Cerebral palsy research news

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Professor Nadia Badawi AM
CP Alliance Chair of Cerebral Palsy Research

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Interventions and Management

1.Can we normalize surface electromyography in patients with spasticity of the upper limb?

Anna Pennekamp, Mirjam Thielen, Fraser Philp, Anand Pandyan, Julia Glaser, Ursula Trinler

Clin Biomech (Bristol). 2026 Mar 12;136:106822. Online ahead of print.

Background: Spasticity assessment using surface electromyography (sEMG) is challenging in people with limited voluntary upper-limb motor control. Standardized protocols are limited, and optimal normalization methods remain unclear.
Methods: Elbow flexor spasticity was assessed in 17 individuals after traumatic brain injury, stroke, or cerebral palsy using 3D motion analysis with synchronized sEMG during slow and fast passive stretches. Comparisons included non-normalized sEMG, normalization to maximum voluntary isometric contraction (MVIC), and normalization to maximum sEMG during activities of daily living (ADL) or active elbow flexion (ROM). Correlations between normalized/non-normalized parameters and clinical spasticity scales were examined.
Findings: ROM-based normalization was only feasible in participants with preserved voluntary control. MVIC-based normalization was often unreliable due to impaired motor control, and non-normalized data sometimes performed equally or better. ROM normalization showed the strongest correlation with the Modified Ashworth Scale. Normalization to ROM or ADL correlated best with clinical spasticity scales, particularly in individuals with preserved voluntary control.
Interpretation: No normalization method consistently outperformed others. Results support tailoring sEMG normalization methods to individual functional abilities to improve accuracy of spasticity assessment.
PMID: 41846141

2.Hip Displacement in Spastic Hemiplegia: Increased Risk with Hip Internal Rotation and Adduction Irrespective of Sagittal Gait Pattern

Zhe Yuan, Alexander Aretakis, Chris Church, M Wade Shrader, Freeman Miller, Anuj Gupta, Arianna Trionfo, Jason J Howard

JB JS Open Access. 2026 Mar 18;11(1):e26.00022. eCollection 2026 Jan-Mar.

Background: Hip displacement (HD), common in cerebral palsy (CP), is reportedly less prevalent in spastic hemiplegia. Patients with a Winter-Gage-Hicks (WGH) type IV gait pattern are believed to be at increased risk of HD, but true prevalence is unknown. This study aimed to analyze HD rates according to the sagittal plane-based WGH classification and identify associated risk factors.
Methods: Patients with hemiplegic CP with ≥1 instrumented gait analysis, radiographs, and ≥2-year follow-up were included. The primary outcome was an "unsuccessful hip," defined as migration percentage ≥30% or reconstructive osteotomies. Secondary variables included WGH type, previous surgery, sex, scoliosis, epilepsy, shunt, gastrostomy tube, and hip kinematics.
Results: Among 144 patients, 17 (11.8%) had an unsuccessful hip outcome. Rates by WGH type were: I: 9.5%, II: 9.4%, III: 6.7%, IV: 24.1%. Multivariate analysis identified hip internal rotation (OR 4.7) and hip adduction (OR 5.2) as significant independent risk factors.
Conclusion: HD rates in spastic hemiplegia are higher than expected across all WGH types, especially IV. Regular hip surveillance is required for patients with hip internal rotation and adduction, beginning in preadolescence.
PMID: 41853623

3.Differences in morphological parameters of calf muscles among children and adolescents with spastic cerebral palsy at different mobility levels and their relationships with walking ability

Ümit Erkut, Hasan Bingöl

Physiother Theory Pract. 2026 Mar 20:1-9. Online ahead of print.

Background: Previous studies have demonstrated alterations in skeletal muscle morphology and architecture in individuals with spastic cerebral palsy (CP). However, it remains unclear whether these morphological parameters vary across different mobility levels or how they relate to walking ability.
Purpose: This study aimed to examine morphological parameters of calf muscle across functional mobility levels in children and adolescents with spastic CP and their relationships with walking ability.
Methods: Children and adolescents with spastic CP, aged 5–17 years (mean age: 11.72 ± 4.6 years), were recruited in the study. Morphological parameters of the gastrocnemius medialis (GM), gastrocnemius lateralis (GL), and soleus muscle in the more severely affected lower limb were assessed using a B-mode ultrasound. Walking ability (i.e. mobility and locomotion activities) was evaluated using both the Gillette Functional Assessment Questionnaire-22 item skill set (FAQ-22) and ABILOCO-Kids.
Results: Analysis revealed a significant decrease in muscle thickness ($p1 = .013$; $p2 = .032$; $p3 < .001$) and fascicle length ($p1 < .001$; $p2 < .001$) with declining mobility levels, except for GL fascicle length ($p = .061$). Conversely, pennation angle was significantly greater in children with severe motor involvement ($p < .001$ for all). Moderate to very strong correlations were found between calf muscle morphological parameters and walking ability ($r = -0.41$ to 0.89). Notably, muscle thickness demonstrated the strongest correlation coefficients with walking ability ($r = 0.83$-0.89).
Conclusion: The significant associations between GM and soleus muscle thickness and walking ability indicated that these muscles are important contributors to functional mobility in children and adolescents with CP. These findings also emphasized that musculoskeletal integrity remains a critical factor of mobility and locomotion activities, even within contemporary participation-focused rehabilitation models.
PMID: 41860166

4.Relationship between functional lower limb capacity and falls in ambulant children with cerebral palsy

Laura A Bentley, Sarah K Ashcroft, Sarah Reedman, Robert S Ware, Stina Oftedal, Craig Munns, Leanne Sakzewski, Roslyn N Boyd

Gait Posture. 2026 Mar 7;127:110147. Online ahead of print.

