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## Interventions and Management

### 1. Adult dyskinetic cerebral palsy: upper limb movement and muscle function.

Barcala L, Politti F, Artilheiro MC, Speciali DS, Garbelotti Junior SA, Correa JCF, Lucareli PRG.

Acta Neurol Scand. 2019 Feb 27. doi: 10.1111/ane.13083. [Epub ahead of print]

**AIM:** The aim of this study was to characterize upper-limb motor function during a comparative analysis of electromyographic and upper limb movement analysis during drinking between healthy adults and individuals with DCP. **METHOD:** Fifteen healthy individuals (CG) and fifteen individuals with DCP (DG) participated in the study. Upper limb function was analyzed during drinking and consisted of a task divided into three phases: the going, the adjustment, and the return. **RESULTS:** Electromyographic analysis revealed a lower activity of the anterior deltoid, posterior deltoid, and biceps brachii muscles in the DG. When comparing the interactions between groups and phases, only biceps brachii show lower muscle activity during going and adjustment phases. The DG presented a smaller range of motion (ROM) for the shoulder, elbow, forearm and wrist movements. An interaction between groups and phases showed smaller ROM for the flexion and internal rotation of the shoulder, elbow flexion, forearm pronation and ulnar deviation in the return phase compared to CG. **INTERPRETATION:** The results may contribute positively to the quantification of the level of motor impairment and may be used as a reference for the development of therapeutic interventions for patients with DCP. This article is protected by copyright. All rights reserved.

PMID: [30810219](#)

### 2. Actigraph assessment for measuring upper limb activity in unilateral cerebral palsy.

Beani E, Maselli M, Sicola E, Perazza S, Cecchi F, Dario P, Braito I, Boyd R, Cioni G, Sgandurra G.

J Neuroeng Rehabil. 2019 Feb 22;16(1):30. doi: 10.1186/s12984-019-0499-7.

**BACKGROUND:** Detecting differences in upper limb use in children with unilateral cerebral palsy (UCP) is challenging and highly dependent on examiner experience. The recent introduction of technologies in the clinical environment, and in particular the use of wearable sensors, can provide quantitative measurement to overcome this issue. This study aims to evaluate ActiGraph GT3X+ as a tool for measuring asymmetry in the use of the two upper limbs (ULs) during the assessment with a standardized clinical tool, the Assisting Hand Assessment (AHA) in UCP patients aged 3-25 years compared to age-matched typically developing (TD) subjects. **METHODS:** Fifty children with UCP and 50 TD subjects were assessed with AHA while wearing ActiGraphs GT3X+ on both wrists. The mean activity of each hand (dominant and non-dominant, MADH and MANDH, respectively) and the asymmetry index (AI) were calculated. Two linear mixed model analyses were carried out to evaluate how dependent actigraphic variables (i.e. MANDH and AI) varied by group (TD vs UCP) and among levels of manual ability based on Manual Ability Classification System (MACS). In both models age, sex, side of hemiplegia, presence/absence of mirror movements were specified as random effects. **RESULTS:** The MANDH was significantly lower in

UCP compared to TD, while the AI was significantly higher in UCP compared to TD. Moreover, in UCP group there were significant differences related to MACS levels, both for MANDH and AI. None of the random variables (i.e. age, sex, side, presence/absence of mirror movements) showed significant interaction with MANDH and AI. **CONCLUSIONS:** These results confirm that actigraphy could provide, in a standardized setting, a quantitative description of differences between upper limbs activity. **TRIAL REGISTRATION:** ClinicalTrials.gov, NCT03054441 . Registered 15 February 2017.

PMID: [30795810](#)

### **3. Validating Accelerometry as a Measure of Arm Movement for Children With Hemiplegic Cerebral Palsy.**

Dawe J, Yang JF, Fehlings D, Likitlersuang J, Rumney P, Zariffa J, Musselman KE.

Phys Ther. 2019 Feb 25. pii: pzz022. doi: 10.1093/ptj/pzz022. [Epub ahead of print]

**BACKGROUND:** For children with hemiplegic cerebral palsy (HCP), rehabilitation aims to increase movement of the affected arm. However, no validated measure objectively examines this construct in pediatric practice or daily life. **OBJECTIVE:** The objective of this study was to evaluate the criterion and known-groups validity of accelerometry as a measure of arm movement in children with HCP. **DESIGN:** This was a prospective cross-sectional study. **METHODS:** Twenty-seven children with typical development (3.4-13.9 years old) and 11 children with HCP (4.7-14.7 years old; Manual Ability Classification System rating I or II) wore accelerometers on the wrists while engaged in 20 minutes of play, which included intermittent intervals of stillness and vigorous movement of the arms. Vector magnitude (VM) values identified the presence (VM of > 2.0 counts per epoch) and absence (VM of ≤ 2.0 counts per epoch) of arm movement for every 2-second epoch. Video was simultaneously recorded; each 2-second interval of footage was scored as "movement" or "no movement" for each arm. **RESULTS:** Agreement between accelerometry and video observation was ≥ 81%, and the prevalence-adjusted and bias-adjusted kappa value was ≥ 0.69 for both groups of children; these results supported the criterion validity of accelerometry. The ratio of nondominant arm movement to dominant arm movement measured by accelerometry was significantly greater in children with typical development (mean = 0.87; SD = 0.09) than in children with HCP (mean = 0.78; SD = 0.07) on the basis of 10 age- and sex-matched pairs; these results supported known-groups validity. **LIMITATIONS:** The small sample size of the group with HCP prevented the stratification of data by age. Participants with HCP had high or moderately high function of the affected arm; hence, the findings do not apply to children with more significant hemiparesis. **CONCLUSIONS:** Accelerometry is a valid measure of arm movement in children with HCP and children without HCP. These findings contribute to the development of innovative upper limb assessments for children with hemiparesis.

PMID: [30801644](#)

### **4. Commentary on Development of a Pediatric Goal-Centered Upper Limb Spasticity Home Exercise Therapy Program.**

Novak I.

Phys Occup Ther Pediatr. 2019;39(2):136-138. doi: 10.1080/01942638.2019.1573627.

PMID: [30821172](#)

### **5. Soleus muscle weakness in cerebral palsy: Muscle architecture revealed with Diffusion Tensor Imaging.**

Sahrman AS, Stott NS, Besier TF, Fernandez JW, Handsfield GG.

PLoS One. 2019 Feb 25;14(2):e0205944. doi: 10.1371/journal.pone.0205944. eCollection 2019.

Cerebral palsy (CP) is associated with movement disorders and reduced muscle size. This latter phenomenon has been observed by computing muscle volumes from conventional MRI, with most studies reporting significantly reduced volumes in leg muscles. This indicates impaired muscle growth, but without knowing muscle fiber orientation, it is not clear whether muscle growth in CP is impaired in the along-fiber direction (indicating shortened muscles and limited range of motion) or the cross-fiber direction (indicating weak muscles and impaired strength). Using Diffusion Tensor Imaging (DTI) we can determine muscle fiber orientation and construct 3D muscle architectures which can be used to examine both along-fiber length and cross-sectional area. Such an approach has not been undertaken in CP. Here, we use advanced DTI sequences with fast imaging times to capture fiber orientations in the soleus muscle of children with CP and age-matched, able-bodied controls. Cross sectional areas perpendicular to the muscle fiber direction were reduced ( $37 \pm 11\%$ ) in children with CP compared to

controls, indicating impaired muscle strength. Along-fiber muscle lengths were not different between groups. This study is the first to demonstrate along-fiber and cross-fiber muscle architecture in CP using DTI and implicates impaired cross-sectional muscle growth in children with cerebral palsy.

