Cerebral palsy research news

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Interventions and Management

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1.Reliability of upper limb kinematic variables: adults with unilateral cerebral palsy performing a standardized drinking task

Camilla Aksdal, Viven Jørgensen, Arve Opheim, Linda Rennie

J Rehabil Med. 2025 Nov 12:57:jrm42583.

Objective: To evaluate the test-retest reliability and agreement of kinematic variables measured with an optical motion capture system during a standardized drinking task in adults with unilateral cerebral palsy (CP).
Design: Test-retest.
Subjects/patients: 25 subjects (12 males) with spastic unilateral CP, aged 18-60 years.
Methods: Kinematic variables were collected while participants performed a drinking task with the affected upper limb on 2 consecutive days. Inter-session reliability and agreement were estimated using the intra-class correlation coefficient (ICC) 2.1, and standard error of measurement (SEM).
Results: Reliability was excellent for all investigated variables (ICCs: 0.90-0.99). Agreement for elbow flexion/extension, shoulder flexion, and abduction: SEM ≤ 3.1 degrees, max trunk displacement during reaching: SEM = 9.9 mm, number of stops/starts during total movement: SEM = 2.1 movement units, total movement time: SEM = 1.0 s.
Conclusion: Optical motion capture of a standardized drinking task was reliable for evaluating upper limb movements in adults with spastic unilateral CP. The method may be used as an outcome measure to evaluate the effect of treatments of upper limb function, as well as to follow the function over time.
PMID: 41222126

2.Development of a core outcome set for paediatric upper limb spasticity; a structured review protocol for a systematic review of the literature and identification of a core outcome set using a Delphi survey

Liddle A, Sandu K, Marcelline A, Swaby L, Ridsdale K, Dorman Sl

Trials. 2025 Nov 10;26(1):485.

Background: Upper limb spasticity is a common condition in paediatric patients, often resulting from neurological disorders such as cerebral palsy, traumatic brain injury, or stroke. There are currently no standardised outcome measures to assess progress after interventions for upper limb spasticity in children. Wide variation in currently reported outcomes makes comparison of treatments difficult. This study aims to identify outcome measures that have previously been reported in studies evaluating the management of upper limb spasticity in children and to facilitate the development of a consensus core outcome set (COS) suitable for use in all future studies of upper limb spasticity in children.
Methods/design: This study will include a systematic review of the academic literature to identify a list of outcome measures that have previously been reported. The list of outcome measures will be used in a consensus setting exercise with focus groups of key stakeholders to identify key outcomes. A Delphi process to include two rounds will then be used to define the most important outcomes to all stakeholders forming the COS.
Discussion: Core outcomes represent the minimum expected data reported for a specific condition and will improve the quality of future studies, reducing bias, allowing easier comparison and enhancing opportunities for larger meta-analysis and more meaningful future research.
Trial registration: Core Outcome Measures in Effectiveness Trials Initiative (COMET). Registered on 20 Jan 2024. Prospero International prospective register of systematic reviews, registration number: CRD42024536296. Registered on 17 April 2024.
PMID: 41214740

3.Photographic Posture Analysis in Children With Cerebral Palsy and Its Relationship With Motor Performance and Trunk Control

Nilay Comuk Balci, Betul Erbay, Mert Demirsoz, Bircan Yucekaya

J Manipulative Physiol Ther. 2025 Nov 13:S0161-4754(25)00052-1. Online ahead of print.

Objective: The primary purpose of this study was to investigate the relationship of photographic posture analysis (PPA) with motor performance and trunk, and the reliability of PPA in the sitting position control in children with cerebral palsy (CP).
Methods: Sixty-five children with CP between 5 and 12 years of age were investigated by PPA in a sitting position. The angles calculated for the PPA were the craniovertebral angle, sagittal head tilt, sagittal shoulder-C7 angle, thoracic kyphosis angle, lumbal lordosis angle, coronal head tilt, coronal shoulder angle, and coronal pelvic angle. Trunk control was measured by the Trunk Control Measurement Scale (TCMS), and motor functions were evaluated by the Gross Motor Function Measure (GMFM).
Results: We found that PPA had high intra- and inter-rater reliability in sitting posture in children with CP (ICC: 0.951-0.998). Additionally, "coronal head tilt" and "coronal pelvic angle" had moderate correlations with some TCMS and GMFM scores ($P < .05$). There was a negative moderate significant correlation between "coronal pelvic angle" and "standing" ($r = 0.557$, $P = .001$), "walking/running/jumping" ($r = -0.549$, $P = .001$), and "total" ($r = -0.535$, $P = .001$) GMFM scores. There was a negative moderate significant correlation between "coronal head tilt" and "static sitting" ($r = -0.444$, $P = .001$), "dynamic reach" ($r = -0.437$, $P = .001$), and "total" ($r = 0.442$, $P = .001$) scores of TCMS. There was a negative moderate significant correlation between "coronal pelvic angle" and "static sitting" ($r = -0.479$, $P = .001$) and "total" ($r = -0.454$, $P = .001$) scores of TCMS.
Conclusion: PPA was a reliable method for children with CP in a sitting posture. The findings suggest that posture and function may affect each other; in particular, coronal angles and gross motor and trunk functions may be related.
PMID: 41231168

4.Microscopic and molecular aspects of skeletal muscle alterations in cerebral palsy

No authors listed

Dev Med Child Neurol. 2025 Nov 12. Online ahead of print.

Abstract
No abstract available.
PMID: 41225304

5.Tasks for Assessing Dystonia in Young People With Cerebral Palsy

Emma Lott, Alyssa Rust, Leon Dure, Darcy Fehlings, Toni Pearson, Roser Pons, Jonathan W Mink, Bhooma R Aravamuthan

Pediatr Neurol. 2025 Oct 22:174:126-134.

Background: Dystonia in childhood is typically associated with cerebral palsy (CP). Dystonia severity scales for CP require prolonged exam protocols with numerous tasks, often making them onerous for routine clinical use. We aimed to identify which individual tasks best approximate dystonia severity compared to the gold standard full protocol.
Methods: In this cross-sectional study, comprehensive exam protocol videos were taken during routine care of ambulatory people with CP age 5 years and up. Five pediatric dystonia experts reviewed individual tasks and the full protocol for dystonia using the Global Dystonia Severity Rating Scale. Experts' written scoring justifications were qualitatively analyzed to determine commonly cited features of dystonia.
Results: When examining the difference in dystonia severity ratings between each task and the full protocol, seated upper extremity tasks had the lowest variance ($P < 0.05$, F-test) and had lower score differences than the stand/walk/run and seated lower extremity tasks ($P < 0.05$, repeated measures Friedman test). Experts most commonly identified the following movements as dystonic: wrist flexion (8.4% of all movement statements), finger flexion (7.3%), wrist ulnar deviation (6.8%), toe dorsiflexion (8.4%), ankle inversion (7.9%), and ankle plantarflexion (6.4%). Experts rated dystonic movements as more severe if they were consistently triggered by multiple stimuli (26.8% of all severity statements) or functionally impactful (20.7%).
Conclusions: Seated upper extremity tasks may be valuable for identifying dystonia and estimating its severity during routine clinical care. Clinical dystonia severity assessment could be guided by assessing specific dystonic movements, the consistency with which they are triggered, and their functional impact.
PMID: 41223735

6.Collagenase treatment does not impair fiber contractile function in muscle biopsies from children with cerebral palsy

Faizan Syed, Latif Omerkhil, Venus Joumaa, Jason J Howard, Timothy R Leonard, Walter Herzog

Physiol Rep. 2025 Nov;13(21):e70645.

