

Monday 7 November 2022

**Cerebral Palsy Alliance** is delighted to bring you this free weekly bulletin of the latest published research into cerebral palsy. Our organisation is committed to supporting cerebral palsy research worldwide - through information, education, collaboration and funding. Find out more at [cerebralpalsy.org.au/our-research](https://cerebralpalsy.org.au/our-research)

**Professor Nadia Badawi AM**  
CP Alliance Chair of Cerebral Palsy Research

[Subscribe to CP Research News](#)

## Interventions and Management

### 1. Upper limb manual training for children with cerebral palsy: A systematic review and network meta-analysis of randomized controlled trials

Fu-An Yang, Ting-Hsuan Lee, Shih-Wei Huang, Tsan-Hon Liou, Reuben Escorpizo, Hung-Chou Chen

Clin Rehabil. 2022 Nov 4;2692155221137698. doi: 10.1177/02692155221137698. Online ahead of print.

**Objective:** There are different upper limb manual training protocols, namely constraint-induced movement therapy, modified constraint-induced movement therapy, hand-arm bimanual intensive training, hand-arm bimanual intensive training including lower extremity, action observation training, and mirror therapy, available for improving functional outcomes in children with cerebral palsy. However, the effect and priority of these strategies remain unclear. **Data sources:** We searched the PubMed, Cochrane Library, and Embase databases for relevant articles from inception to October 12, 2022. **Review methods:** To assess the effect and priority of different strategies of upper limb manual training protocols through a systematic review and network meta-analysis of randomized controlled trials. **Results:** We included 22 randomized controlled trials in this network meta-analysis. The ranking probability and standard mean differences with 95% credible intervals of the comparison between placebo and other forms of upper limb manual training were as follows: mirror therapy = 2.83 (1.78, 3.88), hand-arm bimanual intensive training including the lower extremity = 0.53 (0.09, 0.96), constraint-induced movement therapy = 0.44 (0.18, 0.71), hand-arm bimanual intensive training = 0.41 (0.15, 0.67), modified constraint-induced movement therapy = 0.39 (0.03, 0.74), and action observation training = 0.18 (- 0.29, 0.65). No significant inconsistency was noted between the results of direct and indirect comparisons. **Conclusion:** We suggest that mirror therapy could be the upper limb manual training protocol of choice for improving functional outcomes in patients with cerebral palsy.

PMID: [36330696](https://pubmed.ncbi.nlm.nih.gov/36330696/)

### 2. An increase in relative contribution of compensatory postural adjustments during voluntary movement while standing in adolescents and young adults with bilateral spastic cerebral palsy

Hidehito Tomita, Yoshiki Fukaya, Daisuke Kawaguchi, Tadashi Ito, Yumi Aoki

Exp Brain Res. 2022 Nov 1. doi: 10.1007/s00221-022-06499-0. Online ahead of print.

Previous studies have revealed several deficits in anticipatory postural adjustments (APAs) during voluntary movements while standing in individuals with bilateral spastic cerebral palsy (BSCP). However, it remains unclear whether compensatory postural adjustments (CPAs) during movement increase to compensate for APA deficits. We investigated the anticipatory and compensatory activities of postural muscles during voluntary movement while standing in adolescents and young adults with BSCP. The study included seven participants with BSCP with level II on the Gross Motor Function Classification System (GMFCS), seven with BSCP with level III on the GMFCS, and fourteen healthy controls. The participants stood on a force

platform and lifted a load under two weight conditions (light and heavy). The electromyographic activities of postural muscles were analyzed at time intervals typical for APAs and CPAs. The percentage of muscle activity in the CPA time epoch against the total muscle activity during the APA and CPA time epochs was higher in the two BSCP groups than in the control group. In the control group, a load-related modulation was observed only in the APA time epoch, whereas in the BSCP-II group, the load-related increase was observed in both the APA and CPA time epochs. No load-related modulations were observed in the BSCP-III group. These findings suggest that adolescents and young adults with BSCP exhibit an increase in the relative contribution of CPAs during voluntary movement and that there exist severity-related differences in the modulation of APAs and CPAs.

PMID: [36318317](#)

### 3. Scoliosis assessment tools to reduce follow-up X-rays

Alexander T D Grünwald, Susmita Roy, Renée Lampe

J Orthop Translat. 2022 Oct 18;38:12-22. doi: 10.1016/j.jot.2022.07.010. eCollection 2023 Jan.

**Purpose:** Clinical examinations of scoliosis often includes X-rays. Regular clinical monitoring is recommended in particular at young age, because of the high risk of progression during periods of rapid growth. Supplementary methods free of ionizing radiation thus could help to reduce the potential risk of ionizing radiation related health problems. **Methods:** Twelve 3D scan images from female and male patients with different types and severities of spinal deformations were analysed using body scanner image analysis tools. The scan images were captured with a 3D body scanner, which used an infrared sensor and a video camera. To calculate and compare with the patient's specific spinal deformations, simulations based on finite elements methods were performed on biomechanical models of ribcage and spinal column. **Results:** The methods and parameters presented here are in good agreement with corresponding X-rays, used for comparison. High correlation coefficients of  $|\rho| \geq 0.87$  between Cobb angle and lateral deviation, as well as between Cobb angle and rotation of the vertebrae, indicate that the parameters could provide supplementary informations in the assessment of spinal deformations. So-called apex angles, in addition introduced to relate the results of the present method with Cobb angles, show strong correlations of  $|\rho| \geq 0.68$  and thus could be used for comparison in later follow-up examinations. **Conclusion:** The user-friendly 3D body scanner image analysis tools enable orthopaedic specialists to simulate, visualize and inspect patient's specific spinal deformations. The method is intended to provide supplementary information in complement to the Cobb angle for the assessment of spinal deformations in clinical daily routine and might have the potential to reduce X-rays in follow-up examinations. **The translational potential of this article:** The study presents a new method, based on 3D body scanner images and biomechanical modelling, that has the potential to reduce X-rays when monitoring scoliosis especially in young patients.

PMID: [36313977](#)

### 4. Efficacy of a Hip Brace for Hip Displacement in Children With Cerebral Palsy: A Randomized Clinical Trial

Bo Ryun Kim, Jin A Yoon, Hyun Jung Han, Young Il Yoon, Jiwoon Lim, Seungeun Lee, Seon Cho, Yong Beom Shin, Hyun Jung Lee, Jee Hyun Suh, Joonyoung Jang, Jaewon Beom, Yulhyun Park, Jung-Hwa Choi, Ju Seok Ryu

JAMA Netw Open. 2022 Nov 1;5(11):e2240383. doi: 10.1001/jamanetworkopen.2022.40383.

**Importance:** There is no consensus on interventions to slow the progress of hip displacement in patients with cerebral palsy. **Objective:** To investigate the efficacy of a novel hip brace in preventing progressive hip displacement in patients with cerebral palsy. **Design, setting, and participants:** This 2-group randomized clinical trial was conducted at 4 tertiary hospitals in South Korea from July 2019 to November 2021. Participants included children aged 1 to 10 years with nonambulatory cerebral palsy (Gross Motor Function Classification System level IV or V). Block randomization was used to assign an equal number of patients to the study and control groups via computerized random allocation sequences. Data were analyzed from November to December 2021. **Interventions:** The intervention group wore the hip brace for at least 12 hours a day for the study duration (ie, 12 months). Follow-up evaluations were performed after 6 and 12 months of wearing the brace. Both groups proceeded with conventional rehabilitation therapy during the trial. **Main outcomes and measures:** The primary outcome was the Reimers migration index (MI) on radiography, as assessed by 3 blinded investigators. Primary outcome variables were analyzed using linear mixed models. Secondary outcomes include change in the Caregiver Priorities & Child Health Index of Life with Disabilities, on which lower scores indicate better quality of life. **Results:** A total of 66 patients were included, with 33 patients (mean [SD] age, 68.7 [31.6] months; 25 [75.8%] boys) randomized to the intervention group and 33 patients (mean [SD] age, 60.7 [24.9] months; 20 [60.6%] boys) randomized to the control group. The baseline mean (SD) MI was 37.4% (19.3%) in the intervention group and 30.6% (16.3%) in the control group. The mean difference of the MI between the intervention group and

control group was -8.7 (95% CI, -10.2 to -7.1) percentage points at 6 months and -12.7 (95% CI, -14.7 to -10.7) percentage points at 12 months. The changes in the Caregiver Priorities & Child Health Index of Life with Disabilities were favorable in the study group and reached statistical significance at the 6-month follow-up compared with the control group (difference, -14.2; 95% CI, -25.2 to -3.3). Conclusions and relevance: In this randomized clinical trial, the novel hip brace was significantly effective in preventing the progression of hip displacement, compared with the control group. It effectively improved quality of life in patients with nonambulatory cerebral palsy. Therefore, hip brace use could be a promising treatment method to delay hip surgery and improve the quality of life of patients with nonambulatory cerebral palsy. Trial registration: ClinicalTrials.gov Identifier: NCT04033289.

