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## Interventions and Management

1. *PLoS One*. 2016 Mar 24;11(3):e0151798. doi: 10.1371/journal.pone.0151798. eCollection 2016.

### **Developing the Observatory Test of Capacity, Performance, and Developmental Disregard (OTCPDD) for Children with Cerebral Palsy.**

Liu KC, Chen HL, Wang TN, Shieh JY.

**PURPOSE:** The purpose of this study was to develop a reliable and valid instrument, named the Observatory Test of Capacity, Performance, and Developmental Disregard (OTCPDD), for measuring the amount and quality of use of affected upper limb functions in the daily routines of children with CP. **METHODS:** Forty-eight participants (24 children with CP and 24 matched typically developing children) were recruited. The OTCPDD was administered twice (the spontaneous use condition first, followed by the forced use condition) on children with CP. Their parents were asked to complete the Pediatric Motor Activity Log-Revised (PMAL-R). The internal consistency, the intrarater and interrater reliabilities, and the convergent and discriminant validities were measured. **RESULTS:** The internal consistency (Cronbach's alpha) and the intrarater and interrater reliabilities were higher than 0.9 for all of the OTCPDD scores. The convergent validity was confirmed by significant correlations between the OTCPDD and the PMAL-R. For the discriminant validity, significant differences ( $p < 0.05$ ) were found between children with CP and typically developing children. **CONCLUSIONS:** The results support that the OTCPDD is a reliable and valid observation-based assessment. The OTCPDD, which uses bimanual daily living activities, is able to represent the children's general affected hand functions (including capacity, performance, and developmental disregard) in their daily routines.

[PMID: 27010941](#)

2. *Acta Ortop Bras*. 2016 Jan-Feb;24(1):27-31.

### **Does Rectus Femoris Transfer Increase Knee Flexion During Stance Phase in Cerebral Palsy?**

de Moraes MC Filho, Blumetti FC, Kawamura CM, Lopes JA, Neves DL, Cardoso MO.

**OBJECTIVE:** To evaluate whether distal rectus femoris transfer (DRFT) is related to postoperative increase of knee flexion during the stance phase in cerebral palsy (CP). **METHODS:** The inclusion criteria were Gross Motor Function Classification System (GMFCS) levels I-III, kinematic criteria for stiff-knee gait at baseline, and individuals who underwent orthopaedic surgery and had gait analyses performed before and after intervention. The patients included were divided into the following two groups: NO-DRFT (133 patients), which included patients who underwent orthopaedic surgery without DRFT, and DRFT (83 patients), which included patients who underwent orthopaedic surgery that included DRFT. The primary outcome was to evaluate in each group if minimum knee flexion in stance phase (FMJFA) changed after treatment. **RESULTS:** The mean FMJFA increased from 13.19° to 16.74° ( $p = 0.003$ ) and from 10.60° to 14.80° ( $p = 0.001$ ) in Groups NO-DRFT and DRFT, respectively. The post-operative FMJFA was similar between groups NO-DRFT and DRFT ( $p = 0.534$ ). The increase of

FMJFA during the second exam (from 13.01° to 22.51°) was higher among the GMFCS III patients in the DRFT group ( $p < 0.001$ ). CONCLUSION: In this study, DRFT did not generate additional increase of knee flexion during stance phase when compared to the control group. Level of Evidence III, Retrospective Comparative Study.

[PMID: 26997910](#)

### 3. Dev Neurorehabil. 2016 Mar 22;1-7. [Epub ahead of print]

#### **Cerebellar transcranial direct current stimulation in children with ataxic cerebral palsy: A sham-controlled, crossover, pilot study.**

Grecco LA, Oliveira CS, Duarte NA, Lima VL, Zanon N, Fregni F.

OBJECTIVE: The aim of the present study was to analyze the use of anodal tDCS of the cerebellar region combined with treadmill training to improve balance and functional performance in children with ataxic cerebral palsy. DESIGN: Single-blind, sham-controlled, crossover, pilot study. SETTING: Rehabilitation center and research motion analysis laboratory. PARTICIPANTS: Children (N = 6) with ataxic cerebral palsy and balance deficit. MAIN OUTCOME MEASURES: Static balance (oscillations of the center of pressure), functional balance (Pediatric Balance Scale) and functional performance (Pediatric Evaluation of Disability Inventory) were evaluated. RESULTS: Significant reductions occurred in oscillations of the center of pressure with eyes closed after active anodal tDCS only. The effects of treadmill training on functional balance and functional performance in mobility were maintained in the active tDCS group only. CONCLUSION: These preliminary data support the notion that anodal tDCS of the cerebellar region combined with treadmill training improves balance in children with ataxic cerebral palsy.