Abstract
Cerebral palsy (CP) often presents with increased passive stiffness of the skeletal muscles, primarily due to increased collagen in the extracellular matrix. Collagenase from Clostridium histolyticum (CCH), an enzyme that degrades collagen, is used clinically to treat fibrotic conditions such as Dupuytren's contracture and Peyronie's disease. Although prior work demonstrated reduced passive stiffness in muscle bundles from children with CP following CCH incubation, its effects on active contractile properties remain unknown. Thus, this study was aimed at investigating the maximal active force, calcium sensitivity, and myofibrillar protein content (myosin and actin) after CCH incubation. Nine muscle biopsies from children with CP were used for skinned fiber mechanical testing at an average sarcomere length of 2.4 μm, and for myosin and actin analysis using 12% SDS-PAGE. Maximal active stress (control 59.8 ± 24.2 kPa; CCH 63.2 ± 24.5 kPa; $p = 0.51$) and pCa_{50} (control 6.04 ± 0.10; CCH 5.99 ± 0.18; $p = 0.43$) did not significantly differ. Similarly, the normalized myosin (control 1.000 ± 0.167, CCH 1.004 ± 0.178; $p = 0.93$) and actin (control 1.000 ± 0.336, CCH 1.107 ± 0.330; $p = 0.231$) content did not differ between conditions. These results suggest that collagenase does not impair the contractile function in muscle fibers from children with CP and thus might be a feasible treatment to reduce stiffness due to muscle fibrosis. Research into whole-muscle force transmission following collagenase treatment is needed to evaluate its clinical viability.
PMID: 41214868

7.Microscopic and molecular aspects of skeletal muscle alterations in cerebral palsy

Sebastian Edman, Oscar Horwath, Eva Pontén, Sudarshan Dayanidhi, Ferdinand von Walden

Dev Med Child Neurol. 2025 Nov 9. Online ahead of print.

Abstract
Cerebral palsy (CP), the most prevalent childhood-onset motor disability, frequently entails progressive musculoskeletal complications. This comprehensive review synthesizes existing knowledge of microscopic and molecular alterations in CP skeletal muscle. Considerable methodological variability, heterogeneous patient cohorts, and inconsistent control groups significantly complicate comparative interpretations across studies. Nonetheless, some structural abnormalities consistently emerge, including increased variability in muscle fibre size, altered fibre type distribution, long sarcomeres at standardized joint positions, increased collagen content, disrupted neuromuscular junction integrity, reduced capillary density, and mitochondrial and satellite cell impairments. Investigations of satellite cell function in vitro further underscore potential mechanistic alterations, although findings remain inconsistent. Remarkably, few studies have systematically explored the cellular and molecular consequences of standard clinical interventions, revealing a notable research gap. In conclusion, the overall literature reveals considerable divergence in reported outcomes, reflecting the profound complexity of CP muscle biology. We believe that resolving this complexity will require more coordinated and collaborative research approaches.
PMID: 41206855

8.Gait characteristics in 6-year-old children born extremely preterm

Yuji Ito, Yuichiro Sugiyama, Tadashi Ito, Tetsuo Hattori, Sho Narahara, Erina Kataoka, Yoshihiro Tanahashi, Reina Hyodo, Hiroyuki Kidokoro, Tetsuo Kubota, Akio Nakai, Nobuhiko Ochi, Jun Natsume, Yuichi Kato

Eur J Pediatr. 2025 Nov 12;184(12):749.

Abstract
This study aimed to clarify the characteristics of motor impairments and their relationship with perinatal risk factors in children born extremely preterm (EP). Forty children aged 6 years born EP (n = 10) and at term (n = 30) were enrolled. Patients with cerebral palsy or intellectual disabilities were excluded from the EP group. Data on the following items were collected: one-leg standing time, two-step test, grip strength, five-times sit-to-stand test, and Developmental Coordination Disorder (DCD) questionnaire. The Gait Deviation Index (GDI), an index of gait quality, and its symmetry ratio were evaluated using three-dimensional gait analysis. The results were compared between the two groups, and their correlations with perinatal risk factors in the EP group were analyzed. The EP group exhibited shorter one-leg standing times, lower two-step test scores, lower grip strength, and lower total and general coordination scores on the DCD Questionnaire compared with the control group. Regarding gait function, the EP group had a lower GDI and a higher GDI symmetry ratio. Birth weight was positively correlated with the GDI. Body weight at 36 weeks postmenstrual age was positively correlated with the GDI and DCD Questionnaire total and general coordination scores.
Conclusion: Children born EP exhibited potentially decreased gait quality and increased gait quality asymmetry, in addition to decreased muscle strength, decreased balance function, and increased DCD traits. Lower birth weight and the subsequent weight gain may be related to decreased gait quality and increased DCD trait in school-aged children.
What is known: • Developmental coordination disorders occur in approximately 20-50% of children born extremely preterm (EP). • Decreased muscle strength has been reported in children and adults born EP.
What is new: • Children born EP showed decreased gait quality and increased gait asymmetry using three-dimensional gait analysis in addition to decreased muscle strength, decreased balance function, and increased DCD traits. • Lower birth weight and subsequent weight gain were associated with decreased gait quality and increased DCD traits in school-aged children born EP.
PMID: 41219534

9.Does body weight support improve neural and biomechanical measures during treadmill gait in children with unilateral cerebral palsy?

Rajit Banerjee, Yushin Kim, Thomas C Bulea, Diane L Damiano

Front Rehabil Sci. 2025 Oct 23:6:1607515. eCollection 2025.

Introduction: Body weight support (BWS) treadmill training, commonly utilized to improve gait, has inconsistent evidence of effectiveness across disorders.
Methods: We aimed to comprehensively evaluate its scientific rationale by comparing immediate effects of two weight support levels (20%, 40%) to unsupported (0%) treadmill walking on neural and biomechanical measures in children with unilateral cerebral palsy (CP) and typical development (TD). We hypothesized BWS would demonstrate positive effects only in CP. Participants included 10 with TD and 8 with CP (mean age = 14.6 and 15.4 years, respectively).
Results: Minimal or no group differences or BWS effects were found for synergy number, structure or Walk-DMC, whereas the Gait Deviation Index (GDI) showed a significant interaction with 20% BWS where the dominant side in CP improved with 20% BWS while both sides in TD worsened. Beta band EEG activation from 0% to 20% BWS showed a significant triple interaction increasing in the non-dominant and decreasing in the dominant hemisphere in TD, while increasing in both in CP. A worsening trend was seen with 40% BWS in all measures except z scores.
Conclusion: BWS has beneficial effects on kinematics in CP supporting the basic premise for use in neurorehabilitation at the body structure level.
PMID: 41211478

10.Frame-Running Practice in People With Cerebral Palsy and Similar Conditions: A Systematic Review

Carlota Cunha, Filomena Vieira, Filipa João

Adapt Phys Activ Q. 2025 Nov 14:1-16. Online ahead of print.

Abstract
Frame Running stands out as one of the few sports that allows individuals with neuromuscular challenges and difficulties in controlling movements in the body to participate competitively. This review aims to critically analyze the scientific literature regarding the practice of Frame Running among individuals with cerebral palsy or similar conditions. This systematic review was registered in the International Prospective Register for Systematic Reviews with the registration code CRD42024523358. It follows PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines. Ten studies were included: five examine the impact of Functional-Running practice on physical and/or psychological variables and participants' quality of life, and five focus on the effects of athletes' impairments on their Functional-Running performance. Further research is required, particularly in biomechanics, to analyze running motion and understand the relationship between the frame, athlete morphology, and functionality as functional rehabilitation gains recognition in Paralympic sports.
PMID: 41237763

11.Efficacy of functional training on cardiorespiratory fitness in individuals with cerebral palsy: A systematic review

No authors listed

Dev Med Child Neurol. 2025 Nov 12. Online ahead of print.

Abstract
No abstract available.
PMID: 41225290

12.Early intervention guidelines for infants at risk of neurodevelopmental delay using traditional childcare practices from India

Tanochni Mohanty, Mallikarjunaiah H S, Umme Uzma M, Kavitha Raja

BMJ Paediatr Open. 2025 Nov 10;9(1):e003928.

Background: India is witnessing a growing concern around neurodevelopmental disorders, with nearly one in eight children potentially affected. The early years of life, especially the first 1000 days offer a crucial window to support brain development and positive long-term outcomes. Global early intervention (EI) strategies focus on caregiver involvement, enriched environments and learning through meaningful repetition. However, applying these approaches in everyday community settings remains challenging due to the need for specialised training which is inaccessible for grassroots-level workers. Interestingly, many traditional Indian caregiving practices echo these global principles, though they remain undocumented in scientific literature.
Objective: This study aimed to explore traditional Indian child-rearing practices aligned with evidence-based EI and developing culturally rooted, easy-to-follow video resources to train grassroots-level workers (Accredited Social Health Activists (ASHA)).
Methods: We conducted 11 focus group discussions with 121 mothers and grandmothers from varied regions and cultural backgrounds across India. Using open-ended prompts, we gathered insights into daily caregiving routines for infants under 1 year of age. Conversations were recorded, transcribed and thematically analysed by age group (0-3, 3-6, 6-9 and 9-12 months). Based on recurring patterns, a series of EI videos was created and validated through community and expert feedback.
Results: Findings revealed that many common Indian practices—such as massage, floor play, lullabies and face-to-face interaction—align closely with global EI principles. The videos developed from these practices were well-received by caregivers and experts for their clarity, cultural relevance and practical usefulness.
Conclusions: Indian families already practise many nurturing routines that support early development. By capturing these practices in simple, accessible videos, we can bridge traditional wisdom with modern science—empowering parents and ASHA workers to support children's development meaningfully in the home environment.
PMID: 41213834

13.Validity, Reliability and Application of the Paediatric Posterior Drooling Scale

Denise C R M Koeken, Karen van Hulst, Marloes L J Lagarde, Robert F Pangalila, Corrie E Erasmus, Lenie van den Engel-Hoek

Child Care Health Dev. 2025 Nov;51(6):e70153.

