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## Interventions and Management

### 1. A novel risk calculator predicting surgical site infection after spinal surgery in patients with cerebral palsy

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Dev Med Child Neurol. 2022 Feb 28. doi: 10.1111/dmcn.15193. Online ahead of print.

**Aim:** To develop and validate a risk calculator based on preoperative factors to predict the probability of surgical site infection (SSI) in patients with cerebral palsy (CP) undergoing spinal surgery. **Method:** This was a multicenter retrospective cohort study of pediatric patients with CP who underwent spinal fusion. In the development stage, preoperative known factors were collected, and a risk calculator was developed by comparing multiple models and choosing the model with the highest discrimination and calibration abilities. This model was then tested with a separate population in the validation stage. **Results:** Among the 255 patients in the development stage, risk of SSI was 11%. A final prediction model included non-ambulatory status (odds ratio [OR] 4.0), diaper dependence (OR 2.5), age younger than 12 years (OR 2.5), major coronal curve magnitude greater than 90° (OR 1.3), behavioral disorder/delay (OR 1.3), and revision surgery (OR 1.3) as risk factors. This model had a predictive ability of 73.4% for SSI, along with excellent calibration ability ( $p = 0.878$ ). Among the 390 patients in the validation stage, risk of SSI was 8.2%. The discrimination of the model in the validation phase was 0.743 and calibration was  $p = 0.435$ , indicating 74.3% predictive ability and no difference between predicted and observed values. **Interpretation:** This study provides a risk calculator to identify the risk of SSI after spine surgery for patients with CP. This will allow us to enhance decision-making and patient care while providing valid hospital comparisons, public reporting mechanisms, and reimbursement determinations.

PMID: [35229288](https://pubmed.ncbi.nlm.nih.gov/35229288/)

### 2. Goal-oriented locomotion in children with spastic diplegia: Anticipatory orienting strategies and trajectory formation

Alexander Castilla, Alain Berthoz, Giovanni Cioni, Vittorio Belmonti

Dev Neurorehabil. 2022 Feb 28;1-10. doi: 10.1080/17518423.2022.2047122. Online ahead of print.

Goal-oriented locomotion (GOL) is a complex task integrating navigation and gait control. To our knowledge, this is the first study of GOL in subjects with Cerebral Palsy (CP). Thirteen subjects with spastic diplegia and 26 with typical development were enrolled in the study. Subjects performed a GOL task to reach luminous targets. Within-subject trajectory variability, maximal head deviation from trajectory and mean head anticipation over trajectory were analyzed. While all subjects showed gait impairment, only 8 of 13 subjects also showed navigation abnormalities as revealed by either: a) abnormal head orientation and trajectory formation, or b) abnormal head orientation with normal trajectory formation. Abnormal gait patterns do not account for and can be distinguished from navigation disorders in spastic diplegic CP. This distinction has important implications for novel rehabilitation methods that should specifically address navigation, not only gait.

PMID: [35226571](#)

### 3. Number of synergies impacts sensitivity of gait to weakness and contracture

Elijah C Kuska, Naser Mehrabi, Michael H Schwartz, Katherine M Steele

J Biomech. 2022 Feb 18;134:111012. doi: 10.1016/j.jbiomech.2022.111012. Online ahead of print.

Muscle activity during gait can be described by a small set of synergies, weighted groups of muscles, that are theorized to reflect underlying neural control. For people with neurologic injuries, like cerebral palsy or stroke, even fewer synergies are required to explain muscle activity during gait. This reduction in synergies is thought to reflect altered control and is associated with impairment severity and treatment outcomes. Individuals with neurologic injuries also develop secondary musculoskeletal impairments, like weakness or contracture, that can impact gait. Yet, the combined impacts of altered control and musculoskeletal impairments on gait remains unclear. In this study, we use a two-dimensional musculoskeletal model constrained to synergy control to simulate unimpaired gait. We vary the number of synergies, while simulating muscle weakness and contracture to examine how altered control impacts sensitivity to musculoskeletal impairment while tracking unimpaired gait. Results demonstrate that reducing the number of synergies increases sensitivity to weakness and contracture for specific muscle groups. For example, simulations using five-synergy control tolerated 40% and 51% more knee extensor weakness than those using four- or three-synergy control, respectively. Furthermore, when constrained to four- or three-synergy control, the model was increasingly sensitive to contracture and weakness of proximal muscles, such as the hamstring and hip flexors. Contrastingly, neither the amount of generalized nor plantarflexor weakness tolerated was affected by the number of synergies. These findings highlight the interactions between altered control and musculoskeletal impairments, emphasizing the importance of measuring and incorporating both in future simulation and experimental studies.

PMID: [35219146](#)

### 4. How does treadmill training contribute to botulinum toxin application plus routine physical therapy in ambulatory children with spastic bilateral cerebral palsy? A randomized controlled trial

Kübra Seyhan Bıyık, Mintaze Kerem Günel, Ece Ünlü Akyüz

Ir J Med Sci. 2022 Feb 27. doi: 10.1007/s11845-022-02960-9. Online ahead of print.

**Background:** In spite of treadmill training and multilevel botulinum toxin (BoNT-A) injection being the two most commonly used treatment methods in pediatric rehabilitation management, there was no study investigating the effect of treadmill training after BoNT-A injection in children with cerebral palsy (CP). **Aim:** The aim of this study was to investigate the effect of treadmill training in addition to routine physical therapy after BoNT-A injection in ambulatory children with spastic bilateral CP on lower extremity muscle strength, selective motor control, and mobility. **Methods:** A total of 30 spastic bilateral children with CP classified level II-III by the Gross Motor Function Classification System were randomly assigned the study and control groups. Both groups continued routine physical therapy treatments after multilevel BoNT-A injection into lower extremities, while the study group additionally underwent 8 weeks of treadmill training (20 min, two sessions per week). Handheld dynamometer, selective control assessment of lower extremity, temporospatial evaluation of gait, and Pediatric Evaluation of Disability Inventory were assessed before and after 8 weeks. **Results:** In both groups, hip, knee, and ankle muscle strength increased at the end of 8 weeks ( $p < 0.05$ ); however, in the study group, hip flexor/extensor muscle strength ( $p < 0.05$ ,  $ES \geq 0.50$ ), selective motor control of ankle ( $p < 0.01$ ,  $ES = 1.17$ ), walking speed ( $p < 0.01$ ,  $ES = 2.60$ ), step lengths ( $p < 0.01$ ,  $ES = 1.32$ ), and mobility ( $p < 0.01$ ,  $ES = 1.37$ ) increased significantly compared to those of the control group. **Conclusions:** Treadmill training in addition to routine physical therapy after BoNT-A injection is beneficial for hip muscle strength, ankle selective motor control, walking quality, and functional mobility in the short term.

