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Interventions and Management

1. Effect of constraint-induced movement therapy in reducing severity of mirror movements in children with unilateral spastic cerebral palsy

Javeria Shahid, Mir Arif Hussain, Huma Khan

J Pak Med Assoc. 2024 Jan;74(1):141-144. doi: 10.47391/JPMA.9144.

To determine the effect of constraint-induced movement therapy (CIMT) in improving hand function and reduction in severity of mirror movements in children with unilateral spastic cerebral palsy who have mirror movement disorder. Spastic hemiplegic CP children of either gender, aged 6 to 16 years, with mirror movements of grade 1 and 2 who were able to make a gross grip, were included in this single arm feasibility study. CIMT was provided as an intervention to these children for six hours per day for 15 consecutive week days. Woods and Teuber criteria was applied for the assessment of mirror movements. Pre- and postintervention assessment results showed that there was improvement in the unimanual and bimanual hand function in CP-affected children ($p < 0.05$) and reduction in the severity of mirror movements ($p < 0.05$). Constraint induced movement therapy improved hand function and reduced the severity of mirror movements in children with unilateral spastic cerebral palsy.

PMID: [38219183](#)

2. Commentary on "Agreement Between the Gross Motor Ability Estimator-2 and the Gross Motor Ability Estimator-3 in Young Children With Cerebral Palsy"

Lin-Ya Hsu, Lisa Barton Diller, Alexander B Diller

Pediatr Phys Ther. 2024 Jan 1;36(1):41. doi: 10.1097/PEP.0000000000001078.

No abstract available

PMID: [38227747](#)

3. Location Matters: The Role of the Neighborhood Environment for Incident Cardiometabolic Disease in Adults Aging With Physical Disability

Anam M Khan, Paul Lin, Neil Kamdar, Elham Mahmoudi, Kenzie Latham-Mintus, Lindsay Kobayashi, Philippa Clarke

Am J Health Promot. 2024 Jan 18:8901171241228017. doi: 10.1177/08901171241228017. Online ahead of print.

Purpose: People aging with disability may be limited in their ability to engage in healthy behaviors to maintain cardiometabolic health. We investigated the role of health promoting features in the neighborhood environment for incident cardiometabolic disease in adults aging with physical disability in the United States. Design: Retrospective cohort study. Setting: Optum's Clinformatics® Data Mart Database (2007-2018) of administrative health claims. Subjects: ICD-9-CM codes

were used to identify 15 467 individuals with a diagnosis of Cerebral Palsy, Spina Bifida, Multiple Sclerosis, or Spinal Cord Injury. Measures: Cardiometabolic disease was identified using ICD-9-CM/ICD-10-CM codes over 3 years of follow-up. Measures of the neighborhood environment came from the National Neighborhood Data Archive and linked to individual residential ZIP codes over time. Covariates included age, sex, and comorbid health conditions. Analysis: Cox regression models estimated hazard ratios (HR) for incident cardiometabolic disease. Using a 1-year lookback period, individuals with pre-existing cardiometabolic disease were excluded from the analysis. Results: Net of individual risk factors, residing in neighborhoods with a greater density of broadband Internet connections (HR = .88, 95% CI: .81, .97), public transit stops (HR = .89, 95% CI: .83, .95), recreational establishments (HR = .89, 95% CI: .83, .96), and parks (HR = .88, 95% CI: .82, .94), was associated with reduced risk of 3-year incident cardiometabolic disease. Conclusion: Findings identify health-promoting resources that may mitigate health disparities in adults aging with disability.

PMID: [38236090](#)

4. Multiple Equine Therapies for the Treatment of Gross Motor Function in Children with Cerebral Palsy: A Systematic Review

Zhikai Qin, Zizhao Guo, Junsheng Wang

J Community Health Nurs. 2024 Jan 16:1-14. doi: 10.1080/07370016.2024.2304825. Online ahead of print.