PMID: [30802250](#)

## **6. Current practice and preferences to management of equinus in children with ambulatory cerebral palsy: A survey of orthopedic surgeons.**

Gendy S, ElGebeily M, El-Sobky TA, Khoshhal KI, Jawadi AH.

SICOT J. 2019;5:3. doi: 10.1051/sicotj/2019003. Epub 2019 Feb 28.

**INTRODUCTION:** The consensus among orthopedic surgeons on the management of equinus deformity in cerebral palsy (CP) children has not been reported previously despite being a prevalent deformity. The goals of this study were to examine the orthopedic surgeons' current practice regarding the management of equinus deformity in children with ambulatory CP, and analyze variations in current practice between general orthopedic and pediatric orthopedic surgeons. **METHODS:** We implemented a brief cross-sectional self-reported questionnaire that addressed the areas of clinical examination and decision-making skills of management of equinus deformity in CP children. We targeted a convenience sample of 400 participants. Surgeons that provided complete responses to the questionnaire were 223 with a response rate of 56%, of which 123 (55%) were general orthopedic surgeons, whereas 100 (45%) were pediatric orthopedic surgeons. The target population consisted of orthopedic surgeons who were further sub-classified in accordance with practice age, general versus pediatric, and exposure to children's orthopedics during the last three years of their practice. For analytical statistics, the Chi-Square test and Fisher's exact test were used to examine the relationship between two qualitative variables. **RESULTS:** The overall clinical practice preferences of all survey participants were unimpressive with discordant survey responses. Pediatric orthopedic surgeons generally demonstrated a statistically significant difference regarding clinical assessment skill items of the survey, in contrast to general orthopedic surgeons. However, we found no differences between pediatric orthopedic and general orthopedic surgeons regarding most of the decision-making/knowledge items. **DISCUSSION:** Generally, there are insufficient clinical practice trends of both general and pediatric orthopedic surgeons regarding equinus treatment in CP children. This may indicate a knowledge-practice gap with potential risks to CP children undergoing surgery for equinus. There is a need for a more competent exposure to CP in orthopedic surgeons' educational curricula and an updated health referral system.

PMID: [30816087](#)

## **7. Leaving hip rotation out of a conventional 3D gait model improves discrimination of pathological gait in cerebral palsy: A novel neural network analysis.**

Barton GJ, Hawken MB, Scott MA, Schwartz MH.

Gait Posture. 2019 Feb 19;70:48-52. doi: 10.1016/j.gaitpost.2019.02.011. [Epub ahead of print]

**BACKGROUND:** Complex clinical gait analysis results can be expressed as single number gait deviations by applying multivariate processing methods. The original Movement Deviation Profile (MDP) quantifies the deviation of abnormal gait using the most trusted nine dynamic joint angles of lower limbs. **RESEARCH QUESTION:** Which subset of joint angles maximises the ability of the MDP to separate abnormal gait from normality? What is the effect of using the best subset in a large group of patients, and in individuals? **METHODS:** A self-organising neural network was trained using normal gait data from 166 controls, and then the MDP of 1923 patients with cerebral palsy (3846 legs) was calculated. The same procedure was repeated with 511 combinations of the nine joint angles. The standardised distances of abnormal gait from normality were then calculated as log-transformed Z-scores to select the best combination. A mixed design ANOVA was used to assess how removing the least discriminating angle improved the separation of patients from controls. The effect of using the optimal subset of angles was also quantified for each individual leg by comparing the change in MDP to the independent FAQ levels of patients. **RESULTS:** Removal of hip rotation significantly ( $p < 0.0005$ ) increased the separation of the patient group from normality ( $\Delta Z$ -score 0.24) and also at FAQ levels 7-10 ( $\Delta Z$ -score 0.38, 0.27, 0.22, 0.14). The MDP of individual patients changed in a wider range of -4.65 to 1.12 Z-scores and their change matched their independent FAQ scores, with less functional patients moving further from, and more functional patients moving closer to normality. **SIGNIFICANCE:** In existing gait databases we recommend excluding hip rotation from data used to calculate the MDP. Alternatively, the calculation of hip rotation can be improved by post-hoc correction, but the ultimate solution is to use more accurate and reliable models of hip rotation.

PMID: [30822655](#)

**8. Gait-Based Diplegia Classification Using LSMT Networks.**

Ferrari A, Bergamini L, Guerzoni G, Calderara S, Bicocchi N, Vitetta G, Borghi C, Neviani R, Ferrari A.

J Healthc Eng. 2019 Jan 17;2019:3796898. doi: 10.1155/2019/3796898. eCollection 2019.

Diplegia is a specific subcategory of the wide spectrum of motion disorders gathered under the name of cerebral palsy. Recent works proposed to use gait analysis for diplegia classification paving the way for automated analysis. A clinically established gait-based classification system divides diplegic patients into 4 main forms, each one associated with a peculiar walking pattern. In this work, we apply two different deep learning techniques, namely, multilayer perceptron and recurrent neural networks, to automatically classify children into the 4 clinical forms. For the analysis, we used a dataset comprising gait data of 174 patients collected by means of an optoelectronic system. The measurements describing walking patterns have been processed to extract 27 angular parameters and then used to train both kinds of neural networks. Classification results are comparable with those provided by experts in 3 out of 4 forms.

PMID: [30800255](#)

**9. Effect of hippotherapy on gait symmetry in children with cerebral palsy: A pilot study.**

Mutoh T, Mutoh T, Tsubone H, Takada M, Doumura M, Ihara M, Shimomura H, Taki Y, Ihara M.

Clin Exp Pharmacol Physiol. 2019 Feb 27. doi: 10.1111/1440-1681.13076. [Epub ahead of print]

We aimed to investigate the effect of hippotherapy on gait symmetry in children with cerebral palsy (CP). Twelve children with Gross Motor Function Classification System (GMFCS) levels II-IV received weekly hippotherapy lesson for one year. Gait analyses were performed during a 5-meter walking test, using a portable, tri-axial accelerometer-based motion recorder. The baseline symmetry index derived from the Lissajous figure (LI) before hippotherapy was greater than the LI in age-matched normal subjects ( $P < 0.01$ ). Hippotherapy was associated with a decreased LI ( $-10.4 \pm 4.9\%$ ,  $P = 0.018$ ) and an improved GMFCS score ( $-0.6 \pm 0.7$ ,  $P = 0.02$ ). These data suggest that hippotherapy has a beneficial effect on symmetry of the trunk movement in children with CP. This article is protected by copyright. All rights reserved.

