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Interventions and Management

1. *Res Dev Disabil.* 2014 Jul 22;35(11):2651-2657. doi: 10.1016/j.ridd.2014.07.005. [Epub ahead of print]

Functional classifications for cerebral palsy: Correlations between the gross motor function classification system (GMFCS), the manual ability classification system (MACS) and the communication function classification system (CFCS).

Compagnone E, Maniglio J, Camposeo S, Vespino T, Losito L, De Rinaldis M, Gennaro L, Trabacca A.

This study aimed to investigate a possible correlation between the gross motor function classification system-expanded and revised (GMFCS-E&R), the manual abilities classification system (MACS) and the communication function classification system (CFCS) functional levels in children with cerebral palsy (CP) by CP subtype. It was also geared to verify whether there is a correlation between these classification systems and intellectual functioning (IF) and parental socio-economic status (SES). A total of 87 children (47 males and 40 females, age range 4-18 years, mean age 8.9 ± 4.2) were included in the study. A strong correlation was found between the three classifications: Level V of the GMFCS-E&R corresponds to Level V of the MACS ($r_s=0.67$, $p=0.001$); the same relationship was found for the CFCS and the MACS ($r_s=0.73$, $p<0.001$) and for the GMFCS-E&R and the CFCS ($r_s=0.61$, $p=0.001$). The correlations between the IQ and the global functional disability profile were strong or moderate (GMFCS and IQ: $r_s=0.66$, $p=0.001$; MACS and IQ: $r_s=0.58$, $p=0.001$; CFCS and MACS: $r_s=0.65$, $p=0.001$). The Kruskal-Wallis test was used to determine if there were differences between the GMFCS-E&R, the CFCS and the MACS by CP type. CP types showed different scores for the IQ level (Chi-square=8.59, $df=2$, $p=0.014$), the GMFCS-E&R (Chi-square=36.46, $df=2$, $p<0.001$), the CFCS (Chi-square=12.87, $df=2$, $p=0.002$), and the MACS Level (Chi-square=13.96, $df=2$, $p<0.001$) but no significant differences emerged for the SES (Chi-square=1.19, $df=2$, $p=0.554$). This study shows how the three functional classifications (GMFCS-E&R, CFCS and MACS) complement each other to provide a better description of the functional profile of CP. The systematic evaluation of the IQ can provide useful information about a possible future outcome for every functional level. The SES does not appear to affect functional profiles.

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[PMID: 25062096](https://pubmed.ncbi.nlm.nih.gov/25062096/) [PubMed - as supplied by publisher]

2. J Exerc Rehabil. 2014 Jun 30;10(3):176-83. doi: 10.12965/jer.140114. eCollection 2014.**The effect of the action observation physical training on the upper extremity function in children with cerebral palsy.**

Kim JY, Kim JM, Ko EY.

The purpose this study was to investigate the effect of action observation physical training (AOPT) on the functioning of the upper extremities in children with cerebral palsy (CP), using an evaluation framework based on that of the International Classification of Functioning, Disability and Health (ICF). The subjects were divided into an AOPT group and a physical training (PT) group. AOPT group practiced repeatedly the actions they observed on video clips, in which normal child performed an action with their upper extremities. PT group performed the same actions as the AOPT group did after observing landscape photographs. The subjects participated in twelve 30-min sessions, 3 days a week, for 4 weeks. Evaluation of upper extremity function using the following: the power of grasp and Modified Ashworth Scale for body functions and structures, a Box and Block test, an ABILHAND-Kids questionnaire, and the WeeFIM scale for activity and participation. Measurements were performed before and after the training, and 2 weeks after the end of training. The results of this study showed that, in comparison with the PT group, the functioning of the upper extremities in the AOPT group was significantly improved in body functions and activity and participation according to the ICF framework. This study demonstrates that AOPT has a positive influence on the functioning of the upper extremities in children with CP. It is suggested that this alternative approach for functioning of the upper extremities could be an effective method for rehabilitation in children with CP.

[PMID: 25061598](#) [PubMed]**3. Neurorehabil Neural Repair. 2014 Jul 11. pii: 1545968314541172. [Epub ahead of print]****Upper Limb Robot-Assisted Therapy in Cerebral Palsy: A Single-Blind Randomized Controlled Trial.**

Gilliaux M, Renders A, Dispa D, Holvoet D, Sapin J, Dehez B, Detrembleur C, Lejeune TM(5), Stoquart G.

Background. Several pilot studies have evoked interest in robot-assisted therapy (RAT) in children with cerebral palsy (CP). **Objective.** To assess the effectiveness of RAT in children with CP through a single-blind randomized controlled trial. **Patients and Methods.** Sixteen children with CP were randomized into 2 groups. Eight children performed 5 conventional therapy sessions per week over 8 weeks (control group). Eight children completed 3 conventional therapy sessions and 2 robot-assisted sessions per week over 8 weeks (robotic group). For both groups, each therapy session lasted 45 minutes. Throughout each RAT session, the patient attempted to reach several targets consecutively with the REAPlan. The REAPlan is a distal effector robot that allows for displacements of the upper limb in the horizontal plane. A blinded assessment was performed before and after the intervention with respect to the International Classification of Functioning framework: body structure and function (upper limb kinematics, Box and Block test, Quality of Upper Extremity Skills Test, strength, and spasticity), activities (Abilhand-Kids, Pediatric Evaluation of Disability Inventory), and participation (Life Habits). **Results.** During each RAT session, patients performed 744 movements on average with the REAPlan. Among the variables assessed, the smoothness of movement ($P < .01$) and manual dexterity assessed by the Box and Block test ($P = .04$) improved significantly more in the robotic group than in the control group. **Conclusions.** This single-blind randomized controlled trial provides the first evidence that RAT is effective in children with CP. Future studies should investigate the long-term effects of this therapy.

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4. BMC Neurol. 2014 Jul 15;14:144. doi: 10.1186/1471-2377-14-144.

Effectiveness of functional hand splinting and the cognitive orientation to occupational performance (CO-OP) approach in children with cerebral palsy and brain injury: two randomised controlled trial protocols.

Jackman M, Novak I, Lannin N.

BACKGROUND: Cerebral palsy (CP) and brain injury (BI) are common conditions that have devastating effects on a child's ability to use their hands. Hand splinting and task-specific training are two interventions that are often used to address deficits in upper limb skills, both in isolation or concurrently. The aim of this paper is to describe the method to be used to conduct two randomised controlled trials (RCT) investigating (a) the immediate effect of functional hand splints, and (b) the effect of functional hand splints used concurrently with task-specific training compared to functional hand splints alone, and to task-specific training alone in children with CP and BI. The Cognitive Orientation to Occupational Performance (CO-OP) approach will be the task-specific training approach used. **METHODS/DESIGN:** Two concurrent trials; a two group, parallel design, RCT with a sample size of 30 participants (15 per group); and a three group, parallel design, assessor blinded, RCT with a sample size of 45 participants (15 per group). **INCLUSION CRITERIA:** age 4-15 years; diagnosis of CP or BI; Manual Abilities Classification System (MACS) level I - IV; hand function goals; impaired hand function; the cognitive, language and behavioural ability to participate in CO-OP. Participants will be randomly allocated to one of 3 groups; (1) functional hand splint only (n=15); (2) functional hand splint combined with task-specific training (n=15); (3) task-specific training only (n=15). Allocation concealment will be achieved using sequentially numbered, sealed opaque envelopes opened by an off-site officer after baseline measures. Treatment will be provided for a period of 2 weeks, with outcome measures taken at baseline, 1 hour after randomisation, 2 weeks and 10 weeks. The functional hand splint will be a wrist cock-up splint (+/- thumb support or supination strap). Task-specific training will involve 10 sessions of CO-OP provided in a group of 2-4 children. Primary outcome measures will be the Canadian Occupational Performance Measure (COPM) and the Goal Attainment Scale (GAS). Analysis will be conducted on an intention-to-treat basis. **DISCUSSION:** This paper outlines the protocol for two randomised controlled trials investigating functional hand splints and CO-OP for children with CP and BI.

[PMID: 25023385](#) [PubMed - in process]

5. Front Hum Neurosci. 2014 Jun 27;8:396. doi: 10.3389/fnhum.2014.00396. eCollection 2014.

The functional significance of cortical reorganization and the parallel development of CI therapy.

Taub E, Uswatte G, Mark VW.

