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Interventions and Management

1. Motor patterns of the impaired upper limb in children with unilateral cerebral palsy performing bimanual tasks

Marine Cacioppo, Mathieu Lempereur, Antoine Marin, H el ene Rauscent, Armel Cr etual, Sylvain Brochard, Isabelle Bonan

Clin Biomech (Bristol, Avon). 2022 Jun 22;97:105710. doi: 10.1016/j.clinbiomech.2022.105710. Online ahead of print.

Background: Upper limb movement patterns have not yet been identified in bimanual conditions despite the difficulties children with unilateral cerebral palsy have performing bimanual activities. The aim was to identify specific motor patterns from kinematic deviations during bimanual tasks in this population. **Methods:** Twenty children with unilateral cerebral palsy and 20 age-matched, typically developing children performed the five tasks of a 3D bimanual protocol. To evaluate upper limb kinematic deviations, 10 Arm Variable Scores were calculated for the affected /non-dominant upper limb of each participant for each task. Sparse K-means cluster analysis was applied to the 50 Arm Variable Scores of all the children to