Cerebral palsy research news

Monday 05 May 2025

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Interventions and Management

Interventions and Management

1.Selecting Patient-Reported Outcome Measures for Pediatric Upper Extremity Function: A Systematic Review

Miguel Fiandeiro, Holly Cordray, John R Vaile, Sarah L Struble, Manisha Banala, Meagan Pehnke, Apurva S Shah, Shaun D Mendenhall

J Pediatr Orthop . 2025 Apr 30. doi: 10.1097/BPO.0000000000002991. Online ahead of print.

Background: Patient-reported outcome measures (PROMs) are important in understanding pediatric upper extremity outcomes. Little guidance is available to help clinicians select appropriate PROMs, which are often used beyond their scope of validation. This systematic review analyzed the content, readability, and psychometrics of existing PROMs of pediatric upper extremity function.
Methods: PubMed, Embase, CINAHL, and Scopus were searched. Eligible studies evaluated psychometrics of global upper extremity function PROMs in pediatric patients. Following PRISMA guidelines, 2 reviewers screened studies, extracted data, assessed risk of bias, and rated psychometrics using the COnsensus-based Standards for selection of health Measurement INstruments (COSMIN). Content was analyzed using the Occupational Therapy Practice Framework and well-established readability indices.
Results: Reviewers screened 2513 studies; 44 reports on 9 PROMs were included. The Pediatric Outcomes Data Collection Instrument (PODCI) showed strong evidence of validity and responsiveness for the widest range of conditions, covered all upper extremity functional categories and occupational domains, and easily achieved the American Medical Association's readability standards. The Upper-Extremity Cerebral Palsy Profile of Health and Function Computerized Adaptive Test (UE-CP-PRO) showed stronger psychometrics for cerebral palsy and brachial plexus birth injury. The Infant Motor Activity Log (IMAL) is the strongest option for infants under 2 years old. The Patient-Reported Outcomes Measurement Information System Upper Extremity Module (PROMIS-UE) has strong potential but requires more diagnosis-specific validation.
Conclusions: We recommend the PODCI, UE-CP-PRO, and IMAL as outlined. We also urge further validation of the PROMIS-UE computerized adaptive test and short form as shorter, more customizable alternatives to the PODCI.
PMID: 40304435

2.Executive function and bimanual performance in children with unilateral cerebral palsy

No authors listed

Dev Med Child Neurol . 2025 Apr 27. doi: 10.1111/dmcn.16336. Online ahead of print.

No abstract available
PMID: 40289510

3.Characteristics of children with ataxic cerebral palsy

Katina Pettersson, Mette Johansen, Reidun Jahnsen, Elisabet Rodby-Bousquet

BMC Pediatr . 2025 Apr 29;25(1):335. doi: 10.1186/s12887-025-05681-x.

Background: To compare the characteristics, functional levels, and comorbidities of children with ataxic cerebral palsy (CP), with those of children with other CP subtypes.
Methods: A cross-sectional study of children with CP born between 2000 and 2019 as reported in the Scandinavian national CP follow-up programmes and quality registries. Data for age, sex, levels of the Gross Motor Function Classification System (GMFCS), the Manual Ability Classification System (MACS), the Communication Function Classification System (CFCS), epilepsy, intellectual disability, and pain were extracted.
Results: There were 302 children (3.9%) with ataxic CP and 7336 children (96.1%) with other subtypes. Children with ataxic CP differed significantly from other subtypes, with a greater proportion classified in GMFCS II (37.7% vs. 15%), MACS II (41.4% vs. 24.8%), and CFCS II (24.7% vs. 10.5%), more girls (50.7% vs. 41.7%), school-aged (47% vs. 41.6%), adolescents (33.4% vs. 25.4%), or had an intellectual disability (51.2% vs. 38.4%), but the prevalence of pain and epilepsy was similar between the subtypes.
Conclusions: Children with ataxic CP have different characteristics and functional levels than children with other subtypes. We recommend a thorough examination of motor performance, communication, and intellectual disability to meet the individual needs of children with ataxic CP.
PMID: 40296036

4.Tele-assessment of trunk control in children with cerebral palsy: Intra- and inter-rater reliability, and validity of the trunk control measurement scale

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J Telemed Telecare . 2025 Apr 30:1357633X251336009. doi: 10.1177/1357633X251336009. Online ahead of print.

Abstract
Introduction The aim of the study was to evaluate the intra- and inter-rater reliability, and validity of the Trunk Control Measurement Scale (TCMS) for tele-assessment in children with cerebral palsy (CP).Method A cross-sectional study was conducted with 36 children aged 4-18 years, diagnosed with hemiplegic CP. Participants underwent four TCMS assessments: in-person assessment, tele-assessment via videoconferencing, and two video-based tele-assessments scored by same rater and by a second rater. Reliability was analyzed using intraclass correlation coefficients (ICC). Discriminant validity was assessed by comparing TCMS tele-assessment scores between children with Gross Motor Function Classification System (GMFCS) levels I and II, while criterion validity was evaluated by examining the correlation between face-to-face and tele-assessment TCMS scores. Results Excellent reliability was observed between face-to-face and tele-assessment (ICC: 0.91; 95%CI: 0.83-0.95). TCMS tele-assessment also demonstrated excellent intra-rater reliability (ICC: 0.90, 95%CI: 0.80-0.94) and high inter-rater reliability (ICC: 0.82, 95%CI: 0.66-0.90). Criterion validity was confirmed by strong correlations between face-to-face and tele-assessment scores ($r = 0.925$, and $r = 0.892$, $p < 0.001$ for rater-1 and rater-2, respectively). The TCMS successfully discriminated children by functional levels, demonstrating discriminative validity ($p = 0.002$). Bland-Altman analysis revealed minimal systematic error, with internal consistency remaining high across all assessments (>0.88).Discussion TCMS is a valid and reliable tool for teleassessing trunk control in children with hemiplegic CP. These results may pave the way for developing child-specific, targeted telerehabilitation programs, bringing telerehabilitation closer to its primary aim of ensuring equal opportunities. This study was registered as a clinical trial (NCT06707831). https://clinicaltrials.gov/study/NCT06707831.
PMID: 40302488

5.Comparison of the Effectiveness of Different Trunk-Focused Exercise Approaches for Children With Unilateral Cerebral Palsy: A Randomized Controlled Trial

Derya Azim, Burcu Ersoz Huseyinsinoglu, Ipek Yeldan

Pediatr Exerc Sci . 2025 Apr 30:1-9. doi: 10.1123/pes.2024-0126. Online ahead of print.