For the nineteenth and the better part of the twentieth centuries two correlative beliefs were strongly held by almost all neuroscientists and practitioners in the field of neurorehabilitation. The first was that after maturity the adult CNS was hardwired and fixed, and second that in the chronic phase after CNS injury no substantial recovery of function could take place no matter what intervention was employed. However, in the last part of the twentieth century evidence began to accumulate that neither belief was correct. First, in the 1960s and 1970s, in research with primates given a surgical abolition of somatic sensation from a single forelimb, which rendered the extremity useless, it was found that behavioral techniques could convert the limb into an extremity that could be used extensively. Beginning in the late 1980s, the techniques employed with deafferented monkeys were translated into a rehabilitation treatment, termed Constraint Induced Movement therapy or CI therapy, for substantially improving the motor deficit in humans of the upper and lower extremities in the chronic phase after stroke. CI therapy has been applied successfully to other types of damage to the CNS such as traumatic brain injury, cerebral palsy, multiple sclerosis, and spinal cord injury, and it has also been used to improve function in focal hand dystonia and for aphasia after stroke. As this work was proceeding, it was being shown during the 1980s and 1990s that sustained modulation of afferent input could alter the structure of the CNS and that this topographic reorganization could have relevance to the function of the individual. The alteration in these once fundamental beliefs has given rise to important recent developments in neuroscience and neurorehabilitation and holds promise for further increasing our understanding of CNS function and extending the boundaries of what is possible in neurorehabilitation.

[PMID: 25018720](#) [PubMed]

6. *Eur J Paediatr Neurol*. 2014 Jun 19. pii: S1090-3798(14)00108-1. doi: 10.1016/j.ejpn.2014.06.004. [Epub ahead of print]

Responsiveness of the MD-Childhood Rating Scale in dyskinetic cerebral palsy patients undergoing anticholinergic treatment.

Battini R, Casarano M, Sgandurra G, Olivieri I, Di Pietro R, Romeo DM, Mercuri E, Cioni G.

BACKGROUND: Movement Disorder-Childhood Rating Scale (MD-CRS) is a new tool for assessment of movement disorders during developmental age. **AIM:** In this study we evaluated a cohort of 47 patients affected by dyskinetic cerebral palsy and treated with anticholinergic drug (trihexyphenidyl) over one year in order to verify the responsiveness of the new scale. **METHODS:** The participants were divided into two groups according to their age (0-3 years; 4-18 years) and were evaluated using MD-CRS 0-3 or MD-CRS 4-18 at baseline, i.e. before starting pharmacological treatment (T0), after 6 (T1) and 12 months (T2) of treatment. Univariate repeated measures ANOVA with a Greenhouse-Geisser correction was performed to analyse the scale responsiveness for the three indexes (e.g. Index I, Index II and Global Index) in each group with time (T0, T1 and T2). In addition, Bonferroni test was performed to identify the source of significant differences among means. **RESULTS:** Significant differences were found between time points (T1 vs T0, T2 vs T0 and T2 vs T1) in both scales for all indexes with the exception for T2 vs T1 for Index II in both scales and for T2 vs T1 for the Global Index in the older age group. There was not significant correlation between observed changes in the scores and age of children, either for MD-CRS 0-3 or MD-CRS 4-18. **CONCLUSIONS:** Our results suggest that MD-CRS is a suitable tool to detect changes and could be used as outcome measure for clinical trials. Further studies will be necessary to prove the efficacy of trihexyphenidyl for dyskinetic cerebral palsy.

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7. *Dev Med Child Neurol*. 2014 Jul 9. doi: 10.1111/dmcn.12534. [Epub ahead of print]

Neurophysiological evidence for motor planning limitations in children with cerebral palsy.

Valvano J.

[PMID: 25039416](#) [PubMed - as supplied by publisher]

8. *Hippokratia*. 2013 Oct;17(4):303-6.

Reliability of balance evaluation in children with cerebral palsy.

Iatridou G, Dionyssiotis Y.

The evaluation of balance in children with cerebral palsy (CP) is an extremely difficult and complex procedure. The purpose of the present study was the evaluation of three balance tests: Berg Balance Scale (BBS), time up and go (TUG) and Bruininks-Oseretsky Test of Motor Proficiency (BOTMP) and their reliability in children with CP. The control of the reliability of the tests was based on the successive application to twenty children with CP within a short period in order to substantiate their ability to give the same results in a stable sample. No difference was found according to scores between the measures but important statistical differences were found of the scores of the children in all tests. The tests BBS, TUG and BOTMP are considered to be reliable and valid tests, able to objectively define the quantitative mutation of the balance of the child in test with CP.

[PMID: 25031506](#) [PubMed]

9. BMC Musculoskelet Disord. 2014 Jul 12;15(1):236. doi: 10.1186/1471-2474-15-236.**Intramuscular fat in ambulant young adults with bilateral spastic cerebral palsy.**

Noble JJ, Charles-Edwards GD, Keevil SF, Lewis AP, Gough M, Shortland AP.

BACKGROUND: It is known that individuals with bilateral spastic cerebral palsy (BSCP) have small and weak muscles. However, no studies to date have investigated intramuscular fat infiltration in this group. The objective of this study is to determine whether adults with BSCP have greater adiposity in and around their skeletal muscles than their typically developing (TD) peers as this may have significant functional and cardio-metabolic implications for this patient group. **METHODS:** 10 young adults with BSCP (7 male, mean age 22.5 years, Gross Motor Function Classification System (GMFCS) levels I-III), and 10 TD young adults (6 male, mean age 22.8 years) took part in this study. 11 cm sections of the left leg of all subjects were imaged using multi-echo gradient echo chemical shift imaging (mDixon). Percentage intermuscular fat (IMAT), intramuscular fat (IntraMF) and a subcutaneous fat to muscle volume ratio (SF/M) were calculated. **RESULTS:** IntraMF was higher with BSCP for all muscles ($p=0.001-0.013$) and was significantly different between GMFCS levels ($p<0.001$), with GMFCS level III having the highest IntraMF content. IMAT was also higher with BSCP $p<0.001$). No significant difference was observed in SF/M between groups. **CONCLUSION:** Young adults with BSCP have increased intermuscular and intramuscular fat compared to their TD peers. The relationship between these findings and potential cardio-metabolic and functional sequelae are yet to be investigated.

[PMID: 25016395](#) [PubMed - in process]

10. Braz J Phys Ther. 2014 Jul 18;0:0. [Epub ahead of print]**Relationship between static postural control and the level of functional abilities in children with cerebral palsy [Article in English, Portuguese]**

Pavão SL, Nunes GS, Santos AN, Rocha NA.

Background: Postural control deficits can impair functional performance in children with cerebral palsy (CP) in daily living activities. **Objective:** To verify the relationship between standing static postural control and the functional ability level in children with CP. **Method:** The postural control of 10 children with CP (gross motor function levels I and II) was evaluated during static standing on a force platform for 30 seconds. The analyzed variables were the anteroposterior (AP) and mediolateral (ML) displacement of the center of pressure (CoP) and the area and velocity of the CoP oscillation. The functional abilities were evaluated using the mean Pediatric Evaluation of Disability Inventory (PEDI) scores, which evaluated self-care, mobility and social function in the domains of functional abilities and caregiver assistance. **Results:** Spearman's correlation test found a relationship between postural control and functional abilities. The results showed a strong negative correlation between the variables of ML displacement of CoP, the area and velocity of the CoP oscillation and the PEDI scores in the self-care and caregiver assistance domains. Additionally, a moderate negative correlation was found between the area of the CoP oscillation and the mobility scores in the caregiver assistance domain. We used a significance level of 5% ($p < 0.05$). **Conclusions:** We observed that children with cerebral palsy with high CoP oscillation values had lower caregiver assistance scores for activities of daily living (ADL) and consequently higher levels of caregiver dependence. These results demonstrate the repercussions of impairments to the body structure and function in terms of the activity levels of children with CP such that postural control impairments in these children lead to higher requirements for caregiver assistance.

[PMID: 25054383](#) [PubMed - as supplied by publisher]

11. Dev Neurorehabil. 2014 Jul 24:1-6. [Epub ahead of print]**Does hip displacement influence health-related quality of life in children with cerebral palsy?**

Jung NH, Pereira B, Nehring I, Brix O, Bernius P, Schroeder SA, Kluger GJ, Koehler T, Beyerlein A, Weir S, von Kries R, Narayanan UG, Berweck S, Mall V.

Objective: To evaluate the association of hip lateralisation with health-related quality of life (HRQL) in children with

cerebral palsy (CP) using the Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD®) questionnaire. Methods: We assessed n=34 patients (mean age: 10.2 years, SD: 4.7 years; female: n=16) with bilateral CP and Gross Motor Function Classification System (GMFCS) Level III-V using the CPOCHILD® questionnaire. Hip lateralisation was measured by Reimer's migration percentage (MP). Results: There was an association between both, MP and GMFCS with CPOCHILD® total score. Stratified analyses did not suggest interaction of the association between MP and CPOCHILD® total score by GMFCS level. After adjustment for GMFCS level, we found a significant linear decrease of CPOCHILD® total score of -0.188 points by 1% increment in MP. Conclusions: There was an association between MP and HRQL, which could not be explained by the GMFCS level.

[PMID: 25057804](#) [PubMed - as supplied by publisher]

12. Orthopade. 2014 Jun 29. [Epub ahead of print]

Bilateral spastic cerebral palsy with ambulatory ability (diplegia) : Pathophysiology, state of the art of conservative and surgical treatment and rehabilitation [Article in German]

Westhoff B, Bittersohl D, Krauspe R.

