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NEWS
Cerebral Palsy Research

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# Interventions and Management

**1. Co-activation of the elbow and wrist muscle during an upper limb functional task among adults with dyskinetic cerebral palsy.**
Barcala L, Politti F, Artilheiro M, Speciali D, Garbelotti S, Correa J, Lucareli P.
Gait Posture. 2018 Jul 16. pii: S0966-6362(18)31091-9. doi: 10.1016/j.gaitpost.2018.07.028. [Epub ahead of print]
PMID: 30025601

**2. Feasibility trial of an early therapy in perinatal stroke (eTIPS).**
Basu AP, Pearse J, Watson R, Dulson P, Baggaley J, Wright B, Howel D, Vale L, Mitra D, Embleton N, Rapley T.
BMC Neurol. 2018 Jul 23;18(1):102. doi: 10.1186/s12883-018-1106-4.
Perinatal stroke (PS) affects up to 1/2300 infants and frequently leads to unilateral cerebral palsy (UCP). Preterm-born infants affected by unilateral haemorrhagic parenchymal infarction (HPI) are also at risk of UCP. To date no standardised early therapy approach exists, yet early intervention could be highly effective, by positively influencing processes of activity-dependent plasticity within the developing nervous system including the corticospinal tract. Our aim was to test feasibility and acceptability of an "early Therapy In Perinatal Stroke" (eTIPS) intervention, aiming ultimately to improve motor outcome. Design: Feasibility trial, North-East England, August 2015-September 2017. Participants were infants with PS or HPI, their carers and therapists. The intervention consisted of a parent-delivered lateralised therapy approach starting from term equivalent age and continuing until 6 months corrected age. The outcome measures were feasibility (recruitment and retention rates) and acceptability of the intervention (parental questionnaires including the Warwick-Edinburgh Mental Wellbeing Scale (WEBWMS), qualitative observations and in-depth interviews with parents and therapists). We also reviewed clinical imaging data and undertook assessments of motor function, including the Hand Assessment for Infants (HAI). Assessments were also piloted in typically developing (TD) infants, to provide further information on their ease of use and acceptability. Over a period of 18 months we screened 20 infants referred as PS/HPI: 14 met the inclusion criteria and 13 took part. At 6 months, 11 (85%) of those enrolled had completed the final assessment. Parents valued the intervention and found it acceptable and workable. There were no adverse events related to the intervention. We recruited 14 TD infants, one of whom died prior to undertaking any assessments and one of whom was subsequently found to have a condition affecting neurodevelopmental progress: thus, data for 12 TD infants was analysed to 6 months. The HAI was well tolerated by infants and highly valued by parents. Completion rates for the WEBWMS were high and did not suggest any adverse effect of engagement in eTIPS on parental mental wellbeing. The eTIPS intervention was feasible to deliver and acceptable to families. We plan to investigate efficacy in a multicentre randomised controlled trial.
PMID: 30037324

**3. Does Tibialis anterior activity improve or recover following lengthening of Achilles Tendon in CP?**
Dussa CU, Döderlein L, Böhm H.
Gait Posture. 2018 Jul 10. pii: S0966-6362(18)31062-2. doi: 10.1016/j.gaitpost.2018.07.008. [Epub ahead of print]
Foot drop is a common finding in cerebral palsy and may be associated with foot drop. According to the literature, the shortening of Tibialis anterior would improve the active dorsiflexion of the ankle Joint. However the studies in the literature do not provide any control groups. We conducted a study both in hemiplegics and diplegics where tibialis anterior was shortened in the study group and no shortening was done in the control group. Both groups however underwent the lengthening of the tibialis anterior. The results showed no positive effect of the shortening of tibialis anetrior tendon on the active dorsiflexion of the ankle joint.
PMID: 30031647

**4. Required friction curve patterns in a child with unilateral spastic cerebral palsy and true equinus gait.**
Lazzari RD, Kleiner AFR, Lopes JBP, Dumont AJL, Ferreira LAB, Galli M, Oliveira CS, Sampaio LMM.
Gait Posture. 2018 Jul 10. pii: S0966-6362(18)31070-1. doi: 10.1016/j.gaitpost.2018.07.016. [Epub ahead of print]
The aim of this study was to describe the required coefficient of friction (RCOF) curve pattern of a child with unilateral spastic cerebral palsy (USPC). A child with USCP and true equinus and a healthy age-matched child participated in this study. They walked barefoot at a self-selected pace along a carpeted path and over two force platforms. RCOF was obtained as the ratio between the tangential forces (FT), and the vertical ground reaction force, (FZ). The RCOF curve present different patters when the USCP child was compared with the control, mainly for the affected side where it was observed lower RCOF peaks and valley as respected the nonaffected side and control values.
PMID: 30031645

**5. Analysis of eeg signal in a child with hemiparetic cerebral palsy during a motor activity: Case study.**
Miziara IM, Lopes JBP, Kahani D, Lazzari RD, Moura R, Conway BA, Oliveira CS, Naves ELM.
Gait Posture. 2018 Jul 18. pii: S0966-6362(18)31099-3. doi: 10.1016/j.gaitpost.2018.07.036. [Epub ahead of print]
The fundamental characteristic of hemiparetic cerebral palsy is the greater motor impairment on the body side that corresponds to the injured cerebral hemisphere. Hemiparesis usually affects the upper limbs, which can provide significant functional disabilities to this population. The objective of this study was to compare alpha and beta band synchronization and desynchronization during the execution of the task in a game, using the limbs paretic and non-paretic. As a result, observed a synchronization of the alpha band for the movement performed by the paretic limb and a desynchronization using the non-paretic limb. This result may indicate less cortical and physical effort to perform the task using the paretic limb. It is believed that this information can stimulate research with a greater number of volunteers and the more thorough study of brain activity in this population.
PMID: 30031642

**6. Use of ultrasound shear wave to measure muscle stiffness in children with cerebral palsy.**
Vola EA, Albano M, Di Luise C, Servodidio V, Sansone M, Russo S, Corrado B, Servodio Iammarrone C, Caprio MG, Vallone G.
J Ultrasound. 2018 Jul 20. doi: 10.1007/s40477-018-0313-6. [Epub ahead of print]
Cerebral palsy (CP) is a disorder characterized by an increased muscle stiffness that can be contingent on both neurological and biomechanical factors. The neurological aspects are related to hyper-excitability of the stretch reflex, while the biomechanical factors are related to modifications in muscle structure. We used smart-shear wave elastography (S-SWE) to analyze muscle properties and to compare shear wave speed in soleus muscles of patients affected by CP and typically developing children. We enrolled 21 children (15 males and 6 females; age range 3-16) with spastic hemiplegia CP and 21 healthy children (11 males and 10 females; age range 3-14). Measurements of soleus S-SWE were performed using a Samsung RS80A ultrasound scanner with Prestige equipment (Samsung Medison Co. Ltd., Seoul, Korea), with a convex array transducer (CA1-7; Samsung Medison Co. Ltd., Seoul, Korea). For each CP child clinical assessment included Modified Ashworth Scale (MAS) score. Children with CP showed greater S-SWE values than the healthy ones ($p < 0.001$). Our data suggest a significant correlation between the S-SWE values and the MAS scores (Spearman correlation coefficient 0.74; $p < 0.001$ at Kruskal-Wallis test) in children with CP.Measuring muscle properties with SWE, a non-invasive and real-time technique, may integrate the physical exam. SWE may be a reliable clinical tool for diagnosis and longitudinal monitoring of muscle stiffness, as well as particularly suitable for grading and for assessing the response to treatments.
PMID: 30030747