Purpose: This study aimed to evaluate the impact of three equine therapy approaches on gross motor function in children with cerebral palsy. Methods: The studies were retrieved from PubMed, Web of Science, Science Direct, and the Cochrane Library, in accordance with the style commonly found in scientific journal publications: (1) peer-reviewed articles written in English; (2) experimental or quasi-experimental; (3) three Equine Therapy Interventions as experiment's independent variable; (4) children with cerebral palsy; and (5) measurement of outcomes related to Gross Motor Function. Results: The study examined 596 patients with cerebral palsy, whose average age was 8.03 years. The three types of horse therapy interventions had a significant impact on gross motor function in children with cerebral palsy (SMD = 0.19, 95% CI 0.02-0.36, $p = 0.031$). Additionally, the interventions positively affected dimensions C (SMD = 0.31, 95% CI 0.00-0.62, $p = 0.05$), D (SMD = 0.30, 95% CI 0.06-0.56, $p = 0.017$), and B (SMD = 0.72, 95% CI 0.10-1.34, $p = 0.023$). The Gross Motor Function Measure (GMFM) consists of 88 or 66 items, which are divided into five functional dimensions: GMFM-A (lying down and rolling), GMFM-B (sitting), GMFM-C (crawling and kneeling), GMFM-D (standing), and GMFM-E (walking, running, and jumping). Each subsection of the GMFM can be used separately to evaluate motor changes in a specific dimension of interest. Subgroup analysis revealed that different horse-assisted therapy approaches, types of cerebral palsy, exercise duration, frequency, and intervention periods are important factors influencing treatment outcomes. Conclusion: The intervention period ranged from 8 to 12 weeks, with session durations of 30 to 45 minutes, 2 to 3 times per week. Equine-assisted therapy (EAT) demonstrated significant improvements in the overall gross motor function score, Dimension B, Dimension C, and Dimension D among children with cerebral palsy. The most effective treatment is provided by Equine-Assisted Therapy, followed by Horseback Riding Simulator (HRS). Due to its economic practicality, HRS plays an irreplaceable role. Clinical evidence: Equine-Assisted Therapy (EAT) demonstrates the most effective treatment outcomes, suggesting that hospitals and healthcare professionals can form specialized teams to provide rehabilitation guidance. 2. Within equine-assisted therapy, Horseback Riding Simulator (HRS) exhibits treatment efficacy second only to Equine-Assisted Therapy (EAT), making it a cost-effective and practical option worthy of promotion and utilization among healthcare institutions and professionals. 3. In equine-assisted therapy, Therapeutic Horseback Riding (THR) holds certain value in rehabilitation due to its engaging and practical nature.

PMID: [38229243](#)

5. Articulatory and Vocal Fold Movement Patterns During Loud Speech in Children With Cerebral Palsy

Ignatius S B Nip

J Speech Lang Hear Res. 2024 Jan 16:1-17. doi: 10.1044/2023_JSLHR-23-00411. Online ahead of print.

Purpose: Speech motor control changes underlying louder speech are poorly understood in children with cerebral palsy (CP). The current study evaluates changes in the oral articulatory and laryngeal subsystems in children with CP and their typically developing (TD) peers during louder speech. Method: Nine children with CP and nine age- and sex-matched TD peers produced sentence repetitions in two conditions: (a) with their habitual rate and loudness and (b) with louder speech. Lip and jaw movements were recorded with optical motion capture. Acoustic recordings were obtained to evaluate vocal fold articulation. Results: Children with CP had smaller jaw movements, larger lower lip movements, slower jaw speeds, faster lip speeds, reduced interarticulator coordination, reduced low-frequency spectral tilt, and lower cepstral peak prominences (CPP) in comparison to their TD peers. Both groups produced louder speech with larger lip and jaw movements, faster lip and jaw speeds, increased temporal coordination, reduced movement variability, reduced spectral tilt, and increased CPP. Conclusions: Children with CP differ from their TD peers in the speech motor control of both the oral articulatory and laryngeal subsystems. Both groups alter oral articulatory and vocal fold movements when cued to speak loudly, which may contribute to the increased intelligibility associated with louder speech.

PMID: [38227476](#)

6. Effects of ankle exoskeleton assistance and plantar pressure biofeedback on incline walking mechanics and muscle activity in cerebral palsy

Ying Fang, Zachary F Lerner

J Biomech. 2024 Jan 12;163:111944. doi: 10.1016/j.jbiomech.2024.111944. Online ahead of print.

Ankle dysfunction affects more than 50 % of people with cerebral palsy, resulting in atypical gait patterns that impede lifelong mobility. Incline walking requires increased lower limb effort and is a promising intervention that targets lower-limb extensor muscles. A concern when prescribing incline walking to people with gait deficits is that this exercise may be too challenging or reinforce unfavorable gait patterns. This study aims to investigate how ankle exoskeleton assistance and plantar pressure biofeedback would affect gait mechanics and muscle activity during incline walking in CP. We recruited twelve children and young adults with CP. Participants walked with ankle assistance alone, biofeedback alone, and the combination while we assessed ankle, knee, and hip mechanics, and plantar flexor and knee extensor activity. Compared to incline walking without assistance or biofeedback, ankle assistance alone reduced the peak biological ankle moment by 12 % ($p < 0.001$) and peak soleus activity by 8 % ($p = 0.013$); biofeedback alone increased the biological ankle moment (4 %, $p = 0.037$) and power (19 %, $p = 0.012$), and plantar flexor activities by 9 - 27 % ($p \leq 0.026$); assistance-plus-biofeedback increased biological ankle and knee power by 34 % and 17 %, respectively ($p \leq 0.05$). The results indicate that both ankle exoskeleton assistance and plantar pressure biofeedback can effectively modify lower limb mechanics and muscular effort during incline walking in CP. These techniques may help in establishing personalized gait training interventions by providing the ability to adjust intensity and biomechanical focus over time.