[PMID: 27003795](#)

### 4. PLoS One. 2016 Mar 21;11(3):e0151792. doi: 10.1371/journal.pone.0151792. eCollection 2016.

#### **Multilevel Upper Body Movement Control during Gait in Children with Cerebral Palsy.**

Summa A, Vannozzi G, Bergamini E, Iosa M, Morelli D, Cappozzo A.

Upper body movements during walking provide information about balance control and gait stability. Typically developing (TD) children normally present a progressive decrease of accelerations from the pelvis to the head, whereas children with cerebral palsy (CP) exhibit a general increase of upper body accelerations. However, the literature describing how they are transmitted from the pelvis to the head is lacking. This study proposes a multilevel motion sensor approach to characterize upper body accelerations and how they propagate from pelvis to head in children with CP, comparing with their TD peers. Two age- and gender-matched groups of 20 children performed a 10m walking test at self-selected speed while wearing three magneto-inertial sensors located at pelvis, sternum, and head levels. The root mean square value of the accelerations at each level was computed in a local anatomical frame and its variation from lower to upper levels was described using attenuation coefficients. Between-group differences were assessed performing an ANCOVA, while the mutual dependence between acceleration components and the relationship between biomechanical parameters and typical clinical scores were investigated using Regression Analysis and Spearman's Correlation, respectively ( $\alpha = 0.05$ ). New insights were obtained on how the CP group managed the transmission of accelerations through the upper body. Despite a significant reduction of the acceleration from pelvis to sternum, children with CP do not compensate for large accelerations, which are greater than in TD children. Furthermore, those with CP showed negative sternum-to-head attenuations, in agreement with the documented rigidity of the head-trunk system observed in this population. In addition, the estimated parameters proved to correlate with the scores used in daily clinical practice. The proposed multilevel approach was fruitful in highlighting CP-TD gait differences, supported the in-field quantitative gait assessment in children with CP and might prove beneficial to designing innovative intervention protocols based on pelvis stabilization.

[PMID: 26999362](#)

5. **Gait Posture.** 2016 Feb;**44**:61-7. doi: [10.1016/j.gaitpost.2015.11.010](https://doi.org/10.1016/j.gaitpost.2015.11.010). Epub 2015 Nov 30.

**The role of altered proximal femoral geometry in impaired pelvis stability and hip control during CP gait: A simulation study.**

Bosmans L, Jansen K, Wesseling M, Molenaers G, Scheys L, Jonkers I.

Children with cerebral palsy (CP) often present aberrant hip geometry, more specifically increased femoral anteversion and neck-shaft angle. Furthermore, altered gait patterns are present within this population. This study analyzed the effect of aberrant femoral geometry, as present in subjects with CP, on the ability of muscles to control hip and knee joint kinematics. Given the specific gait deficits observed during crouch gait, increased ability to abduct, externally rotate the hip and extend the knee and hip were denoted as beneficial effects. We ran dynamic simulations of CP and normal gait using two musculoskeletal models, one reflecting normal femoral geometry and one reflecting proximal femoral deformities. The results show that the combination of aberrant bone geometry and CP-specific gait characteristics beneficially increased the ability of gluteus medius and maximus to extend the hip and knee. In contrast, the potentials of the hamstrings to extend the hip decreased whereas the potentials to flex the knee increased. These changes closely followed the observed changes in the muscle moment arm lengths. In conclusion, this study emphasizes the concomitant effect of the presence of proximal femoral deformity and CP gait characteristics on the muscle control of hip and knee joint kinematics during single stance. Not accounting for subject-specific geometry will affect the calculated muscles' potential during gait. Therefore, the use of generic models to assess muscle function in the presence of femoral deformity and CP gait should be treated with caution.

[PMID: 27004634](https://pubmed.ncbi.nlm.nih.gov/27004634/)

6. **Yonsei Med J.** 2016 May;**57**(3):807. doi: [10.3349/ymj.2016.57.3.807](https://doi.org/10.3349/ymj.2016.57.3.807).