PMID: [30811617](#)

**10. Embodied Cognition in Practice: Exploring Effects of a Motor-Based Problem Solving Intervention.**

Harbourne RT, Berger SE.

Phys Ther. 2019 Feb 27. pii: pzz031. doi: 10.1093/ptj/pzz031. [Epub ahead of print]

**BACKGROUND:** Embodied cognition interests physical therapists because efforts to advance motor skills in young infants may affect learning. However, we do not know if simply advancing motor skill is enough to support advances in cognition. **OBJECTIVE:** The objective was to examine the effect of two interventions on the developing motor skill of sitting and problem solving and to describe the feasibility of using eye-tracking technology to explore visual and motor interaction. **DESIGN:** This was a longitudinal, randomized comparison of interventions. **METHODS:** Twenty infants with developmental delay and/or cerebral palsy, ranging from 8 months to 34 months [mean = 15 months (6.9)] participated in an intervention emphasizing motor-based problem solving (PS), and an intervention focused on advancing motor skill through assistance for attaining optimal movement patterns (OP). Outcome measures were the Gross Motor Function Measure (GMFM) sitting subsection and the Early Problem Solving for Infants (EPSI) test. Active touch and looks were measured with eye-tracking technology. **RESULTS:** Infants in both groups made significant motor gains from baseline, with no difference between intervention groups on GMFM change scores. Children in the PS group showed significant gains in EPSI scores over the children in the OP group. Overall, infants increased active touch of toys and increased concurrent looking with active touching. **LIMITATIONS:** This exploratory study was small, with variation in infant skills. The sampled behaviors for analysis were a small portion of the overall function of the child. **CONCLUSIONS:** An intervention using motor-based problem solving may improve infant problem solving skill. The use of eye-tracking may help to understand embodied cognition as infants develop, but the challenges of embedding the method in natural settings require further work.

PMID: [30810750](#)

### 11. Cognitive approach to rehabilitation in children with hyperkinetic movement disorders post-DBS.

Gimeno H, Brown RG, Lin JP, Cornelius V, Polatajko HJ.

Neurology. 2019 Feb 22. pii: 10.1212/WNL.0000000000007092. doi: 10.1212/WNL.0000000000007092. [Epub ahead of print]

**OBJECTIVE:** This proof-of-concept feasibility trial examined the potential of the Cognitive Orientation to daily Occupational Performance Approach (CO-OP) to augment deep brain stimulation (DBS) outcomes in childhood-onset hyperkinetic movement disorders (HMD) including dystonia and dyskinetic cerebral palsy. **METHODS:** This is a single case experimental design using multiple baseline as n-of-1 trial comprising 10 intervention sessions, with replications across participants (n = 10). Treatment focused on 3 participant-selected goals. Transfer was assessed on 2 additional untreated goals. Individuals enrolled were 6-21 years of age and had DBS in situ and sufficient manual ability. Primary outcome was functional performance change on the Performance Quality Rating Scale-Individualized (PQRS-i) measured before, during, and posttreatment, and at 3-month follow-up. Assessors of outcome were blinded to time of assessment, number of intervention session, and treatment allocation. To measure effect size, a nonoverlapping index, Tau-U, was used. Feasibility measures were captured. **RESULTS:** One participant withdrew before baseline assessment. Effect sizes of at least 0.66 were seen at both posttreatment and follow-up with all participants showing improvements in at least one trained goal in PQRS-i. Six participants improved on all 3 goals and 2 improved on 2 trained goals. Two children showed deterioration in one trained goal each. Transfer to untrained goals was observed in 3 participants for a total of 5 goals. CO-OP was feasible and acceptable to all participants. **CONCLUSION:** A cognitive-based, task-oriented approach to support performance of personally relevant functional skills enabling participation is acceptable in childhood-onset HMD post-DBS. Further, preliminary efficacy to improve outcomes and proof of concept with CO-OP has been established in this population. **CLASSIFICATION OF EVIDENCE:** This study provides Class IV evidence that for children with HMD who had undergone DBS, CO-OP improves performance of personally relevant functional skills.

PMID: [30796136](#)

### 12. [Sedation-analgesia protocol for the injection of botulinum toxin A in cerebral palsy].

Cantador-Hornero M, Jiménez-Espuch P, de Torres-García I, Contreras-Jiménez M, Martínez-Mezo GL, Morales de Los Santos JM, Fernández-Jurado MI, Tirado-Reyes M.

An Pediatr (Barc). 2019 Feb 19. pii: S1695-4033(19)30031-1. doi: 10.1016/j.anpedi.2018.12.018. [Epub ahead of print] [Article in Spanish]

**OBJECTIVE:** To evaluate the impact of the sedation-analgesia technique on the pain experienced by the patient. **METHODS:** This cross-sectional study was conducted on consecutive patients with cerebral palsy (CP) who underwent infiltration with botulinum toxin A (BoTNA). The patients were divided into 4 different groups according to the analgesic strategy assigned: Group I, without sedation or topical anaesthetic cream; Group II, inhalation of nitrous oxide; Group III, deep intravenous sedation; and Group IV, light sedation with benzodiazepines. Pain was assessed with different scales depending on patient age. Parents were asked to rate their satisfaction with their child's comfort by using a 5-point Likert-type scale. The primary end-point was the proportion of patients that experienced a pain level equal or lower than 2, according to pain scales, in the different study groups. **RESULTS:** Of the 124 patients included in the study, 56 (45.2%) experienced a pain level  $\leq 2$ . In the Group III a significantly greater proportion of patients were classified with a pain level score  $\leq 2$ ,  $P < .001$ , as compared with all the study groups, respectively. The BoTNA injection was guided by ultrasonography in 109 (87.9%) patients, and by palpation in 15 (12.1%). **CONCLUSION:** The results of this study suggested that, in patients with CP treated with BoTNA injections, the sedation-analgesic strategy had a significant impact on the pain experienced by the subject. Selecting an appropriate analgesic strategy is crucial for reducing the stress associated with the administration of BoTNA injections in children with CP.

PMID: [30795881](#)

### 13. Delayed Achievement of Oral Feedings Is Associated with Adverse Neurodevelopmental Outcomes at 18 to 26 Months Follow-up in Preterm Infants.

Lainwala S, Kosyakova N, Power K, Hussain N, Moore JE, Hagadorn JI, Brownell EA.

Am J Perinatol. 2019 Mar 1. doi: 10.1055/s-0039-1681059. [Epub ahead of print]

**OBJECTIVE:** To compare neurodevelopmental outcomes in preterm infants at 18 to 26 months corrected age (CA) who did versus did not achieve full oral feedings at 40 weeks postmenstrual age (PMA). **STUDY DESIGN:** This retrospective study

included infants born between 2010 and 2015 with gestational age <32 weeks and followed between 18 and 26 months CA. Achievement of full oral feedings was defined as oral intake >130 mL/kg/d for >72 hours by 40 weeks PMA. Incidence of cognitive, language, or motor delay, or cerebral palsy at 18 to 26 months CA was compared in multivariable analyses for infants in the two feeding groups. RESULTS: Of 372 included infants, those achieving full oral feedings had lower incidence of any adverse neurodevelopmental outcome ( $p < 0.001$ ) compared with those who did not achieve full oral feedings. In multivariable analyses, achievement of full oral feedings by 40 weeks PMA was associated with decreased odds of cognitive, language, and motor delays, cerebral palsy, and any adverse neurodevelopmental outcome at follow-up. CONCLUSION: Achievement of full oral feedings by 40 weeks PMA was associated with better adjusted neurodevelopmental outcomes at 18 to 26 months CA. Inability to fully feed orally at 40 weeks PMA may be a simple, clinically useful marker for risk of adverse neurodevelopmental outcomes.