PMID: [38219555](#)

7. Effect of the VR-guided grasping task on the brain functional network

Guangjian Shao, Gongcheng Xu, Congcong Huo, Zichao Nie, Yizheng Zhang, Li Yi, Dongyang Wang, Zhiyong Shao, Shanfan Weng, Jinyan Sun, Zengyong Li

Biomed Opt Express. 2023 Dec 6;15(1):77-94. doi: 10.1364/BOE.504669. eCollection 2024 Jan 1.

Virtual reality (VR) technology has been demonstrated to be effective in rehabilitation training with the assistance of VR games, but its impact on brain functional networks remains unclear. In this study, we used functional near-infrared spectroscopy imaging to examine the brain hemodynamic signals from 18 healthy participants during rest and grasping tasks with and without VR game intervention. We calculated and compared the graph theory-based topological properties of the brain networks using phase locking values (PLV). The results revealed significant differences in the brain network properties when VR games were introduced compared to the resting state. Specifically, for the VR-guided grasping task, the modularity of the brain network was significantly higher than the resting state, and the average clustering coefficient of the motor cortex was significantly lower compared to that of the resting state and the simple grasping task. Correlation analyses showed that a higher clustering coefficient, local efficiency, and modularity were associated with better game performance during VR game participation. This study demonstrates that a VR game task intervention can better modulate the brain functional network compared to simple grasping movements and may be more beneficial for the recovery of grasping abilities in post-stroke patients with hand paralysis.

PMID: [38223191](#)

8. Brain control of bimanual movement enabled by recurrent neural networks

Darrel R Deo, Francis R Willett, Donald T Avansino, Leigh R Hochberg, Jaimie M Henderson, Krishna V Shenoy

Sci Rep. 2024 Jan 18;14(1):1598. doi: 10.1038/s41598-024-51617-3.

Brain-computer interfaces have so far focused largely on enabling the control of a single effector, for example a single computer cursor or robotic arm. Restoring multi-effector motion could unlock greater functionality for people with paralysis (e.g., bimanual movement). However, it may prove challenging to decode the simultaneous motion of multiple effectors, as we recently found that a compositional neural code links movements across all limbs and that neural tuning changes nonlinearly during dual-effector motion. Here, we demonstrate the feasibility of high-quality bimanual control of two cursors via neural network (NN) decoders. Through simulations, we show that NNs leverage a neural 'laterality' dimension to distinguish between left and right-hand movements as neural tuning to both hands become increasingly correlated. In training recurrent neural networks (RNNs) for two-cursor control, we developed a method that alters the temporal structure of the training data by dilating/compressing it in time and re-ordering it, which we show helps RNNs successfully generalize to the online setting. With this method, we demonstrate that a person with paralysis can control two computer cursors simultaneously. Our results

suggest that neural network decoders may be advantageous for multi-effector decoding, provided they are designed to transfer to the online setting.

PMID: [38238386](#)

9. Prioritized strategies to improve diagnosis and early management of cerebral palsy for both Māori and non-Māori families

Sian A Williams, Ivana Nakarada-Kordic, Anna H Mackey, Stephen Reay, N Susan Stott

Dev Med Child Neurol. 2024 Jan 18. doi: 10.1111/dmcn.15847. Online ahead of print.

Aim: To identify prioritized strategies to support improvements in early health service delivery around the diagnosis and management of cerebral palsy (CP) for both Māori and non-Māori individuals. **Method:** Using a participatory approach, health care professionals and the parents of children with CP attended co-design workshops on the topic of early diagnosis and management of CP. Health design researchers facilitated two 'discovery' (sharing experiences and ideas) and two 'prototyping' (solution-focused) workshops in Aotearoa, New Zealand. A Māori health service worker co-facilitated workshops for Māori families. **Results:** Between 7 and 13 participants (14 health care professionals, 12 parents of children with CP across all functional levels) attended each workshop. The discovery workshops revealed powerful stories about early experiences and needs within clinician-family communication and service provision. The prototyping workshops revealed priorities around communication, and when, what, and how information is provided to families; recommendations were co-created around what should be prioritized within a resource to aid health care navigation. **Interpretation:** There is a critical need for improved communication, support, and guidance, as well as education, for families navigating their child with CP through the health care system. Further input from families and health care professionals partnering together will continue to guide strategies to improve health care service delivery using experiences as a mechanism for change.