**7. Reference centiles for the gross motor function measure and identification of therapeutic effects in children with cerebral palsy.**
Duran I, Stark C, Martakis K, Hamacher S, Semler O, Schoenau E.
J Eval Clin Pract. 2018 Jul 20. doi: 10.1111/jep.12990. [Epub ahead of print]
Children with cerebral palsy (CP) can show an increase in gross motor function until the age of 9 to 10 years under the standard of care. Additionally, the motor development can have large individual fluctuations. Therefore, in clinical setting, it is not trivial to estimate the effect of an additional therapeutic intervention at this age interval. The study aim was to develop a method which allows quantification of the gross motor function changes over 6 months of the individual child with CP. The present study was a single center retrospective analysis. Data were collected in children with CP who participated in a rehabilitation program between 2006 and 2016. The gross motor function of the children was measured with the Gross Motor Function Measurement (GMFM-66). Reference centiles for the GMFM-66 were created with data before starting the rehabilitation program. The variability of the evolution of the GMFM-66 was assessed with data at the start and the end of a 6-month observational phase of standard of care. In total, the GMFM-66 data of 919 children before starting the rehabilitation program were available (age 6.49 ± 2.49 years, GMFCS-level I-V). For 515 study participants (6.76 ± 2.30 years, GMFCS-level I-V), data were also available at the start and the end of a 6-month observational phase. The presented method helps to guide the clinician to track the individual patient's gross motor development and assess the additional effect of an additionally applied intervention while taking into account the expected progression of gross motor function under standard of care.
PMID: 30028064

**8. Soft tissues procedures are effective for reduction of internal hip rotation during gait in cerebral palsy.**
De Morais Filho MC, Blumetti F, Kawamura C, Ferreira CL Jr, Fujino M, Lopes JA, Neves D.
Gait Posture. 2018 Jul 17. pii: S0966-6362(18)31134-2. doi: 10.1016/j.gaitpost.2018.07.067. [Epub ahead of print]
PMID: 30029950

**9. Factors related to better outcomes after single event multilevel surgery (SEMLS) in patients with cerebral palsy.**
De Morais Filho MC, Blumetti F, Kawamura C, Freitas K, Lopes JA, Fujino M, Neves D.
Gait Posture. 2018 Jul 17. pii: S0966-6362(18)31136-6. doi: 10.1016/j.gaitpost.2018.07.069. [Epub ahead of print]
PMID: 30029947

**10. Effect of combined rehabilitation program with botulinum toxin type A injections on gross motor function scores in children with spastic cerebral palsy.**
Flemban A, Elsayed W.
J Phys Ther Sci. 2018 Jul;30(7):902-905. doi: 10.1589/jpts.30.902. Epub 2018 Jul 3.
[Purpose] To examine whether combining botulinum toxin type A with physiotherapy is better than botulinum toxin type A alone in reducing muscle tone and improving gross motor function in spastic diplegia. [Subjects and Methods] Forty-six ambulatory children with spastic diplegia (age: 25-154 months) were recruited. Patients were assigned to Groups 1 (n=18) and 2 (n=28). After baseline assessment, all children received botulinum toxin type A injections (6 units/kg) into the lower limb muscles. A second botulinum toxin type A injection was given 6 months later. The ankles were placed in plaster casts for 2 weeks after the first injection and an orthosis was prescribed after cast removal. Group 2 received 2 weeks of intensive physiotherapy. The gross motor function scores for the 2 groups were recorded at baseline, 4, 6, and 52 weeks. [Results] The improvement in gross motor function scores was significant for Group 2 and non-significant for Group 1. After 4, 6, and 52 weeks, Groups 1 and 2 showed 2.6% and 6.3% improvement, 4.8% and 12% improvement, and 5.5% and 19.4% improvement, respectively. [Conclusion] The addition of a 2-week physiotherapy programme after the initial botulinum toxin type A injections produced significantly greater improvements in gross motor function scores.
PMID: 30034093

**11. Determinants of parent-delivered therapy interventions in children with cerebral palsy: A qualitative synthesis and checklist.**
Lord C, Rapley T, Marcroft C, Pearse J, Basu A.
Child Care Health Dev. 2018 Jul 23. doi: 10.1111/cch.12592. [Epub ahead of print]
Parent-delivered therapy interventions for children with cerebral palsy can help achieve a sufficient therapy dose, improve parental mental well-being, and facilitate parent-child relationships creating a more relaxed familial environment. However, parent-delivered interventions may also lead to increased parental stress, guilt if the therapy is not delivered, and time constraints. The primary aim of this review was to gain a deeper understanding of the determinants of effective parent-delivered therapy interventions. Searches were conducted in the following databases: Medline, PubMed, Scopus, Embase, CINAHL, and Cochrane. Studies had to meet the following inclusion criteria: descriptions of parent/health care professional/child experiences of parent-delivered therapy interventions for children and young people age 0-18 years with cerebral palsy, published in the English language between January 1989 and May 2017, with qualitative or mixed methods research design. The articles were critically appraised, then synthesized using a meta-ethnographic approach. A literature search identified 17 articles, which met the inclusion criteria. Three main themes were identified: (a) building trusting relationships, (b) enabling the parents to cope, and (c) for parents and health care professionals to see the intervention as a priority. Further synthesis presented three concepts identifying the important aspects of the interventions: empowerment, motivation, and relationships. The themes and concepts emerging from this qualitative synthesis can be addressed by specific points of action to support parent-delivered therapy interventions. We have summarized these in a checklist for use by intervention developers, health care professionals, and parents.
PMID: 30033521

**12. How comparable are the alterations in muscle morphology in age-matched children with hereditary spastic paraplegia and spastic cerebral palsy?**
De Beukelaer N, Schless SH, Hanssen B, Cenni F, Peeters N, Bar-On L, Ortibus E, Desloovere K, Van Campenhout A.
Gait Posture. 2018 Jul 19. pii: S0966-6362(18)30811-7. doi: 10.1016/j.gaitpost.2018.06.083. [Epub ahead of print]
PMID: 30033349

**13. Classifying Adverse Events Following Lower Limb Orthopaedic Surgery in Children With Cerebral Palsy: Reliability of the Modified Clavien-Dindo System.**
Zhou L, Willoughby K, Strobel N, Thomason P, Gallagher C, Harambasic M, Khot A, Graham HK.
J Pediatr Orthop. 2018 Jul 20. doi: 10.1097/BPO.0000000000001233. [Epub ahead of print]
The modified Clavien-Dindo (MCD) system is a reliable tool for classifying adverse events (AEs) in hip preservation surgery and has since been utilized in studies involving lower limb surgery for ambulant and nonambulant children with cerebral palsy (CP). However, the profile of AEs recorded in children with CP compared with typically developing children is different, and the reliability of the MCD in CP is unknown.