Purpose: This study compared the effects of Neuro-Developmental Treatment-based trunk training, video game-based trunk training (VG-TT), and VG-TT with an orthotic garment in children with unilateral cerebral palsy.
Methods: Forty-two children with unilateral cerebral palsy received usual physiotherapy (2 d/wk) for 8 weeks (control period). They were then randomized to 8 weeks of Neuro-Developmental Treatment-based trunk training, VG-TT, or VG-TT with an orthotic garment (2 d/wk) alongside usual physiotherapy (intervention period). Primary outcomes were the Trunk Control Measurement Scale and Becure Balance Assessment System. Secondary outcomes included the Pediatric Berg Balance Scale and Gillette Functional Assessment Questionnaire.
Results: No significant improvements in trunk control were observed during the control period ($P > .05$), and all groups showed significant gains during the intervention period ($P < .05$). Functional and sitting balance improved in all groups throughout both periods ($P < .05$). However, no significant differences were found between intervention groups in trunk control, sitting balance, balance, or walking function ($P > .05$).
Discussion: Trunk-specific training enhances trunk control and functional balance in children with unilateral cerebral palsy. As no approach proved superior, interventions can be tailored based on individual needs and clinical context.
PMID: 40306619

6.Study protocol for the Australasian Cerebral Palsy Musculoskeletal Health Network (AusCP MSK) prospective cohort study: early detection of musculoskeletal complications in young children with moderate to severe cerebral palsy (GMFCS III-V)

Craig F Munns, Laura A Bentley, Roslyn N Boyd, Denise Brookes, Maddison J Taylor, Peter Pivonka, Natasha Nassar, Stewart G Trost, J Paige Little, Kylie Tucker, Joshua Burns, Leanne Sakzewski, Nadia Badawi, Robert S Ware, Tracy Comans, Kate L Willoughby, Simon Paget; AusCP MSK Collaborator Group

Multicenter Study BMJ Open . 2025 Apr 30;15(4):e095526. doi: 10.1136/bmjopen-2024-095526.

Background: Cerebral palsy (CP) is the most common physical disability of childhood, affecting movement and posture, resulting from a neurological insult during pregnancy or the neonatal period. While the brain lesion is static, the musculoskeletal sequelae in CP are often progressive and lifelong, associated with pain and can impact the lives of children with CP, their families and the healthcare system. The Australasian Cerebral Palsy Musculoskeletal Health Network (AusCP MSK) study will conduct comprehensive, population-based surveillance of children with moderate to severe functional mobility limitations (Gross Motor Function Classification System (GMFCS) levels III-V) to explore the early biomarkers of, and interactions between, musculoskeletal complications related to CP, including hip displacement, scoliosis and skeletal fragility.
Methods: The AusCP MSK study involves three cohorts of children. Cohort A (n=500) is a multicentre retrospective (3 years) and prospective (4 years) cohort study in children aged 4-9 years that will be implemented at five sites across Australia and New Zealand. Retrospective data will include clinical history, information on CP diagnosis and other investigations (previous X-rays and biochemistry). Primary prospective outcomes will involve measures of hip displacement (migration percentage, acetabular index, femoral head orientation, Hilgenreiner's epiphyseal angle), scoliosis (Anteroposterior/Posteroanterior and lateral spine X-ray), skeletal fragility (Dual Energy X-ray Absorptiometry, peripheral quantitative computed tomography), motor function (GMFCS, Manual Ability Classification System (MACS) and Communication Function Classification System (CFCS)) and range of movement (lower limb and spine). Cohort B (n=4000) is a retrospective analysis of data to evaluate fractures in children up to 18 years of age with CP (GMFCS I-V) from the New South Wales (NSW)/Australian Capital Territory CP Registers linked with corresponding records from NSW administrative health data (n=3000), and a New Zealand cohort of linked data from the New Zealand Cerebral Palsy Register to the Accident Compensation Corporation data for fracture claims (n=1000). Cohort C (n=30) will cross-sectionally examine bone quality through a transiliac bone biopsy in children undergoing scheduled hip surgery. Relationships between early biomarkers, early brain structure and musculoskeletal complications will be explored using multilevel mixed-effect models.
Ethics and dissemination: Ethical approval for this study was granted by Children's Health Queensland Hospital and Health Service Human Research Ethics Committee, The University of Queensland Human Research Ethics Committee and the New Zealand Health and Disability Ethics Committee.Research outcomes will be disseminated via scientific conferences and publications in peer-reviewed journals; to the National Bodies and Clinicians; and to people with CP and their families.
Trial registration number: Australian New Zealand Clinical Trials Registry number: ACTRN12622000788774p.
PMID: 40306994

7.Clinical effectiveness of an individually tailored strengthening programme, including progressive resistance exercises and advice, compared to usual care for ambulant adolescents with spastic cerebral palsy (ROBUST trial): a parallel group randomized controlled trial

Sally Hopewell, David J Keene, Ioana Marian, Daniel C Perry, Ines Rombach, Morag Andrew, Catherine Barry, Loretta Davis, Gregory Firth, Heidi Fletcher, Beth Fordham, Vivi Gregory Osborne, Helen Gregory Osborne, Lesley Katchburian, Joanna O'Mahoney, Jeremy Parr, Rachel Rapson, Jennifer Ryan, Elnaz Saeedi, Megan Stone, Helen Wood, Tim Theologis

Bone Jt Open . 2025 May 1;6(5):517-527. doi: 10.1302/2633-1462.65.BJO-2024-0268.

