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# Cerebral palsy research news

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## Interventions and Management

**1.Effects of Symmetry and Age on Bilateral Upper-Limb Coordination in Children with Unilateral Cerebral Palsy**

Cassandra J Kemmel-Bartletti, Karin Goodfriend, Meghann Sytsma, Sheila Schindler-Ivens, Samuel T Nemanich

J Mot Behav. 2026 Jan 2:1–11. Online ahead of print.

**Abstract**
Bilateral movements are important for daily function and are impaired in children with unilateral cerebral palsy (UCP). Prior work has established that coordination is dependent on symmetry demands between the limbs. We examined how symmetry impacted bilateral coordination, and as an exploratory aim, compared age-related differences in upper-limb (UL) coordination in children with UCP to children with typical development (TD). Using an instrumented cycling device, participants performed bilateral UL cycling in symmetric or asymmetric patterns. Metrics of inter-limb (phase error) coordination were compared between groups (TD or UCP) and with respect to age (young: 7–9 years; older: 13–15 years). Children with UCP had poorer inter-limb coordination in both symmetric (50.88°) and asymmetric (93.22°) bilateral tasks compared to TD children. Younger children, regardless of group, had poorer inter-limb coordination for the asymmetric (32.54°) bilateral task only. Regression modeling revealed UCP, age, and unilateral coordination ability were significantly associated with asymmetric bilateral coordination. The results indicate that bilateral coordination skills reflect atypical processes related to UCP and typical age-related motor development, particularly for more complex asymmetric tasks. Altogether, this research confirms children with UCP have impaired bilateral coordination and highlights potential for future work to study developmental changes in this population.
PMID: 41482733

**2. Validity and reliability of the Hand10 questionnaire in children with unilateral cerebral palsy**

Rabia Zorlular, Bulent Elbasan

Appl Neuropsychol Child. 2025 Dec 31:1–8. Online ahead of print.

Aim: The Hand10 questionnaire is used to assess upper extremity functions through 10 daily activity items and is designed for clarity with visual content that enhances comprehension. This study aimed to determine the validity, test-retest reliability, and internal consistency of the Hand10 in children with unilateral cerebral palsy (uCP). Methods: The Hand10 was tested for validity and internal consistency with 63 children with uCP and their families, aged 6 to 15 years. Additionally, 43 children and their families were re-interviewed two weeks later to determine test-retest reliability. Concurrent validity was examined by correlating scores on Hand10 and ABILHAND-Kids. Results: The Hand10 was strongly correlated with ABILHAND-Kids-Total score ($p < 0.001$, $r = 0.766$). The Hand10 showed excellent test-retest reliability (ICC = 0.96, 95%CI: 0.92–0.97) and high internal consistency for the total score ($\alpha = 0.92$). For all items, item-total correlations were adequate (corrected item-total correlations, 0.62–0.80). The Hand10 score showed a statistically significant difference between the Manual Ability Classification System levels ($p < 0.001$). Conclusion: The Hand10 demonstrates excellent reliability and strong validity in assessing manual dexterity during daily activities in children with uCP.
PMID: 41475395

**3.The lower limb coordination, brain activation during walking and their correlation in adolescents with spastic cerebral palsy: A pilot cross-sectional fNIRS study**

Fenyan Zhou, Liuxin Qi, Wei Sun, Jiangna Wang

Res Dev Disabil. 2025 Dec 30;168:105197. Online ahead of print.

Background: This study aimed to explore the lower limb coordination and brain activation in adolescents with cerebral palsy (CP) during walking, and to investigate their relationship. Methods: Eight adolescents with spastic CP were recruited as the CP group and eight typically developing adolescents as the control group. Functional near-infrared spectroscopy (fNIRS) and the Vicon motion capture system were used to collect hemodynamic signals and kinematic data during walking. Results: The mean absolute value of the continuous relative phase values of the hip-knee joint was lower, but deviation phase values of hip-knee and knee-ankle joints were higher. Activation levels of the supplementary motor area, pre-central gyrus, post-central gyrus, and superior parietal lobe were higher. The deviation phase of the hip-knee joint was positively correlated with the superior parietal lobe and right post-central gyrus; the deviation phase of the knee-ankle joint was positively correlated with the right post-central gyrus. In the control group, the continuous relative phase of the knee-ankle joint was positively correlated with the right pre-central and post-central gyri. The deviation phase of the hip-knee joint was positively correlated with the right supplementary motor area but negatively correlated with the left superior parietal lobe. Conclusion: Adolescents with CP exhibit higher variability in hip-knee and knee-ankle coordination patterns and greater activation demands of the sensorimotor cortex during walking. Overactivation of the parietal cortex may contribute to increased coordination variability.
PMID: 41475314

**4. Mechanical energetics of different sagittal gait patterns in children with bilateral spastic cerebral palsy**

Kosar Barati, Farzam Farahmand, Saeed Behzadipour

J Biomech. 2025 Dec 27;195:113142. Online ahead of print.