Aims: This study aims to assess the construct validity, inter-rater and intra-rater reliability and application of the newly developed Paediatric Posterior Drooling Scale (PPDS), a novel clinical screening tool that uses cervical auscultation (CA) to evaluate posterior drooling in children with neurological disorders.
Methods: In this cross-sectional observational study, 69 children with central neurological disorders aged 1-18 years (mean 8.4 years, 50 males, 19 females) were included for analysis. CA was used by expert and trained speech language therapists (SLT). Due to the correlation between posterior drooling and oropharyngeal dysphagia, two classification systems for eating and drinking ability were used for convergent construct validity calculations: the Functional Oral Intake Scale (FOIS) for children complemented with the Eating and Drinking Ability Classification System (EDACS) in the case of cerebral palsy.
Results: PPDS had a moderate, negative correlation with the FOIS (Spearman's rho = -0.54, $p < 0.001$) and a moderate, positive correlation with the EDACS (Spearman's rho = 0.70, $p < 0.001$). PPDS had an excellent intra-rater (intraclass correlation coefficient = 0.91, $p < 0.001$) and a good inter-rater reliability (intraclass correlation coefficient = 0.85, $p < 0.001$). The perfect agreement percentage of the test-retest reliability was high (84%) for the score 0.
Conclusions: The PPDS is a valid and reliable clinically applicable screening tool for assessing posterior drooling by the SLT. The PPDS enables SLTs to identify posterior drooling more efficiently, non-invasively and reliably in routine clinical settings. Timely recognition of posterior drooling can significantly impact clinical management, particularly by reducing respiratory complications. Performing subsequent PPDS assessments at different times when posterior drooling is suspected is important for the treating paediatrician to determine the underlying cause of posterior drooling. To establish the diagnosis of posterior drooling, the PPDS should not be used as a stand-alone tool but as a bridge between clinical observations and the need for an instrumental assessment.
PMID: 41236173

14.Sleep Disturbances and Disorders in Children and Adolescents with Cerebral Palsy: A Narrative Review

Rebecca A Rausch, Caroline Miller, Amelia Hensler, Mark G Goetting, Dilip R Patel

J Clin Med. 2025 Nov 4;14(21):7828.

Background/Objectives: Children and adolescents with cerebral palsy experience multiple associated comorbidities or impairments that impact their day-to-day life and psychosocial functioning. Sleep difficulties, disturbances, or disorders are a widely recognized concern for youth with cerebral palsy. We aimed to provide an updated narrative review of the most recent research on sleep disturbances or disorders in youth with cerebral palsy.
Methods: A search of the literature cited in the PubMed database published between August of 2019 and August of 2024 was completed, and relevant articles were reviewed.
Results: Relevant areas included the prevalence and type of sleep concerns seen in children and adolescents with cerebral palsy in addition to the relationship with sleep concerns and behavior, pain, comorbidities, physical activity, quality of life, and impact on caregivers. Sleep disturbances and disorders occur at a higher frequency in children and adolescents with cerebral palsy with adverse impact on their quality of life. Sleep concerns appear to be associated with several associated concerns.
Conclusions: Sleep disturbances occur at a higher frequency in youth with cerebral palsy and are associated with a wide range of conditions, symptoms, and impact on quality of life. Treatment recommendations are in line with typically developing children or children with neurodevelopmental disorders. Future directions for research are identified.
PMID: 41227224

15.Successful Anesthetic Management of Patient with Severe Scoliosis Due to Cerebral Palsy Who Underwent Dental Surgery

Diab Bani Hani, Ala A Alhowary, Saif Gharaibeh, Rawand Al-Zoubi

Int Med Case Rep J. 2025 Nov 6:18:1423-1427.

Abstract
Patients with cerebral palsy may have intellectual disabilities, convulsions, scoliosis, or thoracic deformities. Scoliosis is a complex deformity of the spine resulting in secondary involvement of the respiratory, cardiovascular and neurologic systems which may affect the anesthesia for those patients. We reported a case of a 17-year-old female with cerebral palsy and severe scoliosis who presented for dental caries operation under general anesthesia. General anesthesia was conducted, difficult airway management sets have been prepared, and pressure control ventilation to minimize peak airway pressure was adopted. Anesthetic management was performed without anesthesia-related complications. We recognize that considerable attention is required in patients with cerebral palsy. Perioperative management and general anesthesia of patients with cerebral palsy who have severe scoliosis represent significant challenges. Multidisciplinary approach through team included surgeons, anesthesiologists, neurophysiologists, pediatricians, nurses, nutritionists, and physiotherapists is required.
PMID: 41221539

16.Risk Estimates of Five Adverse Outcomes Following Hip and Spine Surgery Among Children with Cerebral Palsy to Inform Peri-operative Care

Daniel G Whitney, Tania D Strout, Judi A Vessey, Rachel L DiFazio

J Pediatr Soc North Am. 2025 Sep 9:13:100256. eCollection 2025 Nov.

Background: Children with cerebral palsy (CP) are vulnerable to post-operative adverse outcomes following orthopaedic surgery; yet clinically usable risk estimates of these outcomes remain underreported. The number of anti-seizure medications (ASMs) may capture a child's underlying medical complexity, thus serving as a simple, easily attainable measure for risk stratification. The objective of this study was to generate post-operative risk estimates of five adverse outcomes based on the number of ASMs among children with CP undergoing hip or spine surgery.
Methods: Using the IBM® MarketScan® Multi-State Medicaid and Commercial Databases, this retrospective cohort study accessed patient-level claims from 01/01/2009-12/31/2022 for children with CP aged 3-21 years old who underwent hip or spine surgery. The count of unique ASM prescriptions was identified during the 2-year, pre-operative period. Using logistic regression, the age- and sex-adjusted risk of 1-week respiratory failure or pulmonary collapse (RF/PC), 1-month pneumonia, 3-month surgical site infection (SSI), 3-month systemic inflammatory response syndrome (SIRS), and 6-month fracture was estimated based on exposure to 0 ASMs, 1-2 unique ASMs, or ≥3 unique ASMs during the 2-year, pre-operative period.
Results: Of n = 2,378 children with CP who underwent hip surgery (mean age[SD] = 9.4[4.0] years old) and n = 2,216 who underwent spine surgery (mean age[SD] = 13.5[3.4] years old), 6.1% and 29.3% developed RF/PC, 2.9% and 5.6% developed pneumonia, 5.6% and 12.4% developed SSI, 1.4% and 5.4% developed SIRS, and 8.5% and 4.4% sustained a fracture, respectively, during each outcome's follow-up period. The age- and sex-adjusted post-operative risk estimates of each adverse outcome for each surgical cohort are reported based on ASMs. In general, having greater than or equal to 3 ASMs prescribed places you at greater risk for developing a post-operative adverse outcome.
Conclusions: This study generated clinically relevant risk estimates of adverse post-operative outcomes based on 2-year pre-operative ASMs for children with CP undergoing hip or spine surgery. This information can be used to support shared decision-making, optimize health status pre-operatively, plan for peri-operative care, and develop preventive strategies.
Key concepts: (1)Children with cerebral palsy (CP) undergoing hip or spine surgery are at heightened risk for post-operative medical complications beyond orthopaedic issues, including pneumonia, surgical site infections, fractures, systemic inflammatory response syndrome, and respiratory failure.(2)Multidisciplinary preoperative optimization programs and standardized clinical pathways have been implemented to reduce the risk of post-operative complications in children with CP, yet clinical tools to assess individualized risk remain limited.(3)Administrative claims data provide a potential avenue for generating post-operative risk estimates by leveraging variables that serve as proxies for medical complexity, such as the number of unique anti-seizure medications (ASMs) prescribed.(4)The severity of seizure disorders, as reflected by ASM prescriptions, is closely associated with motor dysfunction and comorbidity complexity, making it a useful predictor of adverse post-operative outcomes in children with CP.(5)This study generated clinically meaningful risk estimates for post-operative complications among children with CP undergoing hip or spine surgery based on pre-operative ASM usage, informing decision-making and peri-operative care planning.
PMID: 41216586

17.Evaluation of Static Balance in Children with Cerebral Palsy Using an Innovative Image Processing Software

Zekiye Basaran, Halil Ibrahim Celik, Onder Polat, Bulent Elbasan

Healthcare (Basel). 2025 Oct 23;13(21):2682.