Aims: Muscle strengthening exercises are one of the interventions frequently prescribed by physiotherapists for adolescents with cerebral palsy (CP). However, there is wide variability in the exercise regimes used and limited evidence of their effectiveness. The ROBUST trial will assess the clinical effectiveness of an individually tailored strengthening programme, including progressive resistance exercises and advice, compared to usual care for ambulant adolescents with spastic CP.
Methods: We are conducting a multicentre, two-arm, parallel group, superiority randomized controlled trial. We will recruit adolescents aged 12 to 18 years with a diagnosis of spastic CP (bilateral or unilateral) Gross Motor Function Classification System (GMFCS) levels I to III who are able to comply with the assessment procedures and exercise programme with or without support. Participants will be recruited from at least 12 UK NHS Trust physiotherapy and related services. Participants (n = 334) will be randomized (centralized computer-generated 1:1 allocation ratio) to either: 1) a progressive resistance exercise programme, with six one-to-one physiotherapy sessions over 16 weeks; or 2) usual NHS care, with a single physiotherapy session and an assessment session, and advice regarding self-management and exercise.
Conclusion: The primary outcome is functional mobility measured using the child-/parent-reported Gait Outcomes Assessment List (GOAL) at six months. Secondary outcomes are: clinician-assessed muscle strength (Five Times Sit-to-Stand Test) and motor function (timed up and go test) at six months; functional mobility (GOAL) at 12 months; independence (GOAL subdomain A), balance (GOAL subdomain A, B, D), pain and discomfort (GOAL subdomain C), health-related quality of life (youth version of the EuroQol five-dimension questionnaire; EQ-5D-Y), educational attendance, exercise adherence, and additional physiotherapy treatment (six and 12 months). The primary analysis will be intention to treat.
PMID: 40306695

8.Clinical effectiveness of a child-specific dynamic stretching programme, compared to usual care, for ambulant children with spastic cerebral palsy (SPELL trial): a parallel group randomized controlled trial

Tim Theologis, Daniel C Perry, Ines Rombach, David J Keene, Ioana R Marian, Morag Andrew, Catherine Barry, Loretta Davis, Gregory Firth, Heidi Fletcher, Beth Fordham, Vivi Gregory Osborne, Helen Gregory Osborne, Lesley Katchburian, Joanna O'Mahoney, Jeremy R Parr, Rachel Rapson, Jennifer Ryan, Fema Er, Megan Stone, Helen Wood, Sally Hopewell

Bone Jt Open . 2025 May 1;6(5):506-516. doi: 10.1302/2633-1462.65.BJO-2024-0267

Aims: Dynamic muscle stretching exercises are one of the interventions frequently prescribed by physiotherapists for children with cerebral palsy (CP). However, there is wide variability in the exercise regimes used and limited evidence of their effectiveness. The SPELL trial will assess the clinical effectiveness of an individually tailored dynamic stretching programme, compared to usual care for ambulant children with spastic CP.
Methods: We are conducting a multicentre, two-arm, parallel group, superiority randomized controlled trial. We will recruit children aged four to 11 years with a diagnosis of spastic CP (bilateral or unilateral) and Gross Motor Function Classification System (GMFCS) levels I to III who are able to comply with assessment procedures and exercise programme with or without support. Participants will be recruited from at least 12 UK NHS Trust physiotherapy and related services. Participants (n = 334) will be randomized (centralized computer-generated one:one allocation ratio) to either: 1) a dynamic stretching exercise programme, with six one-to-one physiotherapy sessions over 16 weeks; or 2) usual NHS care, with a single physiotherapy session and an assessment, and advice regarding self-management and exercise.
Conclusion: The primary outcome is functional mobility measured using the child-/parent-reported Gait Outcomes Assessment List (GOAL) at six months. Secondary outcomes are: joint range of motion (Cerebral Palsy Integrated Pathway protocol) and motor function (timed up and go test) at six months; functional mobility (GOAL) at 12 months; independence (GOAL subdomain A); balance (GOAL subdomain A, B, D); pain and discomfort (GOAL subdomain C); health-related quality of life (youth version of the EuroQol five-dimension questionnaire (EQ-5D-Y)); educational attendance; exercise adherence; and additional physiotherapy treatment at six and 12 months. The primary analysis will be intention to treat.
PMID: 40306688

9.Movement-Based Priming: A Clinical Trial on the Effect of Cross-Training on Locomotor Abilities of Children with Unilateral Cerebral Palsy

Tamer M Elsaeed, Ragab K Elnaggar, Mohammed F Elbanna, Mshari Alghadier, Aziza M Kamel, Ahmed M Aboeleneen, Fahad A Qissi, Marwa M Ismaeel

Children (Basel). 2025 Apr 15;12(4):508. doi: 10.3390/children12040508.

