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## Interventions and Management

### 1. Early, Accurate Diagnosis and Early Intervention in Cerebral Palsy: Advances in Diagnosis and Treatment.

Novak I, Morgan C, Adde L, Blackman J, Boyd RN, Brunstrom-Hernandez J, Cioni G, Damiano D, Darrah J, Eliasson AC, de Vries LS, Einspieler C, Fahey M, Fehlings D, Ferriero DM, Fetters L, Fiori S, Forssberg H, Gordon AM, Greaves S, Guzzetta A, Hadders-Algra M, Harbourne R, Kakooza-Mwesige A, Karlsson P, Krumlinde-Sundholm L, Latal B, Loughran-Fowlds A, Maitre N, McIntyre S, Noritz G, Pennington L, Romeo DM, Shepherd R, Spittle AJ, Thornton M, Valentine J, Walker K, White R, Badawi N.

JAMA Pediatr. 2017 Jul 17. doi: 10.1001/jamapediatrics.2017.1689. [Epub ahead of print]

**IMPORTANCE:** Cerebral palsy describes the most common physical disability in childhood and occurs in 1 in 500 live births. Historically, the diagnosis has been made between age 12 and 24 months but now can be made before 6 months' corrected age. **OBJECTIVES:** To systematically review best available evidence for early, accurate diagnosis of cerebral palsy and to summarize best available evidence about cerebral palsy-specific early intervention that should follow early diagnosis to optimize neuroplasticity and function. **EVIDENCE REVIEW:** This study systematically searched the literature about early diagnosis of cerebral palsy in MEDLINE (1956-2016), EMBASE (1980-2016), CINAHL (1983-2016), and the Cochrane Library (1988-2016) and by hand searching. Search terms included cerebral palsy, diagnosis, detection, prediction, identification, predictive validity, accuracy, sensitivity, and specificity. The study included systematic reviews with or without meta-analyses, criteria of diagnostic accuracy, and evidence-based clinical guidelines. Findings are reported according to the PRISMA statement, and recommendations are reported according to the Appraisal of Guidelines, Research and Evaluation (AGREE) II instrument. **FINDINGS:** Six systematic reviews and 2 evidence-based clinical guidelines met inclusion criteria. All included articles had high methodological Quality Assessment of Diagnostic Accuracy Studies (QUADAS) ratings. In infants, clinical signs and symptoms of cerebral palsy emerge and evolve before age 2 years; therefore, a combination of standardized tools should be used to predict risk in conjunction with clinical history. Before 5 months' corrected age, the most predictive tools for detecting risk are term-age magnetic resonance imaging (86%-89% sensitivity), the Prechtl Qualitative Assessment of General Movements (98% sensitivity), and the Hammersmith Infant Neurological Examination (90% sensitivity). After 5 months' corrected age, the most predictive tools for detecting risk are magnetic resonance imaging (86%-89% sensitivity) (where safe and feasible), the Hammersmith Infant Neurological Examination (90% sensitivity), and the Developmental Assessment of Young Children (83% C index). Topography and severity of cerebral palsy are more difficult to ascertain in infancy, and magnetic resonance imaging and the Hammersmith Infant Neurological Examination may be helpful in assisting clinical decisions. In high-income countries, 2 in 3 individuals with cerebral palsy will walk, 3 in 4 will talk, and 1 in 2 will have normal intelligence. **CONCLUSIONS AND RELEVANCE:** Early diagnosis begins with a medical history and involves using neuroimaging, standardized neurological, and standardized motor assessments that indicate congruent abnormal findings indicative of cerebral palsy. Clinicians should understand the importance of prompt referral to diagnostic-specific early intervention to optimize infant motor and cognitive plasticity, prevent secondary complications, and enhance caregiver well-being.

[PMID: 28715518](#)

## 2. Mechanisms contributing to gait speed and metabolic cost in children with unilateral cerebral palsy.

Pinto TPS, Fonseca ST, Gonçalves RV, Souza TR, Vaz DV, Silva PLP, Mancini MC.

Braz J Phys Ther. 2017 Jul 5. pii: S1413-3555(17)30254-X. doi: 10.1016/j.bjpt.2017.06.015. [Epub ahead of print]

**BACKGROUND:** Gait speed and metabolic cost are indicators of functional capacity in children with cerebral palsy. Uncovering their mechanisms helps guide therapeutic actions. **OBJECTIVES:** To investigate the contributions of energy-generating and energy-conserving mechanisms to gait speed and metabolic cost of children with unilateral cerebral palsy. **METHODS:** Data on eccentric and concentric muscle work, co-contraction, elastic torque and vertical stiffness of the affected-limb, forcing torque of the non-affected limb, gait speed and metabolic cost were collected from 14 children with unilateral cerebral palsy, aged 6-12 years. Analyses included two groups of multiple regression models. The first group of models tested the association between each dependent variable (i.e., speed and metabolic cost) and the independent variables that met the input criteria. The second group verified the contribution of the non-selected biomechanical variables on the predictors of the first model. **RESULTS:** Gait speed ( $R^2=0.80$ ) was predicted by elastic torque ( $\beta=0.62$ ; 95%CI: 0.60, 0.63), vertical stiffness ( $\beta=-0.477$ ; 95%CI: -0.479, -0.474) and knee co-contraction ( $\beta=0.27$ ; 95%CI: -1.96, 2.49). The production of eccentric work by the affected limb proved relevant in adjusting the vertical stiffness ( $R^2=0.42$ ;  $\beta=-0.64$ ; 95%CI: 0.86, -0.42); elastic torque of the affected-leg was associated with impulsive torque of the non-affected leg ( $R^2=0.31$ ;  $\beta=0.55$ ; 95%CI: 0.46, 0.64). Metabolic cost of gait ( $R^2=0.48$ ) was partially predicted by knee co-contraction ( $\beta=0.69$ ; 95%CI: 0.685, 0.694). **CONCLUSIONS:** The chain of associations revealed by the two steps models helped uncover the mechanisms involved in the locomotion of children with unilateral cerebral palsy. Intervention that changes specific energy conserving and generating mechanisms may improve gait of these children.

