall negative QoL. Additionally, by utilizing self –report assessments as opposed to parent report, the hope is that a true subjective measure of QoL was obtained in this population. Previous research has demonstrated a significant discrepancy between parent and self-report of QoL in the CP population.[27]

Puspitasari et al. studied relationship between gross motor function and quality of life among 31 children with CP aged 4-12 years. Results of their study indicated that there was no significant relationship between gross motor function and total score of QoL among children with CP. Authors have explained low sample size and consecutive sampling as responsible for this weak relationship between variables. Since the questionnaires in this study were filled by parents of children with CP, the answers about the children's feelings were the perceptions of the parents. It is possible that these were not the children's actual feelings about their disabilities since the children did not answer directly.[28]

Gross motor functions were found to be good predictors of the physical component of health-related quality of life while they are poor predictors of psychosocial component of HRQOL in children with CP.[25]

Majnemer et al studied determinants of life quality in school-age children with cerebral palsy in 95 children with mean age 9.3±2.1 years with almost half of children with GMFCS level I. Results of their study indicate that quality of life is highly variable in children with CP, with half of children experiencing a life quality similar to typically developing children. Motor and other activity limitations are indicators of physical but not psychosocial well-being. Family functioning, behavioral difficulties and motivation are important predictors of social-emotional adaptation. Determinants of life quality may guide resource allocation and health promotion initiatives to optimize health of the child and family.[29]

Subsection dimension 3 of CPCHILD questionnaire represents comfort and emotions while dimension 4 represents communication and social interaction. Pearson's correlation coefficient between GMFM total and SSD 3and 4 was found to be moderately positively correlated with $r=0.563$ with $p<0.01$ and strongly positively correlated with $r= 0.792$.

Mean score of SSD 3 and 4 in GMFCS level I, II and III are greater than mean score of level IV and V with higher scores in GMFCS level II in comparison to level I.

In support of present study findings, several studies have shown that the gross motor function was not related to the psychosocial domain of quality of life.[13,25,31,32]

Gharaborghe et al (2015) studied relationship between quality of life and gross motor function in 60 children with CP aged 4-12 years old from different clinics of occupational therapy. QoL was measured using CP-QoL and gross motor functions were tested by GMFM. They found significant differences between gross motor function and QoL domains such as social well-being and acceptance, feeling about functioning, participation and physical health, pain and feeling about disability, ability to access to health services. They concluded that there is no relation between gross motor function and psychosocial domains of QoL which means children with CP have the potential to show high psychosocial QoL scores even if they have poor functioning skills.[33] CPCHILD questionnaire do not cover the psychosocial aspect of QoL and hence it is very difficult to comment on psychosocial aspect of children with CP in present study.

Positive significant correlation (r = 0.504) was calculated between SSD 5 (Health) and GMFM total score. On analysis of mean scores of SSD 5 of CPCHILD questionnaire across GMFCS levels it was found that non-ambulatory children had low mean scores compared to ambulatory children. Surprisingly GMFCS level III children had mean scores higher than GMFCS levels I and II.

Child attributes such as the severity of motor dysfunction, age and gender were previously described as important predictors of physical well-being, a component of a child's QoL.[29,34,35]

The study of children's QoL with CP is complicated by the heterogeneity of physical, cognitive, and sensory impairments associated with the condition.[13]

## Conclusion

The present study concluded that gross motor functions are positively correlated with quality of life of children with cerebral palsy.

**Conflict of Interest:** None.

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