PMID: [35224682](#)

### 5. Effectiveness of Functional Electrical Stimulation - Cycling Treatment in Children with Cerebral Palsy

Natalya Özen, Ece Unlu, Ozgur Zeliha Karaahmet, Eda Gurcay, Ibrahim Gundogdu, Ebru Umay

Malawi Med J. 2021 Sep;33(3):144-152. doi: 10.4314/mmj.v33i3.1.

**Aim:** The purpose of this study was to evaluate the effects of functional electrical stimulation (FES) bicycle therapy system on motor function, gait pattern, spasticity, daily living activities, and aerobic capacity in children with cerebral palsy (CP) and to

compare the results with sham stimulation and standard treatment. Methods: Patients with cerebral palsy who received botulinum toxin type-A injections to lower extremities and those with Gross Motor Function Measure Classification System (GMFCS) levels I - III, were included in the study. Twenty-five patients were randomly assigned into three treatment groups for 4-weeks: Group 1, FES-cycling and standard treatment; Group 2, Sham stimulus FES-cycling and standard treatment; Group 3, Standard treatment. Clinical assessment tools included the Modified Ashworth Scale (MAS), Modified Tardieu Scale (MTS), Pediatric Functional Independence Measure (WeeFIM), GMFCS, Gross Motor Function Measure-88 (GMFM-88), selective motor control tests, 6-minute walk test, and Visual Gait Analysis (VGA). Results: In all groups, there were significant improvements in MAS, MTS, WeeFIM, GMFM-88, 6-minute walk test, and VGA scores. No changes in GMFCS levels were observed in any group. At the end of the study, there was no significant difference among the groups in terms of any clinical assessment parameter. Conclusions: All groups showed statistically significant improvements in motor function, walking pattern, spasticity, daily living activities, and aerobic capacity in patients with CP following the rehabilitation period. Although FES-cycling demonstrated no superiority over the other approaches and provided no additional benefit to the results, FES appears to be safe and well-tolerated in children with CP, at least as much as standard exercise treatment.

PMID: [35233271](#)

**6. [Rehabilitation strategy and recommendation for dysphagia in children with cerebral palsy] [Article in Chinese]**  
Subspecialty Group of Rehabilitation, the Society of Pediatrics, Chinese Medical Association

Zhonghua Er Ke Za Zhi. 2022 Mar 2;60(3):192-196. doi: 10.3760/cma.j.cn112140-20211208-01029.

PMID: [35240737](#)

**7. Prevalence of tooth grinding in children and adolescents with neurodevelopmental disorders: a systematic review and meta-analysis**

Pedro Vitali Kammer, Juliana Silva Moro, Josiane Pezzini Soares, Carla Massignan, Caoimhin Mac Giolla Phadraig, Michele Bolan

Review J Oral Rehabil. 2022 Feb 26. doi: 10.1111/joor.13315. Online ahead of print.

Aim: To conduct a systematic review and meta-analysis on the prevalence of tooth grinding and/or clenching (TGC) in children and adolescents with a neurodevelopmental disorder or other developmental condition. Methods: A search was performed in seven databases, two sources of grey literature, and reference lists of included studies. Risk of bias was assessed using the Joanna Briggs Institute Critical Appraisal Checklist for Studies Reporting Prevalence Data. We used random-effects models with Freeman-Tukey double arcsine transformation for the meta-analyses. Results: After selection, 77 of the 2240 studies met inclusion criteria and were categorized by disability and type of TGC (reported, clinically observed, and definitive). The pooled prevalence of reported TGC in individuals with attention deficit hyperactivity disorder was 57.6% (95%CI [Confidence Interval]: 49.5-65.6), 50.4% (95%CI: 35.5-65.4) in individuals with autism spectrum disorder, 67% (95%CI: 59.2-74.8) in Cerebral palsy, 68.2% (95%CI: 59.8-76.6) in Down syndrome. Pooled prevalence of clinically observed TGC was 57.5% (95% CI: 31.6-83.4) in autism spectrum disorder and 71.9% (95%CI: 52.4-91.4) in Cerebral Palsy. Individuals with Attention deficit hyperactivity disorder presented 39.8% (95%CI: 24-55.6) of definitive TGC. Conclusion: Prevalence of reported, clinically observed, and definitive TGC varies according to disabilities, although due to high heterogeneity the result should be interpreted with caution. Variations exist mainly due to sampling bias and the use of non-validated methods to assess TGC. CRD42020212640.

PMID: [35218239](#)

**8. Mode of Anesthesia and Bladder Management Following Orthopaedic Surgery in Children With Cerebral Palsy: A System Level Analysis**

Cathleen E Buckon, Nikolas J Koscielniak, Carole A Tucker, Michael D Aiona

J Pediatr Orthop. 2022 Feb 28. doi: 10.1097/BPO.0000000000002108. Online ahead of print.

Background: Postoperative urinary retention (POUR) is a surgical complication more prevalent in children with neurodisability and associated with an increase length of hospitalization. Risk factors include pre-existing bladder dysfunction, type and duration of surgery, anesthesia medications, postoperative opioid pain management, and patient demographics. The purpose of this investigation was (1) to determine the frequency of POUR following hip/lower limb orthopaedic procedures in which epidural analgesia was used for pain management; (2) to explore factors influencing postoperative bladder management.