[PMID: 28728959](#)

## 3. Psychometric properties of measures of gait quality and walking performance in young people with Cerebral Palsy: A systematic review.

Zanudin A, Mercer TH, Jagadamma KC, van der Linden ML.

Gait Posture. 2017 Jul 4;58:30-40. doi: 10.1016/j.gaitpost.2017.07.005. [Epub ahead of print]

Availability of outcome measures (OMs) with robust psychometric properties is an essential prerequisite for the evaluation of interventions designed to address gait deterioration in young people with Cerebral Palsy (CP). This review evaluates evidence for the reliability, validity and responsiveness of outcome measures of gait quality and walking performance in young people with CP. A systematic search was performed in MEDLINE, CINAHL, PubMed and Scopus. Articles that met the eligibility criteria were selected. Methodological quality of studies was independently rated by two raters using the modified Consensus-based Standard for the selection of health status Measurement INstruments checklist. Strength of evidence was rated using standardised guidelines. Best evidence synthesis was scored according to Cochrane criteria. Fifty-one articles reporting on 18 distinct OMs were included for review. Best evidence synthesis indicated a moderate to strong evidence for the reliability for OMs of walking performance but conflicting evidence for the reliability of OMs of gait quality. The evidence for responsiveness for all OMs included in this review was rated as 'unknown'. The limitations of using the modified COSMIN scoring for small sample sizes are acknowledged. Future studies of high methodological quality are needed to explore the responsiveness of OMs assessing gait quality and walking performance in young people with CP.

[PMID: 28711651](#)

## 4. Patients with non-ambulatory cerebral palsy have higher sclerostin levels and lower bone mineral density than patients with ambulatory cerebral palsy.

Shin YK, Yoon YK, Chung KB, Rhee Y, Cho SR.

Bone. 2017 Jul 15. pii: S8756-3282(17)30241-7. doi: 10.1016/j.bone.2017.07.015. [Epub ahead of print]

Bone loss is a serious clinical issue in patients with cerebral palsy (CP). Sclerostin has garnered interest as a key mechanosensor in osteocytes, leading to considerations of the therapeutic utilization of anti-sclerostin medications. This study was undertaken to determine associations among mechanical unloading, sclerostin levels, and bone imbalance in patients with CP. A total of 28 patients with CP participated in this cross-sectional study. The following measurements were taken:

anthropometrics, clinical diagnosis of CP subtype and ambulatory status, bone mineral density (BMD) z-scores at the lumbar spine and hip, and blood biochemical markers, including sclerostin, parathyroid hormone (PTH), osteocalcin, C-terminal telopeptide, 25-hydroxyvitamin D, 1,25-dihydroxyvitamin D, creatinine, calcium, and phosphorus. In analysis according to CP subtype, patients with spastic CP showed significantly lower BMD z-scores at the lumbar spine and femur neck regions than patients with dyskinetic CP. In analysis according to ambulatory status, patients with non-ambulatory CP showed significantly lower BMD z-scores at all lumbar spine and femoral sites, lower PTH and creatinine levels, and higher plasma sclerostin levels than patients with ambulatory CP. In regression analysis, ambulatory status was a significant determinant of plasma sclerostin levels. This study is the first to report on sclerostin levels and BMD in patients with CP, based on the hypothesis that patients who lack sufficient weight-bearing activities would show increased sclerostin levels and decreased BMD scores, compared with patients who sustain relatively sufficient physical activity. Therefore, this report may provide clinical insights for clinicians considering ambulatory status, sclerostin levels, and bone loss in patients with CP.

[PMID: 28720522](#)

### **5. Ultrasonographic Assessment of Femoral Cartilage Thickness in Patients with Cerebral Palsy.**

Adigüzel E, Tok F, Ata E, Yaşar E, Yılmaz B.

