

Monday 23 October 2017

Cerebral Palsy Alliance is delighted to bring you this free weekly bulletin of the latest published research into cerebral palsy. Our organisation is committed to supporting cerebral palsy research worldwide - through information, education, collaboration and funding. Find out more at research.cerebralpalsy.org.au

Professor Nadia Badawi AM

Macquarie Group Foundation Chair of Cerebral Palsy

[Subscribe to CP Research News](#)

Please note: This research bulletin represents only the search results for cerebral palsy and related neurological research as provided by the PubCrawler service. The articles listed below do not represent the views of Cerebral Palsy Alliance.

Interventions and Management

1. Efficacy of constraint-induced movement therapy compared with bimanual intensive training in children with unilateral cerebral palsy: a systematic review.

Tervahauta MH, Girolami GL, Øberg GK.

Clin Rehabil. 2017 Nov;31(11):1445-1456. doi: 10.1177/0269215517698834. Epub 2017 Mar 20.

OBJECTIVE: To systematically review the evidence on the effect of constraint-induced movement therapy compared with bimanual intensive training in children with unilateral cerebral palsy. **DATA SOURCES:** Seven electronic databases (Cinahl, Cochrane Library, EMBASE, Ovid MEDLINE, PEDro, PsycINFO, PubMed) were searched from database inception through December 2016. **METHODS:** A systematic review was performed using the American Academy of Cerebral Palsy and Developmental Medicine and Preferred Reporting Items for Systematic Review and Meta-Analysis guidelines. Standardised mean differences (effect sizes) were calculated for each study and outcome. **RESULTS:** Nine studies met the eligibility criteria. All studies provided level II evidence. Methodological quality was high in two studies, moderate in four studies and low in three studies. The methodology, participant and intervention characteristics were heterogeneous. The participants' ages ranged from 1.5 to 16 years. Their initial hand function ranged from Manual Ability Classification System Level I to Level III. The total intervention dose ranged from 24 to 210 hours and duration from one week to ten weeks. The studies measured outcomes assessing unimanual and bimanual hand and arm function, participation and attainment of individualised goals. Overall, the effect sizes did not favour one of the interventions at short- or long-term follow-up. The 95% confidence intervals were broad, indicating inaccurate precision of the effect sizes. Pooling of the data for a meta-analysis was judged to be of little clinical value owing to heterogeneity. **CONCLUSION:** It is not possible to conclude whether constraint-induced movement therapy or bimanual intensive training is more effective than the other in children with unilateral cerebral palsy.

[PMID: 29050511](#)

2. Negative Influence of Motor Impairments on Upper Limb Movement Patterns in Children with Unilateral Cerebral Palsy. A Statistical Parametric Mapping Study.

Simon-Martinez C, Jaspers E, Mailleux L, Desloovere K, Vanrenterghem J, Ortibus E, Molenaers G, Feys H, Klingels K.

Front Hum Neurosci. 2017 Oct 5;11:482. doi: 10.3389/fnhum.2017.00482. eCollection 2017.

Upper limb three-dimensional movement analysis (UL-3DMA) offers a reliable and valid tool to evaluate movement patterns in children with unilateral cerebral palsy (uCP). However, it remains unknown to what extent the underlying motor impairments explain deviant movement patterns. Such understanding is key to develop efficient rehabilitation programs. Although UL-3DMA has been shown to be a useful tool to assess movement patterns, it results in a multitude of data, challenging the clinical interpretation and consequently its implementation. UL-3DMA reports are often reduced to summary metrics, such as average or peak values per joint. However, these metrics do not take into account the continuous nature of the

data or the interdependency between UL joints, and do not provide phase-specific information of the movement pattern. Moreover, summary metrics may not be sensitive enough to estimate the impact of motor impairments. Recently, Statistical Parametric Mapping (SPM) was proposed to overcome these problems. We collected UL-3DMA of 60 children with uCP and 60 typically developing children during eight functional tasks and evaluated the impact of spasticity and muscle weakness on UL movement patterns. SPM vector field analysis was used to analyze movement patterns at the level of five joints (wrist, elbow, shoulder, scapula, and trunk). Children with uCP showed deviant movement patterns in all joints during a large percentage of the movement cycle. Spasticity and muscle weakness negatively impacted on UL movement patterns during all tasks, which resulted in increased wrist flexion, elbow pronation and flexion, increased shoulder external rotation, decreased shoulder elevation with a preference for movement in the frontal plane and increased trunk internal rotation. Scapular position was altered during movement initiation, although scapular movements were not affected by muscle weakness or spasticity. In conclusion, we identified pathological movement patterns in children with uCP and additionally mapped the negative impact of spasticity and muscle weakness on these movement patterns, providing useful insights that will contribute to treatment planning. Last, we also identified a subset of the most relevant tasks for studying UL movements in children with uCP, which will facilitate the interpretation of UL-3DMA data and undoubtedly contribute to its clinical implementation.