Abstract
Background: Children with unilateral cerebral palsy (UCP) frequently experience limitations in locomotor abilities, attributable to a complex interplay of factors including muscle weakness and reduced joint mobility. Movement-based priming, such as cross-training (CT), has emerged as a potential intervention to enhance motor function in children with UCP. However, evidence of its efficacy remains limited. Objective: This study aimed to investigate the effect of CT-specifically, a strengthening-based unilateral priming protocol-on muscle strength, joint mobility, and locomotor abilities in children with UCP. Methods: Thirty-six children with UCP were enrolled in a randomized controlled trial. Participants were randomized into two groups: the control group (n = 18; underwent a tailored physical rehabilitation program) and the CT group (n = 18; participated in a CT program incorporating unilateral priming exercises targeting the less-affected lower followed by the same rehabilitation program administered to the control group). Dorsiflexor strength, ankle joint mobility, and locomotor ability assessed via the 10 m walk test (10 mWT), 6 min walk test (6 MWT), and timed up-and-go test (TUG) were evaluated pre- and post-intervention. Results: Significant moderate-to-large between-group differences were observed in dorsiflexor strength ($p = 0.032$, partial $\eta2 = 0.128$), ankle mobility ($p = 0.016$, partial $\eta2 = 0.159$), and locomotor ability (10 mWT [$p = 0.017$, partial $\eta2 = 0.157$]; 6 MWT [$p = 0.004$, partial $\eta2 = 0.222$]; TUG [$p = 0.047$, partial $\eta2 = 0.111$]). The CT group demonstrated superior improvements concerning all outcomes. Conclusions: Unilateral priming through strengthening-based CT is a viable intervention for enhancing motor function in children with UCP, providing a promising complement to the current rehabilitation protocols.
PMID: 40310138

10.Physical Activity in Children and Young Adults With Cerebral Palsy: Results From a Three-Month Exercise Intervention

Tiina Savikangas, Pedro Valadão, Eero A Haapala, Iida Laatikainen-Raussi, Timo Rantalainen, Taija Finni

Eur J Sport Sci . 2025 May;25(5):e12313. doi: 10.1002/ejsc.12313.

Abstract
Individuals with cerebral palsy (CP) are suggested to be less active than typically developing controls (TDs). However, their higher physical activity (PA) energy expenditure during a given activity should be considered. We investigated PA in 10 children and young adults with CP (seven males, 15.4 ± 5.1 years, and Gross Motor Function Classification System [GMFCS] level I/III) and eight TDs (six males, 15.3 ± 4.2 years). PA was assessed with a triaxial accelerometer at baseline and, in participants with CP, during a 3-month exercise intervention. Data were analyzed for sedentary time, light PA, and moderate-to-vigorous PA using both general and, for participants with CP, GMFCS-specific cutoffs. Statistical analyses included independent and paired sample t-tests. Based on the general cutoffs, TD and CP participants accumulated on average 516.0 ± 122 and 610 ± 92 min/day sedentary time, 155 ± 37 and 138 ± 46 min/day light PA, and 76 ± 28 and 58 ± 30 min/day moderate-to-vigorous PA at baseline. No statistically significant between-group differences were found ($p \geq 0.081$). When applying GMFCS-specific cutoffs, participants with CP on average accumulated 537 ± 105, 206 ± 61, and 64 ± 31 min/day sedentary time, light PA, and moderate-to-vigorous PA. These values differed from their values based on general cutoffs ($p \leq 0.004$). The 51 min difference in light PA in favor of the CP group was borderline significant ($p = 0.054$). In the CP group, PA did not change from baseline to follow-up ($p \geq 0.098$). In conclusion, children and young adults with CP may be as active as TDs, especially when their higher PA energy cost is considered. Muscle strength and gait performance improving exercise did not seem promising in facilitating PA. TRIAL REGISTRATION: ISRCTN69044459.
PMID: 40305589

11.The Bobath Clinical Reasoning Framework: A systems science approach to the complexity of neurodevelopmental conditions, including cerebral palsy

No authors listed

Dev Med Child Neurol . 2025 Apr 27. doi: 10.1111/dmcn.16338. Online ahead of print.

No abstract available
PMID: 40289408

12.The comprehensibility and feasibility of the modified brief pain inventory and fear of pain questionnaire adapted for children and young people with cerebral palsy

Meredith Grace Smith, Rachel J Gibson, Mathew Schibani, Remo N Russo, Abirami Thirumanickam, Adrienne R Harvey

Qual Life Res. 2025 Apr 29. doi: 10.1007/s11136-025-03981-4. Online ahead of print.

Purpose: To test the comprehensibility and feasibility of the modified brief pain inventory (mBPI) and Fear of Pain Questionnaire for Children short-form (FOPQ-C-SF) adapted for children and young people with cerebral palsy (CP), with diverse cognitive and communication abilities. Improving assessment of pain interference (mBPI) and pain-related fear (FOPQ -C-SF) in CP can enhance quality of life by increasing access to under-utilised interventions targeting pain-related physical disability and mental health.
Methods: A convergent mixed methods approach was used. Twenty-two people (5-30 years) with CP completed the adapted mBPI and FOPQ-C-SF in a cognitive interview, administered by pen/paper or TalkingMats®, an evidence-based visual communication framework. Cognitive interviewing approaches were adapted to optimise participation and expression for diverse cognitive and communication abilities. Quantitative data were analysed to report tool administration times, overall completion rates and communication effectiveness. Qualitative data were analysed by content analysis to determine further changes required to the tools.
Results: Median administration times were 6.2 min (IQR = 5.3-7.6) for mBPI and 4.1 min (IQR = 2.7-4.9) for FOPQ-C-SF. All completed the mBPI. Three did not complete the FOPQ-C-SF due to fatigue, challenging behaviour and parent recommendation. Ten minor changes were identified.
Conclusion: The adapted mBPI and FOPQ-C-SF are likely comprehensible and feasible for children and young people with CP, including those with diverse cognitive and communication abilities. It is likely most children and young people with CP can effectively communicate responses to both tools. The adapted tools will now undergo further psychometric testing, prior to becoming freely available for clinical and research use.
Plain language summary
Up to three-quarters of children and young people with cerebral palsy report chronic pain, which is much higher than those without cerebral palsy. Despite this, chronic pain is often poorly managed, with best practice pain management options being under-utilised by people with cerebral palsy. Improving how chronic pain is assessed can lead to better pain management, which can improve a person's quality of life. Although pain questionnaires are available, many are not suitable for children and young people with cerebral palsy with different communication, cognitive and movement abilities. Previous work by our team has adapted two pain questionnaires for children and young people with cerebral palsy: The Fear of Pain Questionnaire for Children and the modified Brief Pain Inventory. The aim of this study was to test the adapted pain questionnaires in children and young people with cerebral palsy to ensure they were practical to use and were understood appropriately. To ensure this, people with cerebral palsy who also have different communication, cognitive and movement abilities were included. This study found that the adapted questionnaires are likely understood and practical to use for children and young people with cerebral palsy, including those with different abilities. The adapted questionnaires can now be further tested and then made freely available for clinical and research use. Using the adapted questionnaires in clinical practice may help to identify people who could benefit from pain treatments and connect them with supports.
PMID: 40301159