**Erratum to "Relationships between Isometric Muscle Strength, Gait Parameters, and Gross Motor Function Measure in Patients with Cerebral Palsy" by Shin HI, et al. (Yonsei Med J 2016;57:217-24.).**

[This corrects the article DOI: [10.3349/ymj.2016.57.1.217](https://doi.org/10.3349/ymj.2016.57.1.217).]

Erratum for

Relationships between Isometric Muscle Strength, Gait Parameters, and Gross Motor Function Measure in Patients with Cerebral Palsy. [Yonsei Med J. 2016]

[PMID: 26996588](https://pubmed.ncbi.nlm.nih.gov/26996588/)

7. **J Ayub Med Coll Abbottabad.** 2015 Oct-Dec;**27**(4):754-8.

**Gait Pattern Recognition in Cerebral Palsy Patients Using Neural Network Modelling.**

Muhammad J, Gibbs S, Abboud R, Anand S, Wang W.

**BACKGROUND:** Interpretation of gait data obtained from modern 3D gait analysis is a challenging and time consuming task. The aim of this study was to create neural network models which can recognise the gait patterns from pre- and post-treatment and the normal ones. Neural network is a method which works on the principle of learning from experience and then uses the obtained knowledge to predict the unknowns. **METHODS:** Twenty-eight patients with cerebral palsy were recruited as subjects whose gait was analysed in pre and post-treatment. A group of twenty-six normal subjects also participated in this study as control group. All subjects' gait was analysed using Vicon Nexus to obtain the gait parameters and kinetic and kinematic parameters of hip, knee and ankle joints in three planes of both limbs. The gait data was used as input to create neural network models. A total of approximately 300 trials were split into 70% and 30% to train and test the models, respectively. Different models were built using different parameters. The gait modes were categorised as three patterns, i.e., normal, pre- and post-treatments. **RESULTS:** The results showed that the models using all parameters or using the joint angles and moments could predict the gait patterns with approximately 95% accuracy. Some of the models e.g., the models using joint power and moments, had lower rate in recognition of gait patterns with approximately 70-90% successful ratio. **CONCLUSION:** Neural network models can be used in clinical practice to recognise the gait pattern for cerebral palsy patients.

[PMID: 27004315](https://pubmed.ncbi.nlm.nih.gov/27004315/)

**8. Braz J Phys Ther. 2016 Mar 22. pii: S1413-35552016005005103. [Epub ahead of print]**

**The Sarah evaluation scale for children and adolescents with cerebral palsy: description and results.**

Pinto KS, Carvalho CG, Nakamoto L, Nunes LG.

Background Assessments of motor-functional aspects in cerebral palsy are crucial to rehabilitation programs. Objective To introduce the Sarah motor-functional evaluation scale and to report the initial results of its measurement properties. This scale was created based on the experience of the Sarah Network of Rehabilitation Hospitals in the care of children and adolescents with cerebral palsy. Method Preliminary results concerning the measurement properties of the scale were obtained via assessment of 76 children and adolescents with cerebral palsy. Experts' opinions were used to determine an expected empirical score by age group and to differentiate severity levels. Results The scale exhibited a high Cronbach's alpha coefficient (0.95). Strong correlation was observed with experts' classification for severity levels (0.81 to 0.97) and with the scales Gross Motor Function Measure and Pediatric Evaluation of Disability Inventory (0.80 to 0.98). Regression analysis detected a significant relationship between the scale score and the severity of the child's motor impairment. The inter-rater reliability was also strong (intraclass correlation coefficient ranging from 0.98 to 0.99). The internal responsiveness of the scale score was confirmed by significant differences between longitudinal evaluations (paired Student's t test with  $p < 0.01$ ; standardized response mean of 0.60). Conclusion The Sarah scale provides a valid measure for assessing the motor skills and functional performance of children and adolescents with cerebral palsy. The preliminary results showed that the Sarah scale has potential for use in routine clinical practice and rehabilitation units.

[PMID: 27007025](#)

**9. J Med Eng Technol. 2016 Mar 24:1-7. [Epub ahead of print]**

**Effect of r-TMS over standard therapy in decreasing muscle tone of spastic cerebral palsy patients.**

Gupta M, Lal Rajak B, Bhatia D, Mukherjee A.