PMID: [30822799](#)

#### 14. Effects of treatments for drooling on caries risk in children and adolescents with cerebral palsy.

Gutierrez GM, Siqueira VL, Loyola-Rodriguez JP, Diniz MB, Guaré RO, Ferreira AC, Santos MT.

Med Oral Patol Oral Cir Bucal. 2019 Mar 1;24(2):204-210. doi: 10.4317/medoral.22729.

BACKGROUND: Neuromuscular impairment makes individuals with cerebral palsy (CP) more prone to drooling. Among the treatment options, there are procedures that interfere with saliva production. It is imperative to evaluate the effect of the different modalities since the reduction in salivary flow rate/production may exacerbate the risk of dental caries. MATERIAL AND METHODS: The aim of this study was to compare the effects of different treatments for drooling on caries risk and salivary parameters in children and adolescents with CP. STUDY DESIGN: A total of 142 children and adolescents with CP, aged 6 to 18 years, were assigned to groups based on the different treatments they had received for drooling: G1-anticholinergic drugs ( $n = 18$ ), G2-botulinum toxin injection ( $n = 16$ ), G3-salivary glands surgery ( $n = 16$ ), G4-no treatment ( $n = 42$ ), and G5-non-drooling subjects ( $n = 50$ ). All participants were evaluated on the Simplified Oral Hygiene Index, and for the prevalence of dental caries (decayed, missing, and filled teeth index and white spot lesions). Unstimulated whole saliva was collected, and salivary flow rate and osmolality were measured. Chi-square, ANOVA and Poisson regression were calculated. Prevalence ratios and their respective 95 % confidence intervals were obtained. The significance level was fixed at 5%. RESULTS: No differences were found in the decayed, missing, and filled teeth index ( $p = 0.128$ ) and Simplified Oral Hygiene Index ( $p = 0.674$ ) among the different groups. G3 presented significantly higher percentages of WSL ( $p < 0.001$ ), lower values of salivary flow rate ( $p < 0.001$ ), and higher values of osmolality ( $p < 0.001$ ). The white spot lesion prevalence ratio was higher only for G3 (Prevalence ratio = 14.36; IC 95% = 4.64-44.40;  $p < 0.001$ ). CONCLUSIONS: Children and adolescents with CP who had received surgical treatment for drooling exhibited higher number of white spot lesions because of the reduced salivary flow rate and higher salivary osmolality.

PMID: [30818313](#)

#### 15. Constipation, Antiepileptic drugs, and Gingivitis in Children and Adolescents with Cerebral Palsy.

Ferreira ACFM, Mayer MPA, Kawamoto D, Santos MTBR.

Int J Paediatr Dent. 2019 Feb 28. doi: 10.1111/ipd.12488. [Epub ahead of print]

BACKGROUND: Cerebral palsy (CP) individuals present with epilepsy, which requires the use of antiepileptic drug (AED). HYPOTHESIS: Since an inflammatory response may contribute to epileptogenesis, the hypothesis tested was that constipation would be associated with gingivitis and the use of AED in children and adolescents (CA) with CP. DESIGN: A comparative study was conducted with 101 CA aged 5 to 17 years ( $10.8 \pm 4.9$ ), classified as constipated (G1;  $n=57$ ) or not constipated (G2;  $n=44$ ). Clinical patterns, AED used, body mass index (BMI), fluid intake, toilet transfer and gingival condition were evaluated. Student's t-test, chi-squared test and logistic regression analysis were performed ( $\alpha = 0.05$ ). RESULTS: There were no differences between groups regarding gender ( $P = 0.531$ ), age ( $P = 0.227$ ), BMI ( $P = 0.437$ ) and fluid intake ( $P = 0.346$ ). However, G1 presented a higher percentage of quadriplegic individuals ( $P < 0.001$ ), dependency for toilet transfer ( $P < 0.001$ ), presence of gingivitis ( $P = 0.020$ ) and use of AED polytherapy ( $P < 0.001$ ) compared to G2. Constipation was associated with quadriplegic CA, using GABA as AED ( $P = 0.002$ ). CONCLUSIONS: Mucosal inflammation evidenced by constipation and gingivitis are associated with the most neurologically compromised CAs under the use of GABA AED. This article is protected by copyright. All rights reserved.

PMID: [30817037](#)

**16. Family History of Mental and Neurological Disorders and Risk of Autism.**

Xie S, Karlsson H, Dalman C, Widman L, Rai D, Gardner RM, Magnusson C, Schendel DE, Newschaffer CJ, Lee BK.

JAMA Netw Open. 2019 Mar 1;2(3):e190154. doi: 10.1001/jamanetworkopen.2019.0154.

**IMPORTANCE:** Familial aggregation of mental and neurological disorders is often observed in autism spectrum disorders (ASD), but reports have generally focused on single disorders and are limited to first-degree relatives. **OBJECTIVES:** To examine family history of mental and neurological disorders among first- to fourth-degree relatives and risk of ASD with and without intellectual disability (ID) in index persons. **DESIGN, SETTING, AND PARTICIPANTS:** In this population-based cohort study, 567 436 index persons were identified from the Stockholm Youth Cohort, an ongoing longitudinal register-linkage cohort study of the total population aged 0 to 17 years residing in Stockholm County, Sweden. Index persons were nonadopted singleton births born between 1984 and 2009 who were at least 2 years of age at the end of follow-up on December 31, 2011, had resided in Stockholm County for at least 2 years since birth, and could be linked to both biological parents. Data analysis was conducted from May 2017 to December 2018. **EXPOSURE:** Mental and neurological diagnoses of relatives of the index persons. **MAIN OUTCOMES AND MEASURES:** Diagnosis of ASD, with or without co-occurring ID, in the index persons. **RESULTS:** The cohort included 567 436 index persons (291 191 [51.3%] male; mean [SD] age at the end of follow-up, 14.3 [7.5] years). The prevalence of ASD with and without ID was 0.4% and 1.5%, respectively. Positive family history of mental and neurological disorders was associated with higher odds of ASD in index persons; 6895 (63.1%) of index persons with ASD had a parent with history of mental and/or neurological disorders, compared with 252 454 (45.4%) of index persons without ASD. Family history of multiple disorders was associated with higher odds of ASD in index persons, including history of ASD (odds ratio among first-degree relatives for ASD with and without ID: 14.2, 9.0), intellectual disability (7.6, 2.3), attention-deficit/hyperactivity disorder (3.3, 4.7), obsessive compulsive disorder (1.9, 2.1), schizophrenia and other nonaffective psychotic disorders (2.1, 1.8), depression (1.4, 2.0), bipolar disorder (1.4, 2.2), personality disorder (2.1, 2.6), cerebral palsy (2.2, 1.5), and epilepsy (2.0, 1.3). The more closely related the affected family member was, the higher the odds was of ASD for the index person. ASD without intellectual disability was associated with more disorders compared to ASD with intellectual disability. ASD with intellectual disability exhibited a weaker familial association with other mental disorder diagnoses but a stronger familial association with some neurological diagnoses as compared to ASD without intellectual disability. **CONCLUSIONS AND RELEVANCE:** This study suggests that family history of mental and neurological disorders is associated with increased risk of ASD. The familial component of ASD etiology may differ by presence or absence of co-occurring ID.