13.Pain and sleep difficulties in young children with cerebral palsy does not vary by gross motor function, parent demographics, or parent expectations for rehabilitation therapy

Ben Reader, Elizabeth Maus, Jianing Ma, Jeff Xueliang Pan, Jill C Heathcock

Res Dev Disabil. 2025 Apr 30:162:105029. doi: 10.1016/j.ridd.2025.105029. Online ahead of print.

Aim: The aims of the present study were to describe the prevalence of pain and sleep difficulties in children (2-8 years) with cerebral palsy (CP) and investigate the relationships between pain and sleep difficulties and gross motor function, parent demographics, and parent expectations for pain and sleep to improve with therapy services.
Methods and procedures: This cross-sectional study included parent reports of pain and sleep difficulties in children, demographic data, gross motor function, socioeconomic status (Hollingshead Four-Factor Index of Socioeconomic Status), and parent expectations of rehabilitation therapy services on pain and sleep (Pediatric Outcomes Data Collection Instrument).
Outcomes and results: Of the 97 participants, 47.4 % experienced pain in the week prior, 20.6 % the day of, and 33.0 % reported sleep difficulties. Pain in the week prior was significantly associated with sleep difficulties ($p = 0.003$). No significant relationships were found between pain and sleep difficulties and demographics, gross motor function, or parent income. Parent expectations regarding the impact of rehabilitation therapies on pain and sleep varied.
Conclusions and implications: Young children with CP demonstrate a high prevalence of pain and sleep difficulties. While pain is associated with sleep difficulties, gross motor function and parent demographics did not show associations. This underscores the need for comprehensive monitoring and rehabilitative treatments for pain and sleep difficulties in children with CP. Understanding the impact of rehabilitation therapies on pain and sleep in children with CP may help manage expectations for rehabilitation therapy services accurately.
PMID: 40311156

14.Biomechanical and clinical differences in muscle tone, stiffness, range of motion, and pain perception in children with cerebral palsy: a cross-sectional study

Ramón González-Matilla, Vanesa Abuín-Porras, Isabel Mínguez-Esteban, Alberto M Heredia-Rizo

Front Physiol . 2025 Apr 15:16:1588084. doi: 10.3389/fphys.2025.1588084. eCollection 2025.

Introduction: Spasticity and altered muscle tone are key features in children with neurodevelopmental disorders, particularly cerebral palsy (CP). They impact movement, range of motion (ROM), and pain perception, influencing functional abilities and quality of life. Understanding the intrinsic muscle differences in children with CP can help improve clinical assessment and therapeutic interventions. This study aims to evaluate differences in muscle tone, stiffness, ROM, and pain perception between children with CP and typically developing peers using objective biomechanical measures.
Methods: An observational, cross-sectional study was conducted with 40 participants of both sexes (20 children with CP, 20 typically developing peers). Muscle tone and stiffness of the lower limb muscles were measured using the Myoton PRO device. ROM was assessed by goniometry, and pain perception was evaluated using the Visual Analog Scale during a Straight Leg Raise (SLR) test. A generalized linear mixed model was used to detect differences in myotonometry, ROM, and pain perception measurements. In participants with CP, the Pearson product-moment correlation coefficient analysis was used to explore possible associations between clinical features and muscle tone and stiffness.
Results: Children with CP exhibited reduced ROM, with a significant group effect for hip flexion ($P < 0.001$; $\eta2 = 0.843$), knee extension ($P < 0.001$; $\eta2 = 0.355$), and ankle flexion ($P < 0.001$; $\eta2 = 0.959$) and higher pain perception during the SLR test ($P < 0.001$; $\eta2 = 0.831$), compared to controls. Myotonometry revealed significantly increased muscle stiffness of the rectus femoris ($P = 0.004$; $\eta2 = 0.112$) and adductor muscles ($P = 0.019$; $\eta2 = 0.074$) in the CP group, with no differences in muscle tone between the groups. Sex-related differences were found for muscle tone and stiffness, with males showing higher values. Correlation analyses indicated that adductor muscles stiffness was associated with CP severity.
Conclusion: Children with CP demonstrate significant changes in ROM, pain perception, and muscle stiffness, emphasizing the need for targeted therapeutic interventions. These findings support the use of objective biomechanical tools for assessing muscle properties in clinical settings, contributing to better management strategies for spasticity-related impairments.
PMID: 40303594

15.Predictive Factors for Postoperative Outcomes of Cervical Spondylotic Myelopathy in Individuals With Cerebral Palsy

Su Ji Lee, Jihye Hwang, Min Gyu Kang, Minjae Cho, Yoon Ha, Sung-Rae Cho

Global Spine J . 2025 May 2:21925682251337396. doi: 10.1177/21925682251337396. Online ahead of print.