PMID: [38236645](#)

10. Clinical Chorioamnionitis and Neurodevelopment at 5 Years of Age in Children Born Preterm: The EPIPAGE-2 Cohort Study

Fanny Salmon Rm, Gilles Kayem, Emeline Maisonneuve, Laurence Foix-L'Hélias, Valérie Benhammou, Monique Kaminski, Laetitia Marchand-Martin, Gildas Kana, Damien Subtil, Elsa Lorthe Rm, Pierre-Yves Ancel, Mathilde Letouzey; EPIPAGE-2 Infectious diseases working group

J Pediatr. 2024 Jan 17:113921. doi: 10.1016/j.jpeds.2024.113921. Online ahead of print.

Objective: To assess the association between clinical chorioamnionitis and neurodevelopmental disorders at 5 years of age in children born preterm. **Study design:** EPIPAGE 2 is a national, population-based cohort study of children born before 35 weeks of gestation in France in 2011. We included infants born alive between 24+0 and 34+6 weeks following preterm labor (PTL) or preterm premature rupture of membranes (PPROM). Clinical chorioamnionitis was defined as maternal fever before labor (>37.8°C) with at least two of the following criteria: maternal tachycardia, hyperleukocytosis, uterine contractions, purulent amniotic fluid, or fetal tachycardia. The primary outcome was a composite including cerebral palsy, coordination disorders, cognitive disorders, sensory disorders, or behavioral disorders. We also analyzed each of these disorders separately as secondary outcomes. We performed a multivariable analysis using logistic regression models. We accounted for the non-independence of twins and missing data by generalized estimating equation models and multiple imputations, respectively. **Results:** Among 2927 children alive at 5 years of age, 124 (3%) were born in a context of clinical chorioamnionitis. Overall, 8.2% and 9.6% of children exposed and unexposed respectively to clinical chorioamnionitis had moderate-to-severe neurodevelopmental disorders. After multiple imputations and multivariable analysis, clinical chorioamnionitis was not associated with the occurrence of moderate-to-severe neurodevelopmental disorders (adjusted odds ratio = 0.9, 95%CI: 0.5-1.8). **Conclusion:** We did not find any association between clinical chorioamnionitis and neurodevelopmental disorders at 5 years of age in children born before 35 weeks of gestation after PTL or PPRM.

PMID: [38242316](#)

11. Higher versus lower nasal continuous positive airway pressure for extubation of extremely preterm infants in Australia (ÉCLAT): a multicentre, randomised, superiority trial

Anna M Kidman, Brett J Manley, Rosemarie A Boland, Atul Malhotra, Susan M Donath, Friederike Beker, Peter G Davis, Risha Bhatia

Lancet Child Adolesc Health. 2023 Dec;7(12):844-851. doi: 10.1016/S2352-4642(23)00235-3. Epub 2023 Oct 27.

Background: Extremely preterm infants often require invasive mechanical ventilation, and clinicians aim to extubate these infants as soon as possible. However, extubation failure occurs in up to 60% of extremely preterm infants and is associated