PMID: [30821823](#)

**17. Exploring social participants in young adults with cerebral palsy.**

Jacobson DNO, Löwing K, Hjalmarsson E, Tedroff K.

J Rehabil Med. 2019 Feb 28. doi: 10.2340/16501977-2517. [Epub ahead of print]

**OBJECTIVES:** To describe social outcomes for young adults with cerebral palsy, and to explore associations of social outcomes with their classification levels within the Gross Motor Function, Manual Ability and Communication Function Classification Systems, and with the presence of intellectual disability. **DESIGN:** A cross-sectional study with a population-based inclusion approach at a neuropaediatric referral centre in Sweden. **SUBJECTS:** Sixty-one young adults with cerebral palsy, age 20-22 years. **METHODS:** Physical examination and questionnaires on social outcomes including living arrangements, relationships, occupation, personal finances, extent of family support with personal care, and physical examination. **RESULTS:** Twenty percent of the young adults with cerebral palsy had moved out of the parental home. Forty-three percent were dependent on family support for basic activities of daily living. Seventy-nine percent of those without intellectual disability were employed or studying. The Communication Function Classification Systems, and presence of intellectual disability, demonstrated associations with most social outcomes, followed in significance by Manual Ability Classification System. **CONCLUSION:** In this study young adults with cerebral palsy to a high extent lived in the parental home, and more often without employment, compared with their peers. Many were dependent on parental support, financially, and with activities of daily living. Intellectual disability and communication function were important determinants of social participation. Interventions aimed at alleviating the impact of these particular disabilities should be prioritized.

PMID: [30815703](#)

**18. Cross-Cultural Validation of Children's Assessment of Participation and Enjoyment Portuguese Version.**

Vila-Nova F, Oliveira R, Cordovil R.

Front Pediatr. 2019 Feb 12;7:33. doi: 10.3389/fped.2019.00033. eCollection 2019.

**Background:** Participation is a major pediatric rehabilitation goal according to The International Classification of Functioning, Disability and Health Children and Youth version (ICF-CY). ICF-based leisure participation measures for Portuguese-speaking children with cerebral palsy are currently not available. The aim of this study is to assess validity and reliability of the Portuguese (European) version of the Children's Assessment of Participation and Enjoyment (CAPE). **Methods:** CAPE Portuguese version was applied to 170 children with cerebral palsy (n = 69) and typical development (n = 101) aged between 8 and 18 years (mean = 12.5 years; SD = 2.91). Construct validity was assessed by using the know-groups method and the correlation between participation and quality of life. Reliability was determined by internal consistency and test-retest. **Results:** CAPE discriminates between participation scores of children with cerebral palsy and typical development. A positive correlation was found between participation frequency and physical well-being. Internal consistency was not entirely satisfactory but comparable with that from the original CAPE study. Test-retest reliability was considered good. **Conclusions:** CAPE Portuguese (European) version showed satisfactory validity and test-retest reliability to assess leisure participation in children with cerebral palsy and typical development aged between 8 and 18 years.

PMID: [30809515](#)

**19. A Blended Curriculum to Improve Resident Physical Exam Skills for Patients With Neuromuscular Disability.**  
Benjamin JC, Groner J, Walton J, Noritz G, Gascon GM, Mahan JD.

MedEdPORTAL. 2019 Jan 4;15:10792. doi: 10.15766/mep\_2374-8265.10792.

**INTRODUCTION:** Children with neuromuscular disabilities (NMD) receive care in a wide variety of clinical settings. Residents lack training to develop physical examination skills for evaluating patients with NMD. We devised a curriculum to teach residents how to examine patients with NMD using a systematic and simplified approach. **METHODS:** Creation of this resource was a response to a survey of final-year residents that revealed the need for education focused on developing physical examination skills. The curriculum has four components—multimedia PowerPoint with embedded video, knowledge assessment, clinical exam (CEX) assessment, and module feedback—and was completed by 37 residents over an 8-month period from January to September 2016. We utilized knowledge assessment, direct clinical skills observation using the CEX, and module-feedback responses as part of the evaluation. **RESULTS:** All 37 residents completed the curriculum, with an overall knowledge score of greater than 80%. Residents demonstrated most of the desired patient care behaviors on the CEX assessment and provided positive feedback on the quality, usefulness, and applicability of the module, in addition to requesting more curricula to develop their physical examination skills. **DISCUSSION:** The CEX assessment provided a unique opportunity for faculty feedback on residents' physical exam performance. After completing the module, residents achieved high scores in most areas of the standardized CEX and were able to conduct the NMD physical exam in a sensitive manner. The assessment highlighted the need to improve residents' skills of detecting abnormal clinical findings and communicating with the patient during the physical exam.

PMID: [30800992](#)

**20. The Home Program Evaluation Questionnaire – HoPE-Q –for Infants with Hemiplegic Cerebral Palsy: Development and Psychometric Properties**

Chamudot R, Gross-Tsur V, Horovitz R, Parush S.

Physical & Occupational Therapy in Pediatrics. 2019 Jan 16. doi: 10.1080/01942638.2018.1534920.

**Aims:** To develop and examine the psychometric properties of the Home Program Evaluation Questionnaire (HoPE-Q), a novel tool designed to assess the effectiveness of home treatment programs for infants with hemiplegia. The HoPE-Q includes a pre- and a postintervention version and items that relate to Child's Function, Parents' Competence, and their Expectations and Satisfaction from the program. **Methods:** The research was performed in three stages. The first stage consisted of item construction and content validity, followed by the analyses of the tool's reliability and construct validity. The final stage involved the examination of the tool's sensitivity to determine its suitability as an outcome measure of the effectiveness of home programs for infants with hemiplegia. **Results:** Results showed moderate-to-high internal consistency ( $\alpha = 0.65-0.85$ ) and high test-retest reliability in Child's Function and Parents' Competence ( $r = 0.75$ ,  $r = 0.76$ ) respectively ( $p = 0.01$ ). Evidence for Construct Validity, was demonstrated by significant group difference in the Child's Function ( $t(74) = -12.3$ ,  $p \leq 0.001$ ) and Parents' Competence ( $t(68) = -3.7$ ,  $p = 0.01$ ), and high sensitivity to change after treatment was presented in Child's Function ( $F(32,1) = 49.38$ ) and Parents Competence ( $F(32,1) = 26.72$ ) ( $p \leq 0.001$ ). **Conclusions:** Preliminary data support the validity and reliability of the HoPE-Q as well as its suitability as an outcome measure, thereby providing a means of examining the

effectiveness of home intervention programs for infants with hemiplegia.

doi: [10.1080/01942638.2018.1534920](https://doi.org/10.1080/01942638.2018.1534920)

## 21. Pressure Ulcer Prevalence by Level of Paralysis in Patients With Spinal Cord Injury in Long-term Care.

Cowan LJ, Ahn H, Flores M, Yarrow J, Barks LS, Garvan C, Weaver MT, Stechmiller J.