Spastic cerebral palsy (CP) is the one of most common neurological disorders occurring due to damage to the immature brain or any other brain lesion at the time of birth. To aid in making the life of the CP patient meaningful, several interventions such as medical, surgical and rehabilitation have been employed to date. Besides these, recently repetitive Transcranial magnetic stimulation (r-TMS) is a new found approach which is being employed for treating various neurological and psychological conditions. The aim of this study was to observe the effects of r-TMS on muscle spasticity in CP patients by stimulating the motor cortex area of the brain, which is responsible for muscle movements. In this study, 20 subjects diagnosed with CP were recruited and 10 each were placed in two groups, namely the research group (RG) (mean age, height and weight were 7.99 (SD = 4.66) years, 116.7 (SD = 23.57) cm and 21.40 (SD = 10.95) kg, respectively) and the control group (CG) (mean age, height and weight were 8.41 (SD = 4.32) years, 107.9 (SD = 26.33) cm, 21.40 (SD = 12.63) kg, respectively). r-TMS frequencies of 5 Hz and 10 Hz were administered for 15 min daily to patients in RG followed by standard therapy (ST) of 1 h duration daily for 20 days. Moreover, the patients in the control group (CG) were given only standard therapy (ST) of 1 h duration for 20 days. Modified Ashworth Scale (MAS) was used as an outcome measure to determine the level of muscle spasticity. A pre-assessment of MAS score was performed on both RG and CG to determine the level of spasticity prior to starting therapy; and similarly post-assessment after 20 days was done to observe the changes post-therapy. Statistical analysis of pre vs post MAS scores showed that few muscles showed reduction in muscle tightness after administering only ST in the CG. On the contrary, the RG that underwent r-TMS therapy combined with ST showed a significant decrease ( $p < 0.05$ ) in muscle tightness for all the muscles selected for the therapy.

[PMID: 27010377](#)

**10. Yonsei Med J. 2016 May;57(3):769-75. doi: 10.3349/ymj.2016.57.3.769.**

**Change in Pulmonary Function after Incentive Spirometer Exercise in Children with Spastic Cerebral Palsy: A Randomized Controlled Study.**

Choi JY, Rha DW, Park ES.

PURPOSE: The aim of this study was to investigate the effect of incentive spirometer exercise (ISE) on pulmonary function and maximal phonation time (MPT) in children with spastic cerebral palsy (CP). MATERIALS AND METHODS: Fifty children with CP were randomly assigned to two groups: the experimental group and the control group. Both groups underwent

comprehensive rehabilitation therapy. The experimental group underwent additional ISE. The forced vital capacity (FVC), forced expiratory volume at one second (FEV<sub>1</sub>), FEV<sub>1</sub>/FVC ratio, peak expiratory flow (PEF), and MPT were assessed as outcome measures before and after 4 weeks of training. RESULTS: There were significant improvements in FVC, FEV<sub>1</sub>, PEF, and MPT in the experimental group, but not in the control group. In addition, the improvements in FVC, FEV<sub>1</sub>, and MPT were significantly greater in the experimental group than in the control group. CONCLUSION: The results of this randomized controlled study support the use of ISE for enhancing pulmonary function and breath control for speech production in children with CP.

[PMID: 26996580](#)

**11. Eur J Paediatr Neurol. 2016 Mar 3. pii: S1090-3798(16)00046-5. doi: 10.1016/j.ejpn.2016.02.013. [Epub ahead of print]**

**The effect of intrathecal baclofen treatment on activities of daily life in children and young adults with cerebral palsy and progressive neurological disorders.**

Bonouvrié L, Becher J, Soudant D, Buizer A, van Ouwerkerk W, Vles G, Vermeulen RJ.

INTRODUCTION: Intrathecal baclofen (ITB) treatment is applied in patients with spastic cerebral palsy (SCP), dystonic cerebral palsy (DCP) and progressive neurological disease (PND). Our aim was to investigate whether ITB treatment has a different effect on activities of daily life (ADL) in these groups. METHOD: A retrospective and cross-sectional survey was conducted using a questionnaire to assess the qualitative effect of ITB (Likert scale) on different domains of functioning (mobility, personal care, communication, comfort) and satisfaction with the results. Groups were compared using non-parametric statistics. RESULTS: Questionnaires were completed for 68 patients (39 SCP, 13 DCP, 16 PND). Satisfaction scores were relatively high in all groups (7-8) and the positive effect on personal care and communication was similar in all groups. The PND group had the shortest follow-up and scored significantly less favourably for the effect on mobility and comfort. DISCUSSION: This is the first study to show that ITB treatment has similar effects on personal care and communication in stable and progressive neurological disease. The decrease in mobility in the PND group is likely due to the progressive nature of the disease. The different effect on comfort between groups is mainly due to the smaller effect on startles in the PND group.