**Abstract**
Children with cerebral palsy (CP) often exhibit inefficient gait; however, the relationship between their distinct sagittal gait patterns and this inefficiency remains unclear. This study examined mechanical energy characteristics in 148 children with bilateral spastic CP, classified into Crouch, Apparent Equinus, Jump, and True Equinus patterns, and compared them with 19 typically developing controls. Three-dimensional gait data were collected using motion capture. An extended inverted pendulum framework assessed deviations of kinetic and potential energy waveforms from optimal energy exchange during single support. Results indicated that amplitude-related inefficiency was most pronounced in the Crouch pattern and least in True Equinus, although both showed higher amplitude ratios than controls. All CP subgroups had positive time lags and reduced continuous relative phase values, indicating impaired phase coordination. These inefficiencies resulted in significantly greater total energy fluctuations, cost of transport, and reduced energy recovery, particularly in Crouch and Jump patterns. Findings provide gait-pattern-specific biomechanical markers relevant for targeted interventions.
PMID: 41475051

**5.Development of a set of core outcome measures for ambulant children with cerebral palsy after lower limb orthopaedic surgery**

Hajar Almoajil, Sally Hopewell, Helen Dawes, Francine Toye, Rakhshan Kamran, Tim Theologis

Dev Med Child Neurol. 2025 Dec 29. Online ahead of print.

Aim: To develop consensus on a core set of standardized outcome measures to be applied to each domain of the previously developed core outcome set for lower limb orthopaedic surgery for ambulant children with cerebral palsy (CP). Method: This work consisted of the following three steps: (1) a scoping review of the literature to identify previously used outcome measures to assess lower limb orthopaedic surgery of ambulant children with CP; (2) searching the COnsensus-based Standards for the selection of health Measurement Instruments (COSMIN) and PubMed databases to assess the quality of the psychometric properties of outcome measures and feasibility criteria; and (3) a consensus meeting with seven healthcare professionals with expertise in CP research and in the assessment of outcome measure psychometric properties was held in September 2021. Consensus on the outcome measures core set was developed through presentation of the evidence and whole-group discussions. Results: A combination of clinician-driven and patient-reported outcome measures was considered the most appropriate way to assess the outcome of orthopaedic surgical interventions. Agreement was reached on seven core outcome measures: three-dimensional gait analysis, Edinburgh Visual Gait Scale, Gross Motor Function Measure, Gait Outcome Assessment List, Gillette Functional Assessment Questionnaire, Patient-Reported Outcome Measure Instrument System (pain interference, and fatigue), and Cerebral Palsy Quality of Life for Children questionnaire. Interpretation: This study recommends a set of core outcome measures for use in research on lower limb orthopaedic surgery for ambulant children with CP. Consistent use of this core set would enhance validity and comparability of future research.
PMID: 41460157

**6.Commentary on "Lower Limb Training Threshold Dose and Motor Learning Strategy Reporting in Children With Cerebral Palsy"**

Amy F Bailes, Michael Clay, Gina Rolle

Pediatr Phys Ther. 2026 Jan 1;38(1):19. doi: 10.1097/PEP.0000000000001272. Epub 2025 Dec 30.

No abstract available
PMID: 41460989

**7.The Relationship Between Postural Control and Fundamental Movement Skills in Children With Developmental Coordination Disorder, Mild Cerebral Palsy, and Typical Development**

Charlotte Johnson, Ann Hallemans, Pieter Meyns , Silke Velghe , Erik Fransen, Katrijn Klingels, Evi Verbecque

Phys Ther . 2025 Dec 22:pzaf150. doi: 10.1093/ptj/pzaf150.

**Importance:** Impaired fundamental movement skills are prevalent among children with developmental coordination disorder (DCD) and mild cerebral palsy (CP). Although postural control is a prerequisite for gross motor skills, its role in fundamental movement skills is understudied. **Objective:** This study aims to determine the extent to which postural control contributes to fundamental movement skill performance in children with DCD, mild CP, and with typical development (TD). **Design:** This was a case-control study. **Participants:** Participants were 127 children aged 5.0 to 10.9 years (DCD [N = 48], TD [N = 59)], mild spastic CP [N = 20]). Children with CP were classified as Gross Motor Function Classification System (GMFCS) I (N=11) or II (N=9), and as having either unilateral (N=11 or bilateral CP(N= 9). **Main outcomes and measures:** The Test of Gross Motor Development-3 (TGMD-3) evaluated fundamental movement skills, and the Kids-Balance Evaluation Systems Test-2 (Kids-BESTest-2) assessed postural control. The domain and total scores of both tests were used for analysis. **Results:** Children with TD significantly outperformed those with DCD and mild CP, while DCD and mild CP performed similarly. Across groups the Kids-BESTest-2 and TGMD-3 correlated significantly (r = 0.42 - r = 0.77). The total Kids-BESTest-2 score and group (TD-DCD-mild CP) explained 69% of locomotor skill variance but did not significantly explain ball skill performance (R2 = 0.40). Among postural control domains, only anticipatory postural adjustments contributed to fundamental movement skills. Group effects were larger ($\eta p2$ = 0.15-0.31) than the effects of Kids-BESTest-2 scores ($\eta p2$ = 0.01-0.12). **Conclusions and relevance:** The findings suggest that postural control plays a role in locomotor performance but that unique group-specific factors influence this relationship. Further research should investigate the impact of postural control task-oriented training on fundamental movement skills, and should examine the influence of additional factors, such as body functions and environmental influences on fundamental movement skill development.
PMID: 41427869

**8. Acute effects of a rehabilitation dog on walking ability, confidence, safety and enjoyment in children with cerebral palsy**

Valerie L Caron, Sarah J Donkers, Joel L Lanovaz, Romany Pinto, Colleen A Dell, Alison R Oates

Disabil Rehabil. 2026 Jan 2:1–12. Online ahead of print.