Adv Skin Wound Care. 2019 Mar;32(3):122-130. doi: 10.1097/01.ASW.0000553109.70752.bf.

**OBJECTIVE:** Scientific literature suggests pressure ulcer (PU) risk increases as immobility increases, indicating that more extensive paralysis confers a greater risk of PU. Yet the specific level of paralysis (ie, hemiplegia vs paraplegia vs quadriplegia), apart from neurodegenerative diagnoses, has never been examined in the long-term care (LTC) population. This study examined the prevalence of PU among LTC residents with different paralysis levels. **METHODS:** The authors conducted a secondary data analysis of the 2012 US Minimum Data Set of LTC facilities (n = 51,664 residents). Measures included PU stage, level of paralysis, functional impairments, comorbidities, and sociodemographic factors. After removing residents with neurodegenerative disease, comatose patients, and those with hip fractures from the analysis, logistic regressions were used to examine the association of risk factors and sociodemographic characteristics with the presence of PU. **MAIN RESULTS:** The sample included 7,540 patients with quadriplegia, 11,614 patients with paraplegia, and 32,510 patients with hemiplegia in LTC facilities. The PU prevalence in the sample (stages 2, 3, and 4; suspected deep-tissue injury; and unstageable PUs) was 33.9% for patients with quadriplegia, 47.4% for patients with paraplegia, and 9.6% for patients with hemiplegia. **CONCLUSIONS:** Within paralysis groups (quadriplegic, paraplegic, hemiplegic), risk factors for PU differed in type and magnitude. The PU rates associated with quadriplegia and paraplegia are much higher than LTC residents without paralysis, and PU prevalence for hemiplegia is similar to the rate in LTC residents without paralysis. When the risk factor of paraplegia versus quadriplegia was isolated, PU prevalence for patients with paraplegia was significantly higher.

PMID: [30801350](https://pubmed.ncbi.nlm.nih.gov/30801350/)

## 22. Safety and Feasibility of Transcranial Magnetic Stimulation as an Exploratory Assessment of Corticospinal Connectivity in Infants After Perinatal Brain Injury: an Observational Study.

Nemanich ST, Chen CY, Chen M, Zorn E, Mueller B, Peyton C, Elison JT, Stinear J, Rao R, Georgieff M, Menk J, Rudser K, Gillick B.

Phys Ther. 2019 Feb 26. pii: pzz028. doi: 10.1093/ptj/pzz028. [Epub ahead of print]

**BACKGROUND:** Perinatal brain injuries often impact the corticospinal system, leading to motor impairment and cerebral palsy (CP). While transcranial magnetic stimulation (TMS) has been widely used to study corticospinal connectivity in adults and older children, similar studies of young infants are limited. **OBJECTIVES:** The objective was to establish the safety and feasibility of advanced TMS assessments of the corticospinal connectivity of young infants with perinatal brain injury. **DESIGN:** This was a pilot, cross-sectional study of 3-12 month-old (corrected age) infants with perinatal stroke or intracranial hemorrhage. **METHODS:** Six infants (2 term, 4 pre-term) were assessed with stereotactic neuronavigation-guided TMS. Single-pulse TMS was applied to each hemisphere and responses were recorded simultaneously from both upper limbs. During data collection, vital signs and stress responses were measured to assess safety. Developmental motor outcomes were evaluated using the General Movements Assessment and Bayley Scales of Infant and Toddler Development (3rd ed.). A clinical diagnosis of CP was recorded, if available. **RESULTS:** No adverse events occurred during TMS testing. All sessions were well tolerated. Contralateral motor evoked responses were detected in 4 of 6 infants. Both contralateral and ipsilateral responses were observed in 2 of 6 infants. **LIMITATIONS:** TMS responses were not obtained in all infants. This may be related to the location of brain injury or developmental stage of the corticospinal system controlling the wrist flexor muscle group from which responses were recorded. **CONCLUSIONS:** This study provides a summary of the framework for performing novel TMS assessments in infants with perinatal brain injury. Implementing this approach to measure corticospinal connectivity in hypothesis-driven studies in young infants appears to be justified. Such studies may inform the characterization of corticospinal development and the neural mechanisms driving recovery following early interventions.

PMID: [30806664](https://pubmed.ncbi.nlm.nih.gov/30806664/)

## 23. A motor learning therapeutic intervention for a child with cerebral palsy through a social assistive robot.

Buitrago JA, Bolaños AM, Caicedo Bravo E.

Disabil Rehabil Assist Technol. 2019 Feb 26:1-6. doi: 10.1080/17483107.2019.1578999. [Epub ahead of print]

**BACKGROUND:** Children with cerebral palsy have difficulty to sit, stand, walk, run and jump independently. Therapy is an important factor in improving these aspects, and if applied in early intervention treatments, when the child is growing, it could have many benefits. These therapies require intensive and extended sessions, which in turn demand dedication and effort. New strategies that provide interesting and motivating interventions are often incorporated to improve the participation and performance of the children in the therapies. Therapies using social assistive robots can be alternative and complementary methods to promote the participation and motivation of children with cerebral palsy. **METHODS:** The objective of this work is to validate the effectiveness of a 16-session physical therapy program to improve the participation and fulfillment of therapeutic objectives on an 8 year-old boy with dyskinetic cerebral palsy for motor learning to walk using a social assistive robot. The therapy program was carried out through a methodological proposal that uses SMART objectives (Specific, Measurable, Achievable, Realistic and Timed), Goal-Directed Therapy (GDT) and its evaluation through Goal Attainment Scaling (GAS). **RESULTS:** A NAO robot was used as a social assistive robot to support a physical therapy for a child with cerebral palsy. In this work, it was observed that the motivation generated by the interaction with the social assistive robot facilitated the persistence in the walking and the fulfillment of the objectives. **CONCLUSION:** Using humanoid robots as social assistive robots may benefit therapeutic processes on children with motor disabilities. The methodology developed provides a formal way to achieve objectives in therapeutic processes for children with cerebral palsy. Implications for rehabilitation It requires researchers to conduct more studies to validate the potential of the use of social robots in therapeutic interventions that promote development in children with motor disabilities, such as cerebral palsy. Promoting the use of new technologies in therapeutic processes such as humanoid robots allows us to create new strategies to know the impact of this technology in the area of rehabilitation. The use of formal methodologies focused on the patient, along with multidisciplinary teams, could increase the possibilities of using social robots to improve cognitive and motor outcomes in children with cerebral palsy. The formulation of SMART objectives and their quantification through the GAS scale can be used as recommendations to improve the formulation of goals in therapeutic interventions for children with cerebral palsy.