PMID: [36331502](#)

### **5. Prosthetic femoral interposition arthroplasty with adult humeral implant, for children with cerebral palsy and symptomatic hips**

Finian Doyle, Michael D O'Sullivan, Peter Dawson, Evelyn Murphy, Paula Kelly, Noelle Cassidy

Surgeon. 2022 Oct 25;S1479-666X(22)00116-0. doi: 10.1016/j.surge.2022.09.006. Online ahead of print.

Background: Immobile patients with cerebral palsy can suffer with painful dislocated hips. Decision-making and surgical management can prove challenging in this cohort of patients, with hips that cannot be reconstructed. Methods: We conducted a retrospective chart review of all patients who underwent prosthetic femoral interposition arthroplasty (PFIA) by two surgeons from 2013 to 2021, for unreconstructable hips. We compared pain and range of motion in preoperative period to the postoperative period. Caregiver reported outcomes were used to assess satisfaction post operatively. During the follow up, radiographs of the PFIA were obtained to assess for proximal migration, heterotopic ossification and loosening of implants. Results: Eleven index surgeries, which met the inclusion criteria, were included in this study. These were performed in eleven patients with an average follow up of 45 months. Regarding pain and range of motion post-operatively an excellent or good result was seen in nine cases. Two patients were classified as having a fair result with none having a poor result. Most caregivers reported being satisfied or very satisfied with the post-operative outcomes. Conclusion: A prescriptive operative solution to the painful dislocated hip in children with spastic cerebral palsy remains elusive. In this study, we have demonstrated both clinically and radiologically satisfactory results post proximal femoral interposition arthroplasty, for those patients with unreconstructable hips. Patient caregiver reported outcomes, show that the majority of caregivers were satisfied or very satisfied with the outcome of the surgery.

PMID: [36307305](#)

### **6. Acute passive stretching has no effect on gastrocnemius medialis stiffness in children with unilateral cerebral palsy**

Clément Boulard, Vincent Gautheron, Thomas Lapole

Eur J Appl Physiol. 2022 Nov 1. doi: 10.1007/s00421-022-05046-7. Online ahead of print.

Purpose: The aim of this study was to investigate the effects of an acute high-intensity, long-duration passive stretching session of the plantar flexor muscles, on maximal dorsiflexion (DF) angle and passive stiffness at both ankle joint and gastrocnemius medialis (GM) muscle levels in children with unilateral cerebral palsy (CP). Methods: 13 children [mean age: 10 years 6 months, gross motor function classification system (GMFCS): I] with unilateral CP underwent a 5 min passive stretching session at 80% of maximal DF angle. Changes in maximal DF angle, slack angle, passive ankle joint and GM muscle stiffness from PRE- to POST-intervention were determined during passive ankle mobilization performed on a dynamometer coupled with shear wave elastography measurements (i.e., ultrasound) of the GM muscle. Results: Maximal DF angle and maximal passive torque were increased by 6.3° (P < 0.001; + 50.4%; 95% CI 59.9, 49.9) and 4.2 Nm (P < 0.01; + 38.9%; 95% CI 47.7, 30.1), respectively. Passive ankle joint stiffness remained unchanged (P = 0.9; 0%; 95% CI 10.6, - 10.6). GM muscle shear modulus was unchanged at maximal DF angle (P = 0.1; + 34.5%; 95% CI 44.7, 24.7) and at maximal common torque (P = 0.5; - 4%; 95% CI - 3.7, - 4.3), while it was decreased at maximal common angle (P = 0.021; - 35%; 95% CI - 11.4, - 58.5). GM slack angle was shifted in a more dorsiflexed position (P = 0.02; + 20.3%; 95% CI 22.6, 18). Conclusion: Increased maximal DF angle can be obtained in the paretic leg in children with unilateral CP after an acute bout of stretching using controlled parameters without changes in passive stiffness at joint and GM muscle levels. Clinical trial number: NCT03714269.

PMID: [36318307](#)

### 7. Test-retest reliability and minimal detectable change for measures of wearable gait analysis system (G-Walk) in children with cerebral palsy

Melek Volkan Yazıcı, Gamze Çobanoğlu, Gökhan Yazıcı

Turk J Med Sci. 2022 Jun;52(3):658-666. doi: 10.55730/1300-0144.5358. Epub 2022 Jun 16.

Background: Cerebral Palsy (CP) is the most frequent cause of physical disability in childhood. CP causes primary deficits such as impairments in muscle tone, muscle weakness, problems in selective motor control and secondary deficits such as contractures and deformities. These deficits lead to motor disorders during movement causing limitations in gait. Sixty percent of children with CP can walk independently despite these problems, however, they present with various gait abnormalities. Gait analysis is used in the quantitative assessment of gait disturbances providing functional diagnosis, assessment for treatment, planning, and monitoring of progress. G-Walk is a wearable sensor device which provides quantitative gait analysis via spatiotemporal parameters and pelvic girdle angles. In literature, there is no study investigating the reliability of the G-Walk in children with CP. The purpose of this study was to confirm the test-retest reliability of a commercially available body-worn sensor 'BTS G-WALK sensor system' for spatiotemporal gait parameters in children with CP. Methods: Fifty-four children with CP (mean age:  $9.19 \pm 3.49$  years), Gross Motor Function Classification System (GMFCS) level I-II completed the test-retest protocol with 5 days between tests. The test-retest reliability was calculated using intra-class correlation coefficients (ICC). Minimal detectable changes were calculated using standard error measurements. Results: According to the analysis, ICC varied from 0.799 to 0.977 in all of the gait parameters. The statistical analysis showed that all G-Walk parameters' measurements were found to have almost perfect test-retest reliability. Discussion: The G-Walk was found to be reliable in gait parameters for children with CP between ages 5 and 15, in GMFCS level I-II. A gait analysis carried out with the G-Walk system is a reliable method to assess gait in children with CP in a clinical setting.

PMID: [36326313](#)

### 8. Reliability and validity of the gait classification system in children with cerebral palsy (GCS-CP)

Alessandro G Melanda, Jon R Davids, Ana Carolina Pauleto, Alexandre R M Pelegrinelli, Alana Elizabeth Kuntze Ferreira, Luiz Alberto Knaut, Paulo Roberto G Lucareli, Suhaila Mahmoud Smali

Gait Posture. 2022 Sep 23;98:355-361. doi: 10.1016/j.gaitpost.2022.09.083. Online ahead of print.

Background: Gait classification systems (GCS) may enable clinicians to differentiate gait patterns into clinically significant categories that assist in clinical decision-making and assessment of outcomes. Davids and Bagley in 2014 [1] described a GCS for children with cerebral palsy (GCS-CP). The purpose of our study was to use the GCS-CP for the first time on a sample of patients with CP and to evaluate the reliability and utility of the classification system. Methods: The gait of 131 children with CP was retrospectively reviewed and classified according to Davids and Bagley's classification using two-dimensional (2D) video and three-dimensional (3D) lower limb kinematics and kinetics. Gross Motor Function Classification System (GMFCS) levels were determined, and the Gait Profile Scores (GPS) calculated to characterize the sample concerning gait classification. The comparison between the groups was performed using the Kruskal-Wallis test with respect to the non-normal distribution of the data. The intrarater and interrater reliability was determined using the Kappa index (k) statistics with 95% CI. Results: All GCS-CP groups were represented within the evaluated sample. Of the 131 cases evaluated, 127 (96.95%) were able to be classified with respect to sagittal plane stance phase gait deviations. All patients in the sample were able to be classified with respect to sagittal plane swing phase and transverse plane gait deviations. The interrater reliability was 0.596 and 0.485 for the first and second levels of the classification, respectively, according to the Fleiss's Kappa statistics. Intrarater reliability was 0.776 and 0.714 for the raters one and two, respectively, according to the Cohen's Kappa statistics. Significance: The GCS-CP exhibited clinical utility, successfully classifying almost all subjects with CP in two planes, based upon kinematic and kinetic data. The classification is valid and has moderate interrater and moderate to substantial intrarater reliability.