This study aimed to evaluate the interrater and intrarater reliability of the MCD system for classifying AEs following lower limb surgery in children with CP. Eighteen raters were invited to participate, including clinicians from surgical, nursing, and physical therapy professions, and individuals with CP. Following a MCD familiarization session, participants rated 40 clinical scenarios on 2 occasions, 2 weeks apart. Fleiss' κ statistics were used to calculate interrater and intrarater reliability. The overall Fleiss' κ value for interrater reliability in the first rating was 0.70 (95% confidence interval, 0.61-0.80), and increased to 0.75 (95% confidence interval, 0.66-0.84) in the second rating. The average Fleiss' κ value for intrarater reliability was 0.78 (range, 0.48 to 1.00). Grading of more severe AEs (MCD III to V) achieved near perfect agreement (κ, 0.87 to 1.00). There was a lower level of agreement for minor AEs (MCD I-II) (κ, 0.53 to 0.55). A κ score of 0 to 0.2 was deemed as poor, 0.21 to 0.4 as fair, 0.41 to 0.6 as good, 0.61 to 0.8 as very good, and 0.81 to 1.0 as almost perfect agreement. The MCD System demonstrates a very good interrater and intrarater reliability following lower limb surgery in children with CP. The MCD can be used by clinicians from different health care professions with a high level of reliability. The MCD may improve standardization of AE recording with a view to accurate audits and improved clarity in outcome studies for CP. Level II-diagnostic.
PMID: 30036291

**14. Effects of Botulinum Toxin Treatment in Nonambulatory Children and Adolescents With Cerebral Palsy: Understanding Parents' Perspectives.**
Nguyen L, Rezze BD, Mesterman R, Rosenbaum P, Gorter JW.
J Child Neurol. 2018 Jan 1:883073818786567. doi: 10.1177/0883073818786567. [Epub ahead of print]
Children and adolescents with cerebral palsy often receive botulinum toxin A (BoNT-A) to manage hypertonia. This qualitative study aimed to describe and categorize BoNT-A effects that parents observed using the WHO's International Classification of Functioning, Disability and Health (ICF) framework. An interpretive description methodology was used; semi-structured interviews were conducted with 15 parents of nonambulatory young people with cerebral palsy (mean age 10.2 years, SD 3.9, 7 males) who received BoNT-A. Parents reported BoNT-A effects on each ICF category. Through interpretive description, an overall theme emerged: "finding the right path to do what is best." Five subthemes included (1) Parents' hopes, (2) Parents' goals for their child, (3) Parents' learning what works, (4) Parents' reflections, and (5) Parents' destination. This study provides insights into parents' journeys of how they learned about BoNT-A effects in their child, which helped them to identify goals for future treatment.
PMID: 30039731

**15. Spasticity in adults with cerebral palsy and multiple sclerosis measured by objective clinically applicable technique.**
Yamaguchi T, Hvass Petersen T, Kirk H, Forman C, Svane C, Kofoed-Hansen M, Boesen F, Lorentzen J.
Clin Neurophysiol. 2018 Jul 24;129(9):2010-2021. doi: 10.1016/j.clinph.2018.07.004. [Epub ahead of print]
The present study evaluated ankle stiffness in adults with and without neurological disorders and investigated the accuracy and reproducibility of a clinically applicable method using a dynamometer. Measurements were obtained from 8 healthy subjects (age 39.3), 9 subjects with spastic cerebral palsy (CP) (age 39.8) and 8 subjects with multiple sclerosis (MS) (age 49.9). Slow and fast dorsiflexion stretches of the ankle joint were performed to evaluate passive muscle-tendon-joint stiffness, reflex mediated stiffness and range of movement (ROM), respectively. Intra/inter-rater reliability for passive and reflex mediated ankle muscle stiffness was assessed for all groups. Subjects with CP and MS showed significantly larger values of passive stiffness in the triceps surae muscle tendon complex and smaller ROM compared to healthy individuals, while no significant difference in reflex mediated stiffness. Measurements of passive muscle-tendon-joint stiffness and reflex mediated stiffness showed good to excellent inter- and intra-rater reliability (ICC: 0.62-0.91) in all groups. Increased stiffness was found in subjects with CP and MS with a clinically applicable method that provides valid and reproducible measurement of passive ankle muscle-tendon-joint stiffness and reflex mediated stiffness.The present technique may provide important supplementary information for the clinician.
PMID: 30053672

**16. Effects of backward gait training on balance, gross motor function, and gait in children with cerebral palsy: a systematic review.**
Elnahhas AM, Elshennawy S, Aly MG.
Clin Rehabil. 2018 Jul 25:269215518790053. doi: 10.1177/0269215518790053. [Epub ahead of print]
To investigate the effects of backward gait training on balance, gross motor function, and gait parameters in children with cerebral palsy. PubMed, Cochrane Library, Web of Science, Science Direct, Physiotherapy Evidence Database (PEDro), and Google Scholar were searched up to May 2018. Randomized controlled trials were included if they involved any form of backward gait training for children with cerebral palsy. Two authors independently screened articles, extracted data and assessed the methodological quality using PEDro scale, with any confliction resolved by the third author. Modified Sackett Scale was used to determine the level of evidence for each outcome. Out of 1492 papers screened, 7 studies with 172 participants met the inclusion criteria. The duration of treatment ranged from 15 to 25 minutes, three times a week and for 6-12 weeks. The quality of studies ranged from good (two studies) to fair (four studies) and poor (one study), with a mean PEDro score of 4.7 out of 10. All included studies showed positive effects in the measured outcomes.