[PMID: 29051729](#)

3. Effect of sensory and motor connectivity on hand function in pediatric hemiplegia.

Gupta D, Barachant A, Gordon AM, Ferre C, Kuo HC, Carmel JB, Friel KM.

Ann Neurol. 2017 Oct 16. doi: 10.1002/ana.25080. [Epub ahead of print]

OBJECTIVE: We tested the hypothesis that somatosensory system injury would more strongly affect movement than motor system injury in children with unilateral cerebral palsy (USCP). This hypothesis was based on how somatosensory and corticospinal circuits adapt to injury during development: while the motor system can maintain connections to the impaired hand from the uninjured hemisphere, this doesn't occur in the somatosensory system. As a corollary, cortical injury strongly impairs sensory function, so we hypothesized that cortical lesions would impair hand function more than subcortical lesions. **METHODS:** Twenty-four children with unilateral CP had physiological and anatomical measures of the motor and somatosensory systems and lesion classification. Motor physiology was performed with transcranial magnetic stimulation and somatosensory physiology with vibration-evoked EEG potentials. Tractography of the corticospinal tract and the medial lemniscus were performed with diffusion tensor imaging, and lesions were classified by MRI. Anatomical and physiological results were correlated with measures of hand function using two independent statistical methods. **RESULTS:** Children with disruptions in the somatosensory connectivity, and cortical lesions had the most severe upper extremity impairments, particularly somatosensory function. Motor system connectivity was significantly correlated with bimanual function, but not unimanual function or somatosensory function. **INTERPRETATION:** Both sensory and motor connectivity impact hand function in children with USCP. Somatosensory connectivity could be an important target for recovery of hand function in children with USCP. This article is protected by copyright. All rights reserved.

[PMID: 29034483](#)

4. Screening and referral for children with physical disabilities.

Georgiadis AG, Thomason P, Willoughby K, Graham HK.

J Paediatr Child Health. 2017 Oct 17. doi: 10.1111/jpc.13735. [Epub ahead of print]

The clinical care of children with physical disabilities is a major priority for paediatricians and paediatric orthopaedic surgeons. Cerebral palsy (CP) is the prototypical condition and remains the most common cause of physical disability in developed countries. The incidence is approximately 2 per 1000 live births, translating to between 600 and 700 new children per annum in Australia, with approximately 34 000 children and adults currently living with CP. This figure is predicted to rise inexorably over the next 20 years. The care of children with physical disabilities, including those with CP, is usually coordinated by paediatricians, general practitioners and allied health teams including physiotherapists, with input from paediatric orthopaedic surgeons when appropriate. The emphasis in care for children with CP has moved from 'reactive' to 'proactive'. In the past, children are often referred when symptomatic, for example when a hip dislocation had occurred and became painful. The emphasis now is on coordinated, multidisciplinary care in which musculoskeletal manifestations of disability are identified by screening programmes. Systematic screening, especially when population-based and linked to a register, avoids children getting 'lost in the system'. Early and more effective interventions may be offered for the prevention of contractures, dislocation of the hip and spinal deformities. In this review, we will focus on the assessment of gait in children with physical disabilities, and monitoring for hip and spine deformity.

[PMID: 29044835](#)

5. Does Intrathecal Baclofen Therapy Increase Prevalence and/or Progression of Neuromuscular Scoliosis?

Walker KR, Novotny SA, Krach LE.

Spine Deform. 2017 Nov;5(6):424-429. doi: 10.1016/j.jspd.2017.03.006.

STUDY DESIGN: Retrospective, case-matched review. **OBJECTIVES:** Compare a group of individuals with cerebral palsy (CP) who had intrathecal baclofen (ITB) pumps to a group of individuals with CP who did not have ITB pumps in order to determine if there was a difference in the prevalence of new-onset neuromuscular scoliosis, an increased rate of progression of preexisting neuromuscular scoliosis, or an increased rate of posterior spine fusion surgery in skeletally immature individuals with CP who had ITB pumps. **SUMMARY OF BACKGROUND DATA:** Various authors report conflicting findings, with some reporting an increased incidence or prevalence of scoliosis in individuals with CP who have ITB pumps whereas others report no difference in the rate of scoliosis between groups. **METHODS:** Retrospective chart and radiographic case-matched study in which individuals were matched by gender and Gross Motor Function Classification Scale (GMFCS) level. **RESULTS:** We found no difference in the rates of new-onset neuromuscular scoliosis for those with CP and ITB pumps and those without ITB pumps. However, we did see a higher rate of progression as well as an increased rate of posterior spine fusion surgery in individuals with CP who had ITB pumps than for those with CP who did not have an ITB pump. **CONCLUSIONS:** We continue to recommend ITB pump therapy for individuals with severe spasticity associated with CP (GMFCS IV and V). There is a significant risk of complications for individuals in general. The risk of neuromuscular scoliosis is relatively high in this population. Our findings suggest that individuals with CP who have ITB pumps and who do or do not have preexisting scoliosis should be monitored closely for either developing new neuromuscular scoliosis or progression of preexisting scoliosis.