PM R. 2017 Jul 17. pii: S1934-1482(17)30699-8. doi: 10.1016/j.pmrj.2017.07.002. [Epub ahead of print]

**BACKGROUND:** Cerebral palsy (CP) is one of the most disabling syndromes of children. To our knowledge, there has not yet been any reported evaluation of the effect of CP on distal femoral cartilage by ultrasonography. The value of understanding this effect on cartilage is that sonographic evaluation of cartilage thickness may help physician to predict the joint health of these children. **OBJECTIVE:** To determine whether femoral cartilage thickness in patients with CP is different from that of healthy control subjects. **DESIGN:** Cross-sectional study. **SETTING:** National tertiary rehabilitation center **PATIENTS:** The study included 40 patients with diplegic CP (23 males, 17 females) and 51 healthy control subjects (29 males, 22 females). **METHODS:** Demographic and clinical characteristics were recorded. Cartilage thicknesses were measured. **MAIN OUTCOME MEASURE:** Cartilage thickness measurements were taken from the medial and lateral condyles, and intercondylar areas of both knees. **RESULTS:** Both groups were similar in terms of age, gender and weight ( $p > .05$ ). The mean cartilage thickness measurements of the medial condyle and intercondylar area of knees in the CP group were significantly less than those in the healthy control group (all  $p < .05$ ). There was moderate negative correlation between age and all femoral cartilage thickness measurements in the CP group. There was no correlation between age and femoral cartilage thickness measurements in the healthy group. There was a negative correlation between Gross Motor Functional Classification System levels and cartilage thickness in the CP group. While the highest cartilage thickness measurements were detected in level 1, the lowest measurements were detected in level 5 patients. **CONCLUSION:** This study showed that patients with CP have a thinner femoral cartilage than healthy control subjects. The management of patients with CP should include close surveillance.

[PMID: 28729059](#)

### **6. The effect of reflexology upon spasticity and function among children with cerebral palsy who received physiotherapy: Three group randomised trial.**

Özkan F, Zincir H.

Appl Nurs Res. 2017 Aug;36:128-134. doi: 10.1016/j.apnr.2017.05.011. Epub 2017 May 27.

**PURPOSE:** To assess the effectiveness of reflexology method upon spasticity and function among children with cerebral palsy who received physiotherapy. **METHODS:** A three group, randomised trial with blinded evaluator. Randomization was made sealed and opaque envelopes. 45 children with cerebral palsy who were trained at a Special Education and Rehabilitation Centre. In the reflexology and placebo group; a 20min reflexology was performed twice a week in a total 24 sessions. In the control group; no intervention was done. Before and after the implementation; measurements of the participants were obtained. The data were collected using Gross Motor Function Measure, Modified Ashworth Scale (MAS), Modified Tardieu Scale, Pediatric Functional Independence Scale, Pediatric Quality of Life Scale (PedsQL) and demographic data. **RESULTS:** A total of 45 children completed the study. The groups were homogeneous at baseline. Between right MAS Gastrocnemius muscle was a difference and right and left Soleus muscles was significant among the groups ( $p < 0.05$ ). Also; there was significant difference in between right and left Tardieu value in the legs; right M. Gastrocnemius V1, V3 and M. Soleus V1, V3 values;  $p < 0.001$  and left Gastrocnemius V1 and M. Soleus V1, V3 values;  $p < 0.001$ . In Gross Motor Function Measure total scores and sitting position; in Pediatric Functional Independence Scale total scores, self-care and communication subscales ( $p < 0.05$ ). But in terms

of PedsQL was no statistically significant difference among the groups ( $p > 0.05$ ). CONCLUSIONS: Reflexology with physiotherapy reduced spasticity in legs, improved gross motor functions, decreased dependency but led to no change in quality of life.

[PMID: 28720233](#)

### **7. Muscle disuse caused by botulinum toxin injection leads to increased central gain of the stretch reflex in the rat.**

Pingel J, Hultborn H, Naslund-Koch L, Jensen DB, Wienecke J, Nielsen JB.

J Neurophysiol. 2017 Jul 19;jn.00276.2017. doi: 10.1152/jn.00276.2017. [Epub ahead of print]

Botulinum toxin (Btx) is used in children with cerebral palsy and other neurological patients to diminish spasticity and reduce the risk of development of contractures. Here, we investigated changes in the central gain of the stretch reflex circuitry in response to botulinum toxin injection in the triceps surae muscle in rats. Experiments were performed in 21 rats. 8 rats were in a control group and 13 rats were injected with 6 IU of Btx in the left triceps surae muscle. Two weeks after Btx injection larger monosynaptic reflexes (MSR) were recorded from the left (injected) than the right (non-injected) L4 + L5 ventral roots following stimulation of the corresponding dorsal roots. A similar increase on the left side was observed in response to stimulation of descending motor tracts, suggesting that increased excitability of spinal motor neurones may at least partly explain the increased reflexes. However, significant changes were also observed in post-activation depression of the MSR suggesting that plastic changes in transmission from Ia afferent to the motor neurons may also be involved. The data demonstrate that muscle paralysis induced by Btx injection is accompanied by plastic adaptations in the central stretch reflex circuitry, which counteract the antispastic effect of Btx.

[PMID: 28724781](#)

### **8. The Structured Observation of Motor Performance in Infants can detect cerebral palsy early in neonatal intensive care recipients.**

Montgomery C, Johansen K, Lucas S, Strömberg B, Persson K.