BACKGROUND: Infantile cerebral palsy is one of the most common diseases resulting in chronic disability and is mostly concomitant with impairment in the ability to walk. **DISEASE PATTERN:** Muscle contractions typically develop during the growth phase with subsequent joint contracture and instability as well as bone deformities to various extents. From a biomechanical viewpoint the gait impairment is due to a lever arm dysfunction. **THERAPEUTIC STRATEGIES:** The therapy concept is multimodal and involves conservative as well as operative measures. The objectives are to lower the muscle tonus, to avoid muscle and joint contractures and bone deformities and to correct already fixed malformations in order to achieve the best possible function for the patient. Complicated multilevel operations are often necessary to achieve this aim. **CONCLUSION:** Extensive knowledge on the biomechanics of gait and the pathobiomechanics of spastic bilateral cerebral palsy are necessary to carry out surgery. Using instrumental gait analyses the biomechanical relationships can be analyzed better and complicated operations can be planned with greater precision.

[PMID: 25028280](#) [PubMed - as supplied by publisher]

13. Expert Rev Neurother. 2014 Aug;14(8):923-36. doi: 10.1586/14737175.2014.936387. Epub 2014 Jul 21.

Ultrasound-guided botulinum toxin injections in neurology: technique, indications and future perspectives.

Walter U, Dressler D.

Botulinum toxin (BT) therapy is used in neurology to treat muscle hyperactivity disorders including dystonia, spasticity, cerebral palsy, hemifacial spasms and re-innervation synkinesias as well as exocrine gland hyperactivity disorders. To increase its therapeutic effect and to decrease adverse effects in adjacent tissues, exact BT placement is important. Ultrasonography (US) allows non-invasive, real-time imaging of muscular and glandular tissues and their surrounding structures. It can visualize, guide, and standardize the entire procedure of BT application. Small randomized studies suggest that US-guidance can improve therapeutic efficacy and reduce adverse effects of BT therapy when compared to conventional placement. US-guidance should be used in forearm muscles when functionality is important, and in selected leg muscles. It may be used for targeting distinct neck muscles in cervical dystonia. It is helpful for targeting the salivary glands. Here we review the technique, indications and future developments of US-guidance for BT injection in neurological disorders.

[PMID: 25046267](#) [PubMed - in process]

14. Dev Med Child Neurol. 2014 Jul 23. doi: 10.1111/dmcn.12548. [Epub ahead of print]**Gross motor function is an important predictor of daily physical activity in young people with bilateral spastic cerebral palsy.**

Bania TA, Taylor NF, Baker RJ, Graham HK, Karimi L, Dodd KJ.

AIM: The aim of the study was to describe daily physical activity levels of adolescents and young adults with bilateral spastic cerebral palsy (CP) and to identify factors that help predict these levels. METHOD: Daily physical activity was measured using an accelerometer-based activity monitor in 45 young people with bilateral spastic CP (23 males, 22 females; mean age 18y 6mo [SD 2y 5mo] range 16y 1mo-20y 11mo); classified as Gross Motor Function Classification System (GMFCS) level II or III and with contractures of <20° at hip and knee. Predictor variables included demographic characteristics (age, sex, weight) and physical characteristics (gross motor function, lower limb muscle strength, 6min walk distance). Data were analyzed using the information-theoretic approach, using the Akaike information criterion (AIC) and linear regression. RESULTS: Daily activity levels were low compared with published norms. Gross Motor Function Measure Dimension-E (GMFM-E; walking, running, and jumping) was the only common predictor variable in models that best predicted energy expenditure, number of steps, and time spent sitting/lying. GMFM Dimension-D (standing) and bilateral reverse leg press strength contributed to the models that predicted daily physical activity. INTERPRETATION: Adolescents and young adults with bilateral spastic CP and mild to moderate walking disabilities have low levels of daily activity. The GMFM-E was an important predictor of daily physical activity.

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15. Disabil Rehabil. 2014 Jul 23:1-8. [Epub ahead of print]**Patient experiences with intrathecal baclofen as a treatment for spasticity - a pilot study.**

Gunnarsson S, Samuelsson K.

Purpose: This study describes how patients experience intrathecal baclofen (ITB) treatment. Methods: Data were collected from interviews with 14 patients (19-76 years old) who were diagnosed with spinal cord injury (SCI), multiple sclerosis (MS), or cerebral palsy (CP). Data were analyzed using conventional content analysis. Result: The analysis resulted in 16 subcategories arranged into five main categories: procedures before treatment, the effect of ITB on daily life and activities, continuous follow-up, expected and unexpected consequences of ITB, and overall level of satisfaction with ITB. Together these categories described the patients' experiences with ITB treatment. When the patients were asked whether they would undergo ITB again, they all stated that they would. Conclusion: Patients stated that they were highly satisfied with the ITB treatment. However, the patients identified several areas that could be improved. Specifically, the patients wanted more information about the different steps in the treatment process and what to expect from ITB treatment. Implications for Rehabilitation An overall satisfaction with the effect from ITB treatment was shown, but some areas still need to be improved. Complications following ITB treatment still remain a major concern for the patient group. Future clinical practice, should address how to take into account patients' expectations and define relevant goals with respect to ITB treatment as well as how to supply professional information.

[PMID: 25052099](#) [PubMed - as supplied by publisher]

16. Eur J Phys Rehabil Med. 2014 Jul 23. [Epub ahead of print]**Gait analysis contribution to problems identification and surgical planning in CP patients: an agreement study.**

Ferrari A, Brunner R, Faccioli S, Reverberi S, Benedetti MG.

BACKGROUND: Previous studies have demonstrated that the use of Gait Analysis (GA) modifies decision making and changes planned surgical treatment, confirming some clinical indications or defining alternative choices,

excluding or delaying already planned surgery in children with Cerebral Palsy (CP). AIM: To assess the difference in defining functional problems and treatment relevance using clinical assessment or gait analysis in CP children. DESIGN: The study has been designed for assessing the rate of agreement on muscle--skeletal diagnosis, and on surgical recommendations in diplegic CP patients, when decided by two different blinded clinicians based on a) clinical assessment, and b) GA in addition to clinical assessment. POPULATION: 25 diplegic children who have been evaluated by GA before surgery and at a follow up of at least 6 months. METHODS: Two separate lists of problems and consequent surgical interventions were outlined for all the patients by two blinded experts from clinical and GA assessment. The two sets of nominal--scale ratings for all patients of the two groups were statistically evaluated for agreement. RESULTS: A fair and a slight agreement was found respectively between the two sets of problems and the two sets of surgical plans. Main differences in problems identified were relative to the presence of generalized spasticity and bony deformities as detected by means of GA instead of local problems and soft tissues spasticity/retraction clinically identified. As a consequence, by means of GA, surgery was indicated only in 65% of patients. CONCLUSION: The availability of a GA laboratory helps in diagnostic reasoning in CP children indicated for surgery. Low agreement found appears to be a result of a different clinical approach of the surgeons. CLINICAL REHABILITATION IMPACT: The use of GA in the analysis of motor problems in CP children provides a basis for an objective reasoning for clinical decision making and for assessing functional outcome. Further efforts are required to build a body of knowledge about a consensus on the identification of walking problems in CP children.

[PMID: 25052013](#) [PubMed - as supplied by publisher]

17. Yonsei Med J. 2014 Sep 1;55(5):1406-12. doi: 10.3349/ymj.2014.55.5.1406.

Architectural changes of the gastrocnemius muscle after botulinum toxin type a injection in children with cerebral palsy.

Park ES, Sim E, Rha DW, Jung S.

PURPOSE: This study used ultrasonography (US) to investigate the architectural changes in gastrocnemius muscles (GCM) after botulinum toxin injection (BoNT-A) in children with cerebral palsy (CP). MATERIALS AND METHODS: Thirteen children with CP who received a BoNT-A injection into their GCM to treat equinus were recruited (9 males and 4 females). Architectural changes in both the medial and lateral heads of the GCM from a total of 20 legs were assessed using B-mode, real-time US. Muscle thickness (MT), fascicle length (FL), and fascicle angle (FA) were measured over the middle of the muscle belly in both a resting and neutral ankle position. Measures at 1 and 3 months after the injection were compared with baseline data taken before the injection. RESULTS: The mean age of the subjects was 5.8 (± 1.6) years. Spasticity was significantly reduced when measured by both the modified Tardieu scale and the modified Ashworth scale at 1 and 3 months after injection ($p < 0.05$). The MT and FA of both the medial and lateral heads of the GCM were significantly reduced for both neutral and resting ankle positions at 1 and 3 months after the injection. The FL of both the medial and lateral heads of the GCM were significantly increased in a resting position ($p < 0.05$), but not in a neutral position. CONCLUSION: Our results demonstrated muscle architectural changes induced by BoNT-A injection. The functional significances of these changes were discussed.

[PMID: 25048504](#) [PubMed - in process]

18. Duodecim. 2014;130(11):1115-23.

Multi-level surgery of a limb improves walking ability of a CP child [Article in Finnish]

Lehtonen K, Piirainen A, Niemelä T, Kallio P, Peltonen J, Mäenpää H.