[PMID: 29050720](#)

6. Normative Values of Physical Examinations Commonly Used for Cerebral Palsy.

Moon SJ, Choi Y, Chung CY, Sung KH, Cho BC, Chung MK, Kim J, Yoo MS, Lee HM, Park MS.

Yonsei Med J. 2017 Nov;58(6):1170-1176. doi: 10.3349/ymj.2017.58.6.1170.

PURPOSE: The aim of this study was to establish normative values and to identify age-related change in physical examinations that are commonly used while evaluating patients with cerebral palsy (CP). **MATERIALS AND METHODS:** One hundred four healthy volunteers (mean age 36 years, standard deviation 15 years) were enrolled and divided into four age groups: 13-20, 21-35, 36-50, and 51 years and older. The eighteen physical examination tests for CP were selected by five orthopedic surgeons in consensus-building session. The measurements were taken by three orthopedic surgeons. **RESULTS:** There was no significant difference in the measures of physical examination among all the age groups, except for the Staheli test ($p=0.002$). The post hoc test revealed that the mean hip extension was 2.7° higher in the 13-20-year-old group than in the other age groups. The bilateral popliteal angle had a tendency to increase in those over 36-years-old. There were 31 participants (30%) with a unilateral popliteal angle greater than 40° . **CONCLUSION:** We documented normative values that can be widely used for evaluating CP in patients 13 years and older.

[PMID: 29047241](#)

7. The Effects of Exoskeleton Assisted Knee Extension on Lower-Extremity Gait Kinematics, Kinetics, and Muscle Activity in Children with Cerebral Palsy.

Lerner ZF, Damiano DL, Bulea TC.

Sci Rep. 2017 Oct 18;7(1):13512. doi: 10.1038/s41598-017-13554-2.

Individuals with cerebral palsy often exhibit crouch gait, a debilitating and inefficient walking pattern marked by excessive knee flexion that worsens with age. To address the need for improved treatment, we sought to evaluate if providing external knee extension assistance could reduce the excessive burden placed on the knee extensor muscles as measured by knee moments. We evaluated a novel pediatric exoskeleton designed to provide appropriately-timed extensor torque to the knee joint during walking in a multi-week exploratory clinical study. Seven individuals (5-19 years) with mild-moderate crouch gait from cerebral palsy (GMFCS I-II) completed the study. For six participants, powered knee extension assistance favorably reduced the excessive stance-phase knee extensor moment present during crouch gait by a mean of 35% in early stance and 76% in late

stance. Peak stance-phase knee and hip extension increased by 12° and 8°, respectively. Knee extensor muscle activity decreased slightly during exoskeleton-assisted walking compared to baseline, while knee flexor activity was elevated in some participants. These findings support the use of wearable exoskeletons for the management of crouch gait and provide insights into their future implementation.

[PMID: 29044202](#)

8. Postural insoles on gait in children with cerebral palsy: Randomized controlled double-blind clinical trial.

Pasin Neto H, Grecco LAC, Ferreira LAB, Duarte NAC, Galli M, Oliveira CS.

J Bodyw Mov Ther. 2017 Oct;21(4):890-895. doi: 10.1016/j.jbmt.2017.03.005. Epub 2017 Mar 4.

The aim of the present study was to assess the effect of postural insoles on gait performance in children with Cerebral Palsy (CP). Twenty four children between four and 12 years of age were randomly allocated either the control group (n = 12) or experimental group (n = 12). The control group used placebo insoles and the experimental group used postural insoles. Three-dimensional gait analysis was performed under three conditions: barefoot, in shoes and in shoes with insoles. Three evaluations were carried out: 1) immediately following placement of the insoles; 2) after three months of insole use; and 3) one month after suspending insole use. Regarding the immediate effects and after three months use of insole, significant improvements in gait velocity and cadence were found in the experimental group, along with an increase in foot dorsiflexion, a reduction in knee flexion and a reduction in internal rotation. Conversely, these changes were not maintained in the third assessment, one month after withdrawal of the insoles. The use of postural insoles led to improvements in gait performance in children with CP.

[PMID: 29037645](#)

9. Can Measured Muscle Synergies Construct Unmeasured Muscle Excitations?

Bianco NA, Patten C, Fregly BJ.