Abstract
Study Design Retrospective cohort study. Objectives This study aimed to identify factors influencing postoperative outcomes of cervical spondylotic myelopathy (CSM) in individuals with cerebral palsy (CP).Methods Data from admitted individuals were retrospectively reviewed. Individuals whose modified Barthel index score, assessed at least 6 months after surgery, declined by 1 or more grades compared to their preoperative score were classified into the poor outcome (PO) group. Multivariate logistic regression analysis was performed to assess risk factors for poor postoperative outcomes. Results Of the 73 participants, 15 were in the PO group and 58 in the non-PO group. Duration (OR 1.99, 95% CI 1.25-3.65, P = .01), signal change grade 2 (OR 10.44, 95% CI 1.32-118.01, P = .034), and spinal cord compression ratio, M2 (OR 0.85, 95% CI, 0.73-0.96, P = .02) on preoperative MRI were identified as significant factors associated with the risk of poor postoperative outcomes. Based on the receiver operating characteristic curve analysis, the cutoff values for duration and cord compression metric were determined as 2 years (AUC = 0.689, 95% CI 0.532-0.845) and 76.2% (AUC = 0.841, 95% CI 0.696-0.987), respectively. Conclusions This study identified key predictors of poor postoperative outcomes in individuals with CP undergoing surgery for CSM. Symptom duration exceeding 2 years, signal change grade 2, and spinal cord compression ratio below 76.2% on preoperative MRI were found to be predictors of poor outcome. These results underscore the importance of early intervention and detailed preoperative radiological assessment to improve surgical outcomes in this population.
PMID: 40315352

16.School-Based Virtual Reality Programming for Obtaining Moderate-Intensity Exercise Among Children With Disabilities: Pre-Post Feasibility Study

Byron Lai, Ashley Wright, Bailey Hutchinson, Larsen Bright, Raven Young, Drew Davis, Sultan Ali Malik, James H Rimmer; Pelham High Community Engagement Group

JMIR Form Res . 2025 Apr 25:9:e65801. doi: 10.2196/65801.

Background: Children have busy daily schedules, making school an ideal setting for promoting health-enhancing exercise behavior. However, children with mobility disabilities have limited exercise options to improve their cardiorespiratory fitness and cardiometabolic health.
Objective: This study aims to test the feasibility of implementing a virtual reality (VR) exercise program for children with mobility disabilities in a high school setting.
Methods: A pre- to posttrial single-group design with a 6-week exercise intervention was conducted at a high school. The study aimed to enroll up to 12 students with a disability. Participants were given the option of exercising at home or school. The exercise prescription was three 25-minute sessions per week at a moderate intensity, using a head-mounted VR display. School exercise sessions were supervised by research staff. Home exercise sessions were performed autonomously. Several implementation metrics of feasibility were recorded, including exercise attendance, volume, adverse events or problems, and benefits related to health-related fitness (walking endurance and hand-grip strength). The study also included a qualitative evaluation of critical implementation factors and potential benefits for participants that were not included in the study measures. Outcomes were descriptively analyzed, and 2-tailed t tests were used as appropriate.
Results: In total, 10 students enrolled in the program and 9 completed the study (mean age 17, SD 0.6 y). In total, 5 (56%) participants exercised at school, and 4 (44%) exercised at home; 1 participant dropped out prior to exercise. The mean attendance for all 9 completers was 61.1% (11/18 sessions). The mean exercise minutes per week was 35.5 (SD 22) minutes. The mean move minutes per session was 17.7 (SD 11) minutes. The mean minutes per session was 18 (SD 1.4) minutes for school exercisers and 17 (SD 18) minutes for home exercisers, indicating variable responses from home exercisers. The mean rating of perceived exertion per exercise session was 4.3 (SD 2), indicating a moderate intensity that ranged from low to hard intensity. No adverse events or problems were identified. No improvements in walking endurance or hand-grip strength were observed. School exercisers achieved a higher attendance rate (83%) than home exercisers (27%; P<.001) and seemingly had a 2-fold increase in the volume of exercise achieved (school: mean 279, SD 55 min; 95% CI 212-347; home: mean 131, SD 170 min; 95% CI -140 to 401; P=.10). Qualitative themes relating to implementation factors and benefits to participant well-being were identified.
Conclusions: This study identified factors to inform an optimal protocol for implementing a high school-based VR exercise program for children with disabilities. Study findings demonstrated that moderate exercise at school is feasible in VR, but simply providing children with VR exergaming technology at home, without coaching, will not successfully engage them in exercise.
PMID: 40296574

17.VIGMA: An Open-Access Framework for Visual Gait and Motion Analytics

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IEEE Trans Vis Comput Graph. 2025 Apr 28:PP. doi: 10.1109/TVCG.2025.3564866. Online ahead of print.

Abstract
Gait disorders are commonly observed in older adults, who frequently experience various issues related to walking. Additionally, researchers and clinicians extensively investigate mobility related to gait in typically and atypically developing children, athletes, and individuals with orthopedic and neurological disorders. Effective gait analysis enables the understanding of the causal mechanisms of mobility and balance control of patients, the development of tailored treatment plans to improve mobility, the reduction of fall risk, and the tracking of rehabilitation progress. However, analyzing gait data is a complex task due to the multivariate nature of the data, the large volume of information to be interpreted, and the technical skills required. Existing tools for gait analysis are often limited to specific patient groups (e.g., cerebral palsy), only handle a specific subset of tasks in the entire workflow, and are not openly accessible. To address these shortcomings, we conducted a requirements assessment with gait practitioners (e.g., researchers, clinicians) via surveys and identified key components of the workflow, including (1) data processing and (2) data analysis and visualization. Based on the findings, we designed VIGMA, an open-access visual analytics framework integrated with computational notebooks and a Python library, to meet the identified requirements. Notably, the framework supports analytical capabilities for assessing disease progression and for comparing multiple patient groups. We validated the framework through usage scenarios with experts specializing in gait and mobility rehabilitation. VIGMA is available at https://github.com/komar41/vigma.
PMID: 40293881

18.Mobility device use in children with cerebral palsy

Elizabeth Maus, Ben Reader, Jill C Heathcock

Dev Med Child Neurol . 2025 May 1. doi: 10.1111/dmcn.16345. Online ahead of print.