Background: Impaired balance is one of the most common and functionally limiting problems in children with cerebral palsy (CP), significantly affecting their motor abilities and quality of life. Although force platforms are considered the gold standard for evaluating postural stability, they are often costly, non-portable, and require specialized laboratory environments, limiting their accessibility in routine clinical settings.
Objective: This study aimed to develop a novel software program based on image processing techniques to assess static balance in children with CP and to evaluate its validity against traditional force platform measurements.
Methods: A total of 83 children aged 5-15 years (63 with CP, GMFCS levels I-II; 20 healthy controls) participated. Static balance was assessed under four different standing conditions using both a force platform and a newly developed video-based software tool. The software utilized the frame difference method to detect center of mass movements, and parameters such as velocity and total displacement were calculated. Correlation analyses were conducted between the image processing and force platform data.
Results: The software demonstrated moderate to strong positive correlations with force platform parameters in the majority of test conditions, particularly when participants stood with eyes open. In more challenging balance scenarios (e.g., eyes closed, feet together), correlations were weaker but still significant.
Conclusions: The findings suggest that this image-based software is a valid, low-cost, and portable alternative for static balance assessment in children with CP. It has the potential for use in diverse clinical or home settings, supporting individualized rehabilitation strategies.
PMID: 41228049

18.The potential of robotics: A systematic review of neuroplastic changes following advanced lower limb rehabilitation in neurological disorders

Rocco Salvatore Calabrò, Andrea Calderone, Laura Simoncini, Antonino Naro, Lorenzo Octavio Small Haughton, Angelo Quartarone, Charl Froilan D Leochico

Neurosci Biobehav Rev. 2025 Nov 8:180:106459.

Background: Neurological diseases are among the most common pathologies that strongly influence a person's ability to walk and move, affecting the lower extremities. They disrupt motor brain networks that enable precise movement, leading to deficits in gait, balance, and coordination; while conventional therapies remain essential, advances in robotic technologies show growing promise for rehabilitation.
Aim of review: This systematic review aims to investigate the role of robotic rehabilitation in improving neuroplasticity and motor outcomes for individuals with neurological disorders, with a particular focus on studies incorporating neurophysiological or neuroimaging techniques to assess neuroplastic changes and their long-term impact on recovery.
Key scientific concepts of review: A systematic review was carried out utilizing an online search of articles from 2014 to 2025 on the PubMed, Web of Science, Cochrane Library, Embase, EBSCOhost, and Scopus databases in accordance with PRISMA guidelines. Studies were chosen based on predetermined inclusion criteria, with an emphasis on robotic rehabilitation therapies targeted at improving neuroplasticity in lower limb rehabilitation for people with neurological conditions. This review has been registered on Prospero with the following number: CRD42025640347. The search identified 12,769 records; after screening and eligibility assessment, 25 studies met inclusion criteria. Studies demonstrate that robot-assisted gait training (RAGT) and exoskeleton-based therapies improve motor function, gait, balance, and neuroplasticity across stroke, spinal cord injury, cerebral palsy, and brain injury populations. Adjunctive approaches such as brain-computer interface (BCI) integration, virtual reality feedback, and neuromodulation further enhance outcomes, with increases in cortical activation and improvements in functional connectivity supported by convergent neurophysiological and neuroimaging data; changes in corticospinal excitability are also reported. Taken together, robotic interventions, often combined with neuromodulation or virtual reality (VR), appear to catalyze neuroplasticity in ways that align with clinically meaningful gains. These findings underscore their transformative potential for tailored, multimodal rehabilitation strategies in neurological recovery.
PMID: 41213447

19.The effect of robotic assisted gait training on physical activity, motor function, and quality of life in children with spastic cerebral palsy: Exploratory pilot study

Yeon-Gyu Jeong, Won-Cheol Kim, Yeon-Jae Jeong, Ha-Neul Jang, Joo-Young Lee, Jae-Soon Chung, Kyu-Hoon Lee

Brain Dev. 2025 Nov 8;47(6):104482.

Background: Children with spastic cerebral palsy (CP) experience motor impairments and reduced physical activity, negatively impacting health and quality of life.
Objective: The study aimed to assess the effects of wearable exoskeleton robot-assisted gait training on physical activity, motor function, and quality of life in children with CP.
Methods: Ten children with spastic CP (mean age 9.20 ± 2.57 years; gross motor function classification system levels I-IV) received twelve 30-min sessions of robot-assisted gait training over six weeks at a university hospital rehabilitation center. Physical activity was measured using a tri-axial accelerometer to assess energy expenditure, metabolic equivalents (METs), intensity levels, vector magnitude counts per minute (VM CPM), and step counts. Motor function was evaluated using the Gross Motor Function Measure (GMFM), Timed Up and Go Test (TUG), and 6-Minute Walk Test (6MWT). Quality of life was assessed with the Cerebral Palsy Quality of Life questionnaire (CP-QOL). Repeated measures MANOVA and Cohen's d were used for statistical analysis.
Results: Significant improvements were observed in METs ($p = 0.02$, $d = 0.38$), light ($p = 0.03$, $d = 0.51$) and moderate physical activity time ($p = 0.01$, $d = 0.42$), and VM CPM ($p = 0.02$, $d = 0.55$), along with reduced sedentary time ($p = 0.02$, $d = -0.49$). Functional outcomes improved in GMFM ($p<0.01$, $d = 0.22$), TUG ($p = 0.03$, $d = -0.33$), and 6MWT ($p = 0.02$, $d = 0.52$). No significant changes were found in CP-QOL scores.
Conclusion: Wearable robot-assisted gait training appears to enhance physical activity and mobility in children with spastic CP and may be considered a promising therapeutic intervention.
PMID: 41207139

20.Epidemiology of Lower Limb Musculoskeletal Pathology in Cerebral Palsy: A Population-Based, Cohort Study

Tara Korbal, Kerr Graham, Sharmala Thuraisingam, Jason J Howard, Erich Rutz

JB JS Open Access. 2025 Nov 12;10(4):e25.00236. eCollection 2025 Oct-Dec.

Background: Musculoskeletal pathology (MSP) develops in the lower limbs of the majority of children with cerebral palsy (CP) with time and growth. The aims of this study were to investigate the epidemiology of MSP in the lower limbs, of a large population-based sample of children with CP, at long-term follow up.
Methods: An inception cohort was generated from the Victorian Cerebral Palsy Register for the birth years 1990 through 1992 inclusive. Children had regular clinical and radiographic examinations from infancy until after skeletal maturity. Cerebral palsy was classified using the Gross Motor Function Classification System (GMFCS) and a Topographical Classification System (TCS), devised for this study. MSP was classified using the Musculoskeletal Pathology Classification System, which has good reliability.
Results: A full dataset was available for 292 individuals, 78% of the inception cohort (170 males, 122 females). Mean age at final follow-up was 20 years (SD 4.5, range 6-31 years). MSP type changed with age. Hypertonia (MSP 1) was present in 77% of children at age 5 years, contractures (MSP 2) in 22% of children at 10 years, contractures combined with bony torsion (MSP 3) in 31% of teenagers at age 15 years, and decompensation (MSP 4) in 15% of young adults at age 25 years. There were moderate to strong associations between GMFCS and MSP and TCS and MSP (Kendall's tau 0.36-0.55, $p < 0.001$).
Conclusions: The prevalence of MSP in children with CP who were born between 1990 and 1992 and followed into the third decade was high and was related to age and CP severity by GMFCS.
PMID: 41210904

21.Talking the Walk (Along): Lessons Learned From Engaging With Children With Cerebral Palsy and Their Parents for Investigating Lived Experiences of Falls

Rebecca L Walker, Thomas D O'Brien, Gabor J Barton, Bernie Carter, David M Wright, Richard J Foster

Health Expect. 2025 Dec;28(6):e70497.