J Biomech Eng. 2017 Oct 16. doi: 10.1115/1.4038199. [Epub ahead of print]

Accurate prediction of muscle and joint contact forces during human movement could improve treatment planning for disorders such as osteoarthritis, stroke, Parkinson's disease, and cerebral palsy. Recent studies suggest that muscle synergies, a low-dimensional representation of a large set of muscle electromyographic (EMG) signals (henceforth called "muscle excitations"), may increase the uniqueness of muscle excitations predicted by optimization methods. This study explores the feasibility of using muscle synergy information extracted from eight muscle EMG signals (henceforth called "included" muscle excitations) to accurately construct muscle excitations from up to 16 additional EMG signals (henceforth called "excluded" muscle excitations). Using treadmill walking data collected at multiple speeds from two subjects (one healthy, one post-stroke), we performed muscle synergy analysis on all possible subsets of eight included muscle excitations and evaluated how well the calculated time-varying synergy excitations could construct the remaining excluded muscle excitations (henceforth called "synergy extrapolation"). We found that some, but not all, eight-muscle subsets yielded synergy excitations that achieved >90% extrapolation variance account for (VAF). Using the top 10% of subsets, we developed muscle selection heuristics to identify included muscle combinations whose synergy excitations achieved high extrapolation accuracy. For 3, 4, and 5 synergies, these heuristics yielded extrapolation VAF values approximately 5% lower than corresponding reconstruction VAF values for each associated eight-muscle subset. These results suggest that synergy excitations obtained from experimentally measured muscle excitations can accurately construct unmeasured muscle excitations, which could help limit muscle excitations predicted by muscle force optimizations.

[PMID: 29049521](#)

10. External Match Loads of Footballers With Cerebral Palsy: A Comparison Among Sport Classes.

Yanci J, Castillo D, Iturricastillo A, Urbán T, Reina R.

Int J Sports Physiol Perform. 2017 Oct 16:1-23. doi: 10.1123/ijsp.2017-0042. [Epub ahead of print]

PURPOSE: The aim of this study was to determine and to compare the external match load (ML), according to sport class (FT) of footballers with cerebral palsy (CP) during the International Federation of CP Football (IFCPF) World Championships Qualification Tournament. **METHODS:** Forty-two international male footballers with CP participated in the data collection. The footballers with CP were classified according to their FT in three groups (i.e. FT5/6, FT7, and FT8). External ML (i.e. total distance covered, distance covered at different speeds, accelerations, decelerations, player load, peak metabolic power and changes of directions) were collected for both halves during official matches with Global Positioning System (GPS) devices. **RESULTS:** The results of this study showed that players with lower impairment (FT8) covered more distance (ES = .30-.60) at high-intensity running (HIR: 13.0-18.0 km·h⁻¹) and sprinting (SPR: > 18.0 km·h⁻¹), and performed more (ES = .29-1.08) accelerations, decelerations and CODs at high intensity in matches than other players (i.e. FT5/6 and FT7 groups). **CONCLUSION:** Because high-intensity actions are relevant to football performance, and there are differences due to players' impairments, the IFCPF classification protocols should include high-intensity actions during the technical assessment as part of the procedures for determining the sport class of football players with CP.

[PMID: 29035588](#)

11. Testing an AAC system that transforms pictograms into natural language with persons with cerebral palsy.

Pahisa-Solé J, Herrera-Joancomartí J.

Assist Technol. 2017 Oct 18. doi: 10.1080/10400435.2017.1393844. [Epub ahead of print]

In this paper, we describe a compansion system that transforms the telegraphic language that comes from the use of pictogram-based Augmentative and Alternative Communication (AAC) into natural language. The system was tested with 4 participants with severe cerebral palsy and ranging degrees of linguistic competence and intellectual disabilities. Participants had used pictogram-based AAC at least for the past 30 years each and presented a stable linguistic profile. During tests, which consisted in a total of 40 sessions, participants were able to learn new linguistic skills, such as the use of basic verb tenses, while using the compansion system, which proved a source of motivation. The system can be adapted to the linguistic competence of each person and required no learning curve during tests when none of its special features, like gender, number, verb tense or sentence type modifiers, were used. Furthermore, qualitative and quantitative results showed a mean communication rate increase of 41,59%, compared to the same communication device without the compansion system, and an overall improvement in the communication experience when the output is in natural language. Tests were conducted in Catalan and Spanish.

[PMID: 29045194](#)

12. Oral health comprehension in parents of Saudi cerebral palsy children.

Wyne AH, Al-Hammad NS, Splieth CH.

Saudi Dent J. 2017 Oct;29(4):156-160. doi: 10.1016/j.sdentj.2017.07.004. Epub 2017 Aug 2.