PMID: [36308864](#)

### 9. Use of shear wave elastography to analyze the muscle structure in children with spastic cerebral palsy

Pinar Doruk Analan, Hulya Aslan

J Pediatr Rehabil Med. 2022 Oct 22. doi: 10.3233/PRM-201511. Online ahead of print.

**Purpose:** In children with cerebral palsy (CP), gastrocnemius muscle spasticity may lead to pes equinus posture which causes insufficient ankle joint dorsiflexion for normal gait. The aim of this study was to analyze the stiffness of gastrocnemius and tibialis anterior muscles by shear wave elastography (SWE) in children with pes equinus deformity due to spastic CP. **Methods:** 24 legs of 12 children (6 females and 6 males, mean age 45.8 months) with CP were prospectively included in the study. Tissue stiffness quantification with shear-wave velocity (SWV) was analyzed. **Results:** The mean SWVs of the gastrocnemius and tibialis anterior muscles were  $3.91 \pm 0.26$  m/s and  $2.67 \pm 0.18$  m/s, respectively. The stiffness of the gastrocnemius muscle was significantly higher than the stiffness of the tibialis anterior muscle ( $p < 0.0001$ ). There was no correlation between the stiffness of these muscles ( $r = 0.129$ ,  $p > 0.05$ ). **Conclusion:** Gastrocnemius muscles were stiffer than tibialis anterior muscles in patients with spastic CP. But stiffness between these muscles was not correlated with each other. Pes equinus may be related to stiff gastrocnemius in these patients. This study demonstrates the clinical potential for SWE as a non-invasive tool for analyzing calf muscle stiffness.

PMID: [36314221](#)

### **10. Appraisal of the Effectiveness of Pelvic Proprioceptive Neuromuscular Facilitation Methods to Optimize Balance and Gait in an Eight-Year-Old Child**

Vikrant G Salphale, Rakesh K Kovala, Moh'd Irshad Qureshi

Case Reports Cureus. 2022 Sep 27;14(9):e29648. doi: 10.7759/cureus.29648. eCollection 2022 Sep.

Among the different variants of cerebral palsy (CP), spastic diplegia has a greater frequency than the other variants, with each subtype having a diverse clinical presentation. Pelvic asymmetry is observed frequently in children with spastic diplegia which influences the functional abilities of the child such as balancing abilities and independent walking. Currently, physical therapists tackle this condition through numerous strategies of treatment, with each treatment strategy having its own significance. This case report emphasizes the effectiveness of pelvic proprioceptive neuromuscular facilitation (PNF) techniques in optimizing the balance and gait parameters in an eight-year-old female child who presented with spastic diplegia. The child came into the outpatient Department of Neuro Physiotherapy with complaints of delay in attaining milestones according to her age as well as her inability to balance and walk on her toes. History revealed that there was a delayed cry pointing toward birth asphyxia and the linkage of birth asphyxia in the emergence of CP. Pelvic PNF has a beneficial impact on optimizing trunk control and stability. This research presents evidence that pelvic PNF optimizes the balancing capacities and gait parameters and rectifies the malalignment of the pelvis in children with spastic diplegia. The findings of this case report prove that pelvic malalignment which influences the balance and walking abilities of the child can be rectified and tackled with pelvic PNF techniques.

PMID: [36320954](#)

### **11. How many observations in the reference dataset are required to compute a consistent Gait Deviation Index & Gait Profile Score?**

Annie Pouliot-Laforte, Marys Franco Carvalho, Alice Bonnefoy-Mazure, Stéphane Armand

Gait Posture. 2022 Oct 19;99:51-53. doi: 10.1016/j.gaitpost.2022.10.012. Online ahead of print.

**Background:** The Gait Deviation Index (GDI) and the Gait Profile Score (GPS) are the most used scores to sum up gait deviations and are used as primary outcomes in many clinical studies. They are considered as equivalent scores. The computation of these scores is based on a reference dataset but often no description is provided. Among other characteristics, the number of observations needed and its possible influence on the computation of the scores remains unknown. **Research question:** Define the number of observations needed in the reference dataset to compute consistent and reliable GDI and GPS. **Methods:** Fifty individuals with cerebral palsy (CP) were randomly selected from our laboratory database. Both scores were computed based on the reference dataset of Schwartz et al. (2008). A bootstrap analysis was performed, for every individual, to assess the effect of the number of observations on both scores. N number of observations were randomly selected, with replacement, from the reference dataset. This procedure was repeated 2000 times for every individual and every N and performed from  $N = 5$  to  $N = 165$  with an increment of 5. The 95 % of the absolute error distribution was considered for every individual and every N. The smallest detectable change (SDC) for both scores was considered as a threshold (GDI: 10.8; GPS:  $1.3^\circ$ ) to determine the minimum N required. **Results and significance:** A minimum of 90 and 20 observations are required to compute consistent GDI and GPS, respectively. The number of observations has a higher impact on the GDI than the GPS, mainly because the GPS calculation does not rely on the standard deviation (SD). Furthermore, the GDI absolute error seems to



be higher in individuals with greater gait deviations, i.e. lower GDI value. This effect was not observed on the GPS. In the case of a small reference dataset, the GPS should therefore be preferred.

PMID: [36327538](#)

### **12. The challenge point framework to improve stepping reaction and balance in children with hemiplegic cerebral palsy: A case series study**

Somayeh Ashouri, Amir Letafatkar, Abbey C Thomas, Rasoul Yaali, Mino Kalantari

J Pediatr Rehabil Med. 2022 Oct 22. doi: 10.3233/PRM-201522. Online ahead of print.

**Purpose:** This study investigated the effects of the challenge point framework (CPF) to improve stepping reactions and enhance balance in children with hemiplegic cerebral palsy (HCP). The CPF relates practice variables to the skill level of the individual and task difficulty. **Methods:** Nine children with HCP (age:  $7.7 \pm 2.4$  years) completed six weeks (12 sessions) of a CPF intervention which consisted of progressively fewer sets and repetitions of a stepping reaction task wherein participants sought to improve both step length and reaction rate. Stepping reaction (step length and reaction rate) to a balance perturbation in the anterior, posterior, and lateral directions and static and dynamic balance (via the Pediatric Balance Scale) were measured at baseline, a second baseline 3 weeks later, and post-intervention. Repeated measures ANOVAs determined within-group changes. Cohen's d effect sizes were calculated. **Results:** Participants improved balance ( $d = 0.948$ ,  $p = 0.010$ ), step length (forward  $d = 0.938$ ,  $p = 0.002$ ; backward  $d = 0.839$ ,  $p = 0.001$ ; and lateral  $d = 0.876$ ,  $p = 0.002$ ), and reaction rate (forward  $d = 0.249$ ,  $p = 0.042$ ; backward  $d = 0.21$ ,  $p = 0.047$ ; and lateral  $d = 0.198$ ,  $p = 0.049$ ). **Conclusion:** These findings indicate that children with HCP may benefit from completing a CPF program with a motor learning approach. This approach of retraining stepping reactions helped to improve static and dynamic balance. The CPF may aid progression of functional task training in children with HCP aged 4-12, though more studies with a long-term follow-up analysis are needed to confirm this result.

PMID: [36314222](#)

### **13. The effects of power exercises on body structure and function, activity and participation in children with cerebral palsy: an ICF-based systematic review**

Ozgun Kaya Kara, Ceren Gursen, Sebahat Yaprak Cetin, Elif Nur Tascioglu, Seda Muftuoglu, Diane L Damiano

Disabil Rehabil. 2022 Oct 31;1-14. doi: 10.1080/09638288.2022.2138575. Online ahead of print.