Aims: To quantify the number and types of mobility devices used by children with cerebral palsy (CP) and explore the relationships between Gross Motor Functional Classification System (GMFCS) level, age, insurance, income, and number and types of devices.
Method: This was a secondary analysis of a cohort from a larger randomized controlled trial. Data from 89 children with CP (56.2% male and 43.8% female; mean = 4 years 11 months; SD = 2 years 0 months; range 2 years 0 months-8 years 10 months) were collected from electronic medical records, parent-completed medical history questionnaires, and the Hollingshead Four-Factor Index. The analysis included quasi-Poisson and logistical regressions.
Results: Most children had Medicaid insurance (83.2%). All income and GMFCS levels were represented. The most common mobility devices were lower-extremity orthoses (75.3%). The number of devices used increased by 8.2% for each 1-year increase in age. Children classified in GMFCS level V used 5.1, 2.9, and 1.6 times more mobility devices than children classified in GMFCS levels I, II, and III respectively. GMFCS level also predicted the use of wheelchairs, bath chairs, and standers. Income and insurance were not significant.
Interpretation: Children used more devices as age and GMFCS level increased. Device access is an important public health initiative.
PMID: 40312278

19.A sibling study of the prenatal and perinatal risks for cerebral palsy

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Pediatr Res . 2025 May 2. doi: 10.1038/s41390-025-04055-4. Online ahead of print.

Background: To evaluate the associations between prenatal and perinatal factors and CP risk using a statewide sibling-comparison design.
Methods: We established a cohort of over 4 million singleton births in California during 2007-2015, and we identified families with outcome-discordant siblings of 1213 CP and 1544 non-CP. We estimated odds ratio (OR) and 95% confidence interval (CI) for CP according to perinatal factors including preterm birth (PTB), small for gestational age, low Apgar score, and prenatal factors including maternal pregnancy complications (perinatal infection, gestational diabetes, preeclampsia) and lifestyle-related factors (cigarette smoking, pre-pregnancy overweight).
Results: The perinatal factors remained strongly associated with CP using sibling design, although the point estimates were smaller for PTB (cohort OR = 4.72, 95%CI 4.42-5.04, sibling OR = 3.49, 95%CI 2.74-4.46) and low Apgar score (cohort OR = 19.62, 95%CI 17.99-21.41, sibling OR = 8.79, 95%CI 5.49-14.08). In sibling design, the associations between maternal pregnancy complications or pre-pregnancy overweight and CP risk were attenuated to null. We observed stronger effects between maternal cigarette smoking and CP in the sibling design, however sensitivity tests indicated possible bias from carryover effects.
Conclusion: Adverse perinatal factors remained strongly associated with childhood CP, while uncontrolled confounding bias required considerations for pregnancy complications and CP development.
Impact: We conducted a population-based sibling comparison study to evaluate the associations between several prenatal and perinatal factors and cerebral palsy (CP). Preterm birth, small for gestational age, and low Apgar score at birth remained strongly associated with CP using the sibling comparison design. The associations between several maternal pregnancy complications and CP were close to null in the sibling comparison design, raising the possibility of uncontrolled confounding bias in the cohort analyses. We demonstrated that a sibling comparison design can provide valuable information to triangulate research evidence for CP etiology, but a careful implementation and interpretation of findings is warranted.
PMID: 40316681

20.Effects of Different Individuals and Verbal Tones on Neural Networks in the Brain of Children with Cerebral Palsy

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Brain Sci . 2025 Apr 15;15(4):397. doi: 10.3390/brainsci15040397.

Abstract
Background/Objectives: Motivation is a key factor for improving motor function and cognitive control in patients. Motivation for rehabilitation is influenced by the relationship between the therapist and patient, wherein appropriate voice encouragement is necessary to increase motivation. Therefore, we examined the differences between mothers and other individuals, such as physical therapists (PTs), in their verbal interactions with children with cerebral palsy who have poor communication abilities, as well as the neurological and physiological effects of variations in the tone of their speech. Methods: The three participants were children with cerebral palsy (Participant A: boy, 3 years; Participant B: girl, 7 years; Participant C: girl, 9 years). Participants' mothers and the assigned PTs were asked to speak under three conditions. During this, the brain activity of the participants was measured using a 19-channel electroencephalogram. The results were further analyzed using Independent Component Analysis frequency analysis with exact Low-Resolution Brain Electromagnetic Tomography, allowing for the identification and visualization of neural activity in three-dimensional brain functional networks. Results: The results of the ICA frequency analysis for each participant revealed distinct patterns of brain activity in response to verbal encouragement from the mother and PT, with differences observed across the theta, alpha, and beta frequency bands. Conclusions: Our study suggests that the children were attentive to their mothers' inquiries and focused on their internal experiences. Furthermore, it was indicated that when addressed by the PT, the participants found it easier to grasp the meanings and intentions of the words.
PMID: 40309836

21.Participation experiences of young people with cerebral palsy in key life situations: A qualitative study
No authors listed

Dev Med Child Neurol . 2025 Apr 27. doi: 10.1111/dmcn.16339. Online ahead of print.

No abstract available
PMID: 40289480

22.Automated extraction of functional biomarkers of verbal and ambulatory ability from multi-institutional clinical notes using large language models

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Multicenter Study J Neurodev Disord . 2025 Apr 30;17(1):24. doi: 10.1186/s11689-025-09612-w.