Background: Children with cerebral palsy (CP) regularly fall over, but causes of day-to-day falls are not well understood. Further insight may be revealed by engaging with children with CP and their families during patient and public involvement and engagement (PPIE) and adopting a participatory, child-centred perspective. PPIE involves designing, conducting and disseminating research with the public and has been used in health research with children, but has not been utilised to inform research of falls with children with CP.
Objective: This paper aims to critically discuss experiences of PPIE with children with CP and their parents, who engaged with a researcher to inform a novel adaptation of the walk-along interview method for investigating how real-world falls occur.
Methods of engagement: Eight children with CP (8-17 years) and six parents engaged as PPIE participants in consultations and activities with the researcher about a walk-along interview method, specifically tailored to children with CP.
Outcomes of engagement: PPIE participants identified places to walk (e.g., parks), how to conduct interviews (e.g., 'stop and talk') and areas of questioning, that contributed to a walk-along interview protocol. These outcomes demonstrate that PPIE generated unique insights for a protocol specific to children with CP.
Discussion: Strength was brought to PPIE through developing good relationships and using creative activities. Challenges during PPIE included contrasting views and availability, which were managed through adaptation, communication and consensus.
Conclusions: This study supports and expands previous PPIE and child-centred work, reinforcing that children and parents can positively help create impactful research designs, by developing and refining a method to collect real-world information about falls, specifically tailored for children with CP. We offer critical reflections on conducting PPIE, showing that engaging in PPIE to refine a protocol can offer unique insight into the worlds of children with CP and strengthen the design of future studies.
Patient or public contribution: Children with CP and their parents were consulted using PPIE to provide their views about a novel walk-along interview method tailored for children with CP. This paper focuses on lessons learned from this PPIE, which is part of a wider pre-defined PhD project investigating causes of falls in children with CP. Within the wider project PPIE is an ongoing process beyond the scope of this paper.
Patient or public contribution: Children with CP and their parents were consulted using PPIE to provide their views about a novel walk-along interview method tailored for children with CP. This paper focuses on lessons learned from this PPIE, which is part of a wider pre-defined PhD project investigating causes of falls in children with CP. Within the wider project PPIE is an ongoing process beyond the scope of this paper.
PMID: 41239766

22.cpThrive: A Story of Development

DanaKai Bradford, Michelle Jackman, Alex Griffin, Jessica Marie Bugeja, Remy Blatch-Williams, Karin Lind, Maria McNamara, Joel Flude, Catherine Morgan, Jennifer Wilson, Iona Novak

Stud Health Technol Inform. 2025 Nov 12:333:46-51.

Abstract
Cerebral palsy is the most common physical disability and the fifth most common cause of death in childhood. There is no known cure for this lifelong condition that has complex variations in symptoms and severity. Families are faced with challenges in how to find new, safe and effective interventions and how to choose treatments that align with their family priorities. People with the lived experience of cerebral palsy were connected with clinical experts, software developers and mHealth researchers through focus groups and workshops. Together, a mobile health (mHealth) aide was codesigned and developed to streamline and filter treatments based on family priorities. The aide contains a step-by-step guide, a search function, treatment factsheets, and support resources to empower evidence-based personalised decision making. The mHealth app has been endorsed by research partners and will be freely available in app stores worldwide.
PMID: 41235491

23.A GNAI1 Pathogenic Variant Mimicking Cerebral Palsy: Expanding the Phenotypic Spectrum of GNAI1-Associated Neurodevelopmental Disorder

Marco Antônio Veloso de Albuquerque, Fernando Kok

Clin Case Rep. 2025 Nov 11;13(11):e71442. eCollection 2025 Nov.

Abstract
Novel genes are increasingly associated with neurodevelopmental disorders featuring developmental delay, epilepsy, and behavioral abnormalities. We report a child with profound motor and speech delay, hypotonia, dystonia, and spasticity mimicking cerebral palsy. Molecular testing revealed a pathogenic GNAI1 variant, expanding the phenotypic spectrum of this rare condition.
PMID: 41235373

24.Multi-Collaborator Engagement to Identify Research Priorities for Early Intervention in Cerebral Palsy

Angela Shierk, Nancy J Clegg, Daralyn Fulton, Mauricio R Delgado, Vanessa Hunt, Janet Bettger, Sydney Chapa, Sadie Oakley, Heather Roberts

J Clin Med. 2025 Oct 26;14(21):7592.

Background/Objectives: Although clinical practice guidelines and evidence-based practices for early cerebral palsy (CP) diagnosis and treatment are well established, their implementation remains inconsistent across care settings. This study sought to identify key research priorities related to early CP diagnosis and treatment and to develop an actionable framework through multi-collaborator consensus building.
Methods: The 97 adult participants included 42 who have lived experience with CP. Before the conference, participants completed a survey rating the importance of research topics. During the conference, aggregated results were presented, followed by 16 focus group discussions to refine research priorities. A follow-up survey was conducted to validate the final priorities.
Results: Six actionable items were identified: improving diagnosis communication, ensuring early referrals and interdisciplinary collaboration, creating inclusive education and training, scaling evidence-based therapies and researching new interventions, developing social support systems, and advocating for policy and cultural change. A research framework was developed that outlines how these priorities can be addressed through three main strategies: education and training, research expansion, and policy advocacy.
Conclusions: This study highlights the critical need for comprehensive and compassionate care for families receiving a CP diagnosis. Key priorities include early detection, coordinated multidisciplinary teams, and well-trained professionals delivering evidence-based interventions. The comprehensive framework addressing these priorities lays the foundation for future patient-centered comparative clinical effectiveness research.
PMID: 41226990

25.Implementation of a knowledge translation strategy to promote early evidence-based rehabilitation for children with cerebral palsy

No authors listed

Dev Med Child Neurol. 2025 Nov 12. Online ahead of print.

Abstract
No abstract available.
PMID: 41225078

26.Dr Google: Which Parents are Performing the Most Online Research Prior to the First Clinic Visit?

Scott J Schoenleber, Destiny R Wilson, Samantha A Mohler, Eric R Siegel, Brien M Rabenhorst

J Pediatr Soc North Am. 2025 Sep 30:13:100279. eCollection 2025 Nov.

Background: Parents commonly use the internet to research their child's diagnosis, read provider reviews, and find additional resources like support groups before or after a clinic visit. This study aimed to characterize demographic and diagnosis-specific variables associated with more frequent internet-based research prior to initial outpatient evaluation.
Methods: Parents of children presenting to an outpatient orthopaedic clinic completed a survey reporting their history of internet use in preparation for the initial visit. Data on demographics, diagnosis, and types of websites used were collected and analyzed. Predictors of parental previsit internet research were determined. Groups were assessed for differences in internet usage using Pearson's chi-square and Cochran-Armitage trend tests.
Results: Of 514 completed surveys, 179 (34.8%) parents reported internet use to prepare for the initial clinic visit. Internet use was more common among parents of patients with congenital or syndromic conditions (ie clubfoot or cerebral palsy) (19/30, [63.3%]) compared to spine (28/71, [39.4%]), nonspecific (musculoskeletal pain) (28/81, [34.6%]), traumatic (fractures and sport injuries) (72/226 [31.9%]), or non-congenital extremity (toe walking, intoeing, bow legs) (32/106, [30.2%]) concerns (P = .010). Internet use was more common in patients with household income ≥$50,000 (109/242, [45.0%]) compared to lower income (60/209, [28.7%]) and nondisclosed income (10/63, [15.9%]) (P < .001). Among 484 subjects disclosing education level, higher internet-usage rates were associated with more education; 22.6% (30/133) for high-school graduates or less, 36.0% (67/186) for some college, and 43.0% (71/165) for college graduates or more (trend P < .001). Search engines were used most frequently (175/179, [97.8%]), followed by hospital websites (52/179, [29.1%]), social media (31/179, [17.3%]), and medical information sites (28/179, [15.6%]). Few patients (2/179, [1.1%]) utilized medical society sites like Pediatric Orthopaedic Society of North America (POSNA) or OrthoKids.org.
Conclusion: Parents of children with congenital or syndromic conditions were more likely to research their child's condition online before seeing an orthopaedic surgeon. Higher education and household income were linearly associated with previsit internet research.
Key concepts: (1)About 34.8% of surveyed parents used the internet before their child's clinic visit, with higher usage observed among those with higher educational and socioeconomic status, and for more complex or chronic medical conditions.(2)Parents of children with congenital or syndromic conditions (eg clubfoot, developmental dysplasia of the hip) are significantly more likely to utilize internet resources prior to visits (63%) compared to other diagnoses, with trauma-related visits showing much lower rates.(3)Search engines are the most commonly used online resource, followed by hospital or specialty websites and social media, with Facebook being particularly significant among parents of children with congenital or syndromic diagnoses.(4)Disparities in education and income limit access to online health information, reinforcing inequity and highlighting the need for accessible, high-quality resources and clinician awareness.
PMID: 41216588

27.Rehabilitation needs and healthcare utilization of adults with cerebral palsy: A mixed methods study

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J Pediatr Rehabil Med. 2025 Nov 10:18758894251391901.