**Purpose:** To systematically review the literature for evidence of effectiveness of power exercises on physical, physiological, and functional outcomes in children and adolescents with cerebral palsy (CP). **Materials and methods:** Methodological quality and evidence synthesis were assessed with using the Cochrane Risk of Bias (RoB) Tools and Modified Bakker Scale. Using the International Classification of Functioning (ICF), outcome measures for muscle agriculture, gait, balance, motor function, aerobic/anaerobic fitness, daily living, mobility, and school participation were categorised. **Results:** The overall RoB of four randomised clinical trials was low, one had some concerns and two were rated as high. Moderate evidence was found that power exercises increased walking speed, activities of daily living, muscle strength, and enhanced gross motor function more than a routine physical therapy program. **Conclusions:** The lack of stronger evidence for power training interventions to improve muscle architecture, muscle function, walking capacity, and mobility in children with CP might be explained by the differences in training protocols and degree to which these meet the physiological definition of power, different methods of measuring power, limited durations of training, and the relative effectiveness of control interventions. **Future studies should include a stronger focus on child and family-centred participation goals. Implications For Rehabilitation:** Power training can improve gross motor function, walking speed, muscle strength, and activities of daily living more than routine physical therapy. Results comparing power training versus traditional strength training were less pronounced likely because both are intensive and may have positive effects. More research is needed to investigate effects of power training on participation.

PMID: [36314560](#)

#### **14. Time-matched accelerometers on limbs and waist in children with CP give new insights into real-life activities after botulinum toxin treatment: A proof of concept study**

Stefan Gantelius, Sandra Vikerfors, Josefin Jansson Edqvist, Ferdinand von Walden, Maria Hagströmer, Eva Pontén

**Purpose:** This study aimed to explore the feasibility of using time-matched uniaxial accelerometers for measuring movement in daily life in children with cerebral palsy (CP) before and after botulinum toxin injections. **Methods:** This observational study of clinical care with a pre-post design was set in the home and school environment. Participants included eleven children (4-13 years of age) with CP (GMFCS I-III). The children wore uniaxial accelerometers (ActiGraph, model GT1M) for 4 days on both wrists, the right ankle and around the waist before, 3 weeks and 3 months after BoNT-A injections in the legs. Five children also got BoNT-A in the most affected arm. All injections were given according to clinical indications and routine. The accelerometers were all time-matched to define ambulation, arm swing, voluntary activity of arms, and bimanual activity. The feasibility of wearing accelerometers with this setup was evaluated. A linear mixed model was used for analysis of the percentage time and at which intensity the different activities were performed. The confidence interval demonstrated any difference between the dominant and non-dominant arm. **Results:** Time-matching of accelerometers placed on both wrists, the waist, and one ankle is a feasible method of registering ambulation, arm swing during gait, and arm movements while not ambulating. Before injections, the children spent 5.6% of their time ambulating. This value declined to 3.9% at 3 months. Contrary to clinical goals, arm movement did not increase after injecting the most affected arm with BoNT-A, however, injections may have decreased mirror movements, which are often bothersome for the child. **Conclusion:** A time-matched 4-accelerometer set-up is feasible in children with cerebral palsy. A future study including time-matched multi-axial accelerometers on all four limbs, could provide important information on the effect of BoNT-A in daily life.

PMID: [36314229](#)

#### **15. Effect of the cognitive orientation to daily occupational performance (CO-OP) Approach for children with cerebral palsy: A randomized controlled trial**

Zeynep Kolit, Gamze Ekici

J Pediatr Rehabil Med. 2022 Oct 22. doi: 10.3233/PRM-210085. Online ahead of print.

**Purpose:** The study aimed to examine the effects of "Cognitive Orientation to daily Occupational Performance" (CO-OP) approach in terms of performance and satisfaction as well as functional status in children with cerebral palsy (CP) receiving neurodevelopmental treatment (NDT) and determine the parents' satisfaction level. **Methods:** Thirty-two children with CP were randomized to experimental (n = 16) or control (n = 16) groups, with n = 2 dropouts. Therapy was applied twice a week for five weeks. The experimental group received a CO-OP plus NDT, while the control group received only NDT. **Results:** No baseline differences existed, except for years of schooling, which was higher in the experimental group. After treatment, there were statistically significant and clinically meaningful improvements in occupational performance and function, favouring children who received 5-weeks of CO-OP plus NDT over NDT alone ( $p < 0.05$ ). **Conclusion:** CO-OP is expected to be beneficial if incorporated into CP rehabilitation.

PMID: [36314226](#)

#### **16. Reliability and validity of the Dutch-language version of the Viking Speech Scale in children with cerebral palsy**

Irene E M Spaans, Joke J M Geytenbeek, Emma Vaillant, Maaike A M C de Kleijn, Annemieke I Buizer, Lindsay Pennington

Child Care Health Dev. 2022 Nov 3. doi: 10.1111/cch.13076. Online ahead of print.

**Purpose:** The Viking Speech Scale is used to classify speech performance in children with cerebral palsy (CP). A Dutch-language version (VSS-NL) has recently become available. This study aimed to determine the reliability and validity of the VSS-NL and the association with motor type of CP, Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS), Communication Function Classification System (CFCS). **Methods:** A total of ninety children with CP, recruited throughout the Netherlands, took part in the study. VSS-NL classifications by speech and language therapists unfamiliar (SLT1) and familiar (SLT2) with the child, parents, and physicians were compared. Convergent and discriminant validity were determined with the Intelligibility in Context Scale-Dutch (ICS-NL) and the Computer Based Instrument for Low Motor Language Testing (C-BiLLT). Inter- and intrarater reliability were determined by weighted Kappa ( $\kappa_w$ ). Validity and associations between VSS-NL and GMFCS, MACS and CFCS were determined with Spearman's

coefficient. Association between VSS-NL and motor type of CP was determined with Fisher's exact test. Results: Interrater reliability was excellent between SLT1-SLT2 ( $\kappa = 0.93$ , 95% confidence interval [CI] 0.87-0.99), good between SLT1-parent ( $\kappa = 0.71$ , 95% CI 0.60-0.83), SLT1-physician ( $\kappa = 0.70$ , 95% CI 0.58-0.81), SLT2-parent ( $\kappa = 0.71$ , 95% CI 0.57-0.84), SLT2-physician ( $\kappa = 0.73$ , 95% CI 0.62-0.85) and parent-physician ( $\kappa = 0.72$ , 95% CI 0.60-0.85). Intrarater reliability was excellent for SLTs familiar and unfamiliar to the child ( $\kappa = 1.00$ , 95% CI 1.00-1.00), and very good for physicians ( $\kappa = 0.89$ , 95% CI 0.75-1.00) and parents ( $\kappa = 0.72$ , 95% CI 0.62-1.00). Convergent validity was very strong ( $r = -0.81$ ,  $p < 0.001$ ) and discriminant validity moderate ( $r = -0.56$ ,  $p < 0.001$ ). Association with motor type of CP was significant ( $\chi^2 = 27.558$ ,  $p < 0.001$ ) and strong with GMFCS ( $r = 0.62$ ,  $p < 0.001$ ), MACS ( $r = 0.63$ ,  $p < 0.01$ ) and CFCS ( $r = 0.69$ ,  $p < 0.001$ ). Conclusion: The VSS-NL is a reliable and valid system to classify speech performance in children with cerebral palsy. Classifications can be performed by SLTs, parents and physicians.

PMID: [36327098](#)

### **17. Salivary gland surgery and nonviral respiratory-related hospitalizations in children with neurodevelopmental impairment**

Diane W Chen, Kathleen R Billings, Jonathan B Ida, Jennifer Lavin, Saied Ghadersohi, Taher Valika

Int J Pediatr Otorhinolaryngol. 2022 Oct 17;163:111362. doi: 10.1016/j.ijporl.2022.111362. Online ahead of print.

Objectives: Neurodevelopmentally impaired (NI) children with chronic sialorrhea are at elevated risk for aspiration and respiratory tract infections. Direct resection or ligation ("DROOL") of the submandibular glands (SMG) with parotid duct ligation are surgical interventions intended to decrease salivary output. The objective of this study is to determine the impact of DROOL surgery on the incidence of nonviral respiratory-related (NVR) post-procedure hospital encounters including emergency department visits and admissions. Methods: Retrospective case series of NVR related outcomes after DROOL surgery in children performed at a single institution, tertiary referral center. Results: A total of 35 gastrostomy tube-dependent patients (60% male, average age 8.2 [SD 6.0] years) with NI underwent DROOL surgery (86% SMG excision). Pre- and post-surgical follow-up time was 3.6 and 3.2 years, respectively. Presurgical and postsurgical NVR hospital encounters occurred in 28 (80%) and 14 (40%) patients, respectively ( $p < 0.01$ ). Mean (SD) postoperative NVR hospital encounters occurred less frequently when compared to presurgical period (0.4 [0.6] vs. 1.0 [1.2] per year,  $p < 0.01$ ) with average change of -0.7 encounters per year (SD 1.4, 95% CI -1.0 to -0.2). Patients with encounters within a year preceding DROOL (OR 4.9,  $p = 0.04$ , 95% CI 1.1-22.8), or those with at least 3 preoperative encounters (OR 8.0,  $p = 0.01$ , 95% CI 1.6-40.3) were significantly associated with a postsurgical NVR event. Fewer patients used anti-sialorrhea medication postoperatively compared to preoperatively (60% vs. 17%,  $p < 0.01$ ). No patient developed surgical site complications requiring operative interventions. Conclusions: DROOL surgery for chronic sialorrhea in patients with NI was associated with decreased hospitalization and ED visits for NVR respiratory events post-procedurally. Sialorrhea may be an actionable source of recurrent respiratory illnesses requiring hospitalizations.