**Methods:** A retrospective analysis of clinical data was performed in an orthopaedic specialty care health care system. A health outcomes network was queried for patients with a diagnoses of cerebral palsy (ICD-9/10 codes) who had one of 57 unique CPT procedure codes corresponding to hip osteotomies or tenotomies from 2011 to 2019. All surgical observations included in analysis required a discrete data element and the confirmation of a secondary proxy. The database was also queried for postoperative medications received and patient demographics of interest. **Results:** A total of 704 surgical procedures met inclusion criteria resulting in a patient population with a mean age of 11 years, 58% male, 53% Caucasian, and 55% classified as quadriplegia [51% Gross Motor Function Classification System (GMFCS) levels IV/V]. Three hundred and thirty-five procedures (48%) involved epidural anesthesia. Sixty-five patients required intermittent catheterization (9.2%) postoperatively following foley catheter removal, of which 23 (3.3%) required recatheterization. The rate of recatheterization was similar regardless of anesthesia mode; 1.8% for general and 1.4% for epidural and was associated with a greater number of pain medications. Epidural anesthesia resulted in significantly longer periods of catheterization. For the total group the time to urinary catheter removal differed significantly among cerebral palsy subtypes, GMFCS Level, race, and ethnicity. Factors identified as significant predictors of the length of catheterization were epidural analgesia, number of pain medications, and osteotomy. **Conclusions:** The number of postoperative pain medications utilized was more predictive of POUR than the mode of analgesia delivery; however, epidural analgesia and the type of surgical procedure did significantly impact the length of catheterization.

PMID: [35220337](#)

### **9. [Digestive and nutritional problems of children with cerebral palsy] [Article in French]**

Thea Von Graffenried, Gaelle Gay, Nicoletta Bianchi, Andreas Nydegger, Laetitia-Marie Petit

Rev Med Suisse. 2022 Feb 23;18(770):324-327. doi: 10.53738/REVMED.2022.18.770.324.

Digestive and nutritional problems of children with cerebral palsy put them at risk of malnutrition. Identification of these problems through measurements of weight, height, and body composition is essential. Feeding difficulties may be caused by a combination of oral and digestive problems, such as swallowing difficulties, gastroesophageal reflux, and constipation. If oral feeding is difficult or unsafe, a nasogastric tube or gastrostomy may be necessary. Once the feeding regimen has been established, energy needs must be assessed on an individual basis. This nutritional management involves a multidisciplinary team of health care professionals, the child, and the family.

PMID: [35224907](#)

### **10. Eating and drinking ability and nutritional status in adults with cerebral palsy**

Anita McAllister, Eva Sjöstrand, Elisabet Rodby-Bousquet

Dev Med Child Neurol. 2022 Feb 28. doi: 10.1111/dmcn.15196. Online ahead of print.

**Aim:** To describe eating and drinking ability in adults with cerebral palsy (CP) relative to sex, age, subtype, and severity of gross motor and hand function and nutritional status. **Method:** This was a cross-sectional study based on data of 2035 adults with CP, median age 26 years (range 18-78 years). The Eating and Drinking Ability Classification System (EDACS), Gross Motor Function Classification System (GMFCS), and Manual Ability Classification System (MACS) were used in addition to subtype, body weight, height, body mass index (BMI), skin fold thickness, and gastrostomy. Linear regression models were used to estimate associations between body weight and the other variables. **Results:** More than half of the adults (52.5%) eat and drink safely and 32.4% have dysphagia with limitations to eating and drinking safety. Weight, height, and BMI decreased with increasing EDACS levels. In EDACS level V, 86% had a gastrostomy, 23.4% in EDACS levels III to V were underweight, whereas 42.3% in EDACS levels I to II had a BMI over 25, indicating overweight or obesity. Increasing EDACS levels and need of support during meals were associated with lower body weight. **Interpretation:** Adults with CP should be routinely screened and treated for dysphagia to avoid nutritional complications. Being dependent on others during mealtimes is a risk factor for low body weight.

PMID: [35229295](#)

### **11. Relationship of anthropometric measurements and percent body fat mass to cardiovascular disease risk factors in adults with cerebral palsy**

Emily Kivlehan, Deborah Gaebler-Spira, Liqi Chen, Ariane Garrett, Nicole Wysocki, Christina Marciniak

PM R. 2022 Mar 2. doi: 10.1002/pmrj.12797. Online ahead of print.

**Introduction:** Adults with cerebral palsy (CP) face high morbidity from cardiovascular disease (CVD). Concerningly, classic screening parameters are inconsistent in identifying CVD risk in this population. Dual Energy X-ray absorptiometry (DEXA), which provides direct measurements of fat mass (FM), may be an alternative screening method. **Objective:** To evaluate whether FM by DEXA measurements is feasible in adults with CP and compare FM and anthropometric measures to CVD risk factors. **Design:** Cross Sectional Study **SETTING:** Outpatient rehabilitation hospital **PARTICIPANTS:** 47 adults with CP **MAIN OUTCOME MEASURES:** Weight, height, waist (WC) and hip circumference (HC) were measured; waist:hip ratio (WHR) and body mass index (BMI) were calculated. Blood pressure (BP), FM by DEXA, hemoglobinA1c (HbA1c) and lipid measurements were obtained. Logistic regression models investigated odds ratios and 95% confidence intervals between anthropometric measurements/FM, and CVD risk factors; Correlations were assessed using Pearson correlation coefficients. **Results:** Elevated BP or hypertension diagnosis was present in 45.7%; HbA1c $\geq$ 5.7% in 22.2%; HDL level below optimal for 33.3%. DEXA FM was obtained in 29 of 47 participants, as surgical metal and positioning limited many studies. Excess FM was noted in 75.9% versus 41.3% overweight/obese by BMI. WC correlated with HbA1c ( $r=0.46, P=0.002$ ), HDL ( $r=-0.36, P=0.018$ ) and TG levels ( $r=0.30, P=0.045$ ) however at-risk WC values were only associated with odds of elevated HbA1c (OR, 8.53; 95%CI, 1.46-50.05;  $P=0.018$ ). HC correlated with HgbA1c levels ( $r=0.38, P=0.011$ ) and systolic BPs ( $r=0.35, P=0.019$ ); similarly, ORs for elevated HC were weakly associated with elevated HgbA1c and BPs (OR, 1.08; 95% CI, 1.01-1.16;  $P=0.024$  and OR, 1.07; 95%CI, 1.01-1.14;  $P=0.024$ , respectively). WHR correlated with TGs however few TG levels were elevated. FM measures were not associated with at-risk lab values or BPs. **Conclusions:** DEXA FM measurements may not be feasible for CVD screening in many adults with CP. Although CVD risk factors are frequently present, anthropometric measurements commonly used for general population screening may not translate well to adults with CP. This article is protected by copyright. All rights reserved.