Aim: To identify characteristics and clinical measures associated with increased falls in ambulant children with cerebral palsy (CP).
Method: Parent-reported falls from 66 children with CP (GMFCS I–III) were analyzed alongside lower limb functional measures, including the 6-Minute Walk Test, Muscle Power Sprint Test, 10-m Walk Test, Sit-to-Stand, Lateral Step-Up, and Kneel-to-Stand. ROC curve analysis identified thresholds indicating increased fall risk.
Results: 81% of children fell at least once in the previous month (average 11 falls), and 44% of those who fell were injured. GMFCS II children fell most frequently. Poorer performance on Sit-to-Stand, Lateral Step-Up, and Kneel-to-Stand was associated with more falls. ROC analysis identified functional thresholds indicating higher risk of above-average fall frequency.
Interpretation: Ambulant children with CP have a high falls risk. Poor performance in several lower limb balance-related tasks is associated with greater fall frequency.
PMID: 41850191

5.Diffusion-Augmented Spatio-Temporal Graph Convolution for Clinical Gait and Motor Function Assessment

Eran Beeri Bamani, Joao Buzzatto, Hermano Igo Krebs

IEEE Trans Neural Syst Rehabil Eng. 2026 Mar 18. Online ahead of print.

Abstract
Accurate assessment of gross motor function in children with cerebral palsy (CP) is hindered by data scarcity, class imbalance, and heterogeneity. Recent spatio-temporal graph convolutional networks (STGCN) enable automatic GMFCS prediction from video but have limitations in generalization and fairness. This study proposes a unified generative-diagnostic pipeline integrating a Conditional Skeleton Diffusion Model with a Biomechanically-Aware STGCN. The model generates biomechanically plausible 2D skeleton gait sequences conditioned on GMFCS level, GDI, and anthropometrics, which are combined with real data to train the classifier. Evaluation on a clinical pediatric gait dataset showed 85.7% GMFCS accuracy, reduced GDI prediction error, and improved detection of severe phenotypes. This approach offers a scalable, interpretable method for automated clinical gait assessment in CP.
PMID: 41849175

6.How are Achilles tendon properties associated with gait performance in cerebral palsy?

Nathalie Alexander, Maria Sukanen, Iida Laatikainen-Raussi, Afet Mustafaoglu, Taija Finni, Francesco Cenni

Clinical Biomechanics, 10 March 2026. Online ahead of print.

Background: The Achilles tendon (AT) plays a crucial role during walking. In cerebral palsy (CP), altered neuromuscular development may influence AT morphology and stiffness, affecting muscle–tendon dynamics and gait. This study quantified differences in static AT morphology and passive mechanical properties in individuals with CP and examined links to AT function during walking.
Methods: Twelve young individuals with CP and twelve typically developing peers underwent three-dimensional freehand ultrasonography to obtain AT datasets for cross-sectional area (CSA) and length measurements. Shear wave elastography was used to estimate the shear modulus. Three-dimensional gait analysis was synchronized with ultrasound during overground walking to estimate AT length changes during stance alongside kinematic and kinetic data.
Findings: Free AT length was significantly greater in the CP group (mean difference 86.7 ± 34.6 mm, $p = 0.015$), remaining longer after normalization to tibial length ($p = 0.025$). No differences emerged in medial gastrocnemius AT length or CSA. Within the CP group, CSA correlated negatively with walking speed ($r = -0.66$, $p = 0.026$) and positively with AT length changes during walking ($r = 0.79$, $p = 0.002$).
Interpretation: Free AT length is longer in individuals with CP with limited structure–function associations observed. These findings suggest altered AT stretch–recoil behavior during gait, warranting further investigation with larger, more homogeneous cohorts.
PMID: 41830656

7.Environmental supportiveness, physical activity, and sedentary time in children with cerebral palsy

Stina Oftedal, Ellen Armstrong, Gaela Kilgour, Matthew Ahmadi, Stewart G Trost, Sean A Horan, Christopher Carty, Denise Brookes, Roslyn N Boyd, Leanne Sakzewski, Sarah E Reedman

Dev Med Child Neurol. 2026 Mar 20. Online ahead of print.

Aim: To describe how movement behaviours (sedentary time, light-intensity physical activity, moderate-to-vigorous physical activity [MVPA]) and parent-reported community physical activity participation vary across levels of environmental supportiveness (home, school, community) in children with cerebral palsy (CP).
Method: This was a secondary cross-sectional observational study using pooled data (n = 141) from four studies of children with CP aged 6 to 16 years (mean = 10 years 1 month [SD = 2 years 5 months]; Gross Motor Function Classification System level I = 71, level II = 41, levels III-IV = 29). Children wore hip-mounted triaxial accelerometers; validated machine-learning models classified sedentary time, light physical activity, and MVPA. Parents reported community physical activity participation and environmental supportiveness using the Participation and Environment Measure for Children and Youth. Linear models were adjusted for wear time and study. We estimated marginal mean differences (MMDs) in time spent in movement behaviours between the 25th and 75th centiles of supportiveness scores.
Results: Greater community (MMD = -30.1 minutes, 95% confidence interval [CI] = -53.4 to -8.1), home (-31.4 min, 95% CI = -51.5 to -11.3), and school (MMD = -54.1 min, 95% CI = -76.0 to -32.2) supportiveness were associated with less sedentary time. Higher home supportiveness was associated with more time in light physical activity (MMD = 23.7 minutes, 95% CI = 11.0 to 36.3), whereas school and community supportiveness were not associated with light physical activity. No environmental supportiveness measures were associated with time in MVPA.
Interpretation: Greater environmental supportiveness across all contexts was associated with lower sedentary time, while greater home supportiveness was associated with more time in light physical activity. Other factors may have stronger associations with MVPA time.
PMID: 41859877

8.Modulation of corticospinal excitability and muscle synergies during visuomotor locomotor task in individuals with and without cerebral palsy: a TMS and EMG study

Yosra Cherni, Marco Ghislieri, Laurent Bouyer, Catherine Mercier

Front Neurol. 2026 Mar 4;17:1669546. eCollection 2026.