Early Hum Dev. 2017 Jul 17;113:31-39. doi: 10.1016/j.earlhumdev.2017.07.009. [Epub ahead of print]

BACKGROUND: The detection of motor problems in infancy requires a detailed assessment method that measures both the infants' level of motor development and movement quality. AIMS: To evaluate the ability of the Structured Observation of Motor Performance in Infants (SOMP-I) to detect cerebral palsy (CP) in neonatal intensive care recipients. STUDY DESIGN: Prospective cohort study analyzed retrospectively. SUBJECTS: 212 (girls: 96) neonatal intensive care recipients (mean gestational age 34weeks, range: 23-43). Twenty infants were diagnosed with CP. OUTCOME MEASURES: The infants were assessed using SOMP-I at 2, 4, 6 and 10months' corrected age. Accuracy measures were calculated for level of motor development, quality of motor performance and a combination of the two to detect CP at single and repeated assessments. RESULTS: At 2months, 17 of 20 infants with CP were detected, giving a sensitivity of 85% (95% CI 62-97%) and a specificity of 48% (95% CI 40-55%), while the negative likelihood ratio was 0.3 (95% CI 0.1-0.9) and the positive likelihood ratio was 1.6 (95% CI 1.3-2.0). At 6months all infants with CP were detected using SOMP-I, and all infants had repeatedly been assessed outside the cut-offs. Specificity was generally lower for all assessment ages, however, for repeated assessments sensitivity reached 90% (95% CI 68-99%) and specificity 85% (95% CI 79-90%). CONCLUSIONS: SOMP-I is sensitive for detecting CP early, but using the chosen cut-off can lead to false positives for CP. Assessing level and quality in combination and at repeated assessments improved predictive ability.

[PMID: 28728014](#)

## 9. Efficacy of ankle foot orthoses types on walking in children with cerebral palsy: A systematic review.

Aboutorabi A, Arazpour M, Ahmadi Bani M, Saeedi H, Head JS.

Ann Phys Rehabil Med. 2017 Jul 13. pii: S1877-0657(17)30079-9. doi: 10.1016/j.rehab.2017.05.004. [Epub ahead of print]

**BACKGROUND:** Ankle foot orthoses (AFOs) are orthotic devices that can be used to normalize the walking pattern of children with cerebral palsy (CP). One of the aims of orthotic management is to produce a more normal gait pattern by positioning joints in the proper position to reduce pathological reflex or spasticity. **OBJECTIVE:** To conduct a systematic review of the literature and establish the effect of treatment with various types of AFOs on gait patterns of children with CP. **METHODS:** PubMed, Scopus, ISI Web of knowledge, Cochrane Library, EMBASE and Google Scholar were searched for articles published between 2007 and 2015 of studies of children with CP wearing the following AFOs: hinged (HAFO), solid (SAFO), floor reaction (FRO), posterior leaf spring (PLS) and dynamic (DAFO). Studies that combined treatment options were excluded. Outcomes investigated were a change in gait pattern and subsequent walking ability. The PEDro scale used to assess the methodological quality of relevant studies. **RESULTS:** We included 17 studies investigating a total of 1139 children with CP. The PEDro score was poor for most studies (3/10). Only 4 studies, of 209 children in total, were randomized controlled trials, for a good PEDro score (5, 7, 9/10) and an appropriate level of evidence. One study used a case-based series and the remainder a cross-sectional design. In general, the use of AFOs improved speed and stride length. The HAFO was effective for improving gait parameters and decreasing energy expenditure with hemiplegic CP as compared with the barefoot condition. It also improved stride length, speed of walking, single limb support and gait symmetry with hemiplegic CP. The plastic SAFO and FRO were effective in reducing energy expenditure with diplegic CP. With diplegic CP, the HAFO and SAFO improved gross motor function. **CONCLUSION:** For children with CP, use of specific types of AFOs improved gait parameters, including ankle and knee range of motion, walking speed and stride length. AFOs reduced energy expenditure in children with spastic CP. However, further studies with good PEDro scores are required for more conclusive evidence regarding the effectiveness of AFOs in children with CP.

[PMID: 28713039](#)

## 10. Toe Walking: When Do We Need to Worry?

Morozova OM, Chang TF, Brown ME.

Curr Probl Pediatr Adolesc Health Care. 2017 Jul 14. pii: S1538-5442(17)30120-7. doi: 10.1016/j.cppeds.2017.06.004. [Epub ahead of print]

Toe walking refers to the lack of heel strike during the stance phase of the gait cycle. It is a common variation of normal gait development in children. Persistent toe walking past 2-3 years of age warrants further evaluation as toe walking can be associated with cerebral palsy, muscular dystrophy, and autism spectrum disorders. The diagnosis of idiopathic toe walking is a diagnosis of exclusion used for children with persistent toe walking and no associated medical condition. Despite variable pathophysiology, the treatment of toe walking has similarities across diagnoses as it is focused on the maintenance of range of motion through the ankle.

[PMID: 28716514](#)

## 11. Effects of interventions with therapeutic suits (clothing) on impairments and functional limitations of children with cerebral palsy: a systematic review.

Almeida KM, Fonseca ST, Figueiredo PRP, Aquino AA, Mancini MC.