Purpose: Children with cerebral palsy (CP) face challenges in their walking and balance, which can be addressed through rehabilitation. Working with a rehabilitation dog as dynamic walking support as part of rehabilitation is novel, but the influence of a rehabilitation dog on walking is unknown in CP. Method: A repeated-measures, single time point design included ambulatory (GMFCS I-II) children with CP (n = 11; 7–18 years). Spatiotemporal parameters including speed, cadence, step length, and relative (%) stance, swing, and double-support (DS) time were measured while participants walked with (WD) and without (ND) a rehabilitation dog. Visual Analog Scales (VAS) captured perceived change in enjoyment, confidence, safety, and comfort while walking WD and ND. Paired t-tests evaluated differences between walking WD and ND. Results: Spatiotemporal parameters were highly variable WD and ND with no significant differences in means and SDs. VAS scores significantly increased ($p \geq 0.05$) for enjoyment, comfort, and safety when walking with the dog. Conclusion: Walking with a rehabilitation dog significantly improves children's perceived comfort, safety, and enjoyment when walking. Spatiotemporal walking parameters might be affected by walking with the dog. Further evaluation of interventions incorporating a rehabilitation dog would inform how a service dog could impact walking rehabilitation and performance.
Plain language summary
Children with cerebral palsy safely walked with a rehabilitation dog, enhancing comfort, safety, and enjoyment during a first-time interaction.Children with cerebral palsy safely walked with a rehabilitation dog, enhancing comfort, safety, and enjoyment during a first-time interaction.Responses to walking with a rehabilitation dog varied across children with cerebral palsy, underscoring the need for individualized assessment of gait and postural changes.Clinicians should monitor spatiotemporal variability and walking speed when working with rehabilitation dogs to ensure walking performance is not negatively impacted.

PMID: 41481394

**9.Effects of exercise on cognitive function in Cerebral Palsy: A systematic review and Bayesian meta-analytic dose-response modeling**

Qiuxue Pan, Shaoqi Zheng, Jiamin Liang

J Health Psychol. 2025 Dec 31. Online ahead of print.

**Abstract**
This systematic review and meta-analysis evaluated the effects of exercise on cognitive function in individuals with cerebral palsy (CP). Studies were identified from five databases, with the final search on March 15, 2025. Pooled results suggested exercise may improve cognitive performance and daily functioning, although evidence remains limited due to few studies, modest effect sizes, and methodological variability. Subgroup analyses indicated greater improvements in participants over 12 years, while working memory appeared less responsive. Moderate-to-vigorous intensity interventions tended to be beneficial, whereas programs involving virtual reality or combined cognitive-physical components yielded inconsistent findings. Bayesian dose-response modeling indicated a non-linear relationship between exercise volume and cognitive outcomes, with optimal effects around 580 MET-minutes per week, beyond which improvements plateaued. These findings highlight exercise as a promising non-pharmacological approach to support cognition in CP, while underscoring the need for further high-quality studies to confirm modality- and intensity-specific recommendations.

PMID: 41474387

**10.Ultrasound Assessment of Diaphragmatic Function in Children With Cerebral Palsy: A Cross-Sectional Observational Case-Control Study**

Dolors Casellas-Vidal, Inés Osiniri, Raquel Font-Lladó, Maria Camós-Carreras, Aintzane Ruiz-Eizmendi, Juan Serrano-Ferrer, Joaquim Casellas, Abel López-Bermejo, Anna Prats-Puig

Health Sci Rep. 2025 Dec 25;9(1):e71644. eCollection 2026 Jan.

Background and aims: Children with cerebral palsy (CP) are vulnerable to respiratory infections and chronic airway inflammation, which leads to diminished respiratory function. This decline is exacerbated by muscle tone abnormalities and reduced strength, worsening as CP progresses. Traditional lung function tests are often impractical for those with severe cognitive and motor impairments. Diaphragm evaluation through ultrasound imaging emerges as a non-invasive, easy-to-apply technique for assessing respiratory function in CP children. This study aimed to evaluate diaphragm function in CP and typically developing (TD) children using ultrasound, focusing on diaphragm thickness and excursion parameters. The study also explored factors influencing respiratory function, particularly the number of lower respiratory tract infections (LRTI). Methods: The study included 10 CP (11.2; range 4–17 years) and 12 TD children (8.9 years; range 4–13 years). M-mode ultrasound assessed diaphragm thickness, thickening fraction (TF), and inspiratory slope (IS). Additionally, data on demographics, anthropometrics, medical history, and physical examination were collected. Results: The intra-operator reliability for diaphragm ultrasound measurements showed good to excellent consistency (over 0.86). Significant differences were found between CP and TD children; CP children exhibited lower excursion and IS, with a non-significant trend towards reduced diaphragm thickness. LTRI were associated with decreased excursion and IS, and increased TF in CP children. Conclusions: Diaphragmatic ultrasound is a non-invasive, reproducible tool for assessing respiratory function in both CP and TD children, even in cases of severe cognitive and motor impairment. It effectively identifies diaphragm dysfunction associated with LRTI.
PMID: 41458372

**11.Commentary on "Picture Me Moving: Photovoice Study of Children With Motor Disabilities Using Modified Ride-on Toy Cars"**

Hsiang-Han Huang , Hsuan-Wen Huang , Yu-Ning Lin

Pediatr Phys Ther. 2026 Jan 1;38(1):87.  Epub 2025 Dec 30.