BACKGROUND. Correction of the deformities of the lower limbs in CP children is currently attempted in one go by using multi-level surgery in one operation involving multiple procedures. MATERIAL AND METHODS. We examined from patient records the surgical outcomes and operative harms of 40 CP children operated in the HUS Department of Gynecology and Pediatrics in 2000 to 2010. Clinical examination and analysis of gait were the most important methods of assessment. RESULTS AND CONCLUSION: Most CP children benefited from the operation, with a considerable improvement in their walking posture.

[PMID: 24964494](#) [PubMed - indexed for MEDLINE]

19. Exp Brain Res. 2014 Jul 17. [Epub ahead of print]

Reaction time in ankle movements: a diffusion model analysis.

Michmizos KP, Krebs HI.

Reaction time (RT) is one of the most commonly used measures of neurological function and dysfunction. Despite the extensive studies on it, no study has ever examined the RT in the ankle. Twenty-two subjects were recruited to perform simple, 2- and 4-choice RT tasks by visually guiding a cursor inside a rectangular target with their ankle. RT did not change with spatial accuracy constraints imposed by different target widths in the direction of the movement. RT increased as a linear function of potential target stimuli, as would be predicted by Hick-Hyman law. Although the slopes of the regressions were similar, the intercept in dorsal-plantar (DP) direction was significantly smaller than the intercept in inversion-eversion (IE) direction. To explain this difference, we used a hierarchical Bayesian estimation of the Ratcliff's (Psychol Rev 85:59, 1978) diffusion model parameters and divided processing time into cognitive components. The model gave a good account of RTs, their distribution and accuracy values, and hence provided a testimony that the non-decision processing time (overlap of posterior distributions between DP and IE < 0.045), the boundary separation (overlap of the posterior distributions < 0.1) and the evidence accumulation rate (overlap of the posterior distributions < 0.01) components of the RT accounted for the intercept difference between DP and IE. The model also proposed that there was no systematic change in non-decision processing time or drift rate when spatial accuracy constraints were altered. The results were in agreement with the memory drum hypothesis and could be further justified neurophysiologically by the larger innervation of the muscles controlling DP movements. This study might contribute to assessing deficits in sensorimotor control of the ankle and enlighten a possible target for correction in the framework of our on-going effort to develop robotic therapeutic interventions to the ankle of children with cerebral palsy.

[PMID: 25030966](#) [PubMed - as supplied by publisher]

20. ANZ J Surg. 2014 Jul 18. doi: 10.1111/ans.12753. [Epub ahead of print]

Telehealth in paediatric orthopaedic surgery in Queensland: a 10-year review.

Rowell PD, Pincus P, White M, Smith AC.

BACKGROUND: Telemedicine is a patient consultation method commonly available to patients in rural and remote areas throughout Australia. Its use in paediatric orthopaedics has been rarely described. The primary aim of this study was to identify the patient cohort accessing the orthopaedic paediatric telehealth service through the Royal Children's Hospital Queensland, so as to better allocate this resource. The secondary aims were to identify the orthopaedic conditions the patients utilizing this service suffered and to follow-up on treatment outcomes to potentially assess clinical benefit. **METHOD:** A retrospective review of prospectively collected data of paediatric orthopaedic patients consulted using telehealth at the Royal Children's Hospital, Queensland over a 10-year period between January 2004 and September 2012 was conducted. **RESULTS:** One hundred and twenty-six patient records were assessed with a mean age of 6 years. Results showed that 40% of patients seen using telehealth in paediatric orthopaedics had documented cerebral palsy, an intellectual disability or congenital syndrome. Common paediatric orthopaedic conditions were seen, with lower limb malalignment being the most common presenting complaint. About 58% of patients were seen exclusively via telehealth and did not require in-person consultation or operative therapy. **CONCLUSION:** We found that the orthopaedic telepaediatric consultation service at the Royal Children's Hospital reviewed a large proportion of patients with a known disability. We believe there is a role for telehealth medicine for all patients; however, we propose that even greater benefit can be obtained from telehealth consultation in patients with a disability where the cost and inconvenience of patient transport is considerably increased.

© 2014 Royal Australasian College of Surgeons.

[PMID: 25040240](#) [PubMed - as supplied by publisher]

21. Case Rep Med. 2014;2014:538289. doi: 10.1155/2014/538289. Epub 2014 Jun 26.**Superior mesenteric artery syndrome in a patient with cerebral palsy.**

Neuman A, Desai B, Glass D, Diab W.

Superior mesenteric artery syndrome involves compression of the third part of the duodenum due to narrowing of the area between the aorta and the superior mesenteric artery (SMA). We will describe the case of a 34-year-old with cerebral palsy who presented with abdominal pain, nausea, vomiting, and weight loss and was diagnosed with SMA syndrome via CT-imaging. With failure of conservative measures, our patient underwent a duodenojejunostomy after which improvement in her weight as well as relief of her abdominal symptoms was noted. Given the rarity of this syndrome, physicians need to keep a high index of suspicion in order to prevent the damaging consequences.

[PMID: 25053950](#) [PubMed]

22. Ann Rehabil Med. 2014 Jun;38(3):376-80. doi: 10.5535/arm.2014.38.3.376. Epub 2014 Jun 26.**The Usefulness of M-B CDI-K Short Form as Screening Test in Children With Language Developmental Delay.**

Kim SW, Jeon HR, Park EJ, Kim HI, Jung da W, Woo MR.

OBJECTIVE: To investigate the usefulness of MacArthur-Bates Communicative Development Inventories-Korean (M-B CDI-K) short form as a screening test in children with language developmental delay. **METHODS:** From April 2010 to May 2012, a total of 87 patients visited the department of physical medicine and rehabilitation of National Health Insurance Service Ilsan Hospital with the complaint of language developmental delay and were enrolled in this study. All patients took M-B CDI-K short form and Sequenced Language Scale for Infants (SELSI) or Preschool Receptive-Expressive Language Scale (PRES) according to their age. **RESULTS:** The study group consisted of 58 male patients and 29 female patients and the mean age was 25.9 months. The diagnosis are global developmental delay in 26 patients, selective language impairment in 31 patients, articulation disorder in 7 patients, cerebral palsy in 8 patients, autism spectrum disorder in 4 patients, motor developmental delay in 4 patients, and others in 7 patients. Seventy-one patients are diagnosed with language developmental delay in SELSI or PRES and of them showed 69 patients a high risk in the M-B CDI-K short form. Sixteen patients are normal in SELSI or PRES and of them showed 14 patients non-high risk in the M-B CDI-K short form. The M-B CDI-K short form has 97.2% sensitivity, 87.5% specificity, a positive predictive value of 0.97, and a negative predictive value of 0.88. **CONCLUSION:** The M-B CDI-K short form has a high sensitivity and specificity so it is considered as an useful screening tool in children with language developmental delay. Additional researches targeting normal children will be continued to supply the specificity of the M-B CDI-K short form.

[PMID: 25024962](#) [PubMed]

23. J Commun Disord. 2014 Jul 7. pii: S0021-9924(14)00054-9. doi: 10.1016/j.jcomdis.2014.06.003. [Epub ahead of print]**Understanding perceptions of stuttering among school-based speech-language pathologists: An application of attribution theory.**

Boyle MP.

INTRODUCTION: The purpose of this study was to investigate whether attribution theory could explain speech-language pathologists (SLPs) perceptions of children with communication disorders such as stuttering. Specifically, it was determined whether perceptions of onset and offset controllability, as well as biological and non-biological attributions for communication disorders were related to willingness to help, sympathy, and anger toward children with these disorders. It was also of interest to determine if blame for stuttering was related to perceived controllability of stuttering and negative attitudes toward people who stutter (PWS). **METHOD:** A survey was developed to measure perceived onset and offset controllability, biological and non-biological attributions, willingness to help, sympathy, and anger toward middle school children with developmental stuttering,

functional articulation disorders, and cerebral palsy. In addition, a scale was developed to measure blame and negative attitudes toward PWS in general. Surveys were mailed to 1000 school-based SLPs. Data from 330 participants were analyzed. **RESULTS:** Supporting the hypotheses of attribution theory, higher perceived onset and offset controllability of the disorder was linked to less willingness to help, lower sympathy, and more anger across conditions. Increased biological attributions were associated with more reported sympathy. Increased blame for stuttering was linked to higher perceived controllability of stuttering, more dislike of PWS, and more agreement with negative stereotypes about PWS. **CONCLUSIONS:** Educating SLPs about the variable loss of control inherent in stuttering could improve attitudes and increase understanding of PWS. Reductions in blame may facilitate feelings of sympathy and empathy for PWS and reduce environmental barriers for clients. Learning outcomes Readers should be able to: (1) identify the main principles of Weiner's attribution theory (2) identify common negative perceptions of people who stutter (3) describe how disorders of stuttering, articulation disorders, and cerebral palsy are differentiated in terms of perceived onset and offset controllability, and biological and non-biological attributions (4) describe relationships between perceived onset and offset controllability of disorders and sympathy, anger, and willingness to help.