PMID: [36327912](#)

### **18. Effect of oral motor facilitation technique on oral motor and feeding skills in children with cerebral palsy : a case study**

Kyoung-Chul Min, Sang-Min Seo, Hee-Soon Woo

BMC Pediatr. 2022 Nov 3;22(1):626. doi: 10.1186/s12887-022-03674-8.

Background: Deficiencies in oral motor function and feeding skills are common in children with cerebral palsy (CP). Oral motor therapy is a useful method to improve oral motor function and feeding skills. Oral motor facilitation technique (OMFT) is a newly designed comprehensive oral motor therapy, including postural control, sensory adaptation, breathing control, sensorimotor facilitation, and direct feeding. Methods: This study was performed to identify the effect of OMFT on oral motor function and feeding skills in children with CP. A total of 21 children with CP (3-10 years, GMFCS III-V) participated in 16 weeks (16 sessions) of OMFT. The effects on oral motor function and feeding skills were assessed using the Oral Motor Assessment Scale (OMAS) before the treatment, 8 and 16 weeks after OMFT. Data were analyzed using the Friedman test and post-hoc analysis. Results: Significant improvement was found in oral motor function and feeding skills including mouth closure, lip closure on the utensil, lip closure during deglutition, control of the food during swallowing, mastication, straw suction, and control of liquid during deglutition after OMFT. Mouth closure was the most effective and mastication was the least effective item. Sixteen weeks is more effective than 8 weeks of OMFT. Conclusion: OMFT could be an effective and



useful oral motor therapy protocol to improve oral motor function and feeding skills in children with CP.

PMID: [36324103](#)

### **19. Dietary fiber and probiotics based on gut microbiota targeting for functional constipation in children with cerebral palsy**

Congfu Huang, Jinli Lyu, Chunuo Chu, Lan Ge, Yuanping Peng, Zhenyu Yang, Shenghua Xiong, Bin Wu, Xiao Chen, Xiaowei Zhang

Front Pediatr. 2022 Oct 6;10:1001789. doi: 10.3389/fped.2022.1001789. eCollection 2022.

Gastrointestinal (GI) disorders are very common among children with cerebral palsy. Gut microbiota has been confirmed to maintain normal GI physiological function and further contributed to cerebral palsy through the gut-brain axis. Our study was to investigate the effect of dietary fiber combined with probiotics on functional constipated children with cerebral palsy. In total, 35 patient children were enrolled and divided into general diet group (n = 14) and liquid diet group (n = 21). All the participants received Compound Dietary Fiber (CDF) for 1 month and lactic acid-producing and butyric acid-producing probiotics for 6 months. After a 1-month intervention, the frequency of spontaneous and manual defecation, and Bristol score were all significantly improved ( $P < 0.001$ ). The  $\alpha$ -diversity of the gut microbiota was significantly increased after a 1-month intervention ( $P < 0.05$ ), with a higher abundance of butyric acid-producing bacteria and a lower abundance of opportunistic pathogens ( $P < 0.05$ , FDR  $< 0.05$ ). However, the impersistent effect of the 6-month intervention suggested the insufficient impact of intaking probiotics alone and the short duration of CDF intervention. Moreover, although the intervention had affected the constipation symptoms equally in cerebral palsy children with a general diet and liquid diet, the general diet group showed a greater and more durable change in gut microbiota and clinical phenotypes after intervention than the liquid diet group, which indicated that longer intervention time should be considered for liquid diet children. This study not only illustrated that supplementation of dietary fiber combined with probiotics can improve functional constipation in children with cerebral palsy, but also provides guidance for optimal intervention strategy for future studies, which will further benefit cerebral palsy children. Clinical trial registration: <http://www.chictr.org.cn/showproj.aspx?proj=46902>, identifier: ChiCTR1900028257.

PMID: [36313885](#)

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

No authors listed

Dev Med Child Neurol. 2022 Nov 3. doi: 10.1111/dmcn.15450. Online ahead of print.

No abstract available

PMID: [36325961](#)

### **21. Child engagement in daily life measure V2: validation of psychometric properties for children with cerebral palsy**

Lisa A Chiarello, Mohammed S Alghamdi, Sarah Westcott McCoy, Lisa Avery, Robert J Palisano

Disabil Rehabil. 2022 Nov 2;1-10. doi: 10.1080/09638288.2022.2140849. Online ahead of print.

Purpose: Measurement development is a reiterative process requiring refinements and revalidation. The purpose of this study was to examine structural validity and reliability of the Child Engagement in Daily Life Measure (Version 2) for parents of children with cerebral palsy (CP) across a broader age span. Methods: Participants were 1054 parents of children with CP 1.5-11 years of age. Parents completed the Child Engagement in Daily Life measure that consists of the Participation in Family and Recreational Activities domain (11 items) and the Performance of Self-care Activities domain (18 items) as part of two longitudinal studies related to outcomes for children with CP. Results: Rasch analysis indicated acceptable fit of items, stable item calibration, and logical ordering of items by difficulty for both frequency of participation in family and recreational

activities and performance of self-care activities. Test-retest reliability was good to excellent: ICC = 0.78 for frequency of participation, ICC = 0.68 for enjoyment of participation, and ICC = 0.97 for self-care. Conclusions: Evidence supports reliability and validity of the Child Engagement in Daily Life Measure (Version 2) for parent-report of their children's participation in family and recreational activities and performance of self-care activities for children with CP 1.5-12 years of age. IMPLICATIONS FOR REHABILITATION: Participation in family and recreational activities and performance of self-care activities of children with cerebral palsy can be assessed using the concise parent-report Child Engagement in Daily Life Measure V2. Knowledge of the continuum of difficulty of the frequency of participation in family and recreational activities and performance of self-care activities can assist practitioners in progressing service plans. Practitioners are encouraged to use the measure to guide discussions with parents and children on areas to focus services to support participation in family and recreational activities and performance of self-care activities.

PMID: [36322490](#)

## 22. Validity and Reliability of the Turkish Version of the KIDSCREEN-27 for Individuals With Cerebral Palsy

Hasan Bingol, Mintaze Kerem Gunel, Sinem Asena Sel, Eda Burc, Hande Fidan

Percept Mot Skills. 2022 Nov 1;315125221136947. doi: 10.1177/00315125221136947. Online ahead of print.

Our aims in this study were to examine the construct/concurrent validity and internal/test-re-test reliabilities of both the self-report and parent-report questionnaires of a Turkish version of the KIDSCREEN-27 for adolescents with cerebral palsy (CP). We used a convenience sample of 135 children and adolescents with CP aged 8-18 years (65 males, 70 females; M age = 12.39, SD = 3.57) and their parents/caregivers (123 mothers, seven fathers, and five grandmothers). We explored structural construct validity via confirmatory factor analysis (CFA). Concurrent validity was examined via Spearman's correlations between the KIDSCREEN-27 questionnaires and the self-report and primary caregiver report forms of the Cerebral Palsy Quality of Life for Children (CP QOL-Child) and adolescents (CP QOL-Teen). We explored test-retest and internal consistency reliabilities utilizing intraclass correlation coefficients (ICC) and Cronbach's alpha ( $\alpha$ ), respectively. CFA goodness-of fit indices verified that the predefined model of the KIDSCREEN-27 was a good fit for data from the CP population ( $X^2/df < 5$ , GFI  $> 0.90$ , AGFI  $> 0.90$ , RMSEA  $< 0.80$ ). Results showed the subdomains of both KIDSCREEN-27 forms to be significantly correlated with the matched subdomains of the CP QOL-Child and CP QOL-Teen questionnaires (ranges of  $r = 0.62-0.94$ ). Overall,  $\alpha$  and ICC coefficients for all subdomains of both KIDSCREEN-27 versions were acceptable ( $\alpha$  and ICC  $> 0.70$ ). Both versions of the KIDSCREEN-27 have satisfactory psychometric properties for use in evaluating health-related quality of life (HRQOL) outcomes in children and adolescents with CP.