Braz J Phys Ther. 2017 Jul 5. pii: S1413-3555(17)30248-4. doi: 10.1016/j.bjpt.2017.06.009. [Epub ahead of print]

**BACKGROUND:** Therapeutic suits or clothing whether associated with intensive protocols or not, became popular in the rehabilitation of children with cerebral palsy. Studies have reported positive effects of these suits on children's posture, balance, motor function and gait. A summary of current literature may help guide therapeutic actions. **OBJECTIVE:** To evaluate the available evidence on the effects of interventions based on the use of therapeutic suits in the treatment of impairments and functional limitations of children with cerebral palsy. **METHOD:** Three independent reviewers searched for experimental studies on MEDLINE, SciELO, BIREME, LILACS, PEDro and CENTRAL databases, between October and December 2015 and updated in May 2016. The reviewers evaluated the methodological quality of selected studies using the Checklist for

Measuring Quality. The Grading of Recommendations Assessment, Development and Evaluation was used to synthesize the quality of evidence and strength of recommendation. RESULTS: From the 13 studies, two evaluated the Full Body Suit, two tested the Dynamic Elastomeric Fabric Orthose, three evaluated TheraTogs and six tested the TheraSuit/AdeliSuit protocols. The quality of evidence for the Full Body Suit, the Dynamic Elastomeric Fabric Orthose and the TheraSuit/AdeliSuit protocols was very low for body structure and function outcomes, while the evidence for TheraTogs was low quality. Regarding the activity outcomes, the Full Body Suit and TheraSuit showed very low quality evidence while the evidence for TheraSuit/AdeliSuit protocols were of low quality. CONCLUSION: Enthusiasm with new therapeutic approaches that argue modifications in the neuromusculoskeletal impairments and functional limitations of children with cerebral palsy need to be guided by scientific evaluation. The low quality of evidence suggests caution in recommending the use of these therapeutic suits. New studies could change the findings of this review.

[PMID: 28712784](#)

## **12. Equimolar mixture of nitrous oxide and oxygen during post-operative physiotherapy in patients with cerebral palsy: A randomized, double-blind, placebo-controlled study.**

Delafontaine A, Presedo A, Mohamed D, Lopes D, Wood C, Alberti C.

Eur J Pain. 2017 Jul 20. doi: 10.1002/ejp.1071. [Epub ahead of print]

BACKGROUND: The administration of an equimolar mixture of nitrous oxide and oxygen (N2O) is recommended during painful procedures. However, the evaluation of its use during physiotherapy after surgery has not been reported, although pain may hamper physiotherapy efficiency. This study investigated whether the use of N2O improves the efficacy of post-operative physiotherapy after multilevel surgery in patients with cerebral palsy. METHOD: It was a randomized 1:1, double-blind, placebo-controlled study. All patients had post-operative physiotherapy starting the day after surgery. Patients received either N2O or placebo gas during the rehabilitation sessions. All patients had post-operative pain management protocol, including pain medication as needed for acute pain. The primary objective was to reach angles of knee flexion of 110° combined with hip extension of 10°, with the patient lying prone, within six or less physiotherapy sessions. Secondary evaluation criteria were the number of sessions required to reach the targeted angles, the session-related pain intensity and the analgesics consumption for managing post-operative pain. RESULTS: Sixty-four patients were enrolled. Targeted angles were achieved more often in the N2O group (23 of 32, 72%, vs. Placebo: 13/ of 32, 41%; p = 0.01). CONCLUSION: The administration of N2O during post-operative physiotherapy can help to achieve more quickly an improved range of motion, and, although not significant in our study, to alleviate the need for pain medication. Further studies evaluating the administration of N2O in various settings are warranted. SIGNIFICANCE: During this randomized placebo-controlled double-blind study, children receiving nitrous oxide and oxygen (N2O) achieved more often the targeted range of motion during physiotherapy sessions after multilevel surgery. Compared to placebo, nitrous oxide and oxygen (N2O) enabled a better management of acute pain related to physiotherapy procedures.

[PMID: 28726270](#)

## **13. Acoustic changes in the speech of children with cerebral palsy following an intensive program of dysarthria therapy.**

Pennington L, Lombardo E, Steen N, Miller N.

Int J Lang Commun Disord. 2017 Jul 17. doi: 10.1111/1460-6984.12336. [Epub ahead of print]

BACKGROUND: The speech intelligibility of children with dysarthria and cerebral palsy has been observed to increase following therapy focusing on respiration and phonation. AIMS: To determine if speech intelligibility change following intervention is associated with change in acoustic measures of voice. METHODS & PROCEDURES: We recorded 16 young people with cerebral palsy and dysarthria (nine girls; mean age 14 years, SD = 2; nine spastic type, two dyskinetic, four mixed; one Worster-Drought) producing speech in two conditions (single words, connected speech) twice before and twice after therapy focusing on respiration, phonation and rate. In both single-word and connected speech we measured vocal intensity (root mean square-RMS), period-to-period variability (Shimmer APQ, Jitter RAP and PPQ) and harmonics-to-noise ratio (HNR). In connected speech we also measured mean fundamental frequency, utterance duration in seconds and speech and articulation rate (syllables/s with and without pauses respectively). All acoustic measures were made using Praat. Intelligibility was calculated in previous research. OUTCOMES & RESULTS: In single words statistically significant but very small reductions were observed in period-to-period variability following therapy: Shimmer APQ -0.15 (95% CI = -0.21 to -0.09); Jitter RAP -0.08 (95% CI = -0.14 to -0.01); Jitter PPQ -0.08 (95% CI = -0.15 to -0.01). No changes in period-to-period