[PMID: 26995704](#)

**12. Gait Posture. 2016 Feb;44:168-71. doi: 10.1016/j.gaitpost.2015.12.003. Epub 2015 Dec 14.**

**Using a goal attainment scale in the evaluation of outcomes in patients with diplegic cerebral palsy.**

McMorran D, Robinson LW, Henderson G, Herman J, Robb JE, Gaston MS.

A goal attainment scale (GAS) was used to evaluate outcomes of surgical and non-surgical interventions to improve gait in 45 children with diplegic cerebral palsy. Personal goals were recorded during pre-intervention gait analysis in two groups. Twenty children underwent orthopaedic surgery (Group 1) and 25 children received a non-operative intervention (Group 2). Children and/or their carers were contacted post-intervention by telephone to complete a GAS questionnaire, rating the achievement of goals on a 5-point scale. The goals were similar in both groups. The composite GAS was transformed into a standardised measure (T-score) for each patient. Both groups on average achieved their goals (mean T-score for Group 2 was 56.3, versus 47.1 for Group 1). The difference between these two means was significant (p=0.010). Additionally, 16 children had undergone a follow-up gait analysis during the study period, but the relationship between their Gait Profile Score and GAS was not statistically significant. Both surgical and non-surgical interventions enabled children to achieve their goals, although Group 1 reported higher achievements. The GAS reflects patient's/parent's/carer's aspirations and may be as relevant as post-intervention kinematic or kinetic outcomes.

[PMID: 27004652](#)

**13. Disabil Rehabil. 2016 Mar 25:1-6. [Epub ahead of print]****Fatigue in the mothers of children with cerebral palsy.**

Garip Y, Ozel S, Tuncer OB, Kilinc G, Seckin F, Arasil T.

**PURPOSE:** To evaluate fatigue in the mothers of children with cerebral palsy (CP), and to determine its associations with clinical parameters of CP, depression and quality of life (QoL). **METHOD:** Ninety children (50 girls and 40 boys) with spastic CP and their mothers were included. Control group comprised mothers of healthy children. Gross motor function classification system (GMFCS) was used for determining functional status. Spasticity was evaluated by using modified Ashworth scale. Fatigue symptom inventory (FSI) was used for assessing maternal fatigue, Nottingham health profile (NHP) for maternal QoL, and Beck Depression Scale (BDS) for maternal depression. **RESULTS:** Mothers of children with CP scored significantly higher in all FSI subgroups (intensity of fatigue, duration of fatigue and interference with QoL), all NHP subgroups and BDS ( $p < 0.05$ ) when compared with controls. FSI was found to be correlated with BDS and all subgroups of NHP ( $p < 0.01$ ). No association was found between FSI and clinical parameters of children with CP including age, gender, type of CP, tonus and functional impairment ( $p > 0.05$ ). **CONCLUSIONS:** Our findings indicate that fatigue levels of mothers with CP children are higher than those with healthy children and associated with depression and deterioration in QoL in terms of physical, social and emotional functioning. This should be considered while designing a family centred rehabilitation programme for children with CP. Implications for Rehabilitation Caring for a child with cerebral palsy has psychological, social and financial impacts on families and is associated with increased levels of fatigue among mothers. The capacity of current programs and services needs to be strengthened to accommodate the needs of children with CP and their mothers in order to reduce fatigue of mothers. New programs need to be developed to provide psychosocial support for the mothers and to reduce their fatigue as they continue to care for their children. Provision of assistive technology devices (particularly suitable wheelchairs) will be useful in reduction of fatigue levels of mothers.

[PMID: 27015263](#)

## Prevention and Cure

**14. Brain Dev. 2016 Mar 18. pii: S0387-7604(16)30006-7. doi: 10.1016/j.braindev.2016.03.002. [Epub ahead of print]**

### **Stem cells therapy in cerebral palsy: A systematic review.**

Kułał-Bejda A, Kułał P, Bejda G, Krajewska-Kułał E, Kułał W.