PMID: [35235238](#)

## 12. Virtual Reality-Based Intervention for Enhancing Upper Extremity Function in Children With Hemiplegic Cerebral Palsy: A Literature Review

Chanan Goyal, Vishnu Vardhan, Waqar Naqvi

Review Cureus. 2022 Jan 28;14(1):e21693. doi: 10.7759/cureus.21693. eCollection 2022 Jan.

Cerebral palsy (CP) is the most common cause of motor disability in the pediatric population, with hemiplegia as one of the most widely seen subtypes of spastic CP. Although most of the children with hemiplegic CP are independent ambulators, deficits in hand function of the affected side remain a major concern of caregivers and children themselves. Children use the unaffected upper extremity to compensate for the weakness in the affected one, which consequently leads to the disuse of the hemiparetic upper extremity. Interactive virtual environments can enhance the activation of brain areas during training by providing feedback that can catalyze neuroplastic changes for improved function. Although numerous studies have been conducted on the impact of virtual reality (VR)-based rehabilitation in adults with stroke, studies on its use in the pediatric population are scarce. The three broad categories of VR systems based on the type of human-computer interactions are feedback-focused, gesture-based, and haptic-based. Preliminary studies have shown promising results of VR intervention in improving motor function, including upper extremity function, in children with hemiplegic CP. It is an engaging and entertaining intervention that adds an advantage of high compliance due to motivation. The current literature consists of studies with highly heterogeneous groups of participants and small sample sizes. Further investigation on children with a specific type of CP with advanced VR systems technology is warranted.

PMID: [35237486](#)

## 13. Is active video gaming associated with improvements in social behaviors in children with neurodevelopmental disorders: a systematic review

Homa Rafiei Milajerdi, Firoozeh Ordoozar, Deborah Dewey

Review Child Neuropsychol. 2022 Mar 2;1-27. doi: 10.1080/09297049.2022.2046721. Online ahead of print.

Active video gaming (AVG) is a way that children with neurodevelopmental disorders can participate in social play and could be associated with improvements in social behaviors. However, limited research has investigated if AVG is associated with improvements in social behaviors in children and adolescents with neurodevelopmental disorders. A systematic literature search was conducted in Medline, Embase, Psycinfo, Cinahl, and Eric, Web of Science, and Scopus. Three main concepts were searched: exergaming, neurodevelopmental disorders, and social behaviors. Keywords and subject headings were used for each concept. 3080 articles were identified in the initial search in 2019; in January 2021, 167 additional articles were identified. Of

these, 8 studies with 242 children with autism spectrum disorder, cerebral palsy, or developmental coordination disorder were included in this review. Six studies reported that participation in AVG was associated with improved social functioning, social interaction, emotional well-being, and social/emotional skills in children with ASD, CP, and DCD. In contrast, two studies that included children diagnosed with ASD did not find any association between AVG participation and social behaviors. The findings of this systematic review suggest that participation in an AVG intervention may be associated with improved social behaviors in children and adolescents with ASD, CP, and DCD. However, due to the limited number of studies included, this finding must be interpreted with caution. Future research is needed that examines the treatment fidelity of AVG in improving social behavior skills in children with neurodevelopmental disorders and the generalizability of these skills to real-life social situations.

PMID: [35236234](#)

#### **14. Single-Trial Classification of Error-Related Potentials in People with Motor Disabilities: A Study in Cerebral Palsy, Stroke, and Amputees**

Nayab Usama, Imran Khan Niazi, Kim Dremstrup, Mads Jochumsen

Sensors (Basel). 2022 Feb 21;22(4):1676. doi: 10.3390/s22041676.

Brain-computer interface performance may be reduced over time, but adapting the classifier could reduce this problem. Error-related potentials (ErrPs) could label data for continuous adaptation. However, this has scarcely been investigated in populations with severe motor impairments. The aim of this study was to detect ErrPs from single-trial EEG in offline analysis in participants with cerebral palsy, an amputation, or stroke, and determine how much discriminative information different brain regions hold. Ten participants with cerebral palsy, eight with an amputation, and 25 with a stroke attempted to perform 300-400 wrist and ankle movements while a sham BCI provided feedback on their performance for eliciting ErrPs. Pre-processed EEG epochs were inputted in a multi-layer perceptron artificial neural network. Each brain region was used as input individually (Frontal, Central, Temporal Right, Temporal Left, Parietal, and Occipital), the combination of the Central region with each of the adjacent regions, and all regions combined. The Frontal and Central regions were most important, and adding additional regions only improved performance slightly. The average classification accuracies were  $84 \pm 4\%$ ,  $87 \pm 4\%$ , and  $85 \pm 3\%$  for cerebral palsy, amputation, and stroke participants. In conclusion, ErrPs can be detected in participants with motor impairments; this may have implications for developing adaptive BCIs or automatic error correction.

PMID: [35214576](#)

#### **15. Outcomes in extremely low birth weight ( $\leq 500$ g) preterm infants: A Western Australian experience**

Athalye-Jape Gayatri, Lim Mei'En, Nathan Elizabeth, Sharp Mary

Early Hum Dev. 2022 Feb 22;167:105553. doi: 10.1016/j.earlhumdev.2022.105553. Online ahead of print.

Background and aim: Extremely preterm (EP) infant survival has significantly improved with advanced neonatal care; however outcomes of infants born with birth weight (BW)  $\leq 500$  g remain poor. We aimed to review outcomes of this cohort in our institution. Methods: Retrospective study of all inborn preterm infants born at  $\geq 22$  weeks gestational age (GA) and weighing  $\leq 500$  g between January 2001-December 2017. Outcomes included short-term morbidity, mortality, neurodevelopmental impairment and growth up to five years of age. Results: Of a total 438 eligible infants, 92 livebirths were admitted to intensive care [median (range) GA: 24 (22-30) weeks; median (IQR) BW: 427.5 (380-499) grams]. Majority [78/92 (84.7%)] were small for gestational age (SGA). In 50% of non-survivors, median (IQR) age of death was 3.5 (1-17.5) days with no late deaths. Medical morbidities were common. Follow-up, including standardised cognitive assessments, was available for 41/46 (89%) infants. At a median age of 5.06 years, 17/41 (41.5%) had moderate-severe disability; non-statistically higher in SGA compared to appropriate for gestational age/AGA (48.6% vs. 33.3%) group. Cerebral palsy (4/41; 10%), deafness needing amplification (1/41; 2.4%) were noted. Weight (32/41, 78%) and height (27/41, 66%) of most children remained at  $> 2$  SD below normal. Conclusions: In a cohort of preterm infants weighing  $\leq 500$  g at birth, 50% survived after admission to intensive care. Medical morbidities were common and 54% were free from moderate to severe disability at five years. SGA infants had higher rates (48.6%) of moderate to severe disability. Ongoing suboptimal growth in childhood is common.