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[PMID: 25042750](#) [PubMed - as supplied by publisher]

24. Dev Neurorehabil. 2014 Apr;17(2):73-4. doi: 10.3109/17518423.2014.908023.

Innovative communication rehabilitation in the year of the International Communication Project 2014.

Hemsley B, Balandin S.

[PMID: 24694309](#) [PubMed - indexed for MEDLINE]

25. J Child Neurol. 2014 Jul 22. pii: 0883073814538497. [Epub ahead of print]

A Population-Based Study of Communication Impairment in Cerebral Palsy.

Zhang JY, Oskoui M, Shevell M.

To explore factors associated with communication impairments in children with cerebral palsy. Data were obtained on children born between 1999 and 2008 from the Quebec Cerebral Palsy Registry (REPACQ). Out of 535 children with cerebral palsy, 297 were identified to have communication impairments (55.5%). Of these, 96 were unable to communicate verbally (32.3%), 195 had some verbal communication (65.7%), and 6 were unspecified (2.0%). These children were significantly more likely to have a more severe motor deficit (Gross Motor Function Classification System levels IV and V and Manual Ability Classification System levels IV and V), to have spastic quadriplegia or dyskinetic subtypes of cerebral palsy, and gray matter injury on neuroimaging. Communication impairment is a common comorbidity in cerebral palsy and is associated with a more severe motor deficit, spastic quadriplegic or dyskinetic subtype of cerebral palsy, and gray matter injury on neuroimaging. This information allows clinicians to better predict and manage communication impairment in children with cerebral palsy.

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[PMID: 25051968](#) [PubMed - as supplied by publisher]

26. Acta Paediatr. 2014 Jul 15. doi: 10.1111/apa.12748. [Epub ahead of print]

A comparison of three scales for measuring pain in children with cognitive impairment.

Massaro M, Ronfani L, Ferrara G, Badina L, Giorgi R, D'Ossualdo F, Taddio A, Barbi E.

AIM: Pain is a neglected problem in children with cognitive impairments and few studies compare the clinical use of specific pain scales. We compared the Non-Communicating Children's Pain Checklist Postoperative Version (NCCPC-PV), the Echelle Douleur Enfant San Salvador (DESS) and the Children's Hospital of Eastern

Ontario Pain Scale (CHEOPS). The first two were developed for children with cognitive impairment and the third is a more general pain scale. **METHODS:** Two external observers and the child's caregiver assessed 40 children with cognitive impairment for pain levels. We assessed inter-rater agreement, correlation, dependence on knowledge of the child's behaviour, simplicity and adequacy in pain rating according to the caregiver for all three scales. **RESULTS:** The correlation between the NCCPC-PV and the DESS was strong (Spearman correlation coefficient = 0.76) and better than between each scale and the CHEOPS. Although the DESS showed better inter-rater agreement, it was more dependent on familiarity with the child and was judged more difficult to use by all observers. The NCCPC-PV was the easiest use and the most appropriate for rating the child's pain. **CONCLUSION:** The NCCPC-PV was the easiest to use for pain assessment in cognitively impaired children and should be adopted in clinical settings.

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[PMID: 25040148](#) [PubMed - as supplied by publisher]

27. BMC Pediatr. 2014 Jul 14;14(1):182. doi: 10.1186/1471-2431-14-182.

Parent and family impact of raising a child with perinatal stroke.

Bemister TB, Brooks BL, Dyck RH, Kirton A.

BACKGROUND: Perinatal stroke is a leading cause of early brain injury, cerebral palsy, and lifelong neurological morbidity. No study to date has examined the impact of raising a child with perinatal stroke on parents and families. However, a large breadth of research suggests that parents, especially mothers, may be at increased risk for psychological concerns. The primary aim of this study was to examine the impact of raising a child with perinatal stroke on mothers' wellbeing. A secondary aim was to examine how caring for a child with perinatal stroke differentially affects mothers and fathers. **METHODS:** In Study I, a matched case-control design was used to compare the wellbeing of mothers of children with perinatal stroke and mothers of children with typical development. In Study II, a matched case-control design was used to compare mother-father dyads. Participants completed validated measures of anxiety and depression, stress, quality of life and family functioning, marital satisfaction, and marital distress. Parents of children with perinatal stroke also completed a recently validated measure of the psychosocial impact of perinatal stroke including guilt and blame outcomes. Disease severity was categorized by parents, validated by the Pediatric Stroke Outcome Measure (PSOM), and compared across the above outcomes in Study I. **RESULTS:** A total of 112 mothers participated in Study I (n=56 per group; mean child age=7.42 years), and 56 parents participated in Study II (n=28 per group; mean child age=8.25 years). In Study I, parent assessment of disease severity was correlated with PSOM scores (=0.75, p<.001) and associated with parent outcomes. Mothers of children with mild conditions were indistinguishable from controls on the outcome measures. However, mothers of children with moderate/severe conditions had poorer outcomes on measures of depression, marital satisfaction, quality of life, and family functioning. In Study II, mothers and fathers had similar outcomes except mothers demonstrated a greater burden of guilt and higher levels of anxiety. **CONCLUSIONS:** Although most mothers of children with perinatal stroke adapt well, mothers of children with moderate/severe conditions appear to be at higher risk for psychological concerns.

[PMID: 25018138](#) [PubMed - in process]

28. J Child Health Care. 2014 Jul 15. pii: 1367493514540816. [Epub ahead of print]

Quality of life in mothers of children with cerebral palsy: The role of children's gross motor function.

Dehghan L, Dalvand H, Feizi A, Samadi SA, Hosseini SA(5).

Four hundred and twenty-four Iranian mothers of children with cerebral palsy (CP) were recruited using the convenience sampling approach in a cross-sectional study. The researchers assessed the quality of life (QOL) in mothers according to the gross motor function levels and types of CP. The evaluation was done using a well-validated Persian version of the 36-item Short Form Health Survey (SF-36) questionnaire. In 2012, demographic data and clinical relevant information were also collected in rehabilitation clinics affiliated to Tehran University of Medical Sciences. The results indicated that the mean score for the study sample on physical component summary (PCS) and mental component summary (MCS) was 39.21 and 41.23, respectively. This suggests that participants

considered themselves to have a low QOL ($p < .05$). The mean PCS scores for SF-36 were significantly different between mothers having CP children of different age, levels of motor function, and CP types ($p < .05$ and $p < .01$, respectively). The results indicate that mothers of children with CP suffer from poor physical and mental health. Therefore, particular attention should be paid to the QOL in mothers of children with CP, and rehabilitation professionals should offer supportive strategies to promote aspects of their QOL.

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[PMID: 25027158](#) [PubMed - as supplied by publisher]

29. Rev Lat Am Enfermagem. 2014 Jun;22(3):440-7.

Parental stress in mothers of children and adolescents with cerebral palsy [Article in English, Portuguese, Spanish]

Ribeiro MF, Sousa AL, Vandenberghe L, Porto CC.

OBJECTIVES: to evaluate parental stress of mothers of children and adolescents with cerebral palsy; to verify whether parental stress undergoes variations according to the level of motor compromise, the child's phase of life, and sociodemographic variables. **METHOD:** a cross-sectional, descriptive study, with 223 mothers of children and adolescents with cerebral palsy. **RESULTS:** 45.3% of the mothers presented high levels of stress; there were differences in stress between mothers of children with mild and severe motor impairment; mothers of older children were more stressed than mothers of younger children and of adolescents; paid work and leisure activities reduced the stress. **CONCLUSION:** mothers of children and adolescents with cerebral palsy, whose children present mild to severe motor impairment are vulnerable to parental stress. Paid work and leisure activities were the factors that contributed most to reducing the stress.

[PMID: 25029055](#) [PubMed - in process]

30. J Pediatr. 2014 Aug;165(2):273. doi: 10.1016/j.jpeds.2014.02.059.

50 years ago in the journal of pediatrics: an etiologic and diagnostic study of cerebral palsy.

Fisher PG.

[PMID: 25060875](#) [PubMed - in process]

31. Nat Rev Neurol. 2014 Jul 22. doi: 10.1038/nrneuro.2014.130. [Epub ahead of print]

Neural repair and rehabilitation: Robot-assisted physiotherapy in cerebral palsy.

[No authors listed]

[PMID: 25048662](#) [PubMed - as supplied by publisher]

32. Arch Dis Child Fetal Neonatal Ed. 2014 Jun;99 Suppl 1:A147. doi:10.1136/archdischild-2014-306576.431.

PMM.77 Care of pregnant women with physical disabilities.

Gajjar Dave F, Ansar H, Singhal T.