with increased mortality and morbidity. Nasal continuous positive airway pressure (nCPAP) is the most common post-extubation respiratory support, but there is no consensus on the optimal nCPAP level to safely avoid extubation failure in extremely preterm infants. We aimed to determine if higher nCPAP levels compared with standard nCPAP levels would decrease rates of extubation failure in extremely preterm infants within 7 days of their first extubation. Methods: In this multicentre, randomised, open-label controlled trial done at three tertiary perinatal centres in Australia, we assigned extremely preterm infants to extubation to either higher nCPAP (10 cmH₂O) or standard nCPAP (7 cmH₂O). Infants were eligible if they were born at less than 28 weeks' gestation, were receiving mechanical ventilation via an endotracheal tube, and were being extubated for the first time to nCPAP. Eligible infants must have received previous treatment with exogenous surfactant and caffeine. Infants were ineligible if they were planned to be extubated to a mode of respiratory support other than nCPAP, if they had a known major congenital anomaly that might affect breathing, or if ongoing intensive care was not being provided. Parents or guardians provided prospective, written, informed consent. Infants were maintained within an assigned nCPAP range for a minimum of 24 h after extubation (higher nCPAP group 9-11 cmH₂O and standard nCPAP group 6-8 cmH₂O). Randomisation was stratified by both gestation (22-25 completed weeks or 26-27 completed weeks) and recruiting centre. The primary outcome was extubation failure within 7 days and analysis was by intention to treat. This trial was prospectively registered with the Australian New Zealand Clinical Trials Registry, number ACTRN12618001638224. Findings: Between March 3, 2019, and July 31, 2022, 483 infants were born at less than 28 weeks and admitted to the recruiting centres. 92 infants were not eligible, 172 were not approached, 65 families declined to participate, and 15 consented but were not randomly assigned. 139 infants were enrolled and randomly assigned, 70 to the higher nCPAP group and 69 to the standard nCPAP group. One infant in the higher nCPAP group was excluded from the analysis because consent was withdrawn after randomisation. 104 (75%) of 138 mothers were White. The mean gestation was 25.7 weeks (SD 1.3) and the mean birthweight was 777 grams (201). 70 (51%) of 138 infants were female. Extubation failure occurred in 24 (35%) of 69 infants in the higher nCPAP group and in 39 (57%) of 69 infants in the standard nCPAP group (risk difference -21.7%, 95% CI -38.5% to -3.7%). There were no significant differences in rates of adverse events between groups during the primary outcome period. Three patients died (two in the higher nCPAP group and one in the standard nCPAP group), pneumothorax occurred in one patient from each group, spontaneous intestinal perforation in three patients (two in the higher nCPAP group and one in the standard nCPAP group) and there were no events of pulmonary interstitial emphysema. Interpretation: Extubation of extremely preterm infants to higher nCPAP significantly reduced extubation failure compared with extubation to standard nCPAP, without increasing rates of adverse effects. Future larger trials are essential to confirm these findings in terms of both efficacy and safety. Funding: National Health and Medical Research Council Centre for Research Excellence in Newborn Medicine, number 1153176.

PMID: [38240784](#)

12. Mechanisms and timing of brain injury among persons with cerebral palsy

T Michael O'Shea

Dev Med Child Neurol. 2024 Jan 18. doi: 10.1111/dmcn.15849. Online ahead of print.

No abstract available

PMID: [38238983](#)

13. Knowledge mapping of spastic cerebral palsy. A bibliometric analysis of global research (2000-2022)

Xing Wang, Siew Hoon Teh, Xing-Hua Wang

Ital J Pediatr. 2024 Jan 18;50(1):9. doi: 10.1186/s13052-024-01577-1.

Background: Cerebral palsy (CP) is characterized by abnormal pronunciation, posture, and movement. Spastic CP accounts for more than 70% of all CP. To date, there has been no bibliometric analysis to summarize study on spastic CP. Here, we aim to conduct a bibliometric analysis of spastic CP to summarize this field's knowledge structure, research hotspots, and frontiers. Method: Publications about spastic CP were searched utilizing the Web of Science Core Collection (WoSCC) database from 1 January 2000 to 30 November 2022, the WoSCC literature analysis wire, VOSviewer 1.6.18, CiteSpace 6.1.R4 and Online analysis platform for bibliometrics were used to conduct the analysis. Results: A total of 3988 publications, consisting of 3699 articles and 289 reviews, were included in our study. The United States emerged as the most productive country, while Kathleen Univ Leuven was the most productive institution. The leading author was Desloovere K. A total of 238 journals contributed to this field, with Developmental medicine and child neurology being the leading journal. Important keywords and keyword clusters included Spastic cerebral palsy, Reliability, and Gross motor function. Keywords identified through burst detection indicated that hotspots in this field were management, randomized controlled trials, and definition. Conclusion: Based on the analysis of bibliometric on spastic CP over the past 20 years, the trends and the knowledge graph of the countries, institutions, authors, references, and the keywords have been identified, providing accurate and expedited insights into critical information and potentially new directions in the study of spastic CP.

PMID: [38238820](#)

14. Purified cannabidiol as add-on therapy in children with treatment-resistant infantile epileptic spasms syndrome

Gabriela Reyes Valenzuela, Adolfo Gallo, Agustin Calvo, Santiago Chacón, Lorena Fasulo, Santiago Galicchio, Javier Adi, Pablo Sebastian Fortini, Roberto Caraballo

Seizure. 2024 Jan 15:115:94-99. doi: 10.1016/j.seizure.2024.01.010. Online ahead of print.