*No abstract available*
PMID: 41460998

**12.Picture Me Moving: A Photovoice Study of Families and Children With Motor Disabilities Using Modified Ride-on Toy Cars**

Reham A Abuatiq, Heather A Feldner

Pediatr Phys Ther. 2026 Jan 1;38(1):78–86.

Purpose: We investigated the long-term impact and use, from the families' perspectives, of modified ride-on cars for children with motor disabilities. Method: We used Participatory Action Research using photovoice methods with 13 families of young children with disabilities. Families collaborated as coresearchers by capturing photographs representing their experiences and sharing their meanings. Inductive thematic analysis was used. Results: We identified four themes: (1) opening doors for inclusion; (2) facilitating exploration and fun; (3) hopes for the future; and (4) challenges in design and functionality. Conclusion: Photovoice method effectively captured families' experiences with modified ride-on cars. Despite design and functionality limitations, on-time use of modified ride-on cars is valuable for play, learning, exploration, mobility, and engagement for children with motor disabilities and their families.
PMID: 41460997

**13. Cross-cultural adaptation, validation and reliability of the Turkish version of Child engagement in daily life measure V2 for children with cerebral palsy**

Hayriye Simsek Ozguner, Berat Meryem Alkan, Derya Gokmen, Seren Aktas

Disabil Rehabil. 2026 Jan 1:1–16. Online ahead of print.

Purpose: This study aimed to translate the Child Engagement in Daily Life-Version 2 (CEDL-V2) into Turkish and evaluate the psychometric properties, including cultural adaptation, reliability, and validity of the Turkish version (CEDL-V2-T) in children with cerebral palsy (CP). Methods: The CEDL-V2 was translated and culturally adapted following international guidelines. Internal consistency and test-retest reliability were examined. Construct validity was assessed using Rasch analysis and known-groups validity across Gross Motor Function Classification System (GMFCS) levels and age groups. Results: The psychometric properties were tested in a sample of 272 children with CP and 100 typically developing children (TDC), aged 1.5–12 years. Internal consistency was high (Cronbach's α = 0.89–0.98; person separation index = 0.92–0.98). Test-retest reliability was good to excellent for the Frequency (ICC = 0.827, 95%CI = 0.723–0.895), fair to excellent for the Enjoyment (ICC = 0.778, 95%CI = 0.647–0.864), and excellent for the Self-Care (ICC = 0.969, 95%CI = 0.948–0.982). Children with CP scored significantly lower than TDC in all domains, with variations observed according to Gross Motor Function Classification System levels. Rasch analyses supported item fit, ordered thresholds (after minor rescoring), and unidimensionality for Frequency and Self-Care. Conclusions: The CEDL-V2-T demonstrates strong psychometric properties and is appropriate for evaluating participation and self-care in Turkish children with CP aged 1.5 to 12 years.
PMID: 41477705

**14.Clinical spectrum and associated comorbidities of cerebral palsy among children in Eastern India**

Rajan Kumar, Bijit Biswas, Manoj Kumar, Deepak Kumar, Ehtesham Ansari, Soumi Kundu

Sci Rep. 2025 Dec 29;15(1):44678.

**Abstract**
Cerebral palsy (CP) remains a leading cause of childhood disability, with varying clinical presentations and comorbidity patterns. This study explored the clinical spectrum, functional severity, and perinatal risk factors of CP among children aged 4–14 years in eastern India to identify priority areas for early intervention and support. A cross-sectional study was conducted over one year at a tertiary care centre. Data were collected through structured caregiver interviews and clinical assessments using standardized tools—the Gross Motor Function Classification System (GMFCS) and Manual Ability Classification System (MACS). Associations between demographic, perinatal, and clinical variables and CP severity were analysed using likelihood ratio tests and partial correlation analyses. Among 127 children with CP (median age: 5.9 years; 74.0% male), spastic CP was the predominant subtype (75.6%), followed by dyskinetic (9.4%), ataxic (7.9%), and mixed (7.1%) forms. Severe motor impairments (GMFCS IV–V) were present in 63.8% of participants, and manual ability severity increased proportionally with GMFCS levels ($\rho = 0.702$; $p < 0.001$). Significant correlates of severe impairment included younger age, parental age (20–29 years), high birth weight (> 4000 g), home delivery, absence of crying at birth, neonatal seizures, hypoxic-ischemic encephalopathy, and jaundice. Comorbidities were common—language (78.7%), cognitive (62.2%), and personal-social (58.3%) impairments were most frequent. Only 12.6% of children attended school; attendance was positively associated with older age, male gender, lower GMFCS and MACS levels, and absence of cognitive, language, fine-motor, personal-social impairments, and seizure history. Spastic CP was the most frequent subtype, commonly associated with severe motor limitations and multiple comorbidities that significantly restricted educational participation. Strengthening perinatal care, early screening, and multidisciplinary rehabilitation are essential to improve functional outcomes and inclusion for children with CP in resource-limited settings.
PMID: 41462038