PMID: [35217355](#)

#### **16. Time of delivery among low-risk women at 37-42 weeks of gestation and risks of stillbirth and infant mortality, and long-term neurological morbidity**

Neda Razaz, Giulia M Muraca, Katharina Fink, Amélie Boutin, Sid John, Sarka Lisonkova, Olof Stephansson, Sven Cnattingius, K S Joseph

Paediatr Perinat Epidemiol. 2022 Mar 4. doi: 10.1111/ppe.12868. Online ahead of print.

**Background:** The most important knowledge gap in connection with obstetric management for time of delivery in term low-risk pregnancies relates to the absence of information on long-term neurodevelopmental outcomes. **Objectives:** We examined risks of stillbirth, infant mortality, cerebral palsy (CP) and epilepsy among low-risk pregnancies. **Methods:** In this population-based Swedish study, we identified, from 1998 to 2019, 1,773,269 singleton infants born between 37 and 42 completed weeks in women with low-risk pregnancies. Poisson log-linear regression models were used to examine the association between gestational age at delivery and stillbirth, infant mortality, CP and epilepsy. Adjusted rate ratios (RR) and 95% confidence intervals expressing the effect of birth at a particular gestational week compared with birth at a later gestational week were estimated. **Results:** Compared with those born at a later gestation, RRs for stillbirth and infant mortality were higher among births at 37 weeks' and 38 weeks' gestation. The RRs for infant mortality were approximately 20% and 25% lower among births at 40 or 41 weeks compared with those born at later gestation, respectively. Infants born at 37 and 38 weeks also had higher RRs for CP (vs infants born at  $\geq 38$  and  $\geq 39$  weeks, respectively), while those born at 39 gestation had similar RRs (vs infants born at  $\geq 40$  weeks); infants born at 40 and 41 weeks had lower RRs of CP (vs those born at  $\geq 41$  and 42 weeks, respectively). The RRs for epilepsy were higher in those born at 37 and 38 weeks compared with those born at later gestation. **Conclusions:** Among low-risk pregnancies, birth at 37 or 38 completed weeks' gestation is associated with increased risks of stillbirth, infant mortality and neurological morbidity, while birth at 39-40 completed weeks is associated with reduced risks compared with births at later gestation.

PMID: [35244233](#)

### **17. Fetal heart rate evolution patterns in cerebral palsy associated with umbilical cord complications: a nationwide study**

Junichi Hasegawa, Masahiro Nakao, Tomoaki Ikeda, Satoshi Toyokawa, Emi Jojima, Shoji Satoh, Kiyotake Ichizuka, Nanako Tamiya, Akihito Nakai, Keiya Fujimori, Tsugio Maeda, Satoru Takeda, Hideaki Suzuki, Shigeru Ueda, Mitsutoshi Iwashita, Tsuyomu Ikenoue

BMC Pregnancy Childbirth. 2022 Mar 3;22(1):177. doi: 10.1186/s12884-022-04508-2.

**Background:** The aim of the present study was to clarify fetal heart rate (FHR) evolution patterns in infants with cerebral palsy (CP) according to different types of umbilical cord complications. **Methods:** This case-control study included children born: with a birth weight  $\geq 2000$  g, at gestational age  $\geq 33$  weeks, with disability due to CP, and between 2009 and 2014. Obstetric characteristics and FHR patterns were compared among patients with CP associated with (126 cases) and without (594 controls) umbilical cord complications. **Results:** There were 32 umbilical cord prolapse cases and 94 cases with coexistent antenatal umbilical cord complications. Compared with the control group, the persistent non-reassuring pattern was more frequent in cases with coexistent antenatal umbilical cord complications ( $p = 0.012$ ). A reassuring FHR pattern was observed on admission, but resulted in prolonged deceleration, especially during the first stage of labor, and was significantly identified in 69% of cases with umbilical cord prolapse and 35% of cases with antenatal cord complications, compared to 17% of control cases ( $p < 0.001$ ). **Conclusion:** Hypercoiled cord and abnormal placental umbilical cord insertion, may be associated with CP due to acute hypoxic-ischemic injury as well as sub-acute or chronic adverse events during pregnancy, while umbilical cord prolapse may be characterized by acute hypoxic-ischemic injury during delivery.

PMID: [35241026](#)

### **18. Non-attendance at outpatient clinic appointments by children with cerebral palsy**

Simon P Paget, Sarah McIntyre, Shona Goldsmith, Katarina Ostojic, Jane Shrapnel, Francisco Schneuer, Mary-Clare Waugh, Maria Kyriagis, Natasha Nassar

Dev Med Child Neurol. 2022 Mar 4. doi: 10.1111/dmcn.15197. Online ahead of print.

**Aim:** To determine factors that influence non-attendance at outpatient clinics by children with cerebral palsy (CP). **Method:** This was a retrospective cohort study of 1395 children with CP (59.6% male; born 2005 to 2017) identified from the New South Wales (NSW)/Australian Capital Territory CP Register, who had scheduled appointments at outpatient clinics at two NSW tertiary paediatric hospitals between 2012 and 2019. Associations between sociodemographic, clinical, and process-of-care factors and non-attendance were examined using multivariate logistic regression with generalized estimating equations. **Results:** A total of 5773 (12%) of 50 121 scheduled outpatient days were not attended. Non-attendance increased over time (average increase 5.6% per year, 95% confidence interval [CI]: 3.7-7.3). Older children aged 5 to 9 years (adjusted odds ratio

[aOR] 1.11; 95% CI: 1.02-1.22) and 10 to 14 years (aOR 1.17; 95% CI: 1.03-1.34), socioeconomic disadvantage (aOR 1.29; 95% CI: 1.11-1.50), previous non-attendance (aOR 1.38; 95% CI: 1.23-1.53), and recent rescheduled or cancelled appointments (aOR 1.08; 95% CI: 1.01-1.16) were associated with increased likelihood of non-attendance. Interpretation: One in eight outpatient appointments for children with CP were not attended. Non-attendance was associated with increasing age, socioeconomic disadvantage, previous non-attendance, and recent rescheduled or cancelled appointments. Identifying specific barriers and interventions to improve access to outpatient services for these groups is needed.