Purpose: This study aimed to understand and describe the rehabilitation and care complexity needs of adults with cerebral palsy (CP) receiving care in a pediatric healthcare setting.
Methods: This was an exploratory sequential mixed-methods study. Qualitative data included 20 semi-structured interviews with adults with CP and caregivers. Quantitative data included electronic health record data from adults with CP who were active pediatric rehabilitation medicine (PRM) patients over a two-year period at a pediatric health system (N = 280). Results from analyses were mixed and merged through narrative and joint display approaches.
Results: Three qualitative themes were identified: 1) Wide range of equipment and orthotic needs that change over time; 2) Various roles of therapies in adulthood; and 3) High levels of rehabilitation and subspecialty care utilization. Quantitatively, n = 150 (53.8%) had equipment prescription(s), n = 79 (28.2%) had orthotic prescription(s), and n = 162 (57.9%) were actively engaged in at least one type of therapy. Participants cumulatively saw over 30 types of specialists. Only n = 21 (7.7%) had documented transition efforts during their PRM visits.
Conclusion: While the rehabilitation needs of individuals with CP evolve over time, adults with CP have high rehabilitation and overall healthcare utilization needs. This can complicate the transition to adult-based care and underscores the importance of comprehensive and longitudinal transition processes.
PMID: 41212583

28.Exploring communication impairments in children with spastic cerebral palsy through neurovascular coupling: a cross-sectional study

Haoyue Yu, Yu Luo, Chunfeng Zhao, Lisha Nie, Ying Peng, Dan Luo, Yu Yin, Haifeng Ran, Heng Liu

Quant Imaging Med Surg. 2025 Nov 1;15(11):11279-11291.

Background: The coupling between cerebral blood flow (CBF) and blood oxygenation level-dependent signals at rest reflects the mechanism of neurovascular coupling (NVC), which holds great potential for the non-invasive assessment of developmental disorders in humans. However, this has not been illustrated in spastic cerebral palsy (SCP). This study aimed to evaluate alterations in NVC in children with SCP and to explore the clinical significance of these NVC changes.
Methods: Twenty children with SCP (7.5±2.7) and 22 typically developing controls (TDC) (8.9±2.5) underwent resting-state functional magnetic resonance imaging (rs-fMRI) and arterial spin labeling (ASL) to calculate regional homogeneity (ReHo), fractional amplitude of low-frequency fluctuation (fALFF), and CBF, respectively. Two types of NVC metrics (CBF/ReHo, CBF/fALFF) were compared between SCP and TDC, and the inner association between altered NVC metrics and communication function level in the SCP group was further analyzed.
Results: Compared to TDC, among regional level, SCP showed significantly higher CBF/ReHo coupling in the left fusiform gyrus, right lingual gyrus, bilateral thalamus, left calcarine fissure and surrounding cortex, and left caudate nucleus [$P<0.005$, Gaussian random field (GRF) correction] and increased CBF/fALFF coupling in the left lingual gyrus, left middle temporal gyrus, right middle occipital gyrus, bilateral caudate nucleus, left angular gyrus, and left median cingulate and paracingulate gyri ($P<0.005$, GRF correction). Furthermore, increased CBF/fALFF coupling was found in the left middle temporal gyrus ($r=-0.560$, $P=0.010$) and left angular gyrus ($r=-0.541$, $P=0.014$), and negatively correlated with the communication function level of SCP.
Conclusions: Children with SCP present altered NVC, associated with communication function level. The study provides a new insight into the pathophysiology of SCP and provides potential imaging biomarkers of communication performances in children with SCP.
PMID: 41209187

29.Screening Tool Improves Recognition of Movement Disorders by Internists and Paediatricians in Patients With Inherited Metabolic Diseases

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J Inherit Metab Dis. 2025 Nov;48(6):e70105.

Abstract
Movement disorders are common in inherited metabolic diseases (IMDs) and significantly impact quality of life. Unfortunately, they are often underrecognised by metabolic physicians. This study investigated whether a new screening tool improves recognition of movement disorders in IMD patients by non-neurologists. Internists and paediatricians specialized in IMDs assessed videos of 44 IMD patients who perform four specific neurological tests, to evaluate the presence and phenotype of a movement disorder. Initially, baseline assessments were performed without the tool. Eight months later, the same videos were assessed using an instructional video demonstrating the four neurological tests, and a screening tool including these tests with 14 yes/no questions regarding observed abnormalities. One hundred and forty-nine assessments were conducted by 15 metabolic internists and paediatricians. At baseline, 70% (105/149) of assessments correctly determined the presence of a movement disorder. Sensitivity of the tool was 68%. In the second measurement, when the outcome of the tool was considered decisive (with at least one positive answer indicating a movement disorder), 79% (117/149) of assessments were correct. Sensitivity of the tool increased to 87% (Chi-square = 15.75, $p < 0.001$). All severe and moderately severe movement disorders were recognized in the second measurement. The tool and instructional video did not enhance recognition of specific movement disorder phenotypes. However, the tool did improve the accuracy of treatment indications (chi-square = 4.000, $p < 0.05$). The correct use of the screening tool significantly increased the sensitivity and thereby the recognition of movement disorders in IMD patients, though referral to a neurologist remains necessary for phenotype identification.
PMID: 41208362

30.Mostly Mothers, Many Others: Comparing Caregiver Attendance and Missed Treatment Hours in Pediatric Physical Therapy for Children With Cerebral Palsy

Elizabeth Maus, Lee Ann Sansuchat, Tanya Tripathi, Jill C Heathcock

Phys Ther. 2025 Nov 8:pzaf131. Online ahead of print.

Importance: Cerebral palsy is a prevalent childhood motor disability which necessitates frequent outpatient physical therapy. Medical appointments can be time-consuming and burdensome for families and attendance rates for outpatient pediatric physical therapist visits are seldom reported.
Objective: This study investigates the number and types of caregivers that attend physical therapy sessions with the child and factors influencing attendance.
Design: The study is a secondary analysis of a randomized controlled pragmatic clinical trial.
Setting: Intervention occurred in an outpatient hospital-based pediatric clinic.
Participants: The study included 90 children ages 2 to 8 years old with cerebral palsy enrolled in a randomized controlled pragmatic clinical trial (NCT02897024).
Intervention: The study compared two physical therapy schedules, weekly and intensive, both with a total dose of 40 treatment hours. The weekly group received one 1-hour visit per week for 40 weeks. The intensive group repeated 2 bouts of 2-hour visits, 5 days per week for 2 weeks (20 hours, 4-month break, 20 hours). Both groups received 40 hours of physical therapy.
Main outcomes and measures: The primary outcomes were 1) number of caregivers accompanying the child to visits throughout the 40-week episode of care; and 2) number of missed treatment hours. Clinic location and accompanying caregiver(s) were collected from the electronic medical record. Prior to treatment, parents self-reported home zip code and income as part of the Hollingshead Four-Factor Socioeconomic Status as well as concurrent school-based therapy. Travel distance was calculated using home zip code and clinic location.
Results: Forty combinations of caregivers accompanied n = 90 children to 1953 treatment sessions. The most common caregivers in attendance were the mother (70.5%) and father (15.0%). A non-parent attended 15.5% of sessions. The number of caregivers, travel distance, income, and concurrent school-based therapy were not significantly related to missed treatment hours. The intensive group missed significantly fewer treatment hours compared to the weekly group.
Conclusions: The findings highlight the heterogeneity of caregivers attending physical therapist visits and that responsibility primarily falls to mothers. Treatment schedule influenced attendance patterns while number of caregivers involved, distance traveled, household income, and concurrent therapies did not.
Relevance: Attendance rates are an important metric for clinics and clinicians. Offering choices of treatment schedules may improve attendance rates. Future research could prospectively investigate caregiver scheduling preferences and their influence on attendance to outpatient pediatric physical therapy.
Relevance: Attendance rates are an important metric for clinics and clinicians. Offering choices of treatment schedules may improve attendance rates. Future research could prospectively investigate caregiver scheduling preferences and their influence on attendance to outpatient pediatric physical therapy.
PMID: 41206728

Prevention and Cure

31.Acute Kidney Injury and Neurodevelopmental Outcomes in Extremely Premature Neonates: A Secondary Analysis of a Randomized Clinical Trial

Mina Hanna, Valerie Y Chock, Nivedita Kamath, Anjali Raj, Jonathan R Swanson, Russell Griffin, David J Askenazi, Saudamini Nesargi

JAMA Netw Open. 2025 Nov 3;8(11):e2543270.