perturbation across phrases in connected speech were detected. However, changes in connected speech were observed in phrase length, rate and intensity. Following therapy, mean utterance duration increased by 1.11 s (95% CI = 0.37-1.86) when measured with pauses and by 1.13 s (95% CI = 0.40-1.85) when measured without pauses. Articulation rate increased by 0.07 syllables/s (95% CI = 0.02-0.13); speech rate increased by 0.06 syllables/s (95% CI = < 0.01-0.12); and intensity increased by 0.03 Pascals (95% CI = 0.02-0.04). There was a gradual reduction in mean fundamental frequency across all time points (-11.85 Hz, 95% CI = -19.84 to -3.86). Only increases in the intensity of single words (0.37 Pascals, 95% CI = 0.10-0.65) and reductions in fundamental frequency (-0.11 Hz, 95% CI = -0.21 to -0.02) in connected speech were associated with gains in intelligibility. **CONCLUSIONS & IMPLICATIONS:** Mean reductions in impairment in vocal function following therapy observed were small and most are unlikely to be clinically significant. Changes in vocal control did not explain improved intelligibility.

[PMID: 28714530](#)

#### **14. Assessment of nutritional status of children and adolescents with spastic quadriplegic cerebral palsy.**

Caselli TB, Lomazi EA, Montenegro MAS, Bellomo-Brandão MA.

Arq Gastroenterol. 2017 Jul 6:0. doi: 10.1590/S0004-2803.201700000-32. [Epub ahead of print]

**BACKGROUND:** Due to several factors, such as gastrointestinal's diseases and difficulty in feeding, children with Spastic Quadriplegic Cerebral Palsy tend to present nutritional deficits. **OBJECTIVE:** To assess the nutritional status of pediatric patients with Spastic Quadriplegic Cerebral Palsy according to reference curves for this population and with the measures of folds and circumferences, obtained by the upper arm circumference and triceps skin fold. **METHODS:** The data were obtained from: knee-height, estimated height, weight, upper arm circumference, and triceps skin fold. Values of folds and circumferences were compared with Frisancho, and specific curves for these patients were used as reference. The relationship between the values in the growth curve for healthy children, Z-Score, and comparison with the reference curve were verified by Fisher's exact test. We adopted the significance level of 5%. **RESULTS:** We evaluated 54 patients. The mean age was 10.2 years, and 34 were male, 25 fed by gastrostomy and 29, orally. The frequency of low weight by the reference curve was 22.22%. More than half of the patients presented the parameters indicating lean mass below the 5th percentile. The height of all patients was classified as adequate for the age by the reference curve. **CONCLUSION:** Low weight was found in 22% of patients, and there is a greater tendency to present reduced muscle mass and increased fat mass, showing the need for evaluation and appropriate interventions for patients with Spastic Quadriplegic Cerebral Palsy.

[PMID: 28723982](#)

#### **15. The effects of reflexology on constipation and motor functions in children with cerebral palsy.**

Elbasan B, Bezgin S.

Pediatr Neonatol. 2017 Jun 29. pii: S1875-9572(17)30387-X. doi: 10.1016/j.pedneo.2017.01.005. [Epub ahead of print]

**BACKGROUND:** There is no evidence regarding the effects of reflexology on constipation and motor functions in children with cerebral palsy. This study was planned to investigate the effects of reflexology combined with neurodevelopmental therapy on constipation and motor functions in children with cerebral palsy. **METHODS:** Forty children between the ages of 3 and 15 years with cerebral palsy within levels 3/4/5 according to the Gross Motor Function Classification System (GMFCS) were included in the study. The participants were divided into two groups. While children in Group 1 received neurodevelopmental therapy, children in Group 2 also received reflexology. The therapy continued for two sessions per week for 8 weeks. Each session of neurodevelopmental therapy lasted for 45-60 min and reflexology took around 20 min. Motor performance of the children was evaluated with the Gross Motor Function Measure (GMFM) while constipation was assessed with the Modified Constipation Assessment Scale (MCAS). **RESULTS:** Both groups showed significant improvements in the GMFM scores after therapy (<0.001). In the group where neurodevelopmental therapy was applied together with reflexology, there was a decrease in MCAS scores (<0.001). **CONCLUSION:** NGT improved motor performance in both groups and adding reflexology to therapy had a positive effect on constipation. We suggest applying reflexology to children with cerebral palsy who experience constipation problems.

[PMID: 28716693](#)

**16. Exploring structural violence in the context of disability and poverty in Zimbabwe.**

Muderedzi JT, Eide AH, Braathen SH, Stray-Pedersen B.

Afr J Disabil. 2017 Apr 18;6:274. doi: 10.4102/ajod.v6i0.274. eCollection 2017.