OBJECTIVE: To determine oral health comprehension among parents of cerebral palsy (CP) children. **METHODS:** A self-administered questionnaire was utilized to obtain the required information. The study was conducted in two main centers for disabled children in Riyadh, Saudi Arabia. **RESULTS:** Parents of all 157 CP children registered in the two centers completed the questionnaire. Mothers mostly (86.6%) completed the questionnaire. Majority (98.7%) of the parents knew the importance of dental health for general health. More than two-third (70%) of the parents thought that teeth should be brushed thrice daily or after each meal. About three in every ten (29.9%) parents were not aware of the beneficial effect of fluoride in preventing dental caries; and very few (9.6%) were aware of water as a source of fluoride. Almost all (98.7%) the parents knew that sugary foods caused dental caries. Three-fourth (75.8%) of the parents were not aware of the possible harmful effects of bottled juices on teeth. There were no significant ($p > 0.05$) associations between the parental age/gender with any of the dependent variables. **CONCLUSION:** Parents of CP children generally showed satisfactory oral health comprehension. However, they need further oral health education in several areas.

[PMID: 29033525](#)

13. Weak evidence supports intensive, task-oriented, early intervention with parent support for infants with, or at high risk of, cerebral palsy.

Wallen M, Imms C, Hoare B, Greaves S.

Aust Occup Ther J. 2017 Oct;64(5):423-425. doi: 10.1111/1440-1630.12426.

[Critically appraised paper – no abstract available]

[PMID: 29044651](#)

14. [Peptidergic nootropic therapy in cerebral palsy associated with epilepsy].

[Article in Russian; Abstract available in Russian from the publisher]

Kholin AA, Zavadenko NN, Il Ina ES, Kolpakchi LM, Fedonyuk ID, Bembeeva RC, Esipova ES.

Zh Nevrol Psikhiatr Im S S Korsakova. 2017;117(9):37-42. doi: 10.17116/jnevro20171179137-42.

AIM: To assess the efficacy and safety of cortexin in the treatment of children with cerebral palsy (CP) combined with epilepsy. MATERIAL AND METHODS: Eighty-four patients (55 boys and 29 girls), aged from 1 to 11 years, with CP combined with epilepsy received cortexin together with antiepileptic drugs (AEDs). Cortexin was administered in doses of 5-10 mg depending on the patient's age and body weight intramuscularly during hospitalization. RESULTS AND CONCLUSION: Cortexin as add-on to AEDs reduced for more than two times the number of seizures, along with improvement of motor function, in 31 (36.9%) patients. The improvement of motor function, but without a significant decrease in epileptic seizures, was achieved in 15 (17.8%) of the patients. Reduction of epileptic seizures frequency (>2 times), but without a significant effect on motor function, was observed in 14 cases (16.7%). Twenty-three patients (27.4%) did not respond the therapy. The aggravation of epileptic seizures during cortexin therapy was observed in only 1 girl with West syndrome (1.2%), and this was significantly lower than the probability of seizures aggravation on AED. Polypeptide nootropic medication cortexin demonstrated efficacy and safety as adjunctive therapy in children with CP combined with epilepsy.

[PMID: 29053119](#)

15. Classification of cerebral palsy and potential role of video recording.

Masson R, Pagliano E, Baranello G.

Eur J Paediatr Neurol. 2017 Oct 9. pii: S1090-3798(17)31841-X. doi: 10.1016/j.ejpn.2017.10.001. [Epub ahead of print]

We read with great interest the work by Eggink et al.1 recently published on this journal. In this paper, the authors assessed the inter- and intra-rater agreement in the classification of spastic, dyskinetic and ataxic features of 15 patients with cerebral palsy (CP), within a group of 9 selected clinicians experienced in the field of pediatric neurology (3), pediatric rehabilitation (3) and movement disorders (3). Clinical assessment was performed through a standardized video protocol of a complete neurological examination, with the clinicians being blinded to each patient's history and any other clinical information.

[PMID: 29042153](#)

16. Response to 'Classification of cerebral palsy and potential role of video recording'.

Eggink H, Kremer D, Tijssen MAJ.

Eur J Paediatr Neurol. 2017 Oct 9. pii: S1090-3798(17)31934-7. doi: 10.1016/j.ejpn.2017.10.002. [Epub ahead of print]

First of all, we want to thank Dr Masson and colleagues for their interesting letter in which they comment on our recently published paper on the use of video recording in clinical phenotyping children with cerebral palsy (CP). In concordance with

our paper, Dr Masson and colleagues highlight the possible structural problem in the definition of motor syndromes in CP, a population in which management is entirely symptomatic making adequate phenotyping essential.

[PMID: 29046250](#)

17. Psychometric Properties of the Iranian-Children Participation Questionnaire (I-CPQ) When Used with Parents of Preschool Children with Cerebral Palsy.

Amini M, Hassani Mehraban A, Rostamzadeh O, Mehdizadeh F.