PMID: [36318645](#)

## 23. Effectiveness of virtual reality on functional mobility during treadmill training in children with cerebral palsy: a single-blind, two-arm parallel group randomised clinical trial (VirtWalkCP Project)

Mirari Ochandorena-Acha, Marc Terradas-Monllor, Tania Fabiola Nunes Cabrera, Meritxell Torrabias Rodas, Sergi Grau

BMJ Open. 2022 Nov 3;12(11):e061988. doi: 10.1136/bmjopen-2022-061988.

Introduction: Treadmill training and virtual reality have been investigated in children with cerebral palsy. However, few studies have assessed the effectiveness of the combination of both treatments on children's functional and balance activities. The project aims to compare the effects of treadmill training with and without virtual reality on walking endurance and speed, static and dynamic balance, gross motor function, functional independence, quality of life and occupational participation in children with spastic cerebral palsy between the ages of 4 and 12 years classified at levels I, II and III of the Gross Motor Function Classification System. Methods and analysis: This study is a single-blind, two-arm parallel group, randomised, controlled clinical trial. Participants will be recruited at the Pediatric Department of the Vic Hospital Consortium, and the research will be conducted at the University of Vic - Central University of Catalonia. The participants will be randomly allocated into two groups: (1) the experimental group, which will receive the treadmill training at the same time as the virtual reality; and (2) the control group, which will undertake treadmill gait training alone. The training will be provided in 10 sessions over 2 weeks with 30 min for each session. Assessments will be performed on three occasions: 1 week before the intervention, 1 week following the intervention and 1 month after the end of the intervention. The evaluations will involve the 6 min walk test, stabilometry, the Berg Balance Scale, the 10 m walk test, the Gross Motor Function Measure, the Functional Independence Measure, the paediatric quality of life inventory and the Children Participation Questionnaire. For between-within group comparison, a mixed-effect linear model will be used. Ethics and dissemination: The study has been approved by the Clinical

Research Ethics Committee of the Osona Foundation for Health Research and Education (2021061). Results will be published in peer-reviewed journals and presented at international conferences. Trial registration number: NCT05131724.

PMID: [36328390](#)

#### **24. A Systematic Review of Randomized Controlled Trials on Virtual Reality Application in Pediatric Patients**

Ashish Varma, Waqar M Naqvi, Salima Mulla, Samana Syed, Sumit Thakur, Sakshi P Arora, Anuj R Varma, Smruti Besekar

Review Cureus. 2022 Oct 21;14(10):e30543. doi: 10.7759/cureus.30543. eCollection 2022 Oct.

Virtual reality is a novel approach for distracting and alleviating anxiety, pain, and other complications during medical procedures, and it can be more effective than conventional methods. In virtual reality, the patient is completely immersed in the virtual environment, which is used to make patients feel more comfortable and can provide a positive prognosis. The data were searched by using the Boolean operator "AND" between the search phrases "Virtual reality," and "Pediatrics" and the relevant literature was extracted. The inclusion criteria were the free full text, randomized controlled trials, studies between 2016 and 2022 and pediatric patients. This systematic review was conducted to compare randomized controlled trials of virtual reality applications in pediatric patients in different clinical settings. Of the included 15 randomized controlled trials, 12 studies were on pain and anxiety, two on brain injury and cerebral palsy, and one on awareness among asthmatic patients. This review concluded that virtual reality exposure has a beneficial effect on pediatric patients in reducing pain and anxiety, improving muscle strength and dexterity, and awareness among asthmatic patients.

PMID: [36320795](#)

#### **25. Cognitive assessments among children with cerebral palsy in Sweden and the use of augmentative and alternative communication and interpreters: a cross-sectional registry study**

Elisabeth O'Regan, Kristine Stadskleiv, Tomasz Czuba, Ann I Alriksson-Schmidt

Disabil Rehabil. 2022 Oct 29;1-12. doi: 10.1080/09638288.2022.2138571. Online ahead of print.

Purpose: Children with cerebral palsy (CP) have an increased risk of cognitive difficulties and should be offered cognitive assessments. In Sweden, the CPCog protocol recommends children with CP undergo cognitive assessments at the start of primary and secondary school. To assess children with CP can be challenging, in particular when children are non-vocal or do not speak the local language. In such instances, augmentative and alternative communication (AAC) and qualified medical interpreters should be considered. The purpose of this study was to monitor the implementation and equitable delivery of the CPCog protocol in Sweden between the years 2017-2020. Materials and methods: In this cross-sectional study, registry data were extracted from the combined follow-up program and national registry for individuals with CP (CPUP), and a convenience sample of psychologists responded to an online survey. Results and conclusions: Each year, less than 5% of eligible children had registered cognitive assessments in CPUP. There was underuse of AAC during assessments and a discrepancy between the registered versus reported use of interpreters. Psychologists perceived AAC as more reliable for cognitive assessments than interpreters. Greater availability of and capacity to offer cognitive assessments in other formats and languages could help increase test accessibility for all children with CP. Implications for Rehabilitation: The cognitive assessment of children with cerebral palsy (CP) is a complex but important issue within disability and re/habilitation. Individualized cognitive assessments should be offered and carried out by psychologists. Rehabilitation centers should strive to be inclusive through reliable test adaptations for functional abilities, means of communication, and language. Greater availability of- and capacity to offer cognitive assessments in more formats and languages could help increase test accessibility for children with disabilities.

PMID: [36308310](#)

#### **26. Association of Nogo-A gene polymorphisms with cerebral palsy in Southern China: a case-control study**

Yuxin Wang, Lu He, Jingyu Huang, Jinling Li, Liru Liu, Yunxian Xu, Tingting Peng, Xubo Yang, Yiting Zhao, Chaoqiong Fu, Shiya Huang, Hongmei Tang, Kaishou Xu

Dev Neurosci. 2022 Nov 2. doi: 10.1159/000527801. Online ahead of print.

Cerebral palsy (CP) is a motor and postural disorder syndrome caused by the nonprogressive dysfunction of the developing brain. Previous studies strongly indicated that the Nogo-A gene might be related to the pathogenesis of CP. The objective of this research was to explore the relationship between Nogo-A polymorphisms (rs1012603, rs12464595 and rs2864052) and CP in Southern China. The Hardy-Weinberg equilibrium (HWE) testing, allele and genotype frequencies analysis, and haplotype association analysis were applied to the genotyping of 592 CP children and 600 controls. The results showed that the allele and genotype frequencies of rs1012603 of CP group were significantly different from the control group. The haplotype "TTGGG" was significantly associated with an increased risk of CP. The allele frequencies of rs1012603 were significant differences between CP with spastic diplegia, female CP cases and controls. Furthermore, significant differences in allele and genotype frequencies were also noticed between GMFCS I of CP and controls for rs1012603, and significant differences in allele and genotype frequencies were observed between the ADL (>9) of CP and controls for rs1012603, and rs12464595. This study showed that the SNPs rs1012603 of Nogo-A were significantly correlated with CP, and the correlations were also found in spastic diplegia, GMFCS I of CP, ADL (>9) of CP and female subgroups, indicating that Nogo-A might mainly affected mild types of CP and there might be sex-related differences.

PMID: [36323241](#)

### **27. Lessons Learned from the Japan Obstetric Compensation System for Cerebral Palsy: A Novel System of Data Aggregation, Investigation, Amelioration, and No-Fault Compensation**

Shin Ushiro, Antonio Ragusa, Riccardo Tartaglia

In: Textbook of Patient Safety and Clinical Risk Management [Internet]. Cham (CH): Springer; 2021. Chapter 33. 2020 Dec 15.