The results showed level 1b evidence for balance when compared to no intervention, and for gross motor function, step length and walking speed when compared to same dose of forward gait training. The clinical heterogeneity of studies makes meta-analysis inappropriate. In children with cerebral palsy, there is moderate evidence that backward gait training improves balance, gross motor function, step length and walking velocity. More high-quality studies are needed.
PMID: 30043634

**17. Does echo-intensity associate with muscle and fascicle extensibility over the ankle range of motion in children with spastic cerebral palsy?**
Schless SH, Cenni F, Bar-On L, Molenaers G, Desloovere K.
Gait Posture. 2018 Jun 27. pii: S0966-6362(18)30808-7. doi: 10.1016/j.gaitpost.2018.06.080. [Epub ahead of print]
PMID: 30042090

**18. Predictors of midfoot break in children with cerebral palsy and flatfeet.**
Oestreich C, Böhm H, Döderlein L, Rethwilm R, Strobl W, Oberhoffer R.
Gait Posture. 2018 Jun 26. pii: S0966-6362(18)30889-0. doi: 10.1016/j.gaitpost.2018.06.132. [Epub ahead of print]
PMID: 30042088

**19. The association of selective motor control, muscle size and composition with the overall gait deviations of children with cerebral palsy.**
Hanssen B, Schless SH, Peeters N, De Beukelaer N, Bar-On L, Cenni F, Molenaers G, Calders P, Dan B, Desloovere K.
Gait Posture. 2018 Jun 21. pii: S0966-6362(18)30783-5. doi: 10.1016/j.gaitpost.2018.06.056. [Epub ahead of print]
PMID: 30042084

**20. Effect of bilateral tDCS on functional balance and the Gait Profile score in a child with hemiparetic spastic cerebral palsy.**
Duarte N, Grecco L, Lazzari R, Galli M, Oliveira C.
Gait Posture. 2018 Jul 10. pii: S0966-6362(18)31071-3. doi: 10.1016/j.gaitpost.2018.07.017. [Epub ahead of print]
The effects of bilateral tDCS, with anodal stimulation over the motor cortex ispilateral to the brain lesion concomitantly to contralesional cathodal stimulation should be studied to better understand the possible effects of a bihemispheric balance. The objective of this study was verify the effect of bilateral tDCS on functional balance and gait profile score in a child with spastic cerebral palsy. A 8-year-old child with right-side hemiparetic spastic cerebral palsy was the subject of this case report. The intervention consisted of ten sessions of treadmill training (20 minutes per session) combined with anodal tDCS (current; 1 mA) over C4 and cathode over C3. The child was evaluated before, after and one month after the end of intervention through PBS and GPS evaluation. Better results on score of PBS were observed (before: 36; after: 43, follow up: 44). A better result was also observed regarding the GPS score (before: 12.4; after: 10.1; follow up: 10.9). The results of the present case report demonstrate that the bilateral tDCS was able to generate encouraging effects in a child with hemiparetic spastic cerebral palsy. Mainly in relation to GPS, with this value approaching the reference values of normality Although the report of a single case does not allow drawing conclusions, the results are promising for the basis of the development of further studies.
PMID: 30041837

**21. Comparison of the results of primary versus repeat hamstrings surgical lengthening in cerebral palsy.**
De Morais Filho MC, Blumetti F, Kawamura C, Matias M, Fujino M, Lopes JA, Neves D.
Gait Posture. 2018 Jul 20. pii: S0966-6362(18)31135-4. doi: 10.1016/j.gaitpost.2018.07.068. [Epub ahead of print]
PMID: 30037748

**22. Considerations for Testing and Treating Children with Central Vestibular Impairments.**
Christy JB.
Semin Hear. 2018 Aug;39(3):321-333. doi: 10.1055/s-0038-1666821. Epub 2018 Jul 20.
This perspective explores common pediatric diagnoses that could present with central vestibular pathway dysfunction, leading to delays in motor development and postural control, and gaze instability. Specifically, the following diagnoses are considered: cerebral palsy, myelomeningocele, vestibular migraine, attention-deficit hyperactivity disorder, developmental coordination disorder, concussion, childhood cancer, congenital muscular torticollis, adolescent idiopathic scoliosis, and autism. Suggestions for clinical screening, vestibular function testing, and vestibular rehabilitation for children with these diagnoses are based on evidence for the efficacy of testing and interventions for children with peripheral vestibular hypofunction. More research is needed to explore peripheral and central vestibular function in children with these diagnoses. Testing and intervention methods may need to be modified to accommodate for the specific behavior and motor challenges that some children might present. Researchers should develop technology so that gaze stabilization exercises can be delivered in a fun, functional, and effective way.
PMID: 30038458

**23. Vestibular and Oculomotor Function in Children with Cerebral Palsy: A Scoping Review.**
Almutairi A, Christy JB, Vogtle L.
Semin Hear. 2018 Aug;39(3):288-304. doi: 10.1055/s-0038-1666819. Epub 2018 Jul 20.
Cerebral palsy (CP) is a nonprogressive permanent brain injury that causes an impairment of movement and posture. This scoping review aimed to answer the following questions: (1) "What is the status of oculomotor function in children with CP?" (2) "What is the status of vestibular function (i.e., gaze stability, perception of vertical, vestibular-related balance abilities) in children with CP?" Using Arksey's and O'Malley's five-stage framework, we searched six online databases for relevant articles. The inclusion criteria were: (1) participants of the studies included individuals with CP; (2) a primary outcome in the studies was measurement of oculomotor, vestibular, and/or balance; (3) studies were published within the past 20 years; and (4) the participants in the studies were between 0 and 21 years of age. Twenty-one articles were found that described impairments in oculomotor function ( n = 9), vestibular function ( n = 1), and oculomotor and vestibular integration ( n = 11) in children with CP. The evidence suggests that children with CP may have altered saccadic and smooth pursuit eye movements, abnormal saccular function, poor eye-hand coordination, and abnormal use of vestibular information for balance. Future studies should explore peripheral and central vestibular function using reliable and valid methods for this population. This scoping review demonstrated a paucity of rigorous and objective research to describe the status of oculomotor and vestibular function in children with CP. However, preliminary studies suggest that more research is warranted.
PMID: 30038456

**24. Gait functions in children with cerebral palsy improve when challenged with biofeedback.**
Booth A, Buizer A, Harlaar J, Steenbrink F, van der Krogt M.
Gait Posture. 2018 Jun 27. pii: S0966-6362(18)30785-9. doi: 10.1016/j.gaitpost.2018.06.058. [Epub ahead of print]
PMID: 30025599