Occup Ther Health Care. 2017 Oct 17:1-11. doi: 10.1080/07380577.2017.1382753. [Epub ahead of print]

The purpose of the study was to establish the psychometric properties of the Iranian-Children Participation Questionnaire (I-CPQ) among parents (n = 120) of preschool children with cerebral palsy. The mean age of the preschool children was 5.1 years old. The confirmatory factor analysis was conducted in two stages, and the values of all goodness of fit tests reached an acceptable level (greater than 0.9), and achieved an acceptable root mean square error of approximation model fit value of 0.05. The results of convergent validity with the Vineland Adaptive Behavior Scale for all subtests were significant. Internal consistency was acceptable to excellent (α : 0.66-0.85), and test-retest reliability was excellent (ICC: 0.92-0.98). We concluded that the I-CPQ demonstrated good psychometric properties and utility for assessing participation of Iranian preschool children with cerebral palsy.

[PMID: 29039716](#)

18. Caregiving burden of children with chronic diseases.

Piran P, Khademi Z, Tayari N, Mansouri N.

Electron Physician. 2017 Sep 25;9(9):5380-5387. doi: 10.19082/5380. eCollection 2017 Sep.

BACKGROUND: The care demands of children with chronic diseases can affect caregivers' health by imposing caregiving burden to them. The health status of caregivers plays a vital role in the quality of care provided to such children and in their quality of life. **OBJECTIVE:** To determine caregiving burden in caregivers and to identify relevant influential factors. **METHODS:** In this cross-sectional study, a total number of 249 caregivers of children with chronic diseases who referred to hospitalization and ambulatory departments of Bandar Abbas, Iran in 2016 were selected using convenience sampling method. The main caregivers who were older than 18 years and provided care to a sick child for at least three months consecutively were included. Caregiving burden was measured using the Caregiver Burden Scale. Data was analyzed SPSS 16 using descriptive statistics, Spearman's correlation coefficient and Mann-Whitney U test. **RESULTS:** Mean score of caregiving burden was 1.98 which was close to moderate level. The highest caregiving burden was observed in general strain dimension (2.35), and cerebral palsy imposed the maximum burden to caregivers (2.24). Correlation coefficient revealed that perceived caregiving burden was in connection with children's and caregivers' age, duration of disease and caregiving, child's level of disability, number of family members and income level ($p < 0.05$). Mann-Whitney U test showed that female caregivers, villagers, and caregivers dealing with more than one patient experienced higher burden ($p < 0.05$). **CONCLUSION:** Different variables can increase caregiving burden. Therefore, planning for holistic and family-centered interventions to decrease caregiving burden is necessary for health care providers.

[PMID: 29038725](#)

19. When I do, I become someone: experiences of occupational performance in young adults with cerebral palsy.

Bergqvist L, Öhrvall AM, Himmelmann K, Peny-Dahlstrand M.

Disabil Rehabil. 2017 Oct 17:1-7. doi: 10.1080/09638288.2017.1390696. [Epub ahead of print]

PURPOSE: Persons with cerebral palsy, even if they have relatively good motor functions, have a lower level of independence and participation in everyday activities than persons of the same age without disabilities. However, there are few descriptions

of how persons with cerebral palsy themselves perceive their performance of activities in everyday life. The aim of this study was to describe the perceptions that young adults with cerebral palsy have of occupational performance in everyday life. **METHODS:** This qualitative interview study includes 10 participants with cerebral palsy classified with Manual Ability Classification System level I-II, aged 19-30 years. The data were analyzed using a phenomenographic approach. **RESULTS:** The interviews resulted in five categories: "Important to do"; "Demanding but can be facilitated"; "Excludes or includes"; "Diminishes me or makes me grow"; and "Comes at a price". **CONCLUSIONS:** The young adults with cerebral palsy consider that, despite life being so demanding, it is extremely important to perform activities themselves and to feel included, as this enables personal growth. Hence, it is necessary to advance intervention methods based on personally important activities to enable individuals with cerebral palsy to find their own way to perform activities. Further research is needed to increase opportunities for individuals with cerebral palsy to perform everyday activities without too much fatigue and struggle. **Implications for Rehabilitation** For young adults with cerebral palsy it is extremely important to perform everyday activities independently; by DOING activities they form their identity. Intervention models aimed to enable persons with cerebral palsy to be involved and find their own way to perform everyday activities should be emphasized. Attention must be paid to how mental fatigue is manifested in persons with cerebral palsy. To build self-awareness and self-efficacy, individuals with cerebral palsy need information, early in life, about cerebral palsy and the multifaceted difficulties the disability might lead to.

[PMID: 29041822](#)

Prevention and Cure

20. Study of global DNA methylation in monozygotic twins with cerebral palsy.

Yuan Y.

Pak J Pharm Sci. 2017 Jul;30(4(Suppl.)):1467-1473.