Background: Functional biomarkers in neurodevelopmental disorders, such as verbal and ambulatory abilities, are essential for clinical care and research activities. Treatment planning, intervention monitoring, and identifying comorbid conditions in individuals with intellectual and developmental disabilities (IDDs) rely on standardized assessments of these abilities. However, traditional assessments impose a burden on patients and providers, often leading to longitudinal inconsistencies and inequities due to evolving guidelines and associated time-cost. Therefore, this study aimed to develop an automated approach to classify verbal and ambulatory abilities from EHR data of IDD and cerebral palsy (CP) patients. Application of large language models (LLMs) to clinical notes, which are rich in longitudinal data, may provide a low-burden pipeline for extracting functional biomarkers efficiently and accurately.
Methods: Data from the multi-institutional National Brain Gene Registry (BGR) and a CP clinic cohort were utilized, comprising 3,245 notes from 125 individuals and 5,462 clinical notes from 260 individuals, respectively. Employing three LLMs-GPT-3.5 Turbo, GPT-4 Turbo, and GPT-4 Omni-we provided the models with a clinical note and utilized a detailed conversational format to prompt the models to answer: "Does the individual use any words?" and "Can the individual walk without aid?" These responses were evaluated against ground-truth abilities, which were established using neurobehavioral assessments collected for each dataset.
Results: LLM pipelines demonstrated high accuracy (weighted-F1 scores > .90) in predicting ambulatory ability for both cohorts, likely due to the consistent use of Gross Motor Functional Classification System (GMFCS) as a consistent ground-truth standard. However, verbal ability predictions were more accurate in the BGR cohort, likely due to higher adherence between the prompt and ground-truth assessment questions. While LLMs can be computationally expensive, analysis of our protocol affirmed the cost effectiveness when applied to select notes from the EHR.
Conclusions: LLMs are effective at extracting functional biomarkers from EHR data and broadly generalizable across variable note-taking practices and institutions. Individual verbal and ambulatory ability were accurately extracted, supporting the method's ability to streamline workflows by offering automated, efficient data extraction for patient care and research. Future studies are needed to extend this methodology to additional populations and to demonstrate more granular functional data classification.
PMID: 40307685

23.Movement analysis congress from yesterday to today: Text mining analysis

Orhan Ozturk, Mansur Alp Tocoglu

Gait Posture . 2025 Apr 29:121:1-8. doi: 10.1016/j.gaitpost.2025.04.023. Online ahead of print.

Background: Despite the constant publication of motion analysis studies in the literature, the current focus of motion analysis laboratories is often showcased at conferences. Papers and abstracts presented at these events are a crucial source of information for scientists regarding the direction of research in the field. The most comprehensive congress in Europe for presenting current movement analysis studies for adults and children is the European Society for Movement Analysis in Adults and Children (ESMAC) RESEARCH QUESTION: How have motion analysis study trends changed in the last 15 years based on the papers presented at ESMAC congresses?
Methods: The titles of abstracts presented at the ESMAC congress between 2008 and 2023 were included in the study. Text mining was performed using the k-means algorithm in Python. Trend changes were analyzed in three groups of five years each.
Results: A total of 3038 paper titles presented at the ESMAC congress were included in the study. The most prominent term in the word cloud obtained from the paper titles was 'Cerebral Palsy.' The trending topics in each 5-year period were Cerebral Palsy, Gait Analysis, Balance, Foot, and Knee. The highest number of studies was presented in 2019 (n = 334), and the lowest in 2014 (n = 134).
Significance: While Cerebral Palsy remains a central focus in movement analysis, the emphasis has shifted over time. Technological advances have significantly enhanced motion analysis, with trending topics in each 5-year period.
PMID: 40305964

24.Genetic testing in cerebral palsy with clinical and neuroimaging variables

No authors listed

Dev Med Child Neurol . 2025 Apr 27. Doi: 10.1111/dmcn.16334. Online ahead of print.

No abstract available
PMID: 40289496

Prevention and Cure

25.Implementation of national guidelines on antenatal magnesium sulfate for neonatal neuroprotection: extended evaluation of the effectiveness and cost-effectiveness of the National PReCePT Programme in England

Hannah B Edwards, Carlos Sillero-Rejon, Hugh McLeod, Elizabeth M Hill, Brent C Opmeer, Colin Peters, David Odd, Frank de Vocht, Karen Luyt

BMJ Qual Saf . 2025 Apr 27:bmjqs-2024-017763. doi: 10.1136/bmjqs-2024-017763. Online ahead of print.

Background: Since 2015, the National Institute for Health and Care Excellence (NICE) guidelines have recommended antenatal magnesium sulfate (MgSO4) for mothers in preterm labour (<30 weeks' gestation) to reduce the risk of cerebral palsy (CP) in the preterm baby. However, the implementation of this guideline in clinical practice was slow, and MgSO4 use varied between maternity units. In 2018, the PRrevention of Cerebral palsy in PreTerm labour (PReCePT) programme, an evidence-based quality improvement (QI) intervention to improve use of MgSO4, was rolled out across England. Earlier evaluation found this programme to be effective and cost-effective over the first 12 months. We extended the original evaluation to determine the programme's longer-term impact over 4 years, its impact in later preterm births, the impact of the COVID-19 pandemic, and to compare MgSO4 use in England (where PReCePT was implemented) to Scotland and Wales (where it was not).
Methods: Quasi-experimental longitudinal study using data from the National Neonatal Research Database on babies born <30 weeks' gestation and admitted to a National Health Service neonatal unit. Primary outcome was the percentage of eligible mothers receiving MgSO4, aggregated to the national level. Impact of PReCePT on MgSO4 use was estimated using multivariable linear regression. The net monetary benefit (NMB) of the programme was estimated.
Results: MgSO4 administration rose from 65.8% in 2017 to 85.5% in 2022 in England. PReCePT was associated with a 5.8 percentage points improvement in uptake (95% CI 2.69 to 8.86, p<0.001). Improvement was greater when including older preterm births (<34 weeks' gestation, 8.67 percentage points, 95% CI 6.38 to 10.96, p<0.001). Most gains occurred in the first 2 years following implementation. PReCePT had a NMB of £597 000 with 89% probability of being cost-effective. Following implementation, English uptake appeared to accelerate compared with Scotland and Wales. There was some decline in use coinciding with the onset of the pandemic.
Conclusions: The PReCePT QI programme cost-effectively improved use of antenatal MgSO4, with anticipated benefits to the babies who have been protected from CP.
PMID: 40288887