PMID: [35244200](#)

### 19. Participation restriction of children with cerebral palsy living in Thailand and influential factors: A cross-sectional study

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Dev Neurorehabil. 2022 Feb 28;1-8. doi: 10.1080/17518423.2022.2047121. Online ahead of print.

Objective: To explore participation in daily activities of children with cerebral palsy (CP) in Thailand and influential factors. Methods: A convenience sample of family-caregivers of 80 children with CP, 6-18 year-old, completed self-administered questionnaires (i.e., frequency of participation, Gross Motor Function Classification System-Family Report) during clinic visits at a university hospital. Results: Family-caregivers reported that more than one-third of the children never participated in outdoor activities. The gap in the frequency of participation between groups with high versus low motor function was very high. Better gross motor and communication were strong predictors of participation. Caregiver's education and family income were associated with participation in art/cultural, leisure and tourist activities. Conclusions: Family-caregiver-report suggests that Thai-children with CP, especially those with severe impairments, have limited participation in daily activities. Increasing mobility and communication may promote the participation. Comprehensive intervention is needed to narrow the participation gap found between high and low functioning children.

PMID: [35226592](#)

### 20. Cohort profile: the Swiss Cerebral Palsy Registry (Swiss-CP-Reg) cohort study

Fabiën N Belle, Sandra Hunziker, Joël Fluss, Sebastian Grunt, Stephanie Juenemann, Christoph Kuenzle, Andreas Meyer-Heim, Christopher J Newman, Gian Paolo Ramelli, Peter Weber, Kuehni Claudia E, Anne Tscherter

Swiss Med Wkly. 2022 Feb 21;152:w30139. doi: 10.4414/smw.2022.w30139. eCollection 2022 Feb 14.

Background: Cerebral Palsy (CP) is a group of permanent disorders of movement and posture that follow injuries to the developing brain. It results in motor dysfunction and a wide variety of comorbidities like epilepsy; pain; speech, hearing and vision disorders; cognitive dysfunction; and eating and digestive difficulties. Central data collection is essential to the study of the epidemiology, clinical presentations, care, and quality of life of patients affected by CP. CP specialists founded the Swiss Cerebral Palsy Registry (Swiss-CP-Reg) in 2017. This paper describes the design, structure, aims and achievements of Swiss-CP-Reg and presents its first results. Methods: Swiss-CP-Reg records patients of any age diagnosed with CP who are born, are treated, or live in Switzerland. It collects data from medical records and reports, from questionnaires answered by patients and their families, and from data linkage with routine statistics and other registries. The registry contains information on diagnosis, clinical presentation, comorbidities, therapies, personal information, family history, and quality of life. Results: From August 2017 to August 2021, 546 participants (55% male, mean age at registration 8 years [interquartile range IQR: 5-12]), were enrolled in Swiss-CP-Reg. Most had been born at term (56%), were less than two years old at diagnosis (73%, median 18 months, IQR: 9-25), and were diagnosed with spastic CP (76%). Most (59%) live with a mild motor impairment (Gross Motor Function Classification System [GMFCS] level I or II), 12% with a moderate motor impairment (GMFCS level III), and 29% with a severe motor impairment (GMFCS level IV or V). In a subset of 170 participants, we measured intelligence quotient (IQ) and saw lower IQs with increasing GMFCS level. Swiss-CP-Reg has a strong interest in research, with four nested projects running currently, and many more planned. Conclusions: Swiss-CP-Reg collects and exchanges national data on people living with CP to answer clinically relevant questions. Its structure enables retrospective and prospective data collection and knowledge exchange between experts to optimise and standardise treatment and to improve the health and quality of life of those diagnosed with CP in Switzerland.

PMID: [35230014](#)

### 21. What does an aetiological diagnosis actually mean?

Hayley Smithers-Sheedy, Georgina Henry

Dev Med Child Neurol. 2022 Feb 19. doi: 10.1111/dmcn.15189. Online ahead of print.

PMID: [35184280](#)

## **22. Spinocerebellar Ataxia Type 5 (SCA5) Mimicking Cerebral Palsy: a Very Early Onset Autosomal Dominant Hereditary Ataxia**

Luane Abdalla Gouvêa, Ivana Rocha Raslan, Augusto Bragança Reis Rosa, Thiago Yoshinaga Tonholo Silva, Rejane Macedo Campos, Marcelo de Melo Aragão, Orlando Graziani Povoas Barsottini, José Luiz Pedroso

Cerebellum. 2022 Mar 3. doi: 10.1007/s12311-022-01380-w. Online ahead of print.

PMID: [35243593](#)

## **23. Incidence and outcome of prenatal brain abnormalities in twin-to-twin transfusion syndrome: systematic review and meta-analysis**

F G Sileo, J Curado, F D'Antonio, C Benlioglu, A Khalil

Review Ultrasound Obstet Gynecol. 2022 Mar 1. doi: 10.1002/uog.24895. Online ahead of print.