**25. Influence of chronic pain in physical activity of children with cerebral palsy.**
Riquelme I, do Rosário RS, Vehmaskoski K, Natunen P, Montoya P.
NeuroRehabilitation. 2018 Jul 17. doi: 10.3233/NRE-172409. [Epub ahead of print]
Children with cerebral palsy (CP) perform less physical activity than their typically developing peers (TDP). Pain, important comorbidity in children with CP, restrains levels of physical activity. This study aims at exploring the influence of chronic pain in physical activity of children with CP and TDP. 24-hour heart rate was registered in four groups of children: children with CP and TDP, with and without chronic pain. Heart rate based indexes of physical activity (MET percentages, energy expenditure) were computed. A self-reported diary of activities rated activities pain and fatigue intensity.Children with CP and chronic pain reported more painful activities and higher pain than their TDP with chronic pain. Moreover, children with CP and chronic pain presented higher time and periods of light activity and less sedentary activity than their TDP with chronic pain. No differences were found between CP and TDP without chronic pain. Children with CP regulate physical activity differently than TD children in the presence of chronic pain. The maintenance of light levels of physical activity in children with CP may suggest efficient pain coping strategies and perseverance in participation. These findings encourage the implementation of programs to improve fitness in this population.
PMID: 30040759

**26. Self-report of pain in young people and adults with spastic cerebral palsy: interrater reliability of the revised Face, Legs, Activity, Cry, and Consolability (r-FLACC) scale ratings.**
Fox MA, Ayyangar R, Parten R, Haapala HJ, Schilling SG, Kalpakjian CZ.
Dev Med Child Neurol. 2018 Jul 27. doi: 10.1111/dmcn.13980. [Epub ahead of print]
People with cerebral palsy (CP) are often unable to express pain owing to cognitive or speech impairments. Reports that rely on observation can be inaccurate, because behaviours such as grimacing, common in people with spastic CP, resemble pain expressions. We examined preliminary validity and reliability of the revised Face, Legs, Activity, Cry, and Consolability (r-FLACC) scale in people with spastic CP. Forty-eight young people and adults (35 females, 13 males; mean [SD] age 29y 2mo [13y]) were video-recorded during a standard examination, rating their pain (0-10) afterwards. Two raters completed the r-FLACC using the video recordings. Interrater reliability was assessed with an unconditional cross-classified random-effects model and item response theory approach; Pearson correlations measured agreement between raters and participants. Mean (SD) participant (n=48) pain scores were 2.48 (2.5) and mean (SD) r-FLACC scores were 1.46 (1.68). There was moderate agreement between raters (intraclass coefficient 0.41 and 0.57 respectively) but low agreement between participants and raters (r=0.26). There were no significant effects for raters (lay observers, nurses, physicians, and inexperienced raters). Results provide mixed support for the interrater reliability of the r-FLACC in people with spastic CP. The revised Face, Legs, Activity, Cry, and Consolability (r-FLACC) scale can be reliably used by experts and lay raters for people with spastic cerebral palsy (CP). Support is mixed for interrater reliability of the r-FLACC scale used with people with spastic CP.
PMID: 30051908

**27. Parents' Expressions of Concerns and Hopes for the Future and Their Concomitant Assessments of Disability in Their Children.**

Illum NO, Bonderup M, Gradel KO.

Clin Med Insights Pediatr. 2018 Jun 27;12:1179556518784948. doi: 10.1177/1179556518784948. eCollection 2018.

To assess parents' ability to express their concerns and hopes for the future in their children with disability and assess their children's disability as well as to analyse these data for consistency. Parents of 162 children with spina bifida, spinal muscular atrophy, muscular disorders, cerebral palsy, visual impairment, hearing impairment, mental disability, or disability following brain tumours were asked to freely express their concerns and hopes for the future and to assess disability in their own children by employing a set of 26 International Classification of Functioning, Disability and Health, Children and Youth Version (ICF-CY) body function (b) codes and activity and participation (d) codes. A grounded theory approach was employed to systematize parents' expressions of concerns and hopes; then, parents scored qualifiers on a 5-step qualitative Likert scale. Parents assessed their children's disability in the same way using the ICF-CY 5-step qualifier scale. Altogether, 119 parents freely expressed their concerns and hopes, and 101 of them also assessed their children's disability using the 26 ICF-CY codes. A total of 475 expressions of concern and hopes (issues) were expressed and categorized into 34 areas of concern and hopes (subsections). The most frequently mentioned issues were education; understanding, goodwill, and communication between parents; and community support. Qualitative data on both 5-step qualifier scales showed good reliability. Rasch analysis maps on concerns and hopes for children as well as on the ICF-CY assessment demonstrated good alignment and a clinically relevant progression from the least to the most disabled children. Parents can express valid and reliable data on their concerns and hopes for the future and can reliably assess disability in their own children.

PMID: 30046263

**28. White matter changes associated with cognitive visual dysfunctions in children with cerebral palsy: A diffusion tensor imaging study.**

Galli J, Ambrosi C, Micheletti S, Merabet LB, Pinardi C, Gasparotti R, Fazzi E.

J Neurosci Res. 2018 Jun 12. doi: 10.1002/jnr.24307. [Epub ahead of print]

Children with cerebral palsy often present with cognitive-visual dysfunctions characterized by visuo-perceptual and/or visuo-spatial deficits associated with a malfunctioning of visual-associative areas. The neurofunctional model of this condition remains poorly understood due to the lack of a clear correlation between cognitive-visual deficit and morphological brain anomalies. The aim of our study was to quantify the pattern of white matter abnormalities within the whole brain in children with cerebral palsy, and to identify white matter tracts sub-serving cognitive-visual functions, in order to better understand the basis of cognitive-visual processing. Nine subjects (three males, mean age 8 years 9 months) with cerebral palsy underwent a visual and cognitive-visual evaluation. Conventional brain MRI and diffusion tensor imaging were performed. The fractional anisotropy maps were calculated for every child and compared with data from 13 (four males, mean age 10 years 7 months) healthy children. Children with cerebral palsy showed decreased fractional anisotropy (a marker of white matter integrity) in corticospinal tract bilaterally, left superior longitudinal fasciculus and bilateral hippocampus. Focusing on the superior longitudinal fasciculus, the mean fractional anisotropy values were significantly lower in children affected by cerebral palsy with cognitive-visual deficits than in those without cognitive-visual deficits. Our findings reveal an association between cognitive-visual profile and the superior longitudinal fasciculus integrity in children with cerebral palsy, supporting the hypothesis that visuo-associative deficits are related to changes in fibers connecting the occipital cortex with the parietal-frontal cortices. Decreased fractional anisotropy within the superior longitudinal fasciculus could be considered a biomarker for cognitive-visual dysfunctions.

PMID: 30027677

**29. Language-Model Assisted And Icon-based Communication Through a Brain Computer Interface With Different Presentation Paradigms.**

Ahani A, Moghadamfalahi M, Erdogmus D.