Cerebral palsy is a pathological condition whose prevention and treatment have been immensely studied by experts in perinatal medicine and pediatric neurology. Despite this, it is still one of the main concerns nowadays in many countries, not only for scientific reasons but for legal ones also. For instance, in Japan, an increase in lawsuits relating to cerebral palsy was observed more than a decade ago, after healthcare resources in perinatal medicine had increasingly shrunk and had become fragile under the growing burden for physicians and midwives to provide advanced treatment, emergent care, high-risk treatment, and so on. Young physicians did not specialize in obstetrics because of the increased burden, which gave rise to a vicious cycle of shrinking resources in perinatal medicine. To address this issue, the Japan Obstetric Compensation System for Cerebral Palsy (JOCS-CP) was urgently introduced in 2009 to investigate, develop preventive measures, and award monetary compensation on a no-fault basis, with the Japan Council for Quality Health Care (JQ) as its operating organization (Fig. 33.1). It has so far produced annual reports on the prevention of cerebral palsy for nine consecutive years including numerical data and specific themes relating to the occurrence and prevention of cerebral palsy. The success of the system is a good reference for responding to adverse events which may happen in and have a vast impact on perinatal care. Therefore, this chapter focuses on cerebral palsy with primary reference to materials published by the JOCS-CP in the field of perinatal medicine. The aim of this chapter is to learn about the issues mentioned above and to discuss the significance and impact of introducing a nationwide system like the JOCS-CP. It describes knowledge and idea to questions of "Why cerebral palsy is highlighted among adverse event in obstetrics?", "How the no-fault compensation/investigation/prevention system could be introduced?", "What has been achieved by the system?", and "How cerebral palsy is prevented?".

PMID: [36315744](#)

### **28. Identifying racial disparities in care for children with spastic cerebral palsy: A single center study**

Alecia K Daunter, Jessica Prunte, Angeline Bowman, Daniel G Whitney

J Pediatr Rehabil Med. 2022 Oct 22. doi: 10.3233/PRM-210094. Online ahead of print.

Purpose: Existing evidence identifies racial and ethnic disparities impacting the prevalence and severity of cerebral palsy (CP). There is a paucity of literature examining the impact on associated treatment. Methods: In this retrospective cohort study, an institutional database search identified outpatient encounters for pediatric patients with spastic CP. Additional filters were used to determine treatments received. For each treatment, the proportion of African American (AA) patients receiving treatment was compared to the proportion of Caucasian (C) patients receiving the same treatment. Results: 3,686 children with spastic CP

were seen in outpatient clinics associated with an academic tertiary hospital over a 21-year period. There was no significant difference between the proportion of any treatment compared to the entire sample for AA or C patients. Conclusion: In this sample, there was no significant evidence of a racial disparity for AA patients receiving treatments for spasticity. This data is limited by several factors. Further research is needed to determine whether pediatric patients with disabilities are receiving equitable care. Clinicians should consider systematically monitoring their practices to identify areas of bias or inequity in accessing care.

PMID: [36314227](#)

### 29. Preterm Brain Injury and Neurodevelopmental Outcomes: A Meta-analysis

Philippa Rees, Caitriona Callan, Karan R Chadda, Meriel Vaal, James Diviney, Shahad Sabti, Fergus Harnden, Julian Gardiner, Cheryl Battersby, Chris Gale, Alastair Sutcliffe

Pediatrics. 2022 Nov 4;e2022057442. doi: 10.1542/peds.2022-057442. Online ahead of print.

Context: Preterm brain injuries are common; neurodevelopmental outcomes following contemporary neonatal care are continually evolving. Objective: To systematically review and meta-analyze neurodevelopmental outcomes among preterm infants after intraventricular hemorrhage (IVH) and white matter injury (WMI). Data sources: Published and gray literature were searched across 10 databases between 2000 and 2021. Study selection: Observational studies reporting 3-year neurodevelopmental outcomes for preterm infants with IVH or WMI compared with preterm infants without injury. Data extraction: Study characteristics, population characteristics, and outcome data were extracted. Results: Thirty eight studies were included. There was an increased adjusted risk of moderate-severe neurodevelopmental impairment after IVH grade 1 to 2 (adjusted odds ratio 1.35 [95% confidence interval 1.05-1.75]) and IVH grade 3 to 4 (adjusted odds ratio 4.26 [3.25-5.59]). Children with IVH grade 1 to 2 had higher risks of cerebral palsy (odds ratio [OR] 1.76 [1.39-2.24]), cognitive (OR 1.79 [1.09-2.95]), hearing (OR 1.83 [1.03-3.24]), and visual impairment (OR 1.77 [1.08-2.9]). Children with IVH grade 3 to 4 had markedly higher risks of cerebral palsy (OR 4.98 [4.13-6.00]), motor (OR 2.7 [1.52-4.8]), cognitive (OR 2.3 [1.67-3.15]), hearing (OR 2.44 [1.42-4.2]), and visual impairment (OR 5.42 [2.77-10.58]). Children with WMI had much higher risks of cerebral palsy (OR 14.91 [7.3-30.46]), motor (OR 5.3 [3-9.36]), and cognitive impairment (OR 3.48 [2.18-5.53]). Limitations: Heterogeneity of outcome data. Conclusions: Mild IVH, severe IVH, and WMI are associated with adverse neurodevelopmental outcomes. Utilization of core outcome sets and availability of open-access study data would improve our understanding of the nuances of these outcomes.

PMID: [36330752](#)

### 30. Mortality and neurodevelopmental outcomes of infants with spontaneous intestinal perforation: a systematic review and meta-analysis

Ju Li Ang, Chandra Prakash Rath, Herr Tan, Sanjay Patole, Shripada C Rao

Arch Dis Child Fetal Neonatal Ed. 2022 Nov 3;fetalneonatal-2022-324157. doi: 10.1136/archdischild-2022-324157. Online ahead of print.

Background: There is limited information about the mortality and neurodevelopmental outcomes of very preterm infants (<32 weeks) with spontaneous intestinal perforation (SIP). Objective: To explore the association between SIP and neurodevelopmental outcomes and mortality in very preterm infants. Data sources: Medline, EMBASE, Cochrane Library, EMCARE and MedNar. Study selection: Databases were searched until September 2021. Studies comparing outcomes of 'SIP' versus 'no SIP or necrotising enterocolitis (NEC)' were included. Data extraction: Neurodevelopmental outcomes at  $\geq 1$  year corrected age were extracted as the main outcome measure. Data were pooled separately for adjusted and unadjusted ORs using the random-effects model. The evidence level was assessed using the GRADE (Grading of Recommendations, Assessments, Development and Evaluations) framework. Results: Eighteen cohort studies (13 606 infants) were included. Meta-analysis of unadjusted ORs showed that SIP was significantly associated with increased odds of mortality, cerebral palsy, composite outcome of death or disability, visual impairment and hearing impairment. However, pooling of adjusted ORs (aOR) found significant associations only for mortality (aOR (95% CI) 2.27 (2.07 to 2.49); I<sup>2</sup>: 0%; four studies (n=10 695)), severe disability (aOR (95% CI) 2.06 (1.38 to 3.08); I<sup>2</sup>: 0%; two studies (n=321)) and composite outcome of 'death or disability' (aOR (95% CI) 2.18 (1.55 to 3.06); I<sup>2</sup>: 0%; two studies (n=321)). The level of evidence was 'low' or 'very low'. Limitations: Lack of information on aORs from many studies. Conclusions: SIP in very preterm infants is associated with higher odds of mortality, severe disability, and death or disability.

PMID: [36328412](#)



### 31. Review of Necrotizing Enterocolitis and Spontaneous Intestinal Perforation Clinical Presentation, Treatment, and Outcomes

Laura A Rausch, David N Hanna, Anuradha Patel, Martin L Blakely

Review Clin Perinatol. 2022 Dec;49(4):955-964. doi: 10.1016/j.clp.2022.07.005. Epub 2022 Oct 9.

The Necrotizing Enterocolitis Surgery Trial (NEST) highlights the importance of distinguishing necrotizing enterocolitis (NEC) from spontaneous intestinal perforation (SIP) when developing surgical treatment plans. Further research is needed to increase the accuracy of this distinction, but even with our current abilities to do this initial laparotomy appears to be optimal for infants with presumed NEC. The preferred initial operation for those with SIP is more equivocal. Rates of NEC are likely decreasing slowly, whereas those with SIP are not. New imaging modalities, especially ultrasound, are becoming more useful but require more detailed investigation. Understanding the mechanisms causing these two conditions remains of paramount importance.