**BACKGROUND:** While it is widely assumed that disability, poverty and health are closely linked, research falls short of fully understanding the link. One approach to analysing the links between disability and poverty is through the concept of structural violence, referring to social structures that contribute to the impoverishment of individuals or communities. These structures can be political, ecological, legal and economic, among others. **OBJECTIVE:** To explore structural violence and how it affects families of children with cerebral palsy among the Tonga ethnic group living in poor rural communities of Binga in Zimbabwe. **METHOD:** This is a longitudinal, qualitative and ethnographic study. Data were collected over a period of eight years from 2005 to 2013. Data collection techniques were in-depth interviews, participant observation and focus group discussions. Purposive sampling was used to recruit 53 informants. **RESULTS:** Structural violence was noted through four themes: internal displacement and development, food and politics, water and sanitation, and social services. Poverty was noted in the form of unemployment, lack of education, healthcare, food and shelter. The concept of structural violence inflicted social suffering on the informants. Politics played a major role in activities such as food withdrawal, lack of water, development and allocation of local resources to 'the people of the city', leaving the informants struggling with care. **CONCLUSION:** Political and economic forces have structured risks and created a situation of extreme human suffering. The capabilities approach brings out the challenges associated with cerebral palsy in the context of development challenges.

[PMID: 28730065](#)

**17. Sleep: An underemphasized aspect of health and development in neurorehabilitation.**

Verschuren O, Gorter JW, Pritchard-Wiart L.

Early Hum Dev. 2017 Jul 12. pii: S0378-3782(17)30328-6. doi: 10.1016/j.earlhumdev.2017.07.006. [Epub ahead of print]

Sleep deficiency has unique causes and implications for children with neonatal brain injury; contributing to the development or exacerbation of neurodevelopmental impairments and yet it is an underemphasized aspect of health and development. There is very little research evidence to guide the management of sleep disorders in children with cerebral palsy, a common neurodevelopmental disability of childhood. This paper is a comprehensive review and analysis of the literature regarding what is known about sleep quantity and quality in children with cerebral palsy. The specific implications for children with cerebral palsy are explored including the adverse effects of sleep deficiency on general child development, physical health and growth, and mental functioning. The consequences for the family are also discussed. Finally, the assessment and management of sleep problems are summarized to provide guidance to clinicians who work in neurodevelopmental medicine.

[PMID: 28711232](#)

**18. Accuracy of administrative claims data for cerebral palsy diagnosis: a retrospective cohort study.**

Oskoui M, Ng P, Dorais M, Pigeon N, Koclas L, Lamarre C, Malouin F, Richards CL, Shevell M, Joseph L.

CMAJ Open. 2017 Jul 18;5(3):E570-E575. doi: 10.9778/cmajo.20170013.

**BACKGROUND:** Cerebral palsy is the most common cause of childhood physical disability, with multiple associated comorbidities. Administrative claims data provide population-level prevalence estimates for cerebral palsy surveillance; however, their diagnostic accuracy has never been validated in Quebec. This study aimed to assess the accuracy of administrative claims data for the diagnosis of cerebral palsy. **METHODS:** We conducted a retrospective cohort study of children with cerebral palsy born between 1999 and 2002 within 6 health administrative regions of Quebec. Provincial cerebral palsy registry data (reference standard) and administrative physician claims were linked. We explored differences between true-positive and false-negative cases using subgroup sensitivity analysis. **RESULTS:** A total of 301 children were identified with confirmed cerebral palsy from the provincial registry, for an estimated prevalence of 1.8 (95% confidence interval [CI] 1.6-2.1) per 1000 children 5 years of age. The sensitivity and specificity of administrative claims data for cerebral palsy were 65.5% (95% CI 59.8%-70.8%) and 99.9% (95% CI 99.9%-99.9%), respectively, yielding a prevalence of 2.0 (95% CI 1.9-2.3) per 1000 children 5 years of age. The positive and negative predictive values were 58.8% (95% CI 53.3%-64.1%) and 99.9% (95% CI 99.9%-99.9%), respectively. The  $\kappa$  value was 0.62 (95% CI 0.57-0.67). Administrative claims data were more sensitive for

children from rural regions, born preterm, with spastic quadriplegia and with higher levels of motor impairment. INTERPRETATION: Administrative claims data do not capture the full spectrum of children with cerebral palsy. This suggests the need for a more sensitive case definition and caution when using such data without validation.

[PMID: 28720597](#)

## Prevention and Cure

### 19. Analysis of structure-function network decoupling in the brain systems of spastic diplegic cerebral palsy.

Lee D, Pae C, Lee JD, Park ES, Cho SR, Um MH, Lee SK, Oh MK, Park HJ.

Hum Brain Mapp. 2017 Jul 21. doi: 10.1002/hbm.23738. [Epub ahead of print]

Manifestation of the functionalities from the structural brain network is becoming increasingly important to understand a brain disease. With the aim of investigating the differential structure-function couplings according to network systems, we investigated the structural and functional brain networks of patients with spastic diplegic cerebral palsy with periventricular leukomalacia compared to healthy controls. The structural and functional networks of the whole brain and motor system, constructed using deterministic and probabilistic tractography of diffusion tensor magnetic resonance images and Pearson and partial correlation analyses of resting-state functional magnetic resonance images, showed differential embedding of functional networks in the structural networks in patients. In the whole-brain network of patients, significantly reduced global network efficiency compared to healthy controls were found in the structural networks but not in the functional networks, resulting in reduced structural-functional coupling. On the contrary, the motor network of patients had a significantly lower functional network efficiency over the intact structural network and a lower structure-function coupling than the control group. This reduced coupling but reverse directionality in the whole-brain and motor networks of patients was prominent particularly between the probabilistic structural and partial correlation-based functional networks. Intact (or less deficient) functional network over impaired structural networks of the whole brain and highly impaired functional network topology over the intact structural motor network might subserve relatively preserved cognitions and impaired motor functions in cerebral palsy. This study suggests that the structure-function relationship, evaluated specifically using sparse functional connectivity, may reveal important clues to functional reorganization in cerebral palsy. Hum Brain Mapp, 2017. © 2017 Wiley Periodicals, Inc.