Introduction: Studies using transcranial magnetic stimulation and electromyography suggest that disrupted functional corticospinal connectivity significantly contributes to difficulty in initiating and controlling voluntary movements such as walking. In individuals with Cerebral Palsy (CP), the corticospinal tract (CST) may therefore be identified as a potential target for improving gait control. Increasing corticospinal excitability may enhance voluntary control of lower-limb muscles and improve selective activation patterns during gait. However, it remains uncertain whether this pathway can be further activated given the damage caused by the brain lesion. Moreover, muscle synergies, a cooperative activation of groups of muscles, play an essential role in efficient and adaptive locomotion. Disrupted CST projections may reduce the specificity and strength of descending commands, which can lead to the fusion or splitting of muscle synergies. This impaired descending modulation could explain the reduced number of synergies and lower variance often reported in people with CP. Understanding and improving the modulation of these synergies could lead to better rehabilitation strategies for individuals with CP. The objective of this study was to assess whether a visuomotor walking task promotes an increase in corticospinal excitability and a modulation of muscle synergies compared to a simple walking task in individuals with CP.
Methods: Sixteen individuals with CP were initially recruited, muscle synergy analyses were conducted in 14 participants and TMS-based corticospinal excitability assessments in 11 participants, due to contraindications to TMS or technical issues. In addition, 14 control subjects took part in this study. Each participant performed a simple walking task and a visuomotor walking task (i.e., stepping onto virtual targets) at comfortable speed, in counterbalanced order. Transcranial magnetic stimulations were delivered during walking at approximately 40% of the gait cycle (late stance phase), corresponding to minimal tibialis anterior activity. Muscle synergies were extracted from full gait cycles recorded throughout each condition. Motor evoked potentials (MEPs) in the tibialis anterior muscle were induced using transcranial magnetic stimulation. Muscle synergies were extracted from surface electromyography signals acquired from six key lower-limb muscles during both tasks. Values were expressed as (median [Q1-Q3]).
Results: In the visuomotor task, MEPs increased by 59.4% in the CP group and 113.8% in the control group. An increase in the number of synergies was observed during the visuomotor task in the CP group.
Conclusion: Performing a visuomotor walking task enhances corticospinal excitability in both individuals with CP and control subjects. CP participants also demonstrated modulation in the number or structure of muscle synergies during the visuomotor task.
PMID: 41859408

9.Activity and Participation in Adolescents With Hemiplegic Cerebral Palsy: The Role of Upper Extremity Dexterity and Proprioception Within the ICF Framework

Sinem Asena Sel, Merve Arat, Yıldız Erdoğanoğlu

Percept Mot Skills. 2026 Mar 18. Online ahead of print.

Aim: To compare upper extremity proprioception and functional skills between adolescents with hemiplegic CP and typically developing peers, and to explore associations with activity and participation within the ICF framework.
Methods: Nineteen adolescents with hemiplegic CP and 19 peers were assessed for proprioception (kinesthesia, joint position error) and functional skills (GMFM-66, JTHFT, ABILHAND-Kids, PEDI). ANCOVA was used with age as a covariate.
Results: Adolescents with CP demonstrated significantly lower gross motor function, proprioception, dexterity, activity, and participation. Moderate positive correlations were identified between proprioception and functional measures.
Discussion: Adolescents with hemiplegic CP show reduced proprioception and functional participation relative to peers, underscoring sensory-motor contributions to daily activity.
PMID: 41849680

10.Impact of Robotic Assisted Treadmill Gait Training on Walking Performance in Children With Spastic Diplegic Cerebral Palsy: A Randomized Controlled Study

Hamada El-Sayed Ayoub, Islam Hassan Fayed, Mohamed Nabil Fiaad, Radwa Said Ahmed

Physiotherapy Research International, April 2026.

Background and purpose: Children with diplegic cerebral palsy frequently experience gait difficulties that affect independence and quality of life. Advances in technology have created opportunities to improve walking abilities. This study aimed to determine the effects of robotic-assisted treadmill gait training (RATGT) on walking performance in children with spastic diplegia.
Methods: Forty children aged 6–11 years with spastic diplegia participated in this randomized controlled trial. Participants ambulated independently but demonstrated abnormal gait kinematics. They were randomly assigned to two equal groups: the control group received a regular physical therapy program based on the neurodevelopmental approach, while the study group received RATGT using Lokomat in addition to regular therapy. Walking speed, step length, step symmetry, and walking capacity (6-minute walk test) were assessed before and after treatment using the Biodex Gait Trainer II.
Results: Statistically significant improvements were observed in all measured variables within the RATGT group ($p < 0.05$), with significant post-treatment differences between groups favoring RATGT ($p < 0.05$).
Discussion: RATGT appears to be a beneficial adjunct therapy for improving walking performance in children with spastic diplegia.
PMID: 41830908

11.Weight and Health Outcomes in Cerebral Palsy: A Causality Dilemma

Katherin E Portwood, Bhooma Aravamuthan

Pediatrics. 2026 Mar 19:e2025074191. Online ahead of print.

No abstract available
PMID: 41850579

12.Growth of Children With Cerebral Palsy and Health Outcomes

Richard D Stevenson, Mark R Conaway, Gordon Worley, Virginia A Stallings

Pediatrics. 2026 Mar 19:e2025072504. Online ahead of print.

Objective: The California-based cerebral palsy (CP) growth charts published in 2011 demonstrated a link between GMFCS-stratified weight percentile (GWt%-ile) and mortality, but use has been limited. This secondary analysis from the North American Growth in Cerebral Palsy Project (NAGCPP) aimed to evaluate the charts and examine the relationship between GWt%-ile and additional health markers.
Patients and methods: Weight and triceps skinfold thickness were measured in 197 boys and 146 girls aged 2–18 years, GMFCS III–V. Health care utilization and social participation were assessed by questionnaire. GWt%-ile was determined from sex- and GMFCS-specific charts. Using the 20th percentile cutoff, associations with health care utilization and participation were evaluated with and without skinfold thickness and comorbidities.
Results: NAGCPP weight data fit the CP charts. Adjusting for sex and GMFCS, children below the 20th GWt%-ile had more hospital stays, more missed regular programs, and more missed days of activities. Fat stores and severe feeding problems were independently associated with health and participation.
Conclusion: This study validates the CP growth charts and supports their relevance for clinical decision-making and research.
PMID: 41850572

13.Feasibility study of the assessment of upper limb function in children with Unilateral Cerebral Palsy using an end-effector robotic device

Veronica Barzacchi, Elena Beani, Silvia Filogna, Giada Sgherri, Valentina Menici, Giacomo Marsanich, Stefano Mazzoleni, Giovanni Cioni, Giuseppina Sgandurra

J Neuroeng Rehabil. 2026 Mar 19. Online ahead of print.

No abstract available
PMID: 41857735

14.Implanted brain-computer interface functionality during nighttime in late-stage amyotrophic lateral sclerosis

Sacha Leinders, Erik J Aarnoutse, Mariana P Branco, Zac V Freudenburg, Simon H Geukes, Anouck Schippers, Malinda S W Verberne, Max A van den Boom, Benny H van der Vijgh, Nathan E Crone, Timothy Denison, Nick F Ramsey, Mariska J Vansteensel

Sci Rep. 2026 Mar 18. Online ahead of print.