**Objectives:** to ascertain the incidence of antenatally diagnosed brain injuries in twin pregnancies complicated by twin to twin transfusion syndrome (TTTS) and to quantify the perinatal mortality, morbidity and long-term neurodevelopmental outcomes of these fetuses. **Methods:** Medline, Embase, Clinicaltrials.gov and Cochrane Library databases were searched. Inclusion criteria were studies reporting on brain abnormalities diagnosed antenatally in twin pregnancies complicated by TTTS. The primary outcome was the incidence of prenatal brain abnormalities. The secondary outcomes were intrauterine demise (IUD), neonatal death, termination of pregnancy (TOP) and long-term morbidity. All these outcomes were explored in the overall population of fetuses with antenatal diagnosis of brain abnormalities. Sub-group analysis according to: type of treatment, gestational age and Quintero stage at diagnosis and/or treatment, co-twin death was planned. Meta-analyses of proportions were used to combine data and reported pooled proportion and their 95% confidence intervals (CI). **Results:** Thirteen studies including 1573 cases of TTTS and 88 fetuses with an antenatal diagnosis of brain abnormalities were included in the systematic review. The meta-analysis included only studies reporting on brain abnormalities in twin pregnancies complicated by TTTS cases and treated with laser. Overall, brain injuries occurred in 2.2% of fetuses (eight studies (52/2410 fetuses)). These brain abnormalities were reported in 1.03% and 0.82% of recipients or donors, respectively. These abnormalities were mainly ischemic lesions (30.4%, 95%CI 19.1-43), followed by destructive lesions (23.9%, 95%CI 13.7-35.9), ventriculomegaly (19.9%, 95% CI 10.6-31.3) and hemorrhagic (15.3%, 95%CI 7.1-25.8). Spontaneous IUD occurred in 13.4% (95%CI 5.1-24.8) of fetuses, while TOP was chosen by parents in 53.5% (95%CI 38.9-67.8) cases. Neonatal death was reported only by three studies with an incidence of 15.4% (95%CI 2.8-35.4). Finally, only two studies reported on composite morbidity with 20.4% of morbidity reported overall (95%CI 2.5-49.4) which occurred in 29.7% and 20.4% of the recipient and donor fetuses, respectively. Due to the small numbers, only composite morbidity was analyzed and no information on neonatal intensive care unit admission, respiratory distress syndrome or other long-term outcomes such as neurodevelopmental delay or cerebral palsy could be reliably retrieved. **Conclusions:** The overall incidence of antenatally diagnosed fetal brain abnormalities in fetuses from twin pregnancies complicated by TTTS treated with laser is around 2%, mainly ischemic (30.4%) in nature. TOP was chosen by parents in almost half of the cases (53.5%). No information could be retrieved on morbidity outcomes, highlighting the urgent need for long-term follow up studies of these children. This article is protected by copyright. All rights reserved.

PMID: [35233861](#)

## **24. Estimating life expectancy in severe cerebral palsy: Tools for doing it right**

Steven M Day

Dev Med Child Neurol. 2022 Mar 2. doi: 10.1111/dmcn.15192. Online ahead of print.

PMID: [35238021](#)

## **25. The Cognitive Orientation to daily Occupational Performance (CO-OP) Approach is superior to ordinary treatment for achievement of goals and transfer effects in children with cerebral palsy and spina bifida - a randomized controlled trial**

Marie Peny-Dahlstrand, Caisa Hofgren, Barbro Lindquist, Lena Bergqvist, Kate Himmelmann, Arve Opheim, Douglas Sjöwall, Katarina Brock, Ann-Marie Öhrvall

Disabil Rehabil. 2022 Mar 4;1-10. doi: 10.1080/09638288.2022.2043459. Online ahead of print.

**Purpose:** Children with cerebral palsy (CP) or spina bifida (SB) often have executive dysfunction affecting activity performance. With the Cognitive Orientation to daily Occupational Performance (CO-OP) Approach, children find their own way to perform activities, using problem-solving strategies and meta-cognitive thinking. The present study aimed to investigate the effectiveness of the CO-OP Approach in children with CP or SB, compared with conventional rehabilitation, in achieving self-identified activity goals, and to explore any generalization and transfer effects. **Method:** Randomized controlled trial, CO-OP versus treatment as usual, 38 children (7-16 years) participated. Each child identified four goals (to study generalization and transfer, one remained untrained). **Primary outcomes:** Canadian Occupational Performance Measure (COPM) and Performance Quality Rating Scale (PQRS). **Secondary outcomes** assessed executive functions and self-rated everyday-life competence. **Results:** Self-rated goal attainment (COPM) was significantly greater for both trained and untrained goals in the CO-OP group compared with the control group. The rating of observed performance (PQRS) was significantly higher for trained goals in the CO-OP group. The CO-OP group experienced fewer problems in everyday life after treatment. Executive functions did not differ significantly between groups. **Conclusion:** CO-OP is more effective than ordinary treatment in achieving both trained and untrained goals. **IMPLICATIONS FOR REHABILITATION** CO-OP enables children with CP (MACS levels I-III) or SB without intellectual disabilities to reach self-identified goals. CO-OP shows transfer effects to new activities and situations, which may enhance children's self-efficacy. CO-OP is an important complement to conventional rehabilitation services for children with CP and SB.

PMID: [35244504](#)

## 26. "Listen to us!" A qualitative study of adolescents with disabilities to help plan a transition service

Marina B Brandão, Kátia M P Bueno, Ana Paula M Silvério, Fernanda I T Antunes, Aline M Feitosa, Priscilla R P Figueiredo, Marisa C Mancini

Child Care Health Dev. 2022 Feb 28. doi: 10.1111/cch.12992. Online ahead of print.

**Background:** The development and implementation of transition services for adolescents with disabilities should incorporate perceptions of their needs and interests. The aim of the study was to understand the concerns of adolescents with physical disabilities during adolescence and their expectations regarding adulthood to help plan a transition programme in Brazil. **Methods:** This is a qualitative study, using a phenomenological approach. Eight adolescents with physical disabilities (seven with cerebral palsy, one with muscular dystrophy), aged between 15 and 17 years, participated in two focus groups. Prior to the conduction of the groups, clinicians selected topics related to adolescence and the transition to adulthood, based on their professional experience and available literature. During the focus groups, illustrative images of each topic were presented to the participants. Each adolescent was asked to select five topics that he/she considered important to be discussed in a future transition programme. The participants justified their individual choices and, in groups, reached a consensus on the groups' priorities. This strategy was chosen to motivate the discussion among the participants and to explore their concerns regarding adolescence and transition to adulthood. The focus groups were audio recorded and transcribed for content analysis. **Results:** Three themes emerged from the content analysis: (1) "Adolescents and their social relationships," (2) "Identity formation: self-awareness and development of autonomy," and (3) "What about adulthood?" **Conclusion:** The themes revealed conflicts between the adolescents' desire to achieve independence and autonomy and the awareness of their limitations. The interpretation of the results helped structuring the actions of the Adolescence in Focus Programme, with two main actions: promotion of the adolescent's functional performance in daily living activities and assistance with their identity formation and preparation for adulthood.

PMID: [35229345](#)

## 27. Maternal perception of spousal support in raising children with developmental disability in the context of family and child variables

Tayfun Kara, Ömer Alpgan

J Child Adolesc Psychiatr Nurs. 2022 Feb 25. doi: 10.1111/jcap.12372. Online ahead of print.