The objective of this paper is to study the global DNA Methylation in monozygotic (MZ) twins with cerebral palsy. Two pairs of twins (a cerebral palsy children, a normal child) admitted to the First Affiliated Hospital of Zhengzhou University were selected as subjects. The phenol-chloroform method was used to extract DNA from venous blood and micro satellite DNA genotyping technique was used to identify the eggs of the twins. DNA methylation fragments were enriched by MBD affinity column chromatography, followed by Solexa sequencing and bioinformatics analysis. In this study, we found that there were different DNA hypermethylation regions between each pair of twins and normal children through global DNA methylation analysis technique by analyzing the blood cells of two pairs of monozygotic twins with cerebral palsy and normal infants. The results revealed the region of DNA methylation and the protein coding genes of promoter region of common methylation of cerebral palsy were both higher than normal children. These common promoter hypermethylation genes in cerebral palsy are involved in a variety of biological processes such as membrane protein transport, neuronal development, apoptosis, and metabolism. Moreover, DNA methylation plays an important role in gene expression. We hypothesized that the onset of cerebral palsy in twins is associated with hypermethylation of the promoter which inhibiting the expression of hypermethylation genes in children with cerebral palsy. The current research provided a basis for further study of the large sample of twins and sporadic cerebral palsy.

[PMID: 29043999](#)

21. Beyond survival: 5-year neurodevelopmental follow-up of a cohort of preterm infants in Colombo, Sri Lanka.

Sumanasena SP, Vipulaguna DV, Mendis MM, Gunawardena NS.

Paediatr Int Child Health. 2017 Oct 18:1-9. doi: 10.1080/20469047.2017.1380944. [Epub ahead of print]

BACKGROUND: There is a lack of information on long-term neurodevelopmental outcome in preterm neonates in low- and middle-income countries. **OBJECTIVES:** To describe the developmental attainments of preterm neonates followed up for 5 years and to identify the risk factors for impairment. **METHOD:** A prospective descriptive cohort study was undertaken in neonates of 34 weeks gestation born within a period of 12 months at a single tertiary maternity and neonatal unit in Colombo, Sri Lanka. Infants were assessed for neurodevelopment using the Bayley Infant and Toddler III® Assessments at 6, 12 and 24 months of corrected age and school readiness assessment at 5 years. **RESULTS:** Fifty-one infants were assessed at least once, 45 were assessed at 2 years and 39 had a final assessment at 5 years. Neurodevelopmental attainment deteriorated significantly in the cognitive and motor composite scores from 6 to 24 months ($p < 0.05$). By 5 years the number of children with delay in

cognitive, language and motor domains had reduced significantly from 24 months ($p < 0.05$) but the cognitive skills remained most affected (10/39). At 5 years, 13 of 39 children had a confirmed diagnosis of a neurodevelopmental disorder: eight had attention deficit hyperactivity disorder, three autism spectrum disorder, one cerebral palsy and one visual impairment. Surfactant administration and retinopathy of prematurity were the most significant risks for delayed development at 5 years ($p < 0.05$). CONCLUSION: Deterioration of cognitive and motor composite scores over the first 24 months highlights the need for regular surveillance of premature infants. There was a discrepancy between the diagnosis of neurodevelopmental delay at 24 months and at 5 years. But the notable impact on school readiness skills requires public health initiatives to cater for the needs of these children.

[PMID: 29043919](#)

22. Whole-genome scale identification of methylation markers specific for cerebral palsy in monozygotic discordant twins.

Jiao Z, Jiang Z, Wang J, Xu H, Zhang Q, Liu S, Du N, Zhang Y, Qiu H.

Mol Med Rep. 2017 Oct 17. doi: 10.3892/mmr.2017.7800. [Epub ahead of print]

Cerebral palsy (CP) is a severe type of brain disease affecting movement and posture. Although CP has strong genetic and environmental components, considerable differences in the methylome between monozygotic (MZ) twins discordant for CP implicates epigenetic contributors as well. In order to determine the differences in methylation in patients with CP without interference of the interindividual genomic variation, four pairs of MZ twins discordant for CP were profiled for DNA methylation changes using reduced representation bisulfite sequencing on the genomic-scale. Similar DNA methylation patterns were observed in all samples. However, MZ twins demonstrated higher correlations and closer evolutionary associations compared with the other samples, indicating a stable methylome of MZ twins. A total of 190 differentially methylated genes (DMGs) were identified using Student's t-test, of which 37 genes were hypermethylated in the CP group while the remainders were hypomethylated compared with control group. The identified DMGs were enriched in several cerebral abnormalities, including cerebral cortical atrophy and cerebral atrophy, suggesting that the occurrence of CP may be associated with the methylation alterations. The neighboring genes of DMGs in the protein-protein interaction network were enriched in numerous important functions in essential processes. The results of the present study identified important genes that may epigenetically contribute to the occurrence and development of CP in MZ twins, suggesting that the different prevalence of CP in identical twins may be associated with DNA methylation alterations.