Objective: The aim of this study was to assess efficacy, safety, and tolerability of highly purified cannabidiol oil (CBD) as add-on therapy for the treatment of a series of patients with infantile epileptic spasms syndrome (IESS) who were resistant to antiseizure medications and ketogenic dietary therapy. **Material and methods:** We conducted a retrospective analysis of the medical records of 28 infants with treatment-resistant IESS aged 6 to 21 months who received highly purified CBD between July 2021 and June 2023. Data were collected on neurological examinations, EEG, Video-EEG and polygraphic recordings, imaging studies, laboratory testing, and seizure frequency, type, and duration, and adverse effects. As the primary outcome, a reduction of frequency of epileptic spasms (ES) was assessed. ES freedom was considered after a minimal time of 1 month without ES. **Results:** Sixteen male and 12 female patients, aged 6-21 months, who received CBD for treatment-resistant IESS were included. The etiology was structural in 10, Down syndrome in seven, genetic in nine, and unknown in two. Initial CBD dose was 2 mg/kg/day, which was uptitrated to a median dose of 25 mg/kg/day (range, 2-50). Prior to CBD initiation, patients had a median of 69 ES in clusters per day (range, 41-75) and of 10 focal seizures per week (range, 7-13). After a mean and median follow-up of 15 and 12.5 months (range, 6-26 months), seven patients were ES free and 12 had a >50 % ES reduction. Five of seven patients (71 %) with Down syndrome and 3/5 (60 %) with cerebral palsy responded well. Adverse effects were mild. EEG improvements correlated with ES reductions. **Conclusion:** In this study evaluating the use of CBD in children with IESS, 19/28 (67.8 %) had a more than 50 % ES reduction with good tolerability.

PMID: [38237316](#)

15. Co-designing interventions for a continuum of care for children with cerebral palsy

Ashish Kc

Dev Med Child Neurol. 2024 Jan 18. doi: 10.1111/dmcn.15848. Online ahead of print.

No abstract available

PMID: [38236655](#)

16. Phenotyping childhood cerebral palsy-associated epilepsy and the new vision of cerebral palsy spectrum disorder

Martino Ruggieri

Dev Med Child Neurol. 2024 Jan 17. doi: 10.1111/dmcn.15850. Online ahead of print.

No abstract available

PMID: [38233989](#)

17. Frequency of Cerebellar Abnormalities Associated With the Differing Magnetic Resonance Imaging Patterns of Term Hypoxic-Ischemic Injury in Children

Shyam Sunder B Venkatakrishna, Parth Sharma, Luis Octavio Tierradentro-Garcia, Mohamed Elsinger, Fikadu Worede, Jelena Curic, Cesar Augusto P Alves, Savvas Andronikou

Pediatr Neurol. 2024 Jan 1:152:73-78. doi: 10.1016/j.pediatrneurol.2023.12.023. Online ahead of print.

Background: We aimed to determine the frequency of cerebellar injury using delayed magnetic resonance imaging (MRI) in children with cerebral palsy, diagnosed with term hypoxic-ischemic injury (HII), and to characterize this for the different MRI patterns of HII. **Methods:** We retrospectively reviewed delayed MRI scans in children with cerebral palsy, of whom 1175 had term HII. The pattern of HII was classified into basal ganglia-thalamus (BGT) pattern, watershed (WS) pattern, combined BGT/WS, and multicystic HII. Cerebellar location (hemisphere versus vermis) and the MRI characteristics were documented overall and for each of the different patterns of HII, as well as the association with thalamic injury. **Results:** Cerebellar injury was found in 252 of 1175 (21.4%) (median age 6 years [interquartile range: 3 to 9 years]). Of these, 49% (124 of 252) were associated with a BGT pattern, 13% (32 of 252) with a WS pattern, 28% (72 of 252) with a combined BGT/WS pattern, and 10% (24 of 252) with a multicystic pattern. The vermis was abnormal in 83% (209 of 252), and the hemispheres were abnormal in 34% (86 of 252) (with 17% [43 of 252] showing both vermis and hemispheric abnormality). **Conclusions:** Over a fifth of patients with cerebral palsy due to HII had a cerebellar abnormality on delayed MRI, most commonly involving the vermis

(83%), and as part of a BGT pattern of injury in just under half of these likely reflecting the association of cerebellar vermis injury with profound insults.