Importance: Extremely low gestational age neonates are at risk of neurodevelopmental impairment (NDI). Limited data exist on the association between acute kidney injury (AKI) and NDI in this population.
Objective: To describe neurodevelopmental outcomes in a cohort of extremely low gestational age neonates with AKI.
Design, setting, and participants: This study is a secondary analysis of the Preterm Erythropoietin Neuroprotection Trial (PENUT), a phase 3 placebo-controlled randomized clinical trial of erythropoietin conducted from December 2013 to September 2016 in 30 neonatal intensive care units in the US. Participants were extremely premature neonates born at 24 to 27 weeks' gestation. Data were analyzed in February 2024.
Exposure: AKI was the primary exposure. Key aspects of AKI were evaluated in this secondary analysis, including the stage of AKI, and timing (early defined as within the first 7 days after birth; late defined as after the first 7 days).
Main outcomes and measures: The primary outcome for this secondary analysis was the composite outcome of death or moderate to severe NDI (moderate to severe cerebral palsy, Bayley Scales of Infant Development Third Edition [BSID-III] cognitive score <85, or BSID-III motor score <85) at 22 to 26 months' corrected gestational age. The secondary outcomes were the individual components of the composite outcome.
Results: Of 941 enrolled neonates in PENUT, 660 had a follow-up visit with available BSID-III performed per protocol during the follow-up window of 22 to 26 months' corrected gestational age. Among the survivors, 256 neonates (39%) had AKI. Neonates with AKI had significantly lower mean (SD) GA (25.1 [1.1] weeks vs 25.7 [1.1] weeks), lower birth weight (755.3 [180.9] g vs 824.8 [189.4] g), were more likely to have an Apgar score of less than 5 at 5 minutes (24.1% vs 17.1%), and 57% were male. Those with AKI had higher odds of the composite outcome (adjusted odds ratio [AOR], 1.53; 95% CI, 1.07-2.18) and higher odds of cognitive BSID-III scores less than 85 (AOR, 1.94; 1.25-2.99). Neither the stage nor timing of AKI had an association with NDI.
Conclusions and relevance: In this secondary analysis of a randomized clinical trial, AKI in preterm infants was associated with poor neurodevelopmental outcomes at 22 to 26 months' corrected gestational age that was assessed by BSID-III scores.
Trial registration: ClinicalTrials.gov Identifier: NCT01378273.

PMID: 41222934

32.Early motor and cognitive development in typically developing children and those with or at high risk of cerebral palsy: A scoping review

Kanishka Baduni, Owais A Khan, Christopher M Modlesky, Nathalie L Maitre

Dev Med Child Neurol. 2025 Nov 11. Online ahead of print.

Aim: To examine associations between motor skills and cognitive development from birth to 5 years in typically developing children and children diagnosed with or at high risk of cerebral palsy (CP).
Method: Following prospective registration, five databases (PubMed, Web of Science, Embase, PsycINFO, and Cochrane) were searched to identify studies reporting motor and cognitive outcomes in children aged from birth to 5 years. Findings were synthesized using Preferred Reporting Items for Systematic reviews and Meta-Analyses for Scoping Reviews (PRISMA-ScR) guidelines.
Results: Thirty-three studies met the inclusion criteria. In typically developing children, motor skills consistently showed positive associations with later cognitive abilities, with fine motor skills having particularly strong predictive value. Among children with or at high risk of CP, developmental trajectories were more variable, yet motor delays were frequently associated with poorer cognitive performance.
Interpretation: Early motor proficiency is consistently associated with cognitive outcomes during early childhood. Motor impairments among children with or at high risk for CP may constrain cognitive development. Future research should investigate underlying mechanisms and explore integrated interventions targeting motor and cognitive domains.
PMID: 41219173

33.Indications and timings for caffeine initiation in preterm infants

Franciszek Borys, Katarzyna Wróblewska-Seniuk, Michelle Fiander, Roger Soll, Martin Ringsten, Matteo Bruschettini, Greta Sibrecht

Cochrane Database Syst Rev. 2025 Nov 11;11(11):CD016274.

Rationale: Caffeine is commonly used in preterm infants to improve respiratory function. However, the optimal strategies for caffeine initiation have not been defined.
Objectives: To evaluate the relative benefits and harms of different indications and timings for caffeine initiation in preterm infants.
Search methods: We searched MEDLINE, Embase, CENTRAL, and trial registries up to 23 April 2025. We searched conference abstracts, checked references of related systematic reviews and included studies, and searched for errata/ retractions of included studies.
Eligibility criteria: Randomized controlled trials (RCTs) including cluster-RCTs and quasi-RCTs comparing different indications for caffeine initiation in preterm infants: • within two hours of life (C2H) versus 2 to 24 hours; • within 72 hours of life (C72H) versus after 72 hours; • C72H versus treatment of symptomatic infants; • while on mechanical ventilation versus caffeine initiated at the time of extubation; • initiated with minimal symptoms versus with moderate-to-severe apnea.
Outcomes: Critical outcomes: all-cause mortality, chronic lung disease (CLD), and adverse events. Important outcomes: duration of mechanical ventilation (DMV) (days), duration of hospital stay (DHS) until discharge (days), apnea, intermittent hypoxemia (IH), acute kidney injury, severe intraventricular hemorrhage, cerebral palsy, developmental delay, intellectual impairment, blindness, and sensorial deafness.
Risk of bias: We used the Cochrane Risk of bias tool 2.0.
Synthesis methods: We conducted meta-analyses using fixed-effect models to calculate risk ratios (RRs) with 95% confidence intervals (CIs) and mean difference (MD) for dichotomous and continuous outcomes, respectively. We summarized the certainty of evidence according to GRADE methods.
Included studies: We included 11 RCTs enrolling 774 infants with gestational age ranging from 23 to 34 weeks. Studies were published between 2014 and 2023. The 11 studies compared caffeine initiated: • C2H versus 2 to 24 hours (3 studies); • C72H versus after 72 hours (3 studies); • C72H versus treatment of symptomatic infants (2 studies); • while on mechanical ventilation versus caffeine initiated at the time of extubation (3 studies). No studies compared caffeine initiated with minimal symptoms versus caffeine initiated with moderate-to-severe apnea. We identified seven ongoing studies.
Synthesis of results: C2H compared to caffeine initiated 2 to 24 hours: the evidence is very uncertain about the effect on CLD (RR 0.64, 95% CI 0.35 to 1.17; I^2 = 0%; 2 studies, 81 participants; very low-certainty evidence) and on DMV (MD 3.00, 95% CI -3.16 to 9.16; I^2 not applicable; 1 study, 21 participants; very low-certainty evidence). No studies reported two critical outcomes: all-cause mortality until hospital discharge and any adverse event. No studies reported DHS or apnea. C72H compared to caffeine initiated after 72 hours of life: the evidence is very uncertain about the effect on mortality (RR 2.00, 95% CI 0.19 to 21.36; I^2 not applicable; 1 study, 100 participants; very low-certainty evidence), DMV (MD 0.05, 95% CI -0.53 to 0.62; I^2 = 97%; 2 studies, 177 participants; very low-certainty evidence), and DHS (MD -4.59, 95% CI -10.51 to 1.33; I^2 not applicable; 1 study, 90 participants; very low-certainty evidence). C72H likely reduces CLD (RR 0.64, 95% CI 0.40 to 1.03; I^2 = 5%; 2 studies, 177 participants; moderate-certainty evidence) and apnea (number of infants with at least one episode, defined as interruption of breathing for more than 20 seconds until hospital discharge) (RR 0.58, 95% CI 0.37 to 0.90; I^2 = 81%; 2 studies, 177 participants; moderate-certainty evidence). No studies reported any adverse events. C72H for asymptomatic infants compared to treatment of symptomatic infants may result in little to no difference in all-cause mortality until hospital discharge (RR 0.95, 95% CI 0.47 to 1.92; I^2 not applicable; 1 study, 163 participants; low-certainty evidence) or in any adverse event leading to caffeine cessation until hospital discharge compared to caffeine treatment of symptomatic infants (RR 0.27, 95% CI 0.01 to 6.56; I^2 not applicable; 1 study, 163 participants; low-certainty evidence). It likely reduces CLD (RR 0.49, 95% CI 0.26 to 0.94; I^2 = 0%; 2 studies, 219 participants; moderate-certainty evidence). The evidence is very uncertain about DMV (MD -0.81, 95% CI -1.89 to 0.27; 1 study, 56 participants; very low-certainty evidence) and DHS (MD -1.43, 95% CI -4.90 to 2.04; 1 study, 56 participants; very low-certainty evidence). No studies reported apnea. Caffeine initiated during mechanical ventilation compared to caffeine initiated at the time of extubation may reduce CLD (RR 0.77, 95% CI 0.50 to 1.18; I^2 = 0%; 2 studies, 142 participants; low-certainty evidence) and may result in a large reduction in DMV (MD -1.90, 95% CI -3.14 to -0.66; I^2 not applicable; 1 study, 59 participants; low-certainty evidence). The evidence is very uncertain about the effect on all-cause mortality (RR 1.69, 95% CI 0.66 to 4.33; I^2 = 0%; 2 studies, 142 participants; very low-certainty evidence). No studies reported any adverse events, apnea, or DHS. No studies in any comparison reported the outcome IH.
Authors' conclusions: The evidence is very uncertain about the effect of C2H and C72 on CLD and DMV compared to caffeine initiated within 24 hours of life and after 72 hours of life in high-risk preterm infants, respectively. The evidence is very uncertain about the effect of C72 on DHS. C72H likely reduces CLD and apnea. In high-risk preterm infants, C72H compared to caffeine treatment of symptomatic infants only, may result in little to no difference in all-cause mortality until hospital discharge, but likely reduces CLD. C72H of life may result in little to no difference in any adverse event leading to caffeine cessation. The evidence is very uncertain about the effect of C72H on DMV and DHS. The evidence is very uncertain about the effect on all-cause mortality until hospital discharge of caffeine initiated while on mechanical