[PMID: 29039597](#)

23. Neurodevelopmental outcomes at 3 years old for infants with birth weights under 500 g.

Nagara S, Kouwaki M, Togawa T, Sugiura T, Okada M, Koyama N.

Pediatr Neonatol. 2017 Sep 21. pii: S1875-9572(17)30094-3. doi: 10.1016/j.pedneo.2017.09.005. [Epub ahead of print]

BACKGROUND: Marked improvements have been achieved in the survival of extremely low birth weight infants, but survival rates and prognoses of extremely small infants with birth weights ≤ 500 g remain poor. The aim of this study was to clarify long-term outcomes for surviving infants with birth weights ≤ 500 g. METHODS: The study population comprised fetuses of gestational age ≥ 22 weeks, expected live- or stillbirth weight ≤ 500 g, and birth date between 2003 and 2012. Developmental assessments were performed prospectively at 3 years old. RESULTS: Data were obtained for 21 fetuses, including 10 live births and 11 stillbirths. Of the 10 live births, median gestational age was 25.2 weeks (range, 22.4-27.1 weeks), median birth weight was 426 g (range, 370-483 g), and two neonates died before discharge. One infant with severe asphyxia died within 12 h and another infant with Down syndrome died at 34 days. The survival rate was thus 80%. All surviving infants were small for gestational age. Seven of the 8 surviving infants (88%) weighed less than 2500 g at a corrected age of 40 weeks. Seven infants were available for developmental assessments at 3 years old. One infant could not be followed. Two of those seven infants (29%) showed normal development, three infants (42%) showed mild neurodevelopmental disability, and two infants (29%) showed severe neurodevelopmental disability. One infant had periventricular leukomalacia and cerebral palsy. Two of the seven infants (29%) had short stature (< 3 SD) at 3 years old. CONCLUSION: Although the survival rate among live births was good (80%) in this study, neurodevelopmental outcomes remained poor in infants with birth weights ≤ 500 g. Further large studies are needed to assess long-term outcomes for extremely small infants.

[PMID: 29030024](#)

24. Activated microglia targeting dendrimer-minocycline conjugate as therapeutics for neuroinflammation.

Sharma R, Kim SY, Sharma A, Zhang Z, Kambhampati SP, Kannan S, Kannan RM.

Bioconjug Chem. 2017 Oct 13. doi: 10.1021/acs.bioconjchem.7b00569. [Epub ahead of print]

Brain related disorders have outmatched cancer and cardiovascular diseases worldwide as the leading cause of morbidity and mortality. The lack of effective therapies and the relatively dry central nervous system (CNS) drug pipeline pose formidable challenge. Superior, targeted delivery of current clinically approved drugs may offer significant potential. Minocycline has shown promise for the treatment of neurological diseases owing to its ability to penetrate the blood brain barrier (BBB), and potency. Despite its potential in the clinic, and in preclinical models, the high doses needed to affect a positive therapeutic response has led to side effects. Targeted delivery of minocycline to the injured site and injured cells in the brain can be highly beneficial. Systemically-administered hydroxyl poly(amidoamine) (PAMAM) generation-6 (G6) dendrimers have a longer blood circulation time, and have been shown to cross the impaired blood brain barrier. We have successfully prepared, and characterized the in vitro efficacy and in vivo targeting ability of hydroxyl-G6 PAMAM dendrimer-9-amino-minocycline conjugate (D-mino). Minocycline is a challenging drug to carry out chemical transformations, due to its inherent instability. We used a combination of highly efficient and mild copper catalyzed azide-alkyne click reaction (CuAAC) along with microwave energy to conjugate 9-amino-minocycline (mino) to the dendrimer surface via enzyme responsive linkages. D-mino was further evaluated for anti-inflammatory and anti-oxidant activity in LPS-activated murine microglial cells. D-mino conjugates enhanced intracellular availability of the drug due to their rapid uptake, suppressed inflammatory cytokine TNF- α production and reduced oxidative stress by suppressing NO production, both significantly better than the free drug. Fluorescently-labeled dendrimer conjugate (Cy5-D-mino) was systematically administered (i.v., 55mg/kg) on postnatal day 1 to rabbit kits with a clinically relevant phenotype of cerebral palsy. The in vivo imaging study indicates that Cy5-D-mino crossed impaired blood-brain-barrier and co-localized with activated microglia at the periventricular white matter areas, including corpus callosum and the angle of lateral ventricle, with significant implications for positive therapeutic outcomes. The enhanced efficacy of D-mino when combined with the inherent neuroinflammation-targeting capability of the PAMAM dendrimers, may provide new opportunities for targeted drug delivery to treat neurological disorders.

[PMID: 29028353](#)