**15.Advances in Genetic Discoveries in Cerebral Palsy: Implications for Diagnosis, Prognosis, and Counseling**

Juan Darío Ortigoza-Escobar

Curr Neurol Neurosci Rep. 2026 Jan 3;26(1):6

Purpose of review: This review examines the expanding role of genetic factors in cerebral palsy (CP), with a focus on cryptogenic presentations and CP-masquerading conditions. It addresses how genomic insights refine diagnosis, guide management, and influence counseling. Recent findings: Emerging evidence demonstrates that de novo single-nucleotide variants, copy number variants, mitochondrial variants, and, rarely, repeat expansions contribute significantly to CP, particularly when neuroimaging is normal, progression is atypical, or additional neurodevelopmental features are present. Diagnostic yield is highest in these contexts. Trio-based whole-exome sequencing is recommended as first-line testing, supported by chromosomal microarray or whole-genome sequencing. Integration of genomic testing remains limited by inconsistent CP definitions, restricted test access, and under-recognition of genetic etiologies, especially in adults. Standardized CP classification frameworks, such as SCPE (Surveillance of Cerebral Palsy in Europe), combined with early genomic evaluation, can improve diagnostic accuracy, reveal treatable conditions, and enable precision care. This approach has potential to transform management and outcomes across the lifespan.
PMID: 41483429

**16.Neurological Consequences of CMV Infection: Overview of Pathogenesis and Host Responses**

Vijayalakshmi Reddy, Lonika Lodha, Shipra Gupta, Reeta S Mani, M A Ashwini

Rev Med Virol. 2026 Jan;36(1):e70095.

**Abstract**
Human cytomegalovirus (CMV), a member of the Herpesviridae family, is a ubiquitous pathogen that causes mild or asymptomatic infection in healthy individuals but leads to severe complications in immunocompromised patients and congenitally infected newborns. CMV exhibits marked neurotropism, and infection of the central nervous system (CNS) can result in a broad spectrum of neurological manifestations, including encephalitis, cognitive impairment, and developmental anomalies such as microcephaly, cerebral palsy, and sensorineural hearing loss. Though the clinical importance of CMV on the nervous system is well known and studied, the molecular mechanisms underlying CMV neuropathogenesis remain incompletely understood. In this review we present current knowledge on CMV infection of the CNS, highlighting the viral and host determinants that influence neurotropism, latency, immune evasion, and neural injury. We discuss important molecular pathways involved in viral entry, replication, and host immune modulation that contribute to CNS pathology. The article summarises recent insights from in vitro and in vivo models elucidating how CMV interacts with cells of CNS to disrupt neurodevelopment and brain homoeostasis. Furthermore, we review the neurological manifestations of CMV with emphasis on long term neurological sequelae of congenital and acquired CMV infection, as well as characteristic radiological findings associated with CMV neuroinfection. Understanding the complex interplay between CMV and the host nervous system is essential for identifying therapeutic targets and developing effective preventive strategies. This review aims to provide a comprehensive overview of CMV neuropathogenesis and to identify critical knowledge gaps that can guide future research on CMV-associated neurological disease.
PMID: 41469776

**17. MRI patterns and clinical outcomes in cerebral palsy: insights from a large MRICS-based cohort**

Junying Yuan, Kejie Cao, Dong Li, Jiefeng Hu, Xuejie Wang, Wending Xin, Lingling Zhang, Yiran Xu, Changlian Zhu

J Neurodev Disord. 2025 Dec 30;17(1):75.

Background: To classify MRI patterns in children with cerebral palsy (CP) using the MRI Classification System (MRICS) and examine their associations with perinatal risk factors and clinical outcomes. Methods: This retrospective cohort study included 1,403 children with CP who underwent post-neonatal cranial MRI between 2011 and 2020. MRI patterns were categorized using MRICS. We analyzed the associations between MRI findings and perinatal risk factors (e.g., gestational age, birth weight, sex, perinatal adversity, plurality) using univariate and multivariable multinomial logistic regression. Clinical outcomes—including CP subtype, gross motor function, intellectual disability, epilepsy, and composite impairment index—were assessed using chi-square, Kruskal-Wallis tests, and correspondence analysis. Results: MRI abnormalities were observed in 86.5% of children, with predominant white matter injury (PWMI) being most common (46.5%). Preterm birth and perinatal adversity significantly increased the risk of PWMI and PGMI. PWMI was linked with spastic CP, better motor outcomes, and lower rates of intellectual disability. In contrast, PGMI and maldevelopments were associated with epilepsy, hearing loss, and severe impairment. Importantly, a subset of children with normal MRI findings still exhibited substantial functional impairments, emphasizing the limitations of structural imaging alone. Conclusions: MRI patterns, as classified by MRICS, provide critical insight into the neurodevelopmental heterogeneity of CP. Normal MRI findings do not preclude significant clinical impairment, underscoring the need for integrated neuroimaging and clinical-genetic assessment in CP management.
PMID: 41469542

**18.Questions of terminology, genetics, and life stages in the updated cerebral palsy description**

Brigitte Vollmer

Dev Med Child Neurol . 2025 Dec 29. doi: 10.1111/dmcn.70129. Online ahead of print.