PMID: [36328610](#)

### 32. Do Children With Congenital Zika Syndrome Have Cerebral Palsy?

Alessandra Carvalho, Egmar Longo, Cristiana Nascimento-Carvalho, Nayara Argollo, Kátia Edni Coelho, Aline Sampaio, Carlos Brites, Rita Lucena

Glob Health Sci Pract. 2022 Oct 31;10(5):e2100575. doi: 10.9745/GHSP-D-21-00575. Print 2022 Oct 31.

No abstract available

PMID: [36316149](#)

### 33. Paraoxonase-1 and fetuin-A levels in children with cerebral palsy

Özlem Unay Demirel, Özlem Güngör, Seyda İğnak Tarlığ, Meral Yüksel

Turk J Med Sci. 2022 Jun;52(3):803-808. doi: 10.55730/1300-0144.5376. Epub 2022 Jun 16.

Background: Studies mostly focused on risk factors and clinical status in children with cerebral palsy (CP). Various antiinflammatory markers may help us in the early diagnosis and clinical classification of cerebral palsy patients. In this study, the relationship between antiinflammatory marker levels and clinical status in patients with CP is determined. It is the first time that Fetuin-A and Paraoxonase-1 (PON-1) are examined in children with CP. Methods: The study is conducted on 79 children which are divided into two groups as CP and control. Gross motor function and spasticity are evaluated in addition to biochemical parameters. Results: There is a statistically significant difference between CP and control group in terms of PON-1 activity, high sensitive C-Reactive Protein, HDL, and total cholesterol levels. There is no statistically significant difference in Fetuin A levels between the two groups. Discussion: In suspected CP patients less than 24 months of age who possess prenatal and postnatal risk factors, the determination of PON-1 activity can be considered as a biomarker to support early diagnosis.

PMID: [36326319](#)

### 34. Semi-supervised body parsing and pose estimation for enhancing infant general movement assessment

Haomiao Ni, Yuan Xue, Liya Ma, Qian Zhang, Xiaoye Li, Sharon X Huang

Med Image Anal. 2022 Oct 14;83:102654. doi: 10.1016/j.media.2022.102654. Online ahead of print.

General movement assessment (GMA) of infant movement videos (IMVs) is an effective method for early detection of cerebral palsy (CP) in infants. We demonstrate in this paper that end-to-end trainable neural networks for image sequence recognition can be applied to achieve good results in GMA, and more importantly, augmenting raw video with infant body parsing and pose estimation information can significantly improve performance. To solve the problem of efficiently utilizing partially labeled IMVs for body parsing, we propose a semi-supervised model, termed SiamParseNet (SPN), which consists of two branches, one for intra-frame body parts segmentation and another for inter-frame label propagation. During training, the two branches are jointly trained by alternating between using input pairs of only labeled frames and input of both labeled and unlabeled frames. We also investigate training data augmentation by proposing a factorized video generative adversarial network (FVGAN) to synthesize novel labeled frames for training. FVGAN decouples foreground and background generation which allows for generating multiple labeled frames from one real labeled frame. When testing, we employ a multi-source inference mechanism, where the final result for a test frame is either obtained via the segmentation branch or via propagation from a nearby key frame. We conduct extensive experiments for body parsing using SPN on two infant movement video datasets; on these partially labeled IMVs, we show that SPN coupled with FVGAN achieves state-of-the-art performance. We further demonstrate that our proposed SPN can be easily adapted to the infant pose estimation task with superior performance. Last but not least, we explore the clinical application of our method for GMA. We collected a new clinical IMV dataset with GMA annotations, and our experiments show that our SPN models for body parsing and pose estimation trained on the first two datasets generalize well to the new clinical dataset and their results can significantly boost the convolutional recurrent neural network (CRNN) based GMA prediction performance when combined with raw video inputs.

PMID: [36327657](#)

### **35. Early screening tool for developmental delay in infancy: Quantified assessment of movement asymmetry using IR-UWB radar**

Jae Yoon Na, Won Hyuk Lee, Young-Hyo Lim, Seok Hyun Cho, Sung Ho Cho, Hyun-Kyung Park

Front Pediatr. 2022 Oct 14;10:731534. doi: 10.3389/fped.2022.731534. eCollection 2022.

In the uncontact COVID-19 era, the feasibility of a noncontact, impulse-radio ultrawideband (IR-UWB) radar sensor has important medical implications. Premature birth is a major risk factor for brain injury and developmental delay; therefore, early intervention is crucial for potentially achieving better developmental outcomes. Early detection and screening tests in infancy are limited to the quantification of differences between normal and spastic movements. This study investigated the quantified asymmetry in the general movements of an infant with hydrocephalus and proposes IR-UWB radar as a novel, early screening tool for developmental delay. To support this state-of-the-art technology, data from actigraphy and video camcorder recordings were adopted simultaneously to compare relevant time series as the infant grew. The data from the three different methods were highly concordant; specifically, the  $\rho$  values comparing radar and actigraphy, which served as the reference for measuring movements, showed excellent agreement, with values of 0.66 on the left and 0.56 on the right. The total amount of movement measured by radar over time increased overall; movements were almost dominant on the left at first (75.2% of total movements), but following shunt surgery, the frequency of movement on both sides was similar (54.8% of total movements). As the hydrocephalus improved, the lateralization of movement on radar began to coincide with the clinical features. These results support the important complementary role of this radar system in predicting motor disorders very early in life.

PMID: [36313883](#)

### **36. The Dyskinesia Impairment Scale, Second Edition: Development, construct validity, and reliability**

Inti Vanmechelen, Annika Danielsson, Cecilia Lidbeck, Kristina Tedroff, Eleggast Monbaliu, Lena Krumlinde-Sundholm

Dev Med Child Neurol. 2022 Oct 31. doi: 10.1111/dmcn.15444. Online ahead of print.

**Aim:** To create a shortened, more user-friendly Second Edition of the Dyskinesia Impairment Scale (DIS-II) to assess dystonia and choreoathetosis, and evaluate its construct validity and reliability. **Method:** Scale development included an online expert meeting ( $n = 21$ ) and iterative discussions within the research group ( $n = 6$ ). A Rasch measurement model analysis on DIS scores from individuals with dyskinetic cerebral palsy or inherited/idiopathic dystonia ( $n = 123$ , 74 males, mean age 14 years, SD 5 years) was performed to evaluate the construct validity and reliability of the DIS-II. **Results:** The DIS-II evaluates dystonia and choreoathetosis in action and rest in 11 body regions, with action items scored from 0 to 3 and rest items 0 to 2. The number of videos to record are reduced from 26 to 14 and the items to score are reduced from 144 to 88. Rating scale functioning, goodness-of-fit evaluation, principal component analysis, and targeting met the predefined quality criteria of the

study and construct validity was therefore considered good. Furthermore, person reliability indicated that the DIS-II can separate individuals into eight distinct ability levels. Interpretation: The DIS-II provides valid and reliable measures for dystonia and choreoathetosis, and reduces the administration and scoring time compared with the DIS. The DIS-II logit scores (interval level data) enhance comparison over time and between individuals in clinical practice and research.

PMID: [36310446](#)

### **37. DMCN 2022 highlights: Applying global perspectives to paediatric disability research**

Bernard Dan

Editorial Dev Med Child Neurol. 2022 Dec;64(12):1430-1431. doi: 10.1111/dmcn.15417.

No abstract available

PMID: [36316294](#)

---

## **Prevention and Cure**

---

### **38. Review on Prevention of Cerebral Palsy from the Perspective of Social Pediatrics**

Özlem Tezol, Sıddıka Songül Yalçın

Turk Arch Pediatr. 2022 Nov;57(6):591-598. doi: 10.5152/TurkArchPediatr.2022.22213.

Cerebral palsy is a static encephalopathy with multiple etiologies. Several interventions toward perinatal risk factors, intrapartum asphyxia, and head injury or infection have been evaluated in order to deal with irreversible brain damage. Antenatal-intrapartum and neonatal interventions mainly focus on preventing hypoxia, oxidative stress, inflammation, and growth restriction. Among these preventive interventions, magnesium sulfate for neuroprotection of the fetus in women at risk of preterm birth and therapeutic hypothermia (cooling of body or just brain) for newborns with hypoxic-ischemic encephalopathy have effectively reduced cerebral palsy risk. There is still a lack of literature on the effectiveness of preventive interventions toward postnatally acquired brain injury. Social pediatricians are concerned with identifying, reducing, or eliminating risk factors of cerebral palsy and encourage a comprehensive approach to providing integrated and personalized care to children with cerebral palsy with the support of their families and communities.

PMID: [36314954](#)