Abstract
Brain-computer interfaces (BCIs) hold promise as assistive communication technology for people with severe paralysis. Although BCIs should be available 24/7, feasibility of nighttime use has not been investigated. Here, we examined nocturnal dynamics of neural signal features in an electrocorticography-BCI user with amyotrophic lateral sclerosis. We assessed night-time decoder performance trained on daytime data and quantified unintentional nocturnal BCI activations. Mean and variance of neural power features were significantly higher at night. Daytime decoders triggered unintended activations in 100% of nights. A specifically developed nightmode function worked error-free in 79% of nights over ~1.5 years, enabling reliable caregiver calls. Reliable nighttime BCI use requires adjusting to circadian and sleep-related neural signal changes. This case demonstrates long-term functional nightmode BCI usage.
PMID: 41851249

15.Comparison of deep and conventional machine learning methods in predicting joint moments in patients with cerebral palsy

Mustafa Erkam Özates, Firooz Salami, Sebastian Immanuel Wolf, Yunus Ziya Arslan

Med Biol Eng Comput. 2026 Mar 17. Online ahead of print.

No abstract available
PMID: 41843263

16.Predictive utility of a simple cranial magnetic resonance imaging score at term-equivalent age for cerebral palsy

Anne-Kathrin Dathe, Britta Maria Huening, Pia Deborah Weber, Uta Teschler, Maire Brasseler, Ursula Felderhoff-Mueser, Monia Vanessa Dewan

Developmental Medicine & Child Neurology, 16 March 2026. Online ahead of print.

Aim**:** To evaluate the predictive value of the simple Total Abnormality Score (TAS) for assessing cranial magnetic resonance images to predict cerebral palsy (CP).
Method: In this retrospective cohort study, 137 infants with a gestational age no more than 32+0 weeks and/or birthweight less than 1500 g, born between 2017 and 2021, were included. Findings from cranial magnetic resonance imaging at term-equivalent age were assessed using the TAS. At approximately 24 months (corrected age), CP diagnosis and severity using the Gross Motor Function Classification System (GMFCS) were determined interdisciplinarily. Binary logistic regression with CP as outcome and Spearman's rank correlation with TAS and GMFCS were performed.
Results: TAS was higher in infants with CP (median 11, IQR 10–15, n=9) than in those without CP (median 2, IQR 2–4, n=128). The odds ratio for CP was 1.31 per one-point increase in TAS. The optimal TAS cut-off for predicting CP was 9.5 (sensitivity 88.9%, specificity 91.4%). TAS correlated with GMFCS (Spearman's rho = 0.34, $p < 0.001$).
Interpretation**:** TAS is a useful, quick tool for risk stratification of CP in this cohort. Replication in larger samples and integration with additional tools is recommended.
PMID: 41840457

17.Synergy Feedback Control Predicts Walking Across Multiple Cycles

Spencer Williams, Geng Li, B. J. Fregly

bioRxiv preprint, 4 March 2026.

Abstract
Neural feedback is essential for healthy movement control, and various neurological disorders—including stroke, cerebral palsy, Parkinson’s disease, and incomplete spinal cord injury—contribute to impaired or maladaptive feedback. Computational neuromusculoskeletal models using simulated neural feedback have been developed but rarely represent real human subjects, limiting clinical relevance. This study used the Neuromusculoskeletal Modeling Pipeline to develop a synergy-based feedforward (FF) and feedback (FB) control model using a personalized 3D walking model of a post-stroke individual. Five experimental walking cycles informed calibration of FF synergies, which were scaled from 0% to 125%. FB synergies were fitted using joint positions, velocities, and moments. Predictive simulations tested three withheld cycles. The 100% FF model most closely reproduced the testing cycles and generated near-periodic walking motions using realistic initial conditions. Lower FF levels produced near-periodicity only with substantially altered initial conditions. Findings indicate predictive walking simulations require a minimum FF contribution and sufficient calibration data for dynamically consistent motion.
PMID: 41835388

18.Antenatal magnesium sulphate for preterm foetal neuroprotection in low- and middle-income countries: a scoping review of research studies and guidelines

Shona Goldsmith, Tasneem Karim, Sarah McIntyre, Alice Rumbold, Atul Malhotra, Gulam Khandaker, Sugandha Arya, Emily Shepherd

J Glob Health. 2026 Mar 20;16:04088.

Background: Antenatal magnesium sulphate reduces the risk of cerebral palsy (CP) for infants born very preterm. While endorsed by the World Health Organization for global implementation in 2015, studies underpinning this recommendation were conducted in high-income countries. Our objective was to systematically gather, organise, and map published research studies on the use of antenatal magnesium sulphate for preterm foetal neuroprotection in low- and middle-income countries (LMICs), and to obtain existing relevant national and international clinical practice guidelines from (or for) LMICs.
Methods: Following scoping review methods, we searched nine databases and the websites of societies/ministries of health for relevant qualitative or quantitative studies and national or international guidelines, published from 2015, from any LMIC. We screened each publication for inclusion, and two reviewers independently extracted information. Content analysis included narrative summaries and descriptive statistics.
Results: In total, 57 research studies (12 randomised controlled trials) and 25 clinical guidelines were included in the analysis. Most (n = 75) were in English, from lower-middle (n = 45) and upper-middle (n = 31) countries, and published between 2020 and 2025 (n = 60). The most common research scope was effects and/or safety (n = 38). The remaining studies focused on intervention uptake or quality improvement programmes (n = 10), mechanisms of action (n = 5), or regimen comparisons (n = 4). Short-term outcomes were common, and CP was described in only four studies. Regarding clinical guidelines, magnesium sulphate was usually included in general guidelines (n = 24), those published by professional associations (n = 18), or those published by government bodies (n = 6). After categorisation, an upper gestational limit of 32 weeks was most common (n = 18). Treatment regimens varied, commonly including a 4 g intravenous loading dose (n = 12) and a 1 g/h intravenous maintenance dose (n = 11). One in three recommended no specific regimen.
Conclusions: A sizeable number of heterogeneous studies and clinical guidelines exist, primarily from middle-income countries, regarding magnesium sulphate for neuroprotection. Further context-specific research may include regimen comparisons, impact, and implementation studies, informing future updates to clinical guidelines globally.
PMID: 41860331

19.Psychometric Properties of the Children With Cerebral Palsy (7–18 Years Old) Self-Care Skills Scale-Parent Form: A Turkish Validity and Reliability Study

Betul Yavuz, Bircan Kahraman Berberoğlu, Hüsniye Çalişir

Nurs Open. 2026 Mar;13(3):e70477.