No abstract available
PMID: 41460762

**19.Systematic Review on Genetic Variants in Children With Cerebral Palsy**

Signe V Pedersen, Jesper K Sørensen, Rebecca Fabricius, Morten Dunø, Mads L Larsen, Christina E Høi-Hansen, Elsebet Østergaard

**Aim:** To give a comprehensive overview of genetic findings in children with cerebral palsy, including a description of subtype, comorbidities and neuroimaging, providing insight into the clinical utility of genetics. **Method:** A systematic review of previous literature using Embase and Medline as databases. All studies were published between 2000 and 2022, each including at least 10 individuals with cerebral palsy. **Results:** A total of 19 studies were included, comprising a total of 3707 individuals with cerebral palsy. The overall diagnostic yield was 22.2%, with the highest yield (up to 55%) in cryptogenic cerebral palsy. Variants in a total of 377 unique genes were identified, most frequently CTNNB1, SPAST and ATL1. In addition, 59 different CNVs were identified, of which 32 were in known (micro)duplication/-deletion syndromes such as 22q11.2 microdeletion/-duplication and 14q12 microdeletion. Spastic and dyskinetic cerebral palsy were the most common phenotypes among genetically diagnosed cases. Findings also included variants in genes linked to epilepsy, specific neuroimaging patterns and potentially treatable conditions. **Conclusion:** These results highlight the importance of genetic evaluation for diagnostic clarification, targeted treatment, monitoring of comorbidities and genetic counseling. We recommend offering genetic testing to individuals with cryptogenic cerebral palsy to optimize management and prevention.
PMID: 41442323

**20.Bringing the Computer-Based Instrument for Low Motor Language Testing to Canada: A Survey of Caregiver and Clinician Perspectives**

F Aileen Costigan, Tom Chau, Johanna Geytenbeek, Kristine Stadskleiv, Beata Batorowicz, Sarah Hopmans, Dayle McCauley, Danijela Grahovac, Brenda Agnew, Jodi Friesen, B J Cunningham

Int J Lang Commun Disord. 2026 Jan-Feb;61(1):e70176.

Background: Accurate assessment of language comprehension is crucial to positive outcomes for children with cerebral palsy (CP) but is difficult for those with significant speech and physical impairments (SSPI). Standardized tools that typically require these children to speak, vocalize or select directly pose particular challenges. Aim: To describe Canadian caregivers' and clinicians' language comprehension assessment experiences and needs for children with CP and SSPI prior to soliciting feedback to advance the Computer-Based instrument for Low motor Language Testing (C-BiLLT-CAN), a standardized and accessible tool designed specifically for these children. Methods and procedures: Recruiting from Canadian children's treatment centres, augmentative and alternative communication clinics, and via social media, we conducted an environmental scan of caregivers of and clinicians providing services to children with CP and SSPI. Surveys designed using the Knowledge to Action Framework solicited both quantitative and qualitative data, summarized using descriptive statistics and inductive content analysis, respectively. Outcomes and results: Twenty-two caregivers and 39 clinicians from seven Canadian provinces completed the survey. Most caregivers had experienced language comprehension assessment but were typically only 'somewhat confident' in the results, despite considering accuracy 'very important.' Most clinicians were involved in language comprehension assessment and overwhelmingly relied on non-standardized tools despite feeling at best 'fairly confident' in their results. Qualitative comments indicated the utility of a population-specific test/testing procedures and/or associated normative data to complement non-standardized tools. Participants indicated that the C-BiLLT-CAN could be improved by expanding available response methods and supporting visual and auditory access modifications to promote customization. Anticipated benefits of the C-BiLLT-CAN included improved interaction with, participation for, and understanding of the abilities of children with CP and SSPI; and improved interventions and outcomes for these children and their families. Conclusions and implications: The C-BiLLT-CAN could fill a critical gap in services available to Canadian children with CP and SSPI. Caregivers and clinicians recognized the benefits of incorporating a reliable and valid standardized tool as part of a comprehensive language comprehension assessment battery for this population but valued additional response methods and features to support access and implementation.
PMID: 41456947

## Prevention and Cure

**21.Profiles and Predictors of Neurodevelopmental Outcome at 5–6 Years in Children With a History of Acute Provoked Neonatal Seizures**

Hannah C Glass, Adam L Numis, Janet S Soul, Courtney J Wusthoff, Monica E Lemmon, Giulia M Benedetti, Catherine J Chu, Shavonne L Massey, Cameron Thomas, Tayyba Anwar, Julie Sturza, Madison M Berl, Yi Li, Elizabeth E Rogers, Stephanie Rau, Jennifer C Gidley Larson, Jennifer L Guerrero, Linda S Franck, Charles E McCulloch, Renée A Shellhaas

Ann Neurol. 2026 Jan 3. Online ahead of print.