ventilation compared to initiated at time of extubation. Caffeine initiated while on mechanical ventilation may reduce CLD and may result in a large reduction in DMV. No studies reported any adverse events, apnea, or DHS. The results of ongoing studies could change the outcomes of this review.
Registration: PROSPERO: crd.york.ac.uk/PROSPERO/view/CRD42024595715.
PMID: 41216939

34.High-frequency oscillatory ventilation versus conventional ventilation for infants with severe pulmonary dysfunction born at or near term

Nanthida Phattraprayoon, Jacqueline J Ho, Michelle Fiander, Mayank Priyadarshi

Cochrane Database Syst Rev. 2025 Nov 11;11(11):CD002974.

Rationale: Pulmonary disease is a common cause of morbidity and mortality in term and near-term infants. For several decades, conventional ventilation (CV) has been widely used to manage pulmonary dysfunction. High-frequency oscillatory ventilation (HFOV) may prove to be more effective than CV in these infants. However, with recent innovations in CV, it remains unclear whether HFOV is more effective than CV in term or near-term infants with severe pulmonary dysfunction. This is an update of a review previously conducted in 2009.
Objectives: To determine the effect of HFOV compared with CV on mortality and morbidity in infants born at 35 weeks' gestation or more with severe respiratory failure due to lung disease requiring mechanical ventilation.
Search methods: We searched CENTRAL, MEDLINE, Embase, trial registries, and conference abstracts in May 2024. We also checked the references of included studies and related literature for eligible studies.
Eligibility criteria: We included randomized and quasi-randomized trials comparing HFOV to CV in infants born at 35 weeks' gestation or more with severe pulmonary dysfunction within 28 days of life.
Outcomes: Our outcomes included failed therapy on assigned mode of ventilation at any time point; mortality at any time during hospitalization or in the first year; neurodevelopmental outcomes at two years of age or later childhood (such as cerebral palsy, cognitive, behavioral, hearing, and vision outcomes); the combined outcome of death or neurodevelopmental impairment in childhood; pulmonary air leak during hospitalization; and duration of mechanical ventilation (days).
Risk of bias: We assessed risk of bias in the included studies using Cochrane's RoB 1 tool.
Synthesis methods: We synthesized the results of each outcome in meta-analysis using a fixed-effect model. For continuous outcome measures, we reported mean differences (MDs) with 95% confidence intervals (CIs). For dichotomous outcomes, we reported risk ratios (RRs) with 95% CIs. We used GRADE to assess the certainty of evidence for the prespecified outcomes.
Included studies: We included three studies enrolling a total of 368 near-term or term infants of less than 28 days with severe pulmonary dysfunction.
Synthesis of results: We are very uncertain about the effect of HFOV on failed therapy at any time point (RR 1.19, 95% CI 0.86 to 1.64; 3 studies, 368 infants; very low-certainty evidence). HFOV may increase mortality at any time during hospitalization or in the first year (RR 1.47, 95% CI 0.92 to 2.34; 3 studies, 368 infants; low-certainty evidence). Neurodevelopmental at two years of age or more and the combined outcome of death or neurodevelopmental impairment were not reported in any of the included studies. The evidence is very uncertain about the effect of HFOV on pulmonary air leak during hospitalization (RR 0.91, 95% CI 0.33 to 2.54; 2 studies, 197 infants; very low-certainty evidence) and duration of mechanical ventilation (days) (MD 0.70, 95% CI -0.97 to 2.37; 1 study, 112 infants; very low-certainty evidence). The risk of bias was generally low, aside from lack of blinding of participants and personnel and outcome assessment. We therefore judged the risk of detection bias to be high for all outcomes except for the objective outcome (i.e. mortality), which we judged to be at low risk of bias.
Authors' conclusions: Based on the available evidence, we are very uncertain about the effects of HFOV on failed therapy. HFOV may increase mortality. We are unable to support or refute the use of HFOV in near-term or term infants with severe pulmonary dysfunction. Further randomized controlled trials are needed, stratified by disease and including long-term neurodevelopmental outcomes. There is also a need for studies comparing newer forms of CV and HFOV.
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35.Neuroprotective effects of caffeine, erythropoietin, magnesium sulfate, and thyroxine in preterm infants: a network meta-analysis

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Background: Premature infants are prone to having adverse neurodevelopmental outcomes such as cerebral palsy. Some neuroprotective drugs can improve adverse neurological outcomes in premature infants. A network meta-analysis was conducted to compare the effects of four common neuroprotective drugs on neurodevelopmental outcomes in preterm infants.
Methods: To identify eligible randomized clinical trials, three databases (Cochrane Library, PubMed, and EMBASE) were searched from the inception date through March 2024. Neuroprotective drugs included erythropoietin, magnesium sulfate, caffeine, and thyroxine. The primary outcome was whether neurodevelopmental impairment (NDI) or death occurred. Studies that met the eligibility criteria were assessed, and data were extracted. The surface under the cumulative ranking curve (SUCRA) was computed to evaluate and rank the neuroprotective efficacy of various drugs.
Results: Caffeine [relative risk (RR) 0.43, 95% confidence interval (CI): 0.22-0.86] showed the most promising effect in reducing the risk of premature infants with NDI. Caffeine (RR 0.55, 95% CI: 0.43-0.70) and magnesium sulfate (RR 0.66, 95% CI: 0.54-0.80) showed promising effects in reducing the risk of premature infants with cerebral palsy. According to the SUCRA value, caffeine (NDI: 87.9%, cerebral palsy: 91.2%) may be the best drug for neurodevelopmental protection in preterm infants.
Conclusions: The neuroprotective effects of caffeine were observed in the reduction of NDI and cerebral palsy, whereas magnesium sulfate, given to pregnant women at risk of preterm birth, had a protective effect in reducing the risk of cerebral palsy. The analysis of the SUCRA value indicated that caffeine may offer greater benefits compared to other medications in the neuroprotection of premature infants. The findings of this network meta-analysis ought to be regarded as theoretical rather than validated. Additional trials are necessary to validate the existing findings.
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