Aim: This study aimed to develop the children with cerebral palsy (7-18 years old) self-care skills scale-parent form and assess its validity and reliability.
Design: The sample of this methodological study consisted of 317 parents of children with cerebral palsy (CP) aged 7-18 years who were trained in special education and rehabilitation centres.
Methods: The data were collected using the Child-Parent Information Form and the Children with Cerebral Palsy (7-18 Years Old) Self-Care Skills Scale-Parent Form (CCPSCSS-PF). The data were analysed using descriptive statistics, Kruskal-Wallis, Cronbach's alpha, test-retest, the Kaiser-Meyer-Olkin (KMO) test, Bartlett's test, exploratory factor analysis (EFA), and confirmatory factor analysis (CFA).
Results: The Cronbach's alpha coefficients for the overall scale and its two subscales were 0.971, 0.984, and 0.913 and the test-retest reliability coefficient of the overall scale was 0.976. The KMO sample fit coefficient of the scale was 0.948, and Bartlett's test of sphericity χ^2 value was 8472.344 ($p < 0.001$). According to the EFA results, the scale items were grouped under two factors. The factor loadings ranged from 0.767 to 0.951 for Factor 1 and 0.811 to 0.950 for Factor 2. The scale accounted for 83.4% of the total variance. The fit indices calculated in CFA were 1.000 for GFI, AGFI, CFI, TLI, and IFI; 0.097 for RMSEA; and 2.489 for CHISQ/Df.
Conclusion: The CCPSCSS-PF is a valid and reliable assessment tool that can be used to evaluate the self-care skills of children with CP aged 7-18 years.
Implications for practice: The CCPSCSS-PF can be used in preventive and rehabilitative studies by professionals caring for children with CP.
PMID: 41857787

20.Implementation of general movements assessment for early detection and treatment of infants at-risk of cerebral palsy – translating evidence into practice in a low resource setting

Bharathi Balachander, Arushi Rakesh Sharma, Anusha Christina Stanley, Nelia Mathew, Shilpa K Sridharamurthy, Littina George Manalel, Dhruv Shinde, Ramesh Debur Visweswara, Omkar Subbaram Jois Narasipura, Maria Lewin, Suman Rao

BMC Pediatr. 2026 Mar 19. Online ahead of print.

No abstract available
PMID: 41857520

21.Early Diagnoses of Concern Appear Valid in Predicting Adverse Neurodevelopmental Outcomes in Mid-Childhood

Leonora P Noe, Christina E Hoei-Hansen, Gorm Greisen

Acta Paediatr. 2026 Mar 19. Online ahead of print.

Aim: To examine the relationship between 'diagnoses of neurodevelopmental concern' before the age of 2 years and definite adverse outcomes before age 10.
Method: Data from national registries were linked. Children born in Denmark from 1994 to 2017 were included. Eight diagnoses of neurodevelopmental concern recorded before age 2 were compared to four definite outcomes recorded before age 10. The association was also analysed in three subpopulations at risk of perinatal brain damage.
Results: A total of 1.5 million children were included. At least one diagnosis of neurodevelopmental concern was recorded in 34 392 (2.3%) of children before age 2 years. Definite outcomes were recorded in 35 300 (2.3%) before age 10. Of these, 7 757 (22.6%) had previously had an early diagnosis of neurodevelopmental concern (OR = 12.0). In the high-risk subpopulations, diagnoses of concern and the risk of definite outcomes increased 3- to 4-fold.
Conclusion: Early diagnoses of concern appear valid indicators of adverse neurodevelopmental outcomes. Their increasing use over time limits their value as population-level monitoring tools.
PMID: 41855134

22.Implementation of an innovative virtual selective screening program for early detection of cerebral palsy in British Columbia

Keith O'Connor, Nandy Fajardo, Carol Lai, Vivian Wong, Mor Cohen-Eilig, Ram A Mishaal

Front Public Health. 2026 Mar 2;14:1754120. eCollection 2026.

Abstract
Early identification of cerebral palsy (CP) enables timely intervention during critical periods of neuroplasticity, yet diagnosis remains delayed in many health systems. In British Columbia, fragmented referral pathways and restrictive neonatal follow-up criteria have limited access to standardized early motor assessment, particularly for infants outside major urban centers. To address these gaps, a province-wide virtual screening pathway was developed to improve equitable access to early CP detection. The Early Motor Screening Program (EMSP) was implemented in 2022 as a virtual, risk-stratified screening pathway for infants at elevated neurological risk. The program integrates caregiver-recorded General Movements Assessment videos, telehealth-based clinical review, and coordinated referral to an interdisciplinary Cerebral Palsy Early Detection Clinic. Eligibility criteria were based on epidemiological risk stratification. Outcomes included program uptake, screening completion, General Movements Assessment findings, referral patterns, caregiver experience, and system-level indicators. Between June 2022 and September 2025, 883 infants were referred, with 622 (70%) completing General Movements Assessment screenings. Abnormal findings were identified in 114 infants (18%), of whom 25 (22%) were diagnosed with CP. Referral volumes increased across the study period with wide geographic participation. Caregiver feedback indicated high acceptability and feasibility. System-level data demonstrated a reduction in average age of CP diagnosis among high-risk infants from ~25 months to 7 months. This case study supports the feasibility of a telehealth-enabled, province-wide early motor screening pathway and highlights the potential for equitable early neurodevelopmental identification in publicly funded health systems.
PMID: 41846835

23.Prescriptions for mental health and the labor market penalties of cerebral palsy

Derek Asuman, Tinna Laufey Ásgeirsdóttir, Johan Jarl

Econ Hum Biol. 2026 Mar 19;61:101592. Online ahead of print.