The aim of this study was to systematically present the best available stem cell therapies for children with cerebral palsy (CP). The databases Medline, PubMed, EMBASE, and the Cochrane Controlled Trials Register for RCTs were searched for studies published from 1967 to August 2015. Systematic reviews, randomised controlled trials (RCTs), controlled trials, uncontrolled trials, cohort studies, open-label studies, and a meta-analysis were analysed. Of 360 articles, seven fulfilled the inclusion criteria: one RCT and six were open-label trials. In these studies, one application of stem cells for children with CP was typical, and the total number of cells administered to patients ranged from 106 to 108/kg. Different routes of cell delivery were used, though in most studies motor development was applied as an indicator of primary outcomes. In three articles, neuroimaging studies were also implemented to confirm the efficacy of the therapies. Observation periods varied from 3 months to 5 years, and patients' tolerance of the therapy was generally good. Stem cell therapy may improve some symptoms in patients with CP, though larger studies are needed to examine the impact of stem cell therapy upon CP.

[PMID: 27004672](#)

**15. J Pediatr (Rio J). 2016 Mar 17. pii: S0021-7557(16)00051-6. doi: 10.1016/j.jpeds.2015.12.003. [Epub ahead of print]**

### **Fidgety movements - tiny in appearance, but huge in impact.**

Einspieler C, Peharz R, Marschik PB.

**OBJECTIVES:** To describe fidgety movements (FMs), i.e., the spontaneous movement pattern that typically occurs at 3-5 months after term age, and discuss its clinical relevance. **SOURCES:** A comprehensive literature search was performed using the following databases: MEDLINE/PubMed, CINAHL, The Cochrane Library, Science Direct, PsycINFO, and EMBASE. The search strategy included the MeSH terms and search strings ('fidgety movement\*') OR ['(general movement\*') AND ('three month\*') OR ('3 month\*')], as well as studies published on the General Movements Trust website ([www.general-movements-trust.info](http://www.general-movements-trust.info)). **SUMMARY OF THE DATA:** Virtually all infants develop normally if FMs are present and normal, even if their brain ultrasound findings and/or clinical histories indicate a disposition to later neurological deficits. Conversely, almost all infants who never develop FMs have a high risk for neurological deficits such as cerebral palsy, and for genetic disorders with a late onset. If FMs are normal but concurrent postural patterns are not age-adequate or the overall movement character is monotonous, cognitive and/or language skills at school age will be suboptimal. Abnormal FMs are unspecific and have a low predictive power, but occur exceedingly in infants later diagnosed with autism. **CONCLUSIONS:** Abnormal, absent, or sporadic FMs indicate an increased risk for later neurological dysfunction, whereas normal FMs are highly predictive of normal development, especially if they co-occur with other smooth and fluent movements. Early recognition of neurological signs facilitates early intervention. It is important to re-assure parents of infants with clinical risk factors that the neurological outcome will be adequate if FMs develop normally.

[PMID: 26997356](#)

**16. No To Hattatsu. 2016 Jan;48(1):14-9.**

### **[Incidence of cerebral palsy in Himeji over a 25-year period]. [Article in Japanese]**

Koterazawa K, Okada Y, Miyata H.

**OBJECTIVE:** To investigate epidemiological and clinical trends of cases of cerebral palsy between 1983 and 2007 in Himeji, Hyogo, Japan. **METHODS:** A retrospective chart review of all children diagnosed with cerebral palsy and evaluated for complications at the authors' clinic in the targeted 25-year period was conducted. Collected data were analyzed and compared across five 5-year blocks (I : 1983-1987, II : 1988-1992, III : 1993-1997, IV : 1998-2002, V : 2003-2007). **RESULTS:** The incidence of cerebral palsy per 1000 live births increased until block IV (I : 1.4, II : 2.0, III : 2.2, IV : 2.9) and then dropped to

2.0 in block V. The most frequent cause of cerebral palsy was periventricular leukomalacia, which was common in preterm births. The frequencies of twins and triplets were highest in block IV, contributing to the elevated incidence of cerebral palsy in this block. In terms of complication severity, mild cases increased during the study period while the percentage of severe cases remained high, thus resulting in a polarized distribution of severity in block V. CONCLUSIONS: The features of cerebral palsy were observed to change during the study period, most likely as functions of the recent progress in perinatal.

[PMID: 27012104](#)