PMID: [38232653](#)

18. Doxapram for apnoea of prematurity and neurodevelopmental outcomes at age 5-6 years

Ludovic Tréluyer, Elodie Zana-Taieb, Pierre-Henri Jarreau, Valérie Benhammou, Pierre Kuhn, Mathilde Letouzey, Laetitia Marchand-Martin, Wes Onland, Véronique Pierrat, Lauren Saade, Pierre Yves Ancel, Héloïse Torchin

Arch Dis Child Fetal Neonatal Ed. 2024 Jan 16:fetalneonatal-2023-326170. doi: 10.1136/archdischild-2023-326170. Online ahead of print.

Objective: To assess the long-term neurodevelopmental impact of doxapram for treating apnoea of prematurity. Design: Secondary analysis of the French national cohort study EPIPAGE-2. Recruitment took place in 2011. A standardised neurodevelopmental assessment was performed at age 5-6 years. A 2:1 propensity score matching was used to control for the non-randomised assignment of doxapram treatment. Setting: Population-based cohort study. Patients: All children born before 32 weeks' gestation alive at age 5-6 years. Interventions: Blind and standardised assessment by trained neuropsychologists and paediatricians at age 5-6 years. Main outcome measures: Neurodevelopmental outcomes at age 5-6 years assessed by trained paediatricians and neuropsychologists: cerebral palsy, developmental coordination disorders, IQ and behavioural difficulties. A composite criterion for overall neurodevelopmental disabilities was built. Results: The population consisted of 2950 children; 275 (8.6%) received doxapram. Median (IQR) gestational age was 29.4 (27.6-30.9) weeks. At age 5-6 years, complete neurodevelopmental assessment was available for 60.3% (1780 of 2950) of children and partial assessment for 10.6% (314 of 2950). In the initial sample, children receiving doxapram had evidence of greater clinical severity than those not treated. Doxapram treatment was associated with overall neurodevelopmental disabilities of any severity (OR 1.43, 95% CI 1.07 to 1.92, $p=0.02$). Eight hundred and twenty-one children were included in the 2:1 matched sample. In this sample, perinatal characteristics of both groups were similar and doxapram treatment was not associated with overall neurodevelopmental disabilities (OR 1.09, 95% CI 0.76 to 1.57, $p=0.63$). Conclusions: In children born before 32 weeks' gestation, doxapram treatment for apnoea of prematurity was not associated with neurodevelopmental disabilities.

PMID: [38228381](#)

19. Transplantation of human placental chorionic plate-derived mesenchymal stem cells for repair of neurological damage in neonatal hypoxic-ischemic encephalopathy

Lulu Xue, Ruolan Du, Ning Bi, Qiuxia Xiao, Yifei Sun, Ruize Niu, Yaxin Tan, Li Chen, Jia Liu, Tinghua Wang, Liulin Xiong

Neural Regen Res. 2024 Sep 1;19(9):2027-2035. doi: 10.4103/1673-5374.390952. Epub 2023 Dec 15.

Neonatal hypoxic-ischemic encephalopathy is often associated with permanent cerebral palsy, neurosensory impairments, and cognitive deficits, and there is no effective treatment for complications related to hypoxic-ischemic encephalopathy. The therapeutic potential of human placental chorionic plate-derived mesenchymal stem cells for various diseases has been explored. However, the potential use of human placental chorionic plate-derived mesenchymal stem cells for the treatment of neonatal hypoxic-ischemic encephalopathy has not yet been investigated. In this study, we injected human placental chorionic plate-derived mesenchymal stem cells into the lateral ventricle of a neonatal hypoxic-ischemic encephalopathy rat model and observed significant improvements in both cognitive and motor function. Protein chip analysis showed that interleukin-3 expression was significantly elevated in neonatal hypoxic-ischemic encephalopathy model rats. Following transplantation of human placental chorionic plate-derived mesenchymal stem cells, interleukin-3 expression was downregulated. To further investigate the role of interleukin-3 in neonatal hypoxic-ischemic encephalopathy, we established an in vitro SH-SY5Y cell model of hypoxic-ischemic injury through oxygen-glucose deprivation and silenced interleukin-3 expression using small interfering RNA. We found that the activity and proliferation of SH-SY5Y cells subjected to oxygen-glucose deprivation were further suppressed by interleukin-3 knockdown. Furthermore, interleukin-3 knockout exacerbated neuronal damage and cognitive and motor function impairment in rat models of hypoxic-ischemic encephalopathy. The findings suggest that transplantation of hpcMSCs ameliorated behavioral impairments in a rat model of hypoxic-ischemic encephalopathy, and this effect was mediated by interleukin-3-dependent neurological function.

PMID: [38227532](#)

20. Neuroquantification enhances the radiological evaluation of term neonatal hypoxic-ischaemic cerebral injuries

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SA J Radiol. 2023 Dec 26;27(1):2728. doi: 10.4102/sajr.v27i1.2728. eCollection 2023.

Background: Injury patterns in hypoxic-ischaemic brain injury (HIBI) are well recognised but there are few studies evaluating cerebral injury using neuroquantification models. **Objectives:** Quantification of brain volumes in a group of patients with clinically determined cerebral palsy. **Method:** In this retrospective study, 297 children with cerebral palsy were imaged for suspected HIBI with analysis of various cerebral substrates. Of these, 96 children over the age of 3 years with a clinical diagnosis of cerebral palsy and abnormal MRI findings underwent volumetric analyses using the NeuroQuant® software solution. The spectrum of volumetric changes and the differences between the various subtypes (and individual subgroups) of HIBI were compared. **Results:** Compared with the available normative NeuroQuant® database, the average intracranial volume was reduced to the 1st percentile in all patient groups ($p < 0.001$). Statistically significant differences were observed among the types and subgroups of HIBI. Further substrate volume reductions were identified and described involving the thalami, brainstem, hippocampi, putamina and amygdala. The combined volumes of five regions of interest (frontal pole, putamen, hippocampus, brainstem and paracentral lobule) were consistently reduced in the Rolandic basal ganglia-thalamus (RBGT) subtype. **Conclusion:** This study determined a quantifiable reduction of intracranial volume in all subtypes of HIBI and predictable selective cerebral substrate volume reduction in subtypes and subgroups. In the RBGT subtype, a key combination of five substrate injuries was consistently noted, and thalamic, occipital lobe and brainstem volume reduction was also significant when compared to the watershed subtype. **Contribution:** This study demonstrates the value of integrating an artificial intelligence programme into the radiologists' armamentarium serving to quantify brain injuries more accurately in HIBI. Going forward this will be an inevitable evolution of daily radiology practice in many fields of medicine, and it would be beneficial for radiologists to embrace these technological innovations.

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21. Continuity of Care in Adults Aging with Cerebral Palsy and Spina Bifida: The Importance of Community Healthcare and Socioeconomic Context

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Continuity of care is considered a key metric of quality healthcare. Yet, continuity of care in adults aging with congenital disability and the factors that contribute to care continuity are largely unknown. Using data from a national private administrative health claims database in the United States (2007-2018), we examined continuity of care in 8596 adults (mean age 48.6 years) with cerebral palsy or spina bifida. Logistic regression models analyzed how proximity to health care facilities, availability of care providers, and community socioeconomic context were associated with more continuous care. We found that adults aging with cerebral palsy or spina bifida saw a variety of different physician specialty types and generally had discontinuous care. Individuals who lived in areas with more hospitals and residential care facilities received more continuous care than those with limited access to these resources. Residence in more affluent areas was associated with receiving more fragmented care. Findings suggest that over and above individual factors, community healthcare resources and socioeconomic context serve as important factors to consider in understanding continuity of care patterns in adults aging with cerebral palsy or spina bifida.

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22. Differential neuropsychological profiles in children and adolescents with motor disability in an inclusive educational setting

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The aim of this study was to determine the potential cognitive impairment associated with motor disability in a group of children attending regular schools and to analyze whether there were different cognitive profiles according to the type of motor disability they presented. The study had 87 participants, 31 healthy and 56 with three types of motor disability: Neuromuscular Diseases (NMD Group), Cerebral Palsy-Hemiparesis (CP- HPx Group) and Cerebral Palsy-Diplegia (CP-DP). Ages ranged from 6 to 18 years and they had medium and medium-high socioeconomic and cultural levels. All participants attended regular state-funded and independent schools in an inclusive modality. The neuropsychological assessment included the following cognitive domains: processing speed, working memory, verbal and visual episodic memory, language, visuo-perception and constructive praxis and executive functioning. A second analysis was performed with the groups with CP: one based on the severity of gross motor impairment (GMFCS-E&R scale) and the other based on the levels of manual dexterity (MACS scale). ANCOVAs were performed controlling for age and processing speed in the three analyses. The group with CP-HPx was shown to be the most cognitively impaired of the three groups, with significant deficits in visuo-perception, verbal working memory, and visuo-spatial memory. Subjects with greater gross motor dysfunction (GMFCS-E&R) did not show the greatest cognitive impairment, while those with worse manual dexterity (MACS) exhibited greater cognitive impairment. Children and adolescents with motor disabilities, a priori cognitively normal, present different levels of cognitive impairment. This should be considered when planning educational adaptations for this infant-juvenile population.

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