AIMS AND OBJECTIVES: Due to the scarcity of the evidence based literature for women with physical disabilities, we did case reviews of this group of women in our unit during the last ten years to provide preliminary basis for highlighting the challenges involved in their management. **METHODOLOGY/DISCUSSION:** We have had total 46 pregnancies in women with physical disabilities. Total 9 women were wheelchair bound. Eleven were delivered by caesarean section and seven of these women had caesarean section due to their disability. Twenty six had normal

vaginal deliveries, two had forceps delivery and seven had miscarriages. Apart from the miscarriages, all the deliveries had reassuringly normal outcome. Apart from the Obstetric consultant, the multidisciplinary team caring for these women included anaesthetist, haematologist, manual handling team, support workers, ward managers, theatre team and general practitioners. Their carers were also actively involved in their care. The challenges we encountered were difficulty in scanning due to posture, anaesthetic challenges for both airways/spines, positioning at delivery, bladder care, difficulty in looking after baby and also psychological adaptation for some women but due to the care plans from the multidisciplinary team, we could manage these women well. **CONCLUSION:** As a result of recent advances in improved quality of life and life expectancy in patients with physical disabilities, we often see these women attending pre pregnancy and antenatal clinics. A multidisciplinary care plan, as well as clear and effective communication among different health care providers, will help ensure safe and optimal outcome of these women.

[PMID: 25021076](#) [PubMed - in process]

Prevention and Cure

33. Arch Dis Child Fetal Neonatal Ed. 2014 Jun;99 Suppl 1:A72-3. doi:10.1136/archdischild-2014-306576.207.

PC.106 Cerebral Injury and Early Childhood Neurodevelopmental Outcome following Neonatal Encephalopathy in a Middle-income Country.

Pauliah S, Lally P, Price D, Bainbridge A, Kurien J, Sivaswami N, Cowan F, Balraj G, Swamy R, Madhavan V, Nair M, Krishnakumar P, Cady E, Shankaran S, Thayyil S.

BACKGROUND: Although neonatal encephalopathy (NE), accounts for 1 million neonatal deaths annually in low- and middle-income countries (LMIC), underlying brain injury and long term outcomes are not well characterised in LMIC. **OBJECTIVE:** To examine cerebral injury (using magnetic resonance (MR) biomarkers), and early childhood outcomes after NE in a government hospital in India. **DESIGN/METHODS:** We recruited 54 newborns (>36 wk and >1.8 kg) with NE (Thompson score=6) at age <6h, admitted to the neonatal unit at Calicut Medical College, India over 6 months. Conventional MRI (1.5T, Siemens Avanto), diffusion tensor MR imaging and thalamic proton MR spectroscopy (MRS) were performed aged <3 wk. Cerebral injury was graded and group-wise differences in white matter (WM) fractional anisotropy (FA) were examined using tract-based spatial statistics (TBSS). In survivors, adverse neurodevelopmental outcome at mean (SD) 3.4(0.2) years was defined as Bayley-III composite cognitive/motor score =85, slow head growth or cerebral palsy. **RESULTS:** MR data available from 44 cases showed evidence of acute perinatal injury. WM changes were seen in 40(91%), basal ganglia/thalamic (BGT) injury in 12 (27%). Six infants died neonatally, 16(42%) and had adverse neurodevelopmental outcome. TBSS showed a reduction in FA with adverse neurological outcomes, and in those who had moderate/severe BGT or cortical injury. **CONCLUSIONS:** Cerebral injury in this cohort appears to be of perinatal origin and may be amenable to treatment. Although NE stage and injury pattern was mild in the majority of infants, adverse outcomes were seen in 42% at 3½ years. Reduced WM FA was associated with adverse neurodevelopmental outcomes.

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[PMID: 25021338](#) [PubMed - in process]

34. Arch Dis Child Fetal Neonatal Ed. 2014 Jun;99 Suppl 1:A121. doi:10.1136/archdischild-2014-306576.348.

PLD.49 Correlation between umbilical arterial pH = 7.1 and early neonatal outcomes.

Rogers K, Ramalingam K.

BACKGROUND: Intrapartum monitoring aims to identify fetal acidaemia. The fetal acidaemia threshold, reliably accountable for neonatal morbidity, or mortality, is less clear. The International Cerebral Palsy and American Congress of Obstetrics and Gynaecology task force, suggests: "pH <7 ... provides sufficient evidence to blame acute intrapartum events for the neonatal condition". **OBJECTIVE:** We analysed early neonatal outcomes in babies born with an arterial pH =7.1, from paired umbilical cord gases. **METHOD:** Retrospective case notes audit at

Kingston hospital maternity unit, involving 30 singleton live neonates, between 01/01/2012-31/12/2012. Neonatal outcomes were assessed using: 5 min APGAR scores <7, need for resuscitation and neonatal unit (NNU) admissions. RESULTS: Median arterial pH was 7.07, interquartile range 7.00-7.09. Neonates with an arterial pH 6.80-7.02 demonstrated; 100% resuscitation requirements and NNU admission; with 25% APGARs at 5 min <7. Above an arterial pH 7.02; absolute risk for resuscitation was 50%; 36.36% required NNU admission and 9.09% had APGARs at 5 min <7. No ideal arterial pH was identified for good neonatal outcomes. We compared our results against a large cohort study;¹ their threshold pH for adverse neurological outcomes was 7.10 and the 'ideal' cord pH 7.26-7.30. CONCLUSION: Overall, our results suggest an unpredictable association between acidemia and adverse early neonatal outcomes, with a pH >7.02. Highlighting the multifactorial nature of predicting neonatal outcome; which if better understood, will improve interpretation of intrapartum monitoring.

[PMID: 25020989](#) [PubMed - in process]

35. Arch Dis Child Fetal Neonatal Ed. 2014 Jun;99 Suppl 1:A115. doi:10.1136/archdischild-2014-306576.332.

PLD.32 Audit of Unexpected Term Admissions to SCBU at Liverpool Women's Hospital.

Dickins D, Neville A, Clement-Jones M, Benjamin R, Whitham L.

OBJECTIVE: To review unexpected term admissions to SCBU, identify areas for improvement in care of women in labour and highlight specific cases for learning points. BACKGROUND: Birth asphyxia is a significant cause of neonatal morbidity and carries a significant risk to the trust for future litigation. The overall incidence of neonatal encephalopathy attributable to intra-partum hypoxia in the absence of any other abnormality is 1-2/1000 live births. (1) The international Cerebral Palsy Task Force(2) issued criteria to guide the attribution of birth asphyxia to intra-partum events. These include 'evidence of a metabolic acidosis in intra-partum foetal, umbilical arterial cord or very early neonatal blood sampling, a sentinel hypoxic event occurring immediately before or during labour, a sudden, rapid and sustained deterioration of the foetal heart rate pattern where this was previously normal, and APGAR score of six for longer than five minutes'.(2) METHOD: Prospective review of casenotes. All births after 34 weeks' gestation admitted to SCBU were identified. Exclusions included congenital anomalies and post-natal transfers. RESULTS: Over the two year period there were 106 unexpected admissions to SCBU with 23 cases of hypoxic ischaemic encephalopathy. 67% of unexpected admissions were to primiparous mothers and 60% were over 40 weeks' gestation. Onset of labour was equally split between spontaneous and induction or augmentation. The small numbers make interpretation of the data and extrapolation of trends difficult however, trends from the current data suggest those mothers who are primiparous, post-date, induction of labour may be at increased risk of worse neonatal outcomes.

[PMID: 25020970](#) [PubMed - in process]

36. BMJ. 2014 Jul 15;349:g4294. doi: 10.1136/bmj.g4294.

Familial risk of cerebral palsy: population based cohort study.

Tollånes MC, Wilcox AJ, Lie RT, Moster D.

OBJECTIVE: To investigate risks of recurrence of cerebral palsy in family members with various degrees of relatedness to elucidate patterns of heritability. DESIGN: Population based cohort study. SETTING: Data from the Medical Birth Registry of Norway, linked to the Norwegian social insurance scheme to identify cases of cerebral palsy and to databases of Statistics Norway to identify relatives. PARTICIPANTS: 2036741 Norwegians born during 1967-2002, 3649 of whom had a diagnosis of cerebral palsy; 22,558 pairs of twins, 1,851,144 pairs of first degree relatives, 1,699,856 pairs of second degree relatives, and 516,968 pairs of third degree relatives were identified. MAIN OUTCOME MEASURE: Cerebral palsy. RESULTS: If one twin had cerebral palsy, the relative risk of recurrence of cerebral palsy was 15.6 (95% confidence interval 9.8 to 25) in the other twin. In families with an affected singleton child, risk was increased 9.2 (6.4 to 13)-fold in a subsequent full sibling and 3.0 (1.1 to 8.6)-fold in a half sibling. Affected parents were also at increased risk of having an affected child (6.5 (1.6 to 26)-fold). No evidence was found of differential transmission through mothers or fathers, although the study had limited power to detect such differences. For people with an affected first cousin, only weak evidence existed for an increased risk (1.5 (0.9 to 2.7)-fold). Risks in siblings or cousins were independent of sex of the index case. After exclusion of preterm births (an important risk factor for cerebral palsy), familial risks remained and were often stronger.

CONCLUSIONS: People born into families in which someone already has cerebral palsy are themselves at elevated risk, depending on their degree of relatedness. Elevated risk may extend even to third degree relatives (first cousins). The patterns of risk suggest multifactorial inheritance, in which multiple genes interact with each other and with environmental factors. These data offer additional evidence that the underlying causes of cerebral palsy extend beyond the clinical management of delivery.