PMID: [30806105](#)

#### **24. The Investigation of Rate of Birth Asphyxia and its Relationship with Delivery Mode at Shahid Beheshti Hospital of Isfahan during 2013, 2014, and 2015.**

Sadeghnia A, Mohammadpoor S.

Int J Prev Med. 2019 Feb 12;10:23. doi: 10.4103/ijpvm.IJPVM\_383\_16. eCollection 2019.

**BACKGROUND:** Birth asphyxia is considered as one of the biggest challenges faced by perinatal care experts. According to the WHO, in 2005, one-fourth of infant mortality cases occurred due to birth asphyxia. **METHODS:** This study is a retrospective study done on the newborn population with gestational ages of 36 weeks or higher during the years 2013, 2014, and 2015 to find the relationship between the number of birth asphyxia cases and the years. As a secondary objective, the relationship between the mode of delivery and the cases of birth asphyxia were investigated using logistic regression test. The inclusion criteria consisted of three cases, namely, gestational age of 36 weeks or higher, 5 min Apgar of <5, and umbilical cord pH of <7.1. The exclusion criteria involved hydrops fetalis, cyanotic heart disease, chromosomal abnormality, and congenital infections. **RESULTS:** From the two independent variables of the study, only the variable "year" showed a significant difference between the years 2013 and 2015 ( $P < 0.01$ ). The delivery mode did not have any statistically significant influence on the newborns' affliction with birth asphyxia ( $P = 0.993$ ). **CONCLUSIONS:** According to the results, there is a significant difference between the rate of birth asphyxia in Iran and its global rate in 2015, and regarding its multiple growth from 2013 to 2015, conducting a more comprehensive and extensive research on birth asphyxia risk factors at a delivery time seems justified and inevitable.

PMID: [30820310](#)

#### **25. Neuroprotective strategies following perinatal hypoxia-ischemia: Taking aim at NOS.**

Albrecht M, Zitta K, Groenendaal F, van Bel F, Peeters-Scholte C.

Free Radic Biol Med. 2019 Feb 25. pii: S0891-5849(18)32471-7. doi: 10.1016/j.freeradbiomed.2019.02.025. [Epub ahead of print]

Perinatal asphyxia (PA) is characterized by oxygen deprivation and lack of perfusion in the perinatal period, leading to hypoxic-ischemic encephalopathy and sequelae such as cerebral palsy, mental retardation, cerebral visual impairment, epilepsy and learning disabilities. On cellular level, PA is associated with a decrease in oxygen and glucose leading to ATP depletion, and a

compromised mitochondrial function. Upon reoxygenation and reperfusion, the renewed availability of oxygen gives rise to not only restoration of cell function, but also to the activation of multiple detrimental biochemical pathways, leading to secondary energy failure and ultimately cell death. The formation of nitric oxide and peroxynitrite play a central role in the development of subsequent neurological damage. In this review, we give insight into the pathophysiology of PA, discuss its clinical relevance and summarize current neuroprotective strategies related to therapeutic hypothermia (TH), ischemic postconditioning and pharmacological interventions. The review will also focus on the possible neuroprotective actions and molecular mechanisms of the selective neuronal and inducible nitric oxide synthase inhibitor 2-iminobiotin, which may represent a novel therapeutic agent for the treatment of hypoxia-ischemia mediated neurotoxicity both in combination with TH in middle- and high-income countries, as well as stand-alone treatment in low-income countries.

PMID: [30818057](#)

## **26. Neurodevelopmental Follow-up of Preterm Infants: What Is New?**

McGowan EC, Vohr BR.

*Pediatr Clin North Am.* 2019 Apr;66(2):509-523. doi: 10.1016/j.pcl.2018.12.015. Epub 2019 Feb 1.

There is increasing evidence of ongoing changes occurring in short-term and long-term motor and language outcomes in former premature infants. As rates of moderate to severe cerebral palsy (CP) have decreased, there has been increased awareness of the impact of mild CP and of developmental coordination disorder on the preterm population. Language delays and disorders continue to be among the most common outcomes. In conjunction with medical morbidities, there is increased awareness of the negative impact of family psycho-socioeconomic adversities on preterm outcomes and of the importance of intervention for these adversities beginning in the neonatal ICU.

PMID: [30819351](#)

## **27. Severe Perinatal Hypoxic-Ischemic Brain Injury Induces Long-Term Sensorimotor Deficits, Anxiety-Like Behaviors and Cognitive Impairment in a Sex-, Age- and Task-Selective Manner in C57BL/6 Mice but Can Be Modulated by Neonatal Handling.**

Muntsant A, Shrivastava K, Recasens M, Giménez-Llort L.

*Front Behav Neurosci.* 2019 Feb 13;13:7. doi: 10.3389/fnbeh.2019.00007. eCollection 2019.

Perinatal brain injury (PBI) leads to neurological disabilities throughout life, from motor deficits, cognitive limitations to severe cerebral palsy. Yet, perinatal brain damage has limited therapeutic outcomes. Besides, the immature brain of premature children is at increased risk of hypoxic/ischemic (HI) injury, with males being more susceptible to it and less responsive to protective/therapeutical interventions. Here, we model in male and female C57BL/6 mice, the impact of neonatal HI and the protective effects of neonatal handling (NH), an early life tactile and proprioceptive sensory stimulation. From postnatal day 1 (PND1, modeling pre-term) to PND21 randomized litters received either NH or left undisturbed. HI brain damage occurred by permanent left carotid occlusion followed by hypoxia at PND7 (modeling full-term) in half of the animals. The behavioral and functional screening of the pups at weaning (PND23) and their long-term outcomes (adulthood, PND70) were evaluated in a longitudinal study, as follows: somatic development (weight), sensorimotor functions (reflexes, rods and hanger tests), exploration [activity (ACT) and open-field (OF) test], emotional and anxiety-like behaviors [corner, open-field and dark-light box (DLB) tests], learning and memory [T-maze (TM) and Morris Water-Maze (MWM)]. HI induced similar brain damage in both sexes but affected motor development, sensorimotor functions, induced hyperactivity at weaning, and anxiety-like behaviors and cognitive deficits at adulthood, in a sex- and age-dependent manner. Thus, during ontogeny, HI affected equilibrium especially in females and prehensibility in males, but only reflexes at adulthood. Hyperactivity of HI males was normalized at adulthood. HI increased neophobia and other anxiety-like behaviors in males but emotionality in females. Both sexes showed worse short/long-term learning, but memory was more affected in males. Striking neuroprotective effects of NH were found, with significantly lower injury scores, mostly in HI males. At the functional level, NH reversed the impaired reflex responses and improved memory performances in hippocampal-dependent spatial-learning tasks, especially in males. Finally, neuropathological correlates referred to atrophy, neuronal densities and cellularity in the affected areas [hippocampal-CA, caudate/putamen, thalamus, neocortex and corpus callosum (CC)] point out distinct neuronal substrates underlying the sex- and age- functional impacts of these risk/protection interventions on sensorimotor, behavioral and cognitive outcomes from ontogeny to adulthood.