[PMID: 28731515](#)

### 20. Bilirubin enzyme biosensor: potentiality and recent advances towards clinical bioanalysis.

Hooda V, Gahlaut A, Gothwal A, Hooda V.

Biotechnol Lett. 2017 Jul 19. doi: 10.1007/s10529-017-2396-0. [Epub ahead of print]

Bilirubin detection plays a major role in healthcare. Its high concentration in human serum is lethal and must be determined accurately. Clinically, it is vital for assessing patients with deleterious health conditions such as jaundice or icterus, hepatitis, mental disorders, cerebral palsy and brain damage especially in the case of neonates. In evaluating the drawbacks regarding the conventional methodology of bilirubin detection, there is need for a superior analytical tool. Bilirubin oxidase (BOx)-based sensors have been designed for the ultrasensitive analysis of bilirubin and quality deliverance of treatment and this review highlights the different mechanisms of bilirubin detection using different modified electrodes. Further, it also addresses the exploitation of highly attractive electrocatalytic properties of elite nanoparticles such as gold and zirconia-coated silica nanoparticles in enhancing the reproducibility and specificity of bilirubin biosensors.

[PMID: 28726079](#)

**21. Enhanced astrocytic d-serine underlies synaptic damage after traumatic brain injury.**

Perez EJ, Tapanes SA, Loris ZB, Balu DT, Sick TJ, Coyle JT, Liebl DJ.

J Clin Invest. 2017 Jul 17. pii: 92300. doi: 10.1172/JCI92300. [Epub ahead of print]

After traumatic brain injury (TBI), glial cells have both beneficial and deleterious roles in injury progression and recovery. However, few studies have examined the influence of reactive astrocytes in the tripartite synapse following TBI. Here, we have demonstrated that hippocampal synaptic damage caused by controlled cortical impact (CCI) injury in mice results in a switch from neuronal to astrocytic d-serine release. Under nonpathological conditions, d-serine functions as a neurotransmitter and coagonist for NMDA receptors and is involved in mediating synaptic plasticity. The phasic release of neuronal d-serine is important in maintaining synaptic function, and deficiencies lead to reductions in synaptic function and plasticity. Following CCI injury, hippocampal neurons downregulated d-serine levels, while astrocytes enhanced production and release of d-serine. We further determined that this switch in the cellular source of d-serine, together with the release of basal levels of glutamate, contributes to synaptic damage and dysfunction. Astrocyte-specific elimination of the astrocytic d-serine-synthesizing enzyme serine racemase after CCI injury improved synaptic plasticity, brain oscillations, and learning behavior. We conclude that the enhanced tonic release of d-serine from astrocytes after TBI underlies much of the synaptic damage associated with brain injury.

[PMID: 28714867](#)

**22. Inhaled and systemic steroid exposure and neurodevelopmental outcome of preterm neonates.**

Kelly EN, Shah VS, Levenbach J, Vincer M, DaSilva O, Shah PS; Canadian Neonatal Network and Canadian Neonatal Follow-Up Network Investigators.

J Matern Fetal Neonatal Med. 2017 Jul 16:1-8. doi: 10.1080/14767058.2017.1350644. [Epub ahead of print]

**OBJECTIVES:** To compare death and/or neurodevelopmental outcomes of preterm infants exposed to inhaled and/or systemic steroids with those without exposure, and examine the impact of timing of exposure. **METHODS:** Retrospective study of infants born <29 weeks gestation and assessed at 18-21 months corrected age (CA). Neurodevelopmental impairment (NDI) was defined as any Bayley Scales of Infant and Toddler Development-III (BSID-III) score <85, cerebral palsy  $\geq$  grade one, and visual or hearing impairment. Significant NDI (sNDI) was defined as any Bayley Scales of Infant Development (BSID-III) score <70, cerebral palsy  $\geq$  grade three, or severe vision or hearing impairment. **RESULTS:** Of 2570 neonates, 1811 had no exposure, 125 were exposed to inhaled steroids, 522 to systemic steroids and 112 to both. Infants exposed to inhaled steroids had lower odds of bronchopulmonary dysplasia [adjusted odds ratio (AOR) 0.51, (0.33, 0.79)], and displayed no difference in death/NDI or death/significant neurodevelopmental impairment (sNDI), regardless of timing of exposure. Infants only exposed to systemic steroids before 4 weeks of age were at increased odds of death/NDI [AOR 1.83 (1.43, 2.34)] and death/sNDI [AOR 2.28 (1.76, 2.96)]. **CONCLUSIONS:** Exposure to inhaled steroids was not associated with increased odds of death/NDI or death/sNDI. Systemic steroids use before 4 weeks of age was associated with significantly worse outcomes.

[PMID: 28714339](#)