Abstract
We explore mental health as a potential mechanism to explain the labor market penalty of an early-onset physical disability using administrative data from Sweden. For methodological reasons, we focus on persons with Cerebral Palsy (CP) and use prescriptions for mental health conditions. We examine how much of the differences in labor market outcomes is explained by prescriptions for mental health conditions and whether the mental health gradient differs between persons with and without CP. Finally, we assess whether the social insurance system compensates for potential lost earnings due to mental health through access to social benefits. We find that prescriptions for mental health conditions explain only a small part of the labor market penalties of CP. While mental health may impose additional employment penalties, labor market benefits exist for the treatment of mental health conditions among persons with CP. Furthermore, we find that the social insurance system partially compensates for the earnings penalties of CP through access to social benefits. Our results underscore the importance of understanding the interactions between mental health and labor market outcomes of persons with motor disabilities.
PMID: 41861571

24.Mental health of caregivers for people with dementia and cerebral palsy as a key determinant of caregiver burden: a multivariable analysis

Alba Sánchez-Gil, Andrea Calleja-Caballero, Fátima Pérez-Robledo, Carlos Martín-Sánchez, María Rodríguez-Lorenzo, María Martínez-Romo, Enrique Pérez-Saez, Pedro Manuel Rodríguez-Muñoz, Cristina Rivera-Picón, Jesus Perez, Juan Luis Sánchez-González

Front Public Health. 2026 Mar 4;14:1757413. eCollection 2026.

Background: Informal caregiving plays a vital role in supporting dependent individuals; however, prolonged caregiving is associated with significant physical and psychological strain. Understanding factors associated with caregiver burden is essential for designing effective interventions to protect caregiver health and sustain long-term care systems.
Objective: To examine the associations between psychological, physical, and contextual factors on caregiver burden and to identify variables independently associated with caregiver burden.
Methods: A cross-sectional study was conducted with 73 informal caregivers of people living with dementia or cerebral palsy who required substantial assistance in daily living. Standardized instruments assessed caregiver burden, anxiety and depression, mental health and quality of life, pain, and physical activity. Hierarchical multiple regression, mediation, and moderation analyses were performed.
Results: Mental health and anxiety showed the strongest independent associations with caregiver burden, followed by musculoskeletal pain. Patient-related variables such as functional dependence were not directly associated with burden. Mediation analysis showed no mediating effect of mental health on the dependence–burden relationship.
Conclusion: Caregiver mental health is a key determinant of perceived caregiver burden, exerting a stronger influence than patient dependence or physical demands. Interventions should integrate psychological screening and mental health support.
PMID: 41859267

25.Expanding the Phenotypic Spectrum of the Recurrent De Novo FBXO31 p.Asp334Asn Variant: Evidence for a Novel Neurodevelopmental Disorder (Kruer Syndrome)

Carolina I Galaz-Montoya, Sara A Lewis, Maureen K Galindo, Patricia Cornejo, Peter T Skidmore, Pritha Bisarad, Helen Magee, Kelly Bontempo, Boris Keren, Alexandra Afenjar, Matej Skorvanek, Michael Zech, Ingrid M Wentzensen, Christina A Gurnett, Wendy K Chung, Somayeh Bakhtiari, Michael C Kruer

Clin Genet. 2026 Mar 20. Online ahead of print.

Abstract
Biallelic loss-of-function variants in FBXO31 cause autosomal-recessive intellectual disability. A recurrent de novo variant, c.1000G>A (p.Asp334Asn), has been associated with an autosomal-dominant phenotype. To refine this phenotype and its clinical implications, we re-evaluated three published cases and identified four additional probands. Phenotyping included neurologic, behavioral, and dysmorphology assessment. All seven individuals carried the recurrent de novo variant. A core neurodevelopmental profile included cerebral palsy (mixed hypotonia, spasticity, dystonia), global developmental delay/intellectual disability, and speech impairment. Neuropsychiatric features included ADHD, anxiety, stereotypies, autistic features, and behavioral dysregulation. Neuroimaging showed hypoplastic corpus callosum and posterior-predominant white-matter changes, with gray matter heterotopias in one case. A subtle but consistent facial gestalt was observed. Recurrent FBXO31 p.Asp334Asn variants lead to a recognizable neurodevelopmental syndrome. The authors propose the term “autosomal dominant FBXO31-associated neurodevelopmental disorder” and the eponym “Kruer syndrome.”
PMID: 41858232

26.Preconception Counseling for People With Disabilities

Darienne Madlala, Whitney Bender

Clin Obstet Gynecol. 2026 Mar 19. Online ahead of print.

Abstract
Over 70 million Americans, including 35 million women, are living with a disability, including ~10% to 12% of reproductive-age women. Having a disability does not preclude a desire or ability to have children. Studies have demonstrated that an increased risk of adverse outcomes, including hypertensive disorders, hemorrhage, and preterm birth, occurs among pregnant people with physical, intellectual, developmental, and sensory disabilities. This review aims to evaluate pregnancy outcomes, outline general preconception care, and review disability-specific considerations with the goal of improving pregnancy outcomes in this population.
PMID: 41853891

27.Putamen Atrophy as a Predictive Factor of Efficacy of GPi-DBS in Dystonia-Dyskinesia Syndrome Secondary to Perinatal Anoxic Encephalopathy

Marylou Grasso, Pierre-Olivier Moser, Sidonie Sauvageot, Valérie Gil, Emilie Chan-Seng, Emily Sanrey, Philippe Coubes, Gaëtan Poulen

Mov Disord. 2026 Mar 18. Online ahead of print.

Background: Perinatal hypoxic-ischemic encephalopathy (HIE) can lead to motor deficits and dystonia-dyskinetic syndromes (DDS). In selected cases, GPi-DBS may be therapeutic, yet outcomes vary widely.
Objectives: To identify preoperative imaging predictors of GPi-DBS efficacy in DDS secondary to HIE, focusing on putaminal atrophy.
Methods: Seventy-three patients with DDS secondary to HIE who underwent GPi-DBS (2003–2023) were retrospectively analyzed. Imaging was assessed for putaminal atrophy. Clinical outcomes were measured via BFMDRS and BADS at baseline and follow-ups up to 15 years.
Results: Severe putaminal atrophy was associated with higher preoperative severity and significantly poorer DBS response at 1-year follow-up. Volumetric analyses confirmed that lower putaminal volume predicted reduced motor improvement. Predictive value remained significant at 5-year follow-up.
Conclusions: Putaminal atrophy is a key predictor of suboptimal GPi-DBS outcomes in HIE-related DDS, supporting its use as a criterion in candidate selection.
PMID: 41851006

28.Development and Preliminary Validation of a Knowledge, Attitude, and Practice Questionnaire Assessing Parental Self-Healthcare for Respiratory Tract Infections in Children With Cerebral Palsy in Malaysia

Riham M. K. Abualeinein, Sazlina Kamaralzaman, Nur Zakiah Mohd Saat

Cureus, 9 February 2026.