PMID: [30814939](#)

**28. Flaunting our assets. Making the most of the Nordic registry goldmine: Cerebral palsy as an example.**

Alriksson-Schmidt AI, Jeglinsky-Kankainen IFD, Jahnsen RB, Hollung SJ, Andersen GL, HÄggglund GV.

Scand J Public Health. 2019 Feb 28;1403494819829338. doi: 10.1177/1403494819829338. [Epub ahead of print]

**AIMS:** To describe the early experiences of a Nordic multidisciplinary cerebral palsy (CP) registry research program combining data from national medical quality registries, follow-up programs and cohort data, in addition to data from other national registries; to explore the scientific and practical uses of such research, and provide recommendations for facilitating similar work in the future. **METHODS:** The work was divided into three themes: medical outcomes, social and public health outcomes, and health economics; and three cross-cutting teams: a reference team, a challenge team, and a communication and dissemination team. Initially each country will perform domestic research, and in the second stage data will be merged across all Nordic countries. Data from national registries with vital statistics, education and work, social benefits, and healthcare will be used. Comparisons will be matched for both the individuals with CP and their parents. **RESULTS:** Initial work has been done on agreeing which variables to request from the respective agencies and planning the correct procedures and steps required to acquire the data. As of 2018, Sweden, Norway, and Finland have received approved ethics board applications. Iceland and Denmark are waiting for their approvals. A webpage and a platform for internal communication have been created. **CONCLUSIONS:** Nordic register research has great potential. Linking national CP quality registries and follow-up programs with other large national registries holds particular promise because problems identified through research can be applied at a population level. It is imperative that ethical clearance and data delivery processes are streamlined and transparent, and that data variables are measured the same way in the different countries.

PMID: [30813853](#)**29. Obscuring effect of coding developmental disability as the underlying cause of death on mortality trends for adults with developmental disability: a cross-sectional study using US Mortality Data from 2012 to 2016.**

Landes SD, Stevens JD, Turk MA.

BMJ Open. 2019 Feb 24;9(2):e026614. doi: 10.1136/bmjopen-2018-026614.

**OBJECTIVE:** To determine whether coding a developmental disability as the underlying cause of death obscures mortality trends of adults with developmental disability. **DESIGN:** National Vital Statistics System 2012-2016 US Multiple Cause-of-Death Mortality files. **SETTING:** USA. **PARTICIPANTS:** Adults with a developmental disability indicated on their death certificate aged 18 through 103 at the time of death. The study population included 33 154 adults who died between 1 January 2012 and 31 December 2016. **PRIMARY OUTCOME AND MEASURES:** Decedents with a developmental disability coded as the underlying cause of death on the death certificate were identified using the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision code for intellectual disability, cerebral palsy, Down syndrome or other developmental disability. Death certificates that coded a developmental disability as the underlying cause of death were revised using a sequential underlying cause of death revision process. **RESULTS:** There were 33 154 decedents with developmental disability: 7901 with intellectual disability, 11 895 with cerebral palsy, 9114 with Down syndrome, 2479 with other developmental disabilities and 1765 with multiple developmental disabilities. Among all decedents, 48.5% had a developmental disability coded as the underlying cause of death, obscuring higher rates of choking deaths among all decedents and dementia and Alzheimer's disease among decedents with Down syndrome. **CONCLUSION:** Death certificates that recorded the developmental disability in Part I of the death certificate were more likely to code disability as the underlying cause of death. While revising these death certificates provides a short-term corrective to mortality trends for this population, the severity and extent of this problem warrants a long-term change involving more precise instructions to record developmental disabilities only in Part II of the death certificate.

PMID: [30804035](#)**30. The genetic etiology in cerebral palsy mimics: The results from a Greek tertiary care center.**

Zouvelou V, Yubero D, Apostolakopoulou L, Kokkinou E, Bilanakis M, Dalivigka Z, Nikas I, Kollia E, Perez-Dueñas B, Macaya A, Marcé-Grau A, Voutetakis A, Anagnostopoulou K, Kekou K, Sofocleus C, Veltra D, Kokkinis X, Fryssira H, Torres RJ, Amstrong J, Santorelli FM, Artuch R, Pons R.

Eur J Paediatr Neurol. 2019 Feb 14. pii: S1090-3798(18)30442-2. doi: 10.1016/j.ejpn.2019.02.001. [Epub ahead of print]

**OBJECTIVE:** Non-progressive genetic disorders may present with motor dysfunction resembling cerebral palsy (CP). Such

patients are often characterized as CP mimics. The purpose of this work was to delineate the clinical manifestations and molecular findings of CP mimic patients, with the ultimate goal to offer specific disease-modifying therapy and genetic counseling. **METHODS:** Retrospective study of 47 patients diagnosed with CP and no acquired etiology. Chart review of clinical, neuroradiological, biochemical and molecular data was performed. **RESULTS:** 31,91% of patients manifested with features resembling dyskinetic CP, 19,14% spastic CP, 10,63% ataxic CP and 38,30% mixed CP. In 23 patients molecular diagnosis was reached and included 5 hereditary spastic paraplegia genes (SPG) in spastic CP mimics; HPRT1, TH, QDPR, DDC in dystonic CP mimics; ADCY5 and NIKX2-1 in choreic CP mimics; CANA1A in ataxic CP mimics; and SPG, PDHA1, NIKX2-1, AT, SLC2A1 and SPR in mixed CP mimics. In 14 patients, the etiological diagnosis led to specific treatment. **CONCLUSIONS:** CP mimics show a number of features that differ from classic CP and can be used as diagnostic clues, including presence of mixed motor features, minor dysmorphic features, oculogyric movements, multiple features of autonomic dysfunction, and acquired microcephaly. A more stringent use of the concept of CP focused on acquired lesions during the perinatal and infancy periods, and excluding disorders that could be of genetic origin, could contribute to a purer use of the term. Identification of a specific genetic cause for CP mimics may in certain cases lead to etiologic treatment.

PMID: [30799092](#)

## Prevention and Cure

### 31. Exogenous neural stem cell transplantation for cerebral ischemia.

Liao LY, Lau BW, Sánchez-Vidaña DÍ, Gao Q.

Neural Regen Res. 2019 Jul;14(7):1129-1137. doi: 10.4103/1673-5374.251188.

Cerebral ischemic injury is the main manifestation of stroke, and its incidence in stroke patients is 70-80%. Although ischemic stroke can be treated with tissue-type plasminogen activator, its time window of effectiveness is narrow. Therefore, the incidence of paralysis, hypoesthesia, aphasia, dysphagia, and cognitive impairment caused by cerebral ischemia is high. Nerve tissue regeneration can promote the recovery of the aforementioned dysfunction. Neural stem cells can participate in the reconstruction of the damaged nervous system and promote the recovery of nervous function during self-repair of damaged brain tissue. Neural stem cell transplantation for ischemic stroke has been a hot topic for more than 10 years. This review discusses the treatment of ischemic stroke with neural stem cells, as well as the mechanisms of their involvement in stroke treatment.

PMID: [30804235](#)