Objective: The objective of this study was to characterize the neurodevelopment and risk factors for impairment at age 5 to 6 years after acute provoked neonatal seizures. Methods: Multicenter study of neonates with acute provoked seizures. Wechsler Preschool and Primary Scale of Intelligence IV (WPPSI-IV), Vineland-3 Adaptive Behavior Scales, Behavior Assessment System for Children, Behavior Rating Inventory of Executive Function, Social Responsiveness Scale, cerebral palsy (CP), and epilepsy were assessed at age 5 to 6 years. Latent class analysis defined outcome profiles. Least absolute shrinkage and selection operator (LASSO) was used to determine outcome predictors. Results: We characterized 3 latent classes among 164 children: (1) Typical Development (63%); (2) Behavioral Dysregulation (13%; low likelihood of physical impairment or severely impaired cognition, high likelihood of attention deficit hyperactivity disorder [ADHD]); and (3) Multi-Domain Impairment (24%; high likelihood of epilepsy and impairment across all domains). Among 144 children with standardized testing, mean WPPSI-IV was 91 ± 25 and Vineland-3 Adaptive Behavior Composite 90 ± 20. Twenty-nine percent had ADHD or elevated attention/hyperactivity scores; 19% had autism or elevated Social Responsiveness scores; 20% had epilepsy, and 19% had CP. Risk factors for Multi-Domain Impairment were abnormal neonatal neurologic examination (odds ratio [OR] = 3.94, 95% confidence interval [CI] = 1.74-8.95), impaired functional development at age 24 months (OR = 3.82, 95% CI = 1.25-11.66), and CP (OR = 3.71, 95% CI = 1.74-7.90). No neonatal or infant characteristics were significantly associated with Behavioral Dysregulation. Interpretation: Nearly two-thirds of 5 to 6-year-old children with provoked neonatal seizures had typical development. Yet, executive and behavioral dysregulation were prevalent, even with preserved cognitive and physical function. These findings can inform outcome discussions and interventions to promote neurodevelopment.
PMID: 41482857

**22. Factors Associated with High Risk of Cerebral Palsy: Development of a Multicriteria Index**

Lara de Almeida Rodrigues, Rafael Coelho Magalhães, Bernat Vinolas Prat, Karoline Tury de Mendonça, Agnes Flórida Santos da Cunha, Lívia de Castro Magalhães, Ana Cristina Resende Camargos

Phys Occup Ther Pediatr. 2026 Jan 2:1–20. Online ahead of print.

Aims: To develop a multicriteria index with the main factors associated with high risk of cerebral palsy (CP). Methods: Exploratory cross-sectional study. Ninety-two infants, mean age 94.8 (±13.5) days, discharged from neonatal intensive care units (NICU) in Brazil, were included, and assessed using the General Movements (GMs) and Hammersmith Infant Neurological Examination (HINE). The multicriteria index incorporated factors such as infections from the toxoplasmosis, rubella, cytomegalovirus, herpes, syphilis, and zika virus (TORCHSZ), prematurity, birth asphyxia, Apgar score, seizures, duration of mechanical ventilation, corticosteroid and magnesium sulfate medications, therapeutic hypothermia, and caffeine. Validation included the Pearson correlation, simple linear regression analysis, and one-way analysis of variance (ANOVA), with Tukey's post hoc test. Results: The multicriteria index showed a positive and moderate association with high risk of CP ($R2=0.20$, $p < 0.0001$), indicated by abnormal GMs and HINE results. Significant differences between the low- and high-risk groups ($p < 0.0001$) and between the medium- and high-risk groups ($p = 0.005$) of CP were found. Conclusions: The multicriteria high-risk CP index, developed by combining clinical factors, enabled the identification of high-risk infants with CP and a history of NICU admission. These findings can support healthcare professionals in making more precise referrals for early intervention.
PMID: 41481133

**23. Therapeutic potential of stem cells in pediatric neurology: Insights from clinical trials**

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Neuroprotection. 2025 Dec 22;3(4):303–321. eCollection 2025 Dec.

**Abstract**
Pediatric neurological disorders comprise diverse conditions that impair nervous system function in children and contribute substantially to global disease burden. Stem cell therapy has become a promising treatment in neurology due to the cells' ability to self-renew, ensuring a continuous supply of cells. Cells are harvested from various origins, notably embryonic tissues and adult sources such as bone marrow, adipose tissue, and umbilical cord. Therapeutic effects arise from cell or enzyme replacement, trophic support, immunomodulation, and paracrine actions of the secretome. This review summarizes clinical applications of stem cell therapies across pediatric neurological diseases—including autism spectrum disorder, cerebral palsy, traumatic brain and spinal cord injury, epilepsy, neuromuscular disorders, and lysosomal storage diseases—and appraises evidence from preliminary descriptive studies that update the field and reveal methodological limitations. Reported therapeutic effect differs markedly by cell type, disease biology, timing of intervention, dose, and delivery method, producing inconsistent clinical results. Positive functional or developmental improvements have been documented in selected reports, but safety concerns, heterogeneity in study design, short follow-up, and variable potency assays limit conclusions. Because stem cell populations share phenotypic features but vary in therapeutic capacity, a universal, one-size-fits-all strategy is unlikely to succeed. Critical gaps remain regarding long-term safety, durability, standardized manufacturing, and optimal clinical endpoints. Continued rigorous translational research, standardized clinical trials, and expanded long-term surveillance are essential to optimize these therapies and improve outcomes for affected children and to ensure equitable access for diverse pediatric populations worldwide.
PMID: 41479767