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[PMID: 25028249](#) [PubMed - in process]

37. BMJ. 2014 Jul 15;349:g4514. doi: 10.1136/bmj.g4514.

What causes cerebral palsy?

Rosenbaum P.

[PMID: 25026893](#) [PubMed - in process]

38. East Mediterr Health J. 2014 Jul 8;20(7):459-68.

Association of cerebral palsy with consanguineous parents and other risk factors in a Palestinian population.

Daher S, El-Khairy L.

This case-control study investigated risk factors for cerebral palsy in a Palestinian population. Cases were 107 children aged 1-15 years at a cerebral palsy referral centre in Jerusalem; controls were 233 children without cerebral palsy from West Bank outpatient clinics. Data were collected from medical records and a structured questionnaire to parents. In stepwise logistical regression, consanguinity and birth deficits in other family members were positively associated with cerebral palsy (OR = 4.62; 95% CI: 2.07-10.3 and OR = 12.7; 95% CI: 3.13-51.7 respectively), suggesting a possible genetic link. Other risk factors were: perinatal hypoxia (OR = 92.5; 95% CI: 24.5-350), low birth weight (OR = 4.98; 95% CI: 2.01-12.3), twin births (OR = 9.25; 95% CI: 1.29-66.8) and no prenatal medical care (OR = 5.22; 95% CI: 1.18-23.1). This first stepwise model of significant and modifiable risk factors in our population provides useful evidence for policy-makers.

[PMID: 25023773](#) [PubMed - in process]

39. Exp Neurol. 2014 Aug;258C:5-16. doi: 10.1016/j.expneurol.2014.01.001.

Pattern recognition receptors and central nervous system repair.

Kigerl KA, de Rivero Vaccari JP, Dietrich WD, Popovich PG, Keane RW.

Pattern recognition receptors (PRRs) are part of the innate immune response and were originally discovered for their role in recognizing pathogens by ligating specific pathogen associated molecular patterns (PAMPs) expressed by microbes. Now the role of PRRs in sterile inflammation is also appreciated, responding to endogenous stimuli referred to as "damage associated molecular patterns" (DAMPs) instead of PAMPs. The main families of PRRs include Toll-like receptors (TLRs), Nod-like receptors (NLRs), RIG-like receptors (RLRs), AIM2-like receptors (ALRs), and C-type lectin receptors. Broad expression of these PRRs in the CNS and the release of DAMPs in and around sites of injury suggest an important role for these receptor families in mediating post-injury inflammation. Considerable data now show that PRRs are among the first responders to CNS injury and activation of these receptors on microglia, neurons, and astrocytes triggers an innate immune response in the brain and spinal cord. Here we discuss how the various PRR families are activated and can influence injury and repair processes following CNS injury.

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40. Handb Clin Neurol. 2014;123:319-26. doi: 10.1016/B978-0-444-53488-0.00015-8.

Congenital cytomegalovirus infection.

Bale JF Jr.

Congenital cytomegalovirus (CMV) infection, the most common congenital viral infection worldwide, occurs in approximately 1% of infants. Most congenitally infected infants have no long-term sequelae related to CMV infection. Approximately 10% have sensorineural hearing loss or neurologic deficits, including cerebral palsy, epilepsy, and cognitive impairment. Because of the high prevalence of congenital CMV infection, CMV is the most common non-genetic cause of deafness in children and an important cause of permanent neurodevelopmental disabilities. Treatment with ganciclovir has modest beneficial effects on outcome; no vaccine is currently available to prevent congenital CMV infection.

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[PMID: 25015493](#) [PubMed - in process]

41. Minerva Pediatr. 2014 Jul 18. [Epub ahead of print]

The role of prothrombotic factors in children with Hemiplegic Cerebral Palsy.

Türedi Yildirim A, Sütçü R, Köroglu M, Delibas N, Kisioglu N, Akar N, Ilhan IE.

Hemiplegic cerebral palsy (HCP) is a condition occurring as a consequence of a non--progressive damage of the brain with incomplete anatomical and physical development during the early period of life. Its etiology is multifactorial, with the cause remaining unexplained in the majority of cases. This study aims to investigate whether thrombophilic factors correlates with the etiology in children with HCP. We included 36 children with HCP in the patient group, and 41 healthy children with no neurologic disorders in the control group. No significant difference was found between the two groups in terms of factor V leiden, methylenetetrahydrofolate reductase and prothrombin 20210A mutation frequency and protein C, protein S and antithrombin III levels. Homocysteine levels were found significantly higher in the group of patients with HCP as compared to the control group (p: 0.012). Because we could not identify the origin of hyperhomocysteinemia as congenital or acquired, the impact of hyperhomocysteinemia on HCP was considered insignificant. Each thrombophilic disorder was assessed in terms of relatedness to atrophy, periventricular leukomalacia, infarct, congenital anomaly and porencephalic cyst, respectively. No significant correlation was detected between thrombophilic disorders and cranial imaging findings. In conclusion, our study has shown that thrombophilic factors are not involved in the etiology of HCP.

[PMID: 25034217](#) [PubMed - as supplied by publisher]

42. PLoS Negl Trop Dis. 2014 Jul 17;8(7):e2996. doi: 10.1371/journal.pntd.0002996. eCollection 2014.

Neurocognitive Outcome of Children Exposed to Perinatal Mother-to-Child Chikungunya Virus Infection: The CHIMERE Cohort Study on Reunion Island.

Gérardin P, Sampéris S, Ramful D, Boumahni B, Bintner M, Alessandri JL, Carbonnier M, Tiran-Rajaoefera I, Beullier G, Boya I, Noormahomed T, Okoï J, Rollot O, Cotte L, Jaffar-Bandjee MC, Michault A, Favier F, Kaminski M, Fourmaintraux A, Fritel X.

BACKGROUND: Little is known about the neurocognitive outcome in children exposed to perinatal mother-to-child Chikungunya virus (p-CHIKV) infection. **METHODS:** The CHIMERE ambispective cohort study compared the neurocognitive function of 33 p-CHIKV-infected children (all but one enrolled retrospectively) at around two years of age with 135 uninfected peers (all enrolled prospectively). Psychomotor development was assessed using the revised Brunet-Lezine scale, examiners blinded to infectious status. Development quotients (DQ) with subscores covering movement/posture, coordination, language, sociability skills were calculated. Predictors of global

neurodevelopmental delay (GND, DQ=85), were investigated using multivariate Poisson regression modeling. Neuroradiologic follow-up using magnetic resonance imaging (MRI) scans was proposed for most of the children with severe forms. RESULTS: The mean DQ score was 86.3 (95%CI: 81.0-91.5) in infected children compared to 100.2 (95%CI: 98.0-102.5) in uninfected peers ($P<0.001$). Fifty-one percent ($n=217$) of infected children had a GND compared to 15% ($n=21$) of uninfected children ($P<0.001$). Specific neurocognitive delays in p-CHIKV-infected children were as follows: coordination and language (57%), sociability (36%), movement/posture (27%). After adjustment for maternal social situation, small for gestational age, and head circumference, p-CHIKV infection was found associated with GND (incidence rate ratio: 2.79, 95%CI: 1.45-5.34). Further adjustments on gestational age or breastfeeding did not change the independent effect of CHIKV infection on neurocognitive outcome. The mean DQ of p-CHIKV-infected children was lower in severe encephalopathic children than in non-severe children (77.6 versus 91.2, $P<0.001$). Of the 12 cases of CHIKV neonatal encephalopathy, five developed a microcephaly (head circumference <-2 standard deviations) and four matched the definition of cerebral palsy. MRI scans showed severe restrictions of white matter areas, predominant in the frontal lobes in these children. CONCLUSIONS: The neurocognitive outcome of children exposed to perinatal mother-to-child CHIKV infection is poor. Severe CHIKV neonatal encephalopathy is associated with an even poorer outcome.

[PMID: 25033077](#) [PubMed - in process]

43. PLoS One. 2014 Jul 14;9(7):e102275. doi: 10.1371/journal.pone.0102275. eCollection 2014.

Risk of Cerebral Palsy among the Offspring of Immigrants.

Ray JG, Redelmeier DA, Urquia ML, Guttmann A, McDonald SD, Vermeulen MJ.