Background: Children with cerebral palsy (CP) are vulnerable to recurrent respiratory tract infections (RTIs), contributing to morbidity and repeated hospital admissions. Parents and caregivers play a key role in prevention, recognition, and home management, but Malaysia-specific validated tools assessing parental knowledge, attitudes, and practices (KAP) are limited.
Methodology: A methodological study developed and preliminarily validated a KAP questionnaire assessing parental self-healthcare related to RTIs among children with CP. Items were generated based on literature review and the KAP framework. Six experts assessed content validity via the Content Validity Index (CVI). Pilot testing among 33 parents examined item clarity, feasibility, and internal consistency reliability.
Results: Item-level CVIs ranged from 0.67 to 1.00. All domains demonstrated excellent scale-level validity (S-CVI/Ave ≥ 0.90). Minor wording adjustments were made; no items were removed. Internal consistency reliability ranged from acceptable to good across domains (knowledge $\alpha = 0.82$; attitude $\alpha = 0.739$; practice $\alpha = 0.795$) and was excellent for the total scale ($\alpha = 0.905$).
Conclusion: The questionnaire demonstrated excellent content validity and satisfactory internal consistency reliability, supporting preliminary psychometric adequacy. Further validation among parents of children with CP is recommended.
PMID: 41835758

29.Unmasking genetic etiologies in neurodevelopmental disorders characterized by Cerebral Palsy: insights from integrative genomic approaches

Ayca Yigit, Ozlem Akgun-Dogan, Zeynep Ozkeserli, Gunseli Bayram Akcapınar, Semih Ayta, Pinar Gencpinar, Hulya Maras Genc, Busra Kutlubay, Bulent Kara, Hatice Gulhan Sozen, Nihat Bugra Agaoglu, Ozkan Ozdemir, Kaya Bilguvar, Ugur Ozbek

Frontiers in Neurology, 23 February 2026.

Introduction: Cerebral palsy (CP) is characterized by permanent, non-degenerative motor deficits, with increasing evidence for genetic contributions. Although prenatal and perinatal risk factors have been well documented, the underlying etiopathology remains incompletely understood. This study aimed to improve diagnostic accuracy and clarify the genetic architecture of CP and CP-like phenotypes through systematic genomic analyses.
Methods: Patients with clinically confirmed CP or CP-like presentations were recruited, and biological samples were stored in the ACU-Biobank. Whole-exome and whole-genome sequencing data were analyzed using a validated in-house pipeline incorporating comprehensive variant filtering, prioritization, and re-phenotyping.
Results: Pathogenic or likely pathogenic variants were identified in 36.4% (24/66) of patients, and variants of uncertain significance in 25.8% (17/66). Identified variants included genes such as SPAST, KIF1A, PLA2G6, CTNNB1, L1CAM, and SYNGAP1. These findings demonstrate a substantial contribution of rare monogenic variants to CP and CP-like phenotypes.
Discussion: This study supports strong genetic contributions to CP etiology and highlights the clinical value of integrating genomic testing. Exome and genome sequencing improved diagnostic yield and supported genotype-informed classification for management and counselling.
PMID: 41835067

30.Testing the performance of polygenic scores for multiple traits to explain cerebral palsy in two independent cohorts

Jodi T. Thomas, Alexander S. F. Berry, Matthew T. Oetjens, Jesia G. Berry, Alastair H. MacLennan, Scott D. Gordon, Andrew T. Hale, Catherine M. Olsen, David C. Whiteman, Rebecca I. Torene, David H. Ledbetter, Nicholas G. Martin, Clare L. van Eyk, Jozef Gecz, Scott M. Myers, Brittany L. Mitchell, Mark A. Corbett

EBioMedicine, 14 March 2026. Online ahead of print.

Background: Cerebral palsy (CP) is a complex neurodevelopmental disorder with environmental and genetic contributors. While rare variants explain a substantial proportion of CP, the contribution of common variants is less clear. This study evaluated whether polygenic scores for CP and related traits explain CP aetiology.
Methods: Two independent cohorts were analysed: an Australian CP Biobank case–control cohort and the U.S. MyCode cohort with CP identified via electronic health records. Only individuals of European ancestry were included. CP polygenic scores were constructed from a publicly available genome-wide association meta-analysis and applied for out-of-sample prediction. Additional scores for seven related traits were also generated. Predictive performance was assessed using logistic regression, AUC, and variance in CP liability explained.
Findings: The Australian cohort included 525 cases and 20,410 controls, and MyCode included 322 cases and 1,610 controls. A combined model of eight polygenic scores significantly discriminated CP status, explaining 1.3% of liability in the Australian cohort and 0.78% in MyCode. CP-specific polygenic scores showed minimal predictive signal, likely due to limited discovery GWAS power. Polygenic scores for known CP predisposing factors showed modest predictive performance. Stratification by monogenic diagnosis yielded similar results.
Interpretation: Findings demonstrate a measurable polygenic contribution to CP and shared genetic influences with key risk factors. Common variants appear to contribute broadly to CP susceptibility, relevant for earlier diagnosis and intervention strategies.
PMID: 41833578

Prevention and Cure

31.Predicting Outcome After Newborn Stroke: A Lesion Network Mapping Study Leveraging Large-Scale Data
Claire E Kelly, Jian Chen, Richard Beare, Belinda Stojanovski, Jesse S Shapiro, Sebastian Grunt, Nedelina Slavova, Manuela Pastore-Wapp, Maja I Steinlin, Mark T Mackay, Joseph Y M Yang
Stroke. 2026 Mar 20. Online ahead of print.