**24. Hammersmith Infant Neurological Examination at 3 Months in Infants at Risk for Congenital Infections: A Cohort Study**

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J Paediatr Child Health. 2025 Dec 31. Online ahead of print.

Introduction: STORCH refers to a group of congenital infections (syphilis, toxoplasmosis, rubella, cytomegalovirus and herpes) that can impact the central nervous system. As clinical signs may not appear until several months or years after birth, the early detection of risk in STORCH-exposed infants has been challenging, and the use of sensitive tools in this population is understudied. Objective: To compare STORCH-exposed infants with non-exposed controls using the Hammersmith Infant Neurological Examination (HINE) at 3 months of age. Methods: This is an observational cohort study. A total of 60 infants were included and equally allocated into two groups: an exposed group, whose mothers had a clinically confirmed diagnosis of a classic STORCH infection during pregnancy, and a non-exposed control group, whose mothers did not present STORCH infections during gestation. At 3 months of age (13.83 ± 1.09 weeks post-term), infants were assessed using the HINE. Group comparisons were performed for the global score, subscores across the five scorable domains (cranial nerve function, posture, spontaneous movements, tone and reflexes and reactions), number of asymmetries and risk of cerebral palsy. Results: The exposed group showed lower global scores and lower subscores in most HINE domains compared to controls, along with a higher frequency of asymmetries and an increased proportion of infants classified as at high risk for cerebral palsy. Conclusion: Infants prenatally exposed to STORCH infections showed an increased risk of impairment based on the HINE when compared to controls. Potential neurological limitations were detectable in the exposed group at 3 months of age.
PMID: 41476328

**25.Early Screening for Cerebral Palsy: A Systematic Review**

Desi Newberry, Kaylee Apel, Jessica Metcalf, Adrianna Stephens, Christine Snyder, Bria Bernstein, Kara Roche, Kaitlin Pace, Lydia Tillmaand, Ruth Ann Topper, Leila Ledbetter

Adv Neonatal Care. 2025 Dec 30. Online ahead of print.

Background: Cerebral palsy (CP) is the most common motor disability in childhood, with preterm infants at highest risk. Purpose: To evaluate the predictive accuracy and clinical utility of neonatal screening methods for early CP diagnosis. Data sources: Evidence was systematically reviewed from MEDLINE, Embase, and Web of Science. Study selection: Inclusion criteria were preterm infants at high risk for CP with diagnosis before 12 months. Of 3835 citations identified, 44 studies met criteria. Data extraction: Extracted variables included study design, purpose, assessment tools, gestational age, sample size, timing of CP assessment, results, limitations, and bias. Results: Screening using neuroimaging, motor performance, and neurological assessments in combination improves diagnostic accuracy before 12 months. Implications: The General Movements Assessment and MRI show strong predictive value for early CP detection; newer technologies require further validation. Early identification supports timely intervention and may improve developmental outcomes.
PMID: 41474840

**26.Integrated follow-up of former extremely preterm infants: how to do it?**

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**Abstract**
Extremely preterm (EP) infants, defined as those born before 28 weeks of gestation or weighing less than 1000 g, face high rates of long-term complications despite improved neonatal survival. This narrative review summarizes current evidence and international consensus on the post-discharge follow-up of EP infants, with emphasis on neurodevelopment, somatic growth, pulmonary and sensory outcomes, and family-centered care. Key domains include early identification of cerebral palsy using neurological assessments such as the General Movements and Hammersmith scales, cognitive monitoring with standardized tools (e.g., Bayley Scales), nutritional and growth surveillance beyond anthropometrics, structured respiratory evaluations including immunoprophylaxis, and timely screening for vision and hearing deficits. In addition, the integration of caregiver-reported outcomes and mental health screening is essential to tailor follow-up strategies and support parental wellbeing. Models of care vary globally, from tertiary-based programs to hybrid and community-integrated approaches, highlighting the need for adaptable, interdisciplinary frameworks. Coordinated long-term follow-up that extends into early childhood is vital to reduce disparities and optimize functional outcomes in this vulnerable population. What is Known: • Extremely preterm infants are at high risk for long-term neurodevelopmental, respiratory, nutritional, and sensory complications, even when neonatal survival improves. • Neurodevelopmental tools such as the Bayley, General Movements, and Hammersmith Scales are widely used for early screening of cognitive and motor outcomes. What is New: • It highlights the importance of Patient-Reported Outcome Measures in complementing clinical surveillance with caregiver perspectives. • It underscores the limitations of early assessments alone and supports extending developmental monitoring into the preschool and school-age years.
PMID: 41460346