**Objective:** The purpose of this study was to examine the relationship between the variables of mental, physical, and emotional problems in children with developmental disabilities (DDs) and the spousal support perceived by the mothers of those children. **Methods:** One hundred forty-three children diagnosed with autism spectrum disorder (ASD, n:43), intellectual disability (ID, n:28), cerebral palsy (CP, n:47), or Down syndrome (DS, n:25) were included in this study. The support that mothers received

from their spouses was evaluated using the Spousal Support Scale (SSS). Aggressive behavior in the children was evaluated using the anger-aggression subscale of the Social Competence and Behavior Evaluation Scale (SCBE-30). The data obtained were then subjected to statistical comparisons. Results: Multiple comparisons revealed no significant difference between the DD diagnosis groups (ID, CP, ASD, and DS) in terms of spousal support or spousal support sub-dimension scores ( $p > 0.05$ ). Significant negative correlation was found between anger-aggression subscale scores and SSS sub-parameters (emotional support  $r = -0.315$   $p < 0.001$ , financial and informational support  $r = -0.285$   $p < 0.001$ , appreciation  $r = -0.299$   $p < 0.001$ , social support  $r = -0.381$   $p < 0.001$ , and spouse support score  $r = -0.389$   $p < 0.001$ ). Conclusion: Children's anger-aggression levels were adversely affected by a lack of spousal support for their mothers.

PMID: [35218093](#)

## 28. Grappling with uncertainty - Experiences of parents of infants following perinatal stroke

Umme Khan, Rose Watson, Janice Elizabeth Pearse, Louise Irwin, Tim Rapley, Anna Purna Basu

Res Dev Disabil. 2022 Feb 25;124:104201. doi: 10.1016/j.ridd.2022.104201. Online ahead of print.

Background: The term perinatal stroke describes focal damage to the developing brain due to cerebrovascular disease and occurring either before or shortly after birth. Aetiology, presentation and evolution differ from stroke in adults. Aims: We aimed to explore early parental experiences related to having a child with perinatal stroke, including how parental psychological wellbeing had been impacted, to consider how support for families could be improved. Methods and procedures: We undertook a qualitative research study, using in-depth interviews of parents of infants with perinatal stroke when the infants were 5-6 months corrected gestational age. Sixteen parents (11 female, 5 male) of 11 infants with perinatal stroke took part. Thematic analysis was used in data interpretation. Outcomes and results: Parents described distress related to the lack of information regarding likely outcome following perinatal stroke, as well as confusion around the term 'stroke'. Guilt and self-blame were expressed, with increased emotional sensitivity. Seeking information about stroke to reduce uncertainty was a useful strategy for some, but overwhelming for others. Conclusions and implications: The diagnosis of perinatal stroke led to psychological distress in parents. Uncertainty following diagnosis produced significant emotional difficulties. Recommendations for practice include providing timely, paced information and psychological support.

PMID: [35227987](#)

## 29. Effectiveness and safety of botulinum toxin in comparison with surgery for drooling in paediatric patients with neurological disorders: a systematic review

J P S Silva, L V Faria, R C Almeida, Y L Medeiros, L D A Guimarães

Review Br J Oral Maxillofac Surg. 2021 Oct 30;S0266-4356(21)00361-2. doi: 10.1016/j.bjoms.2021.10.010. Online ahead of print.

Different therapeutic methods for chronic drooling in paediatric patients with neurological problems have been described in the scientific literature. However, there is no consensus on the ideal strategy of treatment. The aim of this study was to compare botulinum toxin injection therapy and surgical modalities to control drooling in paediatric patients with neurological disorders. A systematic literature search was conducted on nine electronic databases for publications until April 2020. Six articles were included with a total sample of 209 patients, 67.4% ( $n = 141$ ) of whom had cerebral palsy. All studies used injections of botulinum toxin type A with application to the submandibular and/or parotid salivary glands. The surgical treatments were duct ligation in the parotid and/or submandibular salivary glands, duct relocation in the submandibular salivary glands, and glandular excision of the submandibular and sublingual salivary glands. There were complications in only 16.1% ( $n = 27$ ) of the sample (11 cases due to botulinum toxin application and 16 due to surgery). Drooling control was assessed by objective and subjective measures. Although surgical procedures presented a higher risk of adverse effects than botulinum toxin type A in all the studies and measurements performed, they presented larger and longer-lasting positive effects on drooling. We suggest bilateral submandibular duct relocation with bilateral sublingual gland excision or isolated bilateral submandibular duct ligation, which were the surgical techniques with the largest samples in this review. Nevertheless, further studies are necessary to compare samples with botulinum toxin type A and surgical treatment.

PMID: [35227530](#)

## 30. Neurodevelopmental Outcomes of Neonatal Rotavirus-Associated Leukoencephalopathy

Jae Young Cho, Jung Sook Yeom, Young-Soo Kim, Dae-Seob Choi, Ji Sook Park, Eun Sil Park, Ji-Hyun Seo, Jae-Young Lim, Hyang-Ok Woo, Chan-Hoo Park

Neuropediatrics. 2022 Mar 2. doi: 10.1055/s-0042-1742722. Online ahead of print.

Rotavirus infection has been reported to be associated with neonatal seizures with a diffuse and symmetrical diffusion restriction of periventricular white matter, namely, neonatal rotavirus-associated leukoencephalopathy. The extensive white matter injury seen in this cohort raises concerns about the long-term neurodevelopmental outcomes. In the present study, we prospectively assessed the neurodevelopmental outcomes of 13 patients with neonatal rotavirus-associated leukoencephalopathy at a median age of 26 months (range, 23-68 months). Neurodevelopmental outcomes were evaluated using a neurological examination, developmental evaluations, and magnetic resonance imaging (MRI) of the brain. Overall, 6 of the 13 patients (46%) had abnormal neurodevelopmental outcomes: 1 patient had mental retardation, visual-motor integration (VMI) dysfunction, cerebral palsy, and epilepsy; 1 patient had cerebral palsy and VMI dysfunction; remaining 4 patients had VMI dysfunction. Follow-up MRI in 12 of 13 patients showed an increased signal intensity on periventricular white matter in all patients. These findings suggested that neonatal rotavirus-associated leukoencephalopathy could not be assumed to be benign in long-term neurodevelopment, particularly in VMI function. Early intervention and long-term follow-up are necessary for these patients. Our findings raise caution for rotavirus infection in this vulnerable population for infants.

PMID: [35235991](#)