Background: Predicting the development of cerebral palsy after neonatal stroke remains challenging. This study aimed to identify novel acute brain functional connectome-based correlates of cerebral palsy after neonatal stroke.
Methods: Stroke lesions were segmented from routine clinical diffusion images of a cohort of term-born neonates with symptomatic arterial ischemic stroke, recruited to Swiss (from 2000 to 2013) and Australian (from 2003 to 2014) pediatric stroke registries. Lesions and 3-Tesla resting-state functional magnetic resonance imaging of term-born newborns from the developing Human Connectome Project were coregistered to a template. A neonatal stroke functional connectome was created by computing voxel-wise correlations between lesions and gray matter regions. Linear regressions compared functional connections to lesions between participants who did and did not develop cerebral palsy.
Results: From the total N=199 recruited participants, 85 newborns with stroke were included (65% male; median age at magnetic resonance imaging of 4 days), of which 33% developed cerebral palsy at a median age of 2.1 years. Multiple gray matter regions were more highly functionally correlated to lesions in participants who developed cerebral palsy (1721 voxels; t: 5.4–7.4; all $P<0.05$, family-wise error rate-corrected). These regions included the basal ganglia, thalamus, cerebellum, frontal regions (inferior and orbital frontal and superior frontal), temporal regions (pole, superior, and mesial temporal, including hippocampus and amygdala), and the insula.
Conclusions: This study identified functional networks related to the development of cerebral palsy after neonatal stroke. Building on prior individual lesion-based studies, this work suggests that the development of cerebral palsy after neonatal stroke is related to disruptions of broader functional networks involving motor and extramotor regions, as opposed to only lesions in motor regions.
PMID: 41859782

32.Cerebral Hemodynamics in Pediatric Abusive Head Trauma: 3 Severe Cases with Preserved Motor Cortex, Hyperperfusion, and Recovery of Mild Paralysis

Mitsuru Tamura, Shinji Yamashita, Tomoki Kawano, Satoru Komaki, Takeru Tsukino, Koutarou Kojima, Kenichi Maeda, Yasuhiro Kimoto, Yoshihito Kadota, Minako Azuma, Yoshiko Okita

Case Reports NMC Case Rep J. 2026 Feb 20;13:69–75. eCollection 2026.

Abstract
Abusive head trauma in infants and young children can have a significant impact on neurological outcomes and, in severe cases, may be life-threatening. We report 3 cases of abusive head trauma that presented with acute subdural hematomas on computed tomography scans, accompanied by extensive low-density areas and parenchymal brain swelling. All patients exhibited impaired consciousness due to brain injury and underwent craniotomy for hematoma evacuation as well as extensive decompressive craniectomy. Despite the severity of the initial presentation, hemiparesis was mild and gradually improved over several months. Postoperative magnetic resonance imaging revealed widespread parenchymal injury but preservation of the corticospinal tract, including the precentral gyrus. In the acute phase, diffusion-weighted imaging showed no irreversible infarction in the motor cortex, and arterial spin labeling demonstrated increased perfusion in peri-motor regions of the affected hemisphere. These findings suggest that preserved corticospinal pathways and compensatory hyperperfusion may correlate with favorable motor recovery even in the presence of extensive parenchymal damage. These cases highlight the radiological features and short-term neurological outcomes of abusive head trauma, demonstrating preserved motor function despite extensive parenchymal damage.
PMID: 41859526

33.How good is a simple MRI score for predicting cerebral palsy and more?

Linda S de Vries, Frances M Cowan

Dev Med Child Neurol. 2026 Mar 19. Online ahead of print.

No abstract available
PMID: 41858097

34.Early motor repertoire and motor development at 1, 2 and 5 years in infants born very preterm: A prospective cohort study

Francyne Finlayson, Joy E Olsen, Amanda Kwong, Christa Einspieler, Andrea Guzzetta, Rheanna M Mainzer, Alicia Spittle

Early Hum Dev. 2026 Mar 3;218:106524. Online ahead of print.

Aim: To investigate the relationship between early motor repertoire, assessed using the General Movements Optimality Score-Revised (GMOS-R), and motor outcomes at 1, 2, and 5 years' corrected age in infants born <30 weeks' gestation.
Methods: This prospective cohort included General Movements Assessments at 34 weeks' post-menstrual age (n = 76) and term-equivalent age (n = 66) in infants born <30 weeks' gestation. Early motor repertoire was assessed using GMOS-R. Motor outcomes at 1 year were measured using the Alberta Infant Motor Scale and Neurosensory Motor Developmental Assessment; at 2 years using Bayley-III motor score or diagnosis of cerebral palsy; and at 5 years using Movement ABC-2 or diagnosis of cerebral palsy.
Results: Higher GMOS-R scores at both 34 weeks and term-equivalent age were associated with better motor outcomes at 1 year. However, there was limited evidence of associations between GMOS-R scores and motor outcomes at 2 or 5 years.
Conclusion: Higher early GMOS-R scores are associated with better motor outcomes at 1 year in very preterm infants, suggesting value for early identification and intervention pathways. This relationship was not evident at later ages.
PMID: 41844440

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35.Harnessing Sunlight Safely for Newborn Care: Balancing Risks and Benefits in Resource-Limited Settings

Bolajoko O. Olusanya, Nem Yun Boo

Tropical Medicine & International Health, 16 March 2026. Online ahead of print.

Abstract
Growing global interest in solar energy has renewed attention on sunlight exposure and its health impacts. Although sunlight contains harmful ultraviolet radiation, controlled exposure has preventive and therapeutic benefits. In many low- and middle-income countries, newborns are traditionally exposed to early-morning sunlight to prevent vitamin D deficiency and treat neonatal jaundice. Vitamin D deficiency can lead to nutritional rickets, while untreated severe jaundice may cause complications such as brain injury, deafness, cerebral palsy, or death. However, most clinical guidelines discourage sunlight exposure due to risks including dehydration, hyperthermia, sunburn, and long-term skin cancer. This creates a dilemma in settings where vitamin D supplements, specialised healthcare, and phototherapy are unavailable or unreliable. Recent trials in sub-Saharan Africa indicate that filtered-sunlight phototherapy—which blocks harmful ultraviolet radiation while allowing therapeutic blue light—can safely and effectively treat neonatal jaundice, with potential vitamin D benefits. Further research, improved jaundice screening, and clear guidance are needed to ensure safe use of controlled sunlight exposure.
PMID: 41834566