BACKGROUND: Cerebral palsy (CP) has a multifactorial etiology, and placental vascular disease may be one major risk factor. The risk of placental vascular disease may be lower among some immigrant groups. We studied the association between immigrant status and the risk of CP. METHODS: We conducted a population-based retrospective cohort study of all singleton and twin livebirths in Ontario between 2002-2008, and who survived ≥ 28 days after birth. Each child was assessed for CP up to age 4 years, based on either a single inpatient or ≥ 2 outpatient pediatric diagnoses of CP. Relative to non-immigrants ($n=566,668$), the risk of CP was assessed for all immigrants ($n=177,390$), and further evaluated by World region of origin. Cox proportional hazard ratios (aHR) were adjusted for maternal age, income, diabetes mellitus, obesity, tobacco use, Caesarean delivery, year of delivery, physician visits, twin pregnancy, preterm delivery, as well as small- and large-for-gestational age birthweight. RESULTS: There were 1346 cases of CP, with a lower rate among immigrants (1.45 per 1000) than non-immigrants (1.92 per 1000) (aHR 0.77, 95% confidence interval [CI] 0.67 to 0.88). Mothers from East Asia and the Pacific (aHR 0.54, 95% CI 0.39 to 0.77) and the Caribbean (aHR 0.58, 95% CI 0.37 to 0.93) were at a significantly lower risk of having a child with CP. Whether further adjusting for preeclampsia, gestational hypertension, placental abruption or placental infarction, or upon using a competing risk analysis that further accounted for stillbirth and neonatal death, these results did not change. CONCLUSIONS: Immigration and ethnicity appear to attenuate the risk of CP, and this effect is not fully explained by known risk factors.

[PMID: 25019202](#) [PubMed - in process]

44. Early Hum Dev. 2014 Jul 22. pii: S0378-3782(14)00158-3. doi: 10.1016/j.earlhumdev.2014.06.013. [Epub ahead of print]

The "neurovascular unit approach" to evaluate mechanisms of dysfunctional autoregulation in asphyxiated newborns in the era of hypothermia therapy.

Chalak LF, Tarumi T, Zhang R.

Despite improvements in obstetrical and neonatal care, and introduction of hypothermia as a neuroprotective therapy, perinatal brain injury remains a frequent cause of cerebral palsy, mental retardation and epilepsy. The recognition of dysfunction of cerebral autoregulation is essential for a real time measure of efficacy to identify those who are at highest risk for brain injury. This article will focus on the "neurovascular unit" approach to the care of asphyxiated neonates and will address 1) potential mechanisms of dysfunctional cerebral blood flow (CBF) regulation, 2) optimal monitoring methodology such as NIRS (near infrared spectroscopy), and TCD (transcutaneous Doppler), and 3) clinical implications of monitoring in the neonatal intensive care setting in

asphyxiated newborns undergoing hypothermia and rewarming. Critical knowledge of the functional regulation of the neurovascular unit may lead to improved ability to predict outcomes in real time during hypothermia, as well as differentiate non-responders who might benefit from additional therapies.

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45. Curr Pediatr Rev. 2014;10(1):48-55.

Magnetic resonance imaging of the preterm infant brain.

Doria V, Arichi T, Edwards DA.

Despite improvements in neonatal care, survivors of preterm birth are still at a significantly increased risk of developing life-long neurological difficulties including cerebral palsy and cognitive difficulties. Cranial ultrasound is routinely used in neonatal practice, but has a low sensitivity for identifying later neurodevelopmental difficulties. Magnetic Resonance Imaging (MRI) can be used to identify intracranial abnormalities with greater diagnostic accuracy in preterm infants, and theoretically might improve the planning and targeting of long-term neurodevelopmental care; reducing parental stress and unplanned healthcare utilisation; and ultimately may improve healthcare cost effectiveness. Furthermore, MR imaging offers the advantage of allowing the quantitative assessment of the integrity, growth and function of intracranial structures, thereby providing the means to develop sensitive biomarkers which may be predictive of later neurological impairment. However further work is needed to define the accuracy and value of diagnosis by MR and the techniques's precise role in care pathways for preterm infants.

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46. Praxis (Bern 1994). 2014 Jul 1;103(15):883-92. doi: 10.1024/1661-8157/a001725.

[In Process Citation]. [Article in German; Abstract available in German from the publisher]

Meyer-Heim A, van Hedel HJ.

Impairments of the central motor system can either be congenital (e.g. cerebral palsy) or acquired (e. g. traumatic brain injury, stroke). These lesions are the most frequent morbidities necessitating neuro-rehabilitative measures in childhood. Robot-assisted rehabilitation in combination with virtual reality can complement conventional therapies and provide a task-specific training, with a high number of repetitions over a prolonged time period. The advantage of virtual reality is that it can provide a real time feedback about the patient's performance. Furthermore, challenging virtual scenarios especially motivate young patients to continue with otherwise monotonous exercises. Preliminary findings indicate that robot-assisted training in children with central motor impairment could be beneficial, but conclusive evidence about its efficacy is still missing.

[PMID: 25051931](#) [PubMed - in process]

47. Neuropsychiatr Dis Treat. 2014 Jul 8;10:1267-72. doi: 10.2147/NDT.S59599. eCollection 2014.

Cerebral palsy in Al-Quseir City, Egypt: prevalence, subtypes, and risk factors.

El-Tallawy HN, Farghaly WM, Shehata GA, Rageh TA, Metwally NA, Badry R, Sayed MA, Abd El Hamed M, Abd-Elwarth A, Kandil MR.

Cerebral palsy (CP) is the most frequent cause of motor handicap. The present door-to-door survey was conducted in Al-Quseir City, Egypt, to investigate the epidemiology of CP. All inhabitants were screened by three neurologists. Medical and neurological examinations were performed for all residents and suspected cases of CP were confirmed by meticulous neurological assessment, brain magnetic resonance imaging, electroencephalography, and testing with the Stanford-Binet Intelligence Scale. Forty-six of 12,788 children aged =18 years were found to

have CP, yielding a childhood prevalence of 3.6 (95% confidence interval 1.48-2.59) per 1,000 live births. Five adults (aged 19-40 years) among 13,056 inhabitants had CP, giving an adult prevalence of 0.4 (95% confidence interval 0.04-0.72) per 1,000. The risk factors for CP identified in this study were premature birth, low birth weight, neonatal jaundice, neonatal seizures, and recurrent abortion in mothers of children with CP.

[PMID: 25045270](#) [PubMed]

48. Dev Med Child Neurol. 2014 Jul 9. doi: 10.1111/dmcn.12531. [Epub ahead of print]

Early identification and intervention in cerebral palsy.

Herskind A, Greisen G, Nielsen JB.

Infants with possible cerebral palsy (CP) are commonly assumed to benefit from early diagnosis and early intervention, but substantial evidence for this is lacking. There is no consensus in the literature on a definition of 'early', but this review focuses on interventions initiated within the first 6 months after term age. We cover basic neuroscience, arguing for a beneficial effect of early intervention, and discuss why clinical research to support this convincingly is lacking. We argue that infants offered early intervention in future clinical studies must be identified carefully, and that the intervention should be focused on infants showing early signs of CP to determine an effect of treatment. Such signs may be efficiently detected by a combination of neuroimaging and the General Movements Assessment. We propose a research agenda directed at large-scale identification of infants showing early signs of CP and testing of high-intensity, early interventions.

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49. Dev Med Child Neurol. 2014 Jul 12. doi: 10.1111/dmcn.12519. [Epub ahead of print]

Recent trends in cerebral palsy survival. Part II: individual survival prognosis.

Brooks JC, Strauss DJ, Shavelle RM, Tran LM, Rosenbloom L, Wu YW.

AIM: The aim of the study was to determine survival probabilities and life expectancies for individuals with cerebral palsy based on data collected over a 28-year period in California. **METHOD:** We identified all individuals with cerebral palsy, aged 4 years or older, who were clients of the California Department of Developmental Services between 1983 and 2010. Kaplan-Meier survival curves were constructed for 4-year-old children, and the estimated survival probabilities were adjusted to reflect trends in mortality by calendar year. For persons aged 15, 30, 45, and 60 years, separate Poisson regression models were used to estimate age-, sex-, and disability-specific mortality rates. These mortality rates were adjusted to reflect trends of improved survival, and life expectancies were obtained using life table methods. **RESULTS:** The sample comprised 16 440, 14 609, 11 735, 7023, and 2375 persons at ages 4, 15, 30, 45, and 60 years, respectively. In 1983, 50% of 4-year-old children who did not lift their heads in the prone position and were tube fed lived to age 10.9 years. By 2010, the median age at death had increased to 17.1 years. In ambulatory children the probability of survival to adulthood did not change by more than 1%. Life expectancies for adolescents and adults were lower for those with more severe limitations in motor function and feeding skills, and decreased with advancing age. Life expectancies for tube-fed adolescents and adults increased by 1 to 3 years, depending on age and pattern of disability, over the course of the study period. **INTERPRETATION:** Over the past three decades in California there have been significant improvements in the survival of children with very severe disabilities. There have also been improvements to the life expectancy of tube-fed adults, though to a lesser extent than in children.

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50. Dev Med Child Neurol. 2014 Jul 12. doi: 10.1111/dmcn.12514. [Epub ahead of print]

Single-cause attribution in a multifactorial world: cerebral palsy attributed to or associated with congenital cytomegalovirus?

Korzeniewski SJ.

[PMID: 25040907](#) [PubMed - as supplied by publisher]

51. Dev Med Child Neurol. 2014 Jul 10. doi: 10.1111/dmcn.12544. [Epub ahead of print]

Trends in cerebral palsy survival: are health measures really making a difference?

Reid SM.

[PMID: 25040170](#) [PubMed - as supplied by publisher]