IEEE Trans Neural Syst Rehabil Eng. 2018 Jul 25. doi: 10.1109/TNSRE.2018.2859432. [Epub ahead of print]

Augmentative and alternative communication (AAC) is typically used by people with severe speech and physical disabilities (SSPI) and is one of the main application areas for brain computer interface (BCI) technology. The target population includes people with cerebral palsy (CP), amyotrophic lateral sclerosis (ALS) and locked-in-syndrome (LIS). Word-based AAC systems are mainly faster than letter-based counterparts and are usually supplemented by icons to aid the users. Those iconbased AAC systems that use binary signaling methods such as single click can convert into a single input BCI systems such as ERP detection. Matrix speller paradigm are typically used to help users identify their target icon on the screen, however it ties screen space to vocabulary size and navigation complexity, which may require users to make repetitive head, neck, or eye movements to visually locate their intended targets on the screen. Rapid serial visual presentation (RSVP) is an alternative interface that minimizes required movement by displaying all icons at a fix location, one at a time. IconMessenger is an icon-based BCI-AAC system that combines ERP signal detection with a unified framework for different presentation paradigms including RSVP, matrix speller row&column presentation (RCP) and matrix speller single character presentation (SCP). Icon- Messenger also take advantage of a unique sem-gram language model, incorporated tightly in the inference engine. In this study, we assess the ERP shape, classification accuracy and typing performance of different presentation paradigms on 10 healthy participants.

PMID: 30047890

**30. Conversation-based intervention for adolescents using augmentative and alternative communication.**
Soto G, Clarke MT.
Augment Altern Commun. 2018 Jul 25:1-14. doi: 10.1080/07434618.2018.1490926. [Epub ahead of print]
This study evaluated the effects of a conversation-based intervention on the use of verbs, personal pronouns, bound morphemes and spontaneous clauses in adolescents with cerebral palsy who use augmentative and alternative communication (AAC). Four teenage girls aged from 14 to 18 years participated in the study. After a baseline period, a conversation-based intervention was provided for each participant in the context of a personal collage-building activity. The conversations were videotaped, transcribed, and analyzed using the Systematic Analysis of Language Transcripts (SALT™) . While the results are mixed, all four participants increased their use of at least one linguistic target, three increased their use of verbs and grammatically correct spontaneous clauses, two increased their use of personal pronouns, and one produced more bound morphemes during intervention than in baseline. These findings, and future research needs, are discussed.
PMID: 30043650

**31. Visual perception, visual-spatial cognition and mathematics: Associations and predictions in children with cerebral palsy.**
Critten V, Campbell E, Farran E, Messer D.
Res Dev Disabil. 2018 Sep;80:180-191. doi: 10.1016/j.ridd.2018.06.007. Epub 2018 Jul 23.
Previous research suggests that children with cerebral palsy (CP) have impairments in visual-spatial and mathematics abilities, although we know very little about the association between these two domains. To investigate the extent of visual-spatial and mathematical impairments in children with CP and the associations between these two domains. Thirty-two children with predominantly quadriplegic spastic and/or athetoid (dyskinetic) CP (13 years 7 months) and a group of typically developing (TD) children (8 years 6 months) matched by receptive vocabulary were given a battery of visual-spatial and mathematics tasks. Visual-spatial assessments ranged from simple tests of perception to complex reasoning about these stimuli. A standardised test of mathematics ability was administered to both groups. The children with CP had significantly poorer mathematical and visual-spatial abilities than the TD group. For the TD group age was the best predictor of mathematical ability, in the CP group receptive vocabulary and visual perception abilities were the best predictors of mathematical ability. The CP group had extensive difficulties with visual perception; visual short-term memory; visual reasoning; and mental rotation all of which were associated with their mathematical abilities. These findings have implications for the teaching of visual perception and visual memory skills in young children with CP as these may help the development of mathematical abilities.
PMID: 30048837

**32. A longitudinal, observational study of the features of transitional healthcare associated with better outcomes for young people with long-term conditions.**
Colver A, McConachie H, Le Couteur A, Dovey-Pearce G, Mann KD, McDonagh JE, Pearce MS, Vale L, Merrick H, Parr JR; Transition Collaborative Group.
BMC Med. 2018 Jul 23;16(1):111. doi: 10.1186/s12916-018-1102-y.
Most evidence about what works in transitional care comes from small studies in single clinical specialties. We tested the hypothesis that exposures to nine recommended features of transitional healthcare were associated with better outcomes for young people with long-term conditions during transition from child-centred to adult-oriented health services. This is a longitudinal, observational cohort study in UK secondary care including 374 young people, aged 14-18.9 years at recruitment, with type 1 diabetes (n = 150), cerebral palsy (n = 106) or autism spectrum disorder with an associated mental health problem (n = 118). All were pre-transfer and without significant learning disability. We approached all young people attending five paediatric diabetes centres, all young people with autism spectrum disorder attending four mental health centres, and randomly selected young people from two population-based cerebral palsy registers. Participants received four home research visits, 1 year apart and 274 participants (73%) completed follow-up. Outcome measures were Warwick Edinburgh Mental Wellbeing Scale, Mind the Gap Scale (satisfaction with services), Rotterdam Transition Profile (Participation) and Autonomy in Appointments. xposure to recommended features was 61% for 'coordinated team', 53% for 'age-banded clinic', 48% for 'holistic life-skills training', 42% for 'promotion of health self-efficacy', 40% for 'meeting the adult team before transfer', 34% for 'appropriate parent involvement' and less than 30% for 'written transition plan', 'key worker' and 'transition manager for clinical team'. Three features were strongly associated with improved outcomes. (1) 'Appropriate parent involvement', example association with Wellbeing ($b = 4.5$, 95% CI 2.0-7.0, $p = 0.001$); (2) 'Promotion of health self-efficacy', example association with Satisfaction with Services ($b = -0.5$, 95% CI -0.9 to -0.2, $p = 0.006$); (3) 'Meeting the adult team before transfer', example associations with Participation (arranging services and aids) (odds ratio 5.2, 95% CI 2.1-12.8, $p < 0.001$) and with Autonomy in Appointments (average 1.7 points higher, 95% CI 0.8-2.6, $p < 0.001$). There was slightly less recruitment of participants from areas with greater socioeconomic deprivation, though not with respect to family composition. Three features of transitional care were associated with improved outcomes. Results are likely to be generalisable because participants had three very different conditions, attending services at many UK sites. Results are relevant for clinicians as well as for commissioners and managers of health services. The challenge of introducing these three features across child and adult healthcare services, and the effects of doing so, should be assessed.
PMID: 30032726

**33. Physiological responses during clinical spasticity evaluation in elbow flexors in children with cerebral palsy.**
Brændvik SM PT, PhD, Elkamil AI MD, PhD, Klund-Hansen SL MSc, Roeleveld K PhD.
Physiother Theory Pract. 2018 Jul 20:1-10. doi: 10.1080/09593985.2018.1491079. [Epub ahead of print]
The Tardieu test is often used to identify and evaluate the severity of spasticity for clinical decision-making and treatment evaluation in cerebral palsy (CP).The study's objective was to gain further insight into the construct validity of clinical spasticity evaluation in children with CP. The kinematics and neuromuscular response of the biceps brachii (BB) during passive elbow extension were studied when performing the Tardieu test with its corresponding clinical interpretation. Fifteen children with unilateral spastic CP and 15 typically developing (TD) peers 15 (median/interquartile range age; 13/4 and 12/5 years, respectively) participated. A clinical catch was detected in 9 of the 15 children with CP. During fast passive elbow extension, the CP group had higher BB activation ($p = 0.041$), lower fast maximal angular velocity ($p = 0.001$), and decelerated earlier in the extension movement ($p = 0.001$). On average, the CP group without a clinical detected catch were closer to TD for all those variables, but this only reached statistical 20 significance in the latter variable ($p = 0.018$). This inconsistency also shows in possibly one false positive and three false negative catch observations. The Tardieu test should be carried out with caution on individual level and more studies including kinematic and neuromuscular measures are necessary.
PMID: 30028217

**34. Content Validity of the Comprehensive ICF Core Set for Children with Cerebral Palsy Aged 0-6 Years: Iranian Occupational Therapists Perspective.**
Raji P, Hassani Mehraban A, Aliabadi F, Ahmadi M, Schiariti V.
Iran J Child Neurol. 2018 Summer;12(3):40-58.
Comprehensive ICF Core Set of cerebral palsy (CP) includes a set of functions of children with CP has been created recently. This study determined the content validity of this version based on Iranian Occupational Therapists' perspectives to explore whether the ICF Core Sets for CP include the areas of function of CP in Occupational Therapy practice. This qualitative study conducted from Feb 2015 to Apr 2016 in Tehran, Iran. Experts were the academic staffs selected through convenience sampling. Content validity of comprehensive ICF-Core Set of CP with 135 ICF categories was done by them. Delphi survey was used for generating consensus on the final version. Participants were 50 clinical Occupational Therapists invited via email from across Iran. An agreement of 75% was considered as the cut-off for inclusion of each code-category. About 60% of the code-categories of comprehensive version of ICF Core Set of CP were approved by Occupational Therapists. In the final version, 82 code-categories were listed that included 21 code-categories for Body Functions, 40 for Activity/Participation, and 21 for Environmental Factors. The validity of the Iranian ICF Core Set for children with CP aged 0-6 yr was supported by Iranian Occupational Therapists. It could be the basis for evaluation of this population in Occupational Therapy.
PMID: 30026768

## Prevention and Cure

**35. Bilateral Thalamic Ischemic Stroke Secondary to Occlusion of the Artery of Percheron.**
Garcia-Grimshaw MA, Peschard-Franco M, Gutierrez-Manjarrez FA.
Cureus. 2018 May 23;10(5):e2676. doi: 10.7759/cureus.2676.
The occlusion of the artery of Percheron (AOP) is a rare condition that causes bilateral thalamic ischemic stroke with or without midbrain involvement. It happens as a result of an anatomical variant of the diencephalic irrigation, in which the thalamic paramedian arteries arise from a common trunk from the posterior cerebral artery (PCA), which generates a clinical syndrome characterized by bilateral vertical gaze palsy, memory impairment and hypersomnia. In this case, we report a 62-year -old woman admitted to the emergency room with altered mental status, mainly somnolence. On physical examination, she was somnolent, apathetic and with no motor deficit. Magnetic resonance imaging (MRI) of the brain demonstrated bilateral thalamic hyperintensities and midbrain involvement in diffusion-weighted imaging (DWI) and T2 sequences, suggesting occlusion of the AOP. Bilateral thalamic infarction due to this anatomical variant is an entity with a low prevalence, and its diagnosis can be delayed because of the wide spectrum of clinical signs.
PMID: 30050731

**36. [The design of a population register on cerebral palsy: its application and analysis in Andorra and Navarre].**
[Article in Spanish; Abstract available in Spanish from the publisher]
Avellanet M, Mena A, Aisa-Pardo E.
Rev Neurol. 2018 Sep 1;67(5):168-174.
Cerebral palsy describes a group of developmental and posture disorders, which cause a limitation of activity due to non-progressive damage occurring in the developing brain. A population register facilitates the identification of cerebral palsy cases within a specific geographic population. Its usefulness is recognized in the world literature but in Spain, published databases focus on the treatment or complications of cerebral palsy. To propose a population register that can be useful in different areas of our environment and to evaluate its validity through its application in two differentiated and geographically delimited health areas. The registry consists of 124 items divided into seven sections: data on the child filiations, maternal history and parents' information, pregnancy and neonatal period data, diagnoses and classification, neuroimaging tests, therapeutic interventions and others. Patients attended in external consultations in Navarre and Andorra were included. In the register, 53 patients (52.8% females) were evaluated. 56.5% were premature. Spastic cerebral palsy is the most frequent presentation. 42% have associated epilepsy.

The use of population registers allows a better knowledge of cerebral palsy as well as the evaluation and development of prevention strategies and optimization of care resources with objective data. It is necessary to generalize the use of this type of records in our environment.
PMID: 30047119

**37. Neurodevelopmental disorders in children aged 2-9 years: Population-based burden estimates across five regions in India.**
Arora NK, Nair MKC, Gulati S, Deshmukh V, Mohapatra A, Mishra D, Patel V, Pandey RM, Das BC, Divan G, Murthy GVS, Sharma TD, Sapra S, Aneja S, Juneja M, Reddy SK, Suman P, Mukherjee SB, Dasgupta R, Tudu P, Das MK, Bhutani VK, Durkin MS, Pinto-Martin J, Silberberg DH, Sagar R, Ahmed F, Babu N, Bavdekar S, Chandra V, Chaudhuri Z, Dada T, Dass R, Gourie-Devi M, Remadevi S, Gupta JC, Handa KK, Kalra V, Karande S, Konanki R, Kulkarni M, Kumar R, Maria A, Masoodi MA, Mehta M, Mohanty SK, Nair H, Natarajan P, Niswade AK, Prasad A, Rai SK, Russell PSS, Saxena R, Sharma S, Singh AK, Singh GB, Sumaraj L, Suresh S, Thakar A, Parthasarathy S, Vyas B, Panigrahi A, Saroch MK, Shukla R, Rao KVR, Silveira MP, Singh S, Vajaratkar V.
PLoS Med. 2018 Jul 24;15(7):e1002615. doi: 10.1371/journal.pmed.1002615. eCollection 2018 Jul.
Neurodevelopmental disorders (NDDs) compromise the development and attainment of full social and economic potential at individual, family, community, and country levels. Paucity of data on NDDs slows down policy and programmatic action in most developing countries despite perceived high burden. We assessed 3,964 children (with almost equal number of boys and girls distributed in 2-<6 and 6-9 year age categories) identified from five geographically diverse populations in India using cluster sampling technique (probability proportionate to population size). These were from the North-Central, i.e., Palwal (N = 998; all rural, 16.4% non-Hindu, 25.3% from scheduled caste/tribe [SC-ST] [these are considered underserved communities who are eligible for affirmative action]); North, i.e., Kangra (N = 997; 91.6% rural, 3.7% non-Hindu, 25.3% SC-ST); East, i.e., Dhenkanal (N = 981; 89.8% rural, 1.2% non-Hindu, 38.0% SC-ST); South, i.e., Hyderabad (N = 495; all urban, 25.7% non-Hindu, 27.3% SC-ST) and West, i.e., North Goa (N = 493; 68.0% rural, 11.4% non-Hindu, 18.5% SC-ST). All children were assessed for vision impairment (VI), epilepsy (Epi), neuromotor impairments including cerebral palsy (NMI-CP), hearing impairment (HI), speech and language disorders, autism spectrum disorders (ASDs), and intellectual disability (ID). Furthermore, 6-9-year-old children were also assessed for attention deficit hyperactivity disorder (ADHD) and learning disorders (LDs). We standardized sample characteristics as per Census of India 2011 to arrive at district level and all-sites-pooled estimates. Site-specific prevalence of any of seven NDDs in 2-<6 year olds ranged from 2.9% (95% CI 1.6-5.5) to 18.7% (95% CI 14.7-23.6), and for any of nine NDDs in the 6-9-year-old children, from 6.5% (95% CI 4.6-9.1) to 18.5% (95% CI 15.3-22.3). Two or more NDDs were present in 0.4% (95% CI 0.1-1.7) to 4.3% (95% CI 2.2-8.2) in the younger age category and 0.7% (95% CI 0.2-2.0) to 5.3% (95% CI 3.3-8.2) in the older age category. All-site-pooled estimates for NDDs were 9.2% (95% CI 7.5-11.2) and 13.6% (95% CI 11.3-16.2) in children of 2-<6 and 6-9 year age categories, respectively, without significant difference according to gender, rural/urban residence, or religion; almost one-fifth of these children had more than one NDD. The pooled estimates for prevalence increased by up to three percentage points when these were adjusted for national rates of stunting or low birth weight (LBW). HI, ID, speech and language disorders, Epi, and LDs were the common NDDs across sites. Upon risk modelling, noninstitutional delivery, history of perinatal asphyxia, neonatal illness, postnatal neurological/brain infections, stunting, LBW/prematurity, and older age category (6-9 year) were significantly associated with NDDs. The study sample was underrepresentative of stunting and LBW and had a 15.6% refusal. These factors could be contributing to underestimation of the true NDD burden in our population. The study identifies NDDs in children aged 2-9 years as a significant public health burden for India. HI was higher than and ASD prevalence comparable to the published global literature. Most risk factors of NDDs were modifiable and amenable to public health interventions.
PMID: 30040859

**38. Comprehensive investigation of congenital anomalies in cerebral palsy: protocol for a European-Australian population-based data linkage study (The Comprehensive CA-CP Study).**
Goldsmith S, Garcia Jalon G, Badawi N, Blair E, Garne E, Gibson C, McIntyre S, Scott H, Smithers-Sheedy H, Andersen GL.
BMJ Open. 2018 Jul 23;8(7):e022190. doi: 10.1136/bmjopen-2018-022190.
Cerebral palsy (CP), an umbrella term for non-progressive conditions of cerebral origin resulting in motor impairments, is collectively the most common cause of physical disability in childhood. Cerebral and/or non-cerebral congenital anomalies are present in 15%-40% of children with CP. In order to identify effective prevention strategies for this substantial proportion of CP, a comprehensive understanding of the epidemiology of these congenital anomalies is required. International collaboration is needed, as previous attempts have fallen short due to a lack of power, since the anomalies are individually rare and CP comprises many clinical descriptions. The aim of this study is to generate new knowledge about the aetiologies of CP through a focused investigation into the role of congenital anomalies. This collaborative, population-based data linkage study includes nine geographic regions (six in Europe, three in Australia) served by both congenital anomaly and CP registers.

Register data for children with CP (both with and without congenital anomalies) and children with specific congenital anomalies (without CP) born between 1991 and 2009 will be linked and de-identified within each region. The resulting linked data sets will be quality assured, recoded, harmonised and then pooled into one data set. Analysis of the combined data set will include: frequencies/proportions of congenital anomalies and outcomes (type of CP, severity, impairments); descriptive analyses comparing timing of congenital anomaly development and brain injury/abnormality responsible for CP; ORs to calculate the odds of CP following a specific congenital anomaly; and identification of anomalies on causal pathways to CP. Ethics approval for this collaborative study, The Comprehensive CA-CP Study, has been obtained from the Cerebral Palsy Alliance Human Research Ethics Committee (EC00402). Study findings will be disseminated at conferences and published in peer-reviewed journals, and recommendations will be made regarding the collection and classification of congenital anomaly data by CP registers.
PMID: 30037879

**39. Primary CNS Burkitt Lymphoma: A Case Report of a 55-Year-Old Cerebral Palsy Patient.**
Bower K, Shah N.
Case Rep Oncol Med. 2018 Jun 24;2018:5869135. doi: 10.1155/2018/5869135. eCollection 2018.
With primary central nervous system lymphoma (PCNSL) being a rare disease, the subtype of Burkitt lymphoma (BL) presenting as a sole CNS lesion is an even more exceptional diagnosis. A case of coexistent primary CNS Burkitt lymphoma (PCNSBL) with cerebral palsy (CP) is presented. A 55-year-old Caucasian male presented with increasing bilateral lower extremity weakness above his baseline in addition to signs of increased intracranial pressure. Four abnormal enhancing masses were detected on MRI with biopsy results consistent with Burkitt lymphoma. Complete staging workup was completed with no evidence of extra-CNS disease noted on PET/CT, bone marrow biopsy, or cerebral spinal fluid analysis. The patient was treated with intravenous as well as intrathecal chemotherapy and found to be in a complete remission at six months. Recurrence in the CNS was observed four months later with treatment consisting of whole brain radiation as well as intrathecal chemotherapy. Thirty months after diagnosis, the patient remains disease-free. To our knowledge, this is the first case of PCNSBL in the setting of CP. A review of literature regarding treatment options in this controversial setting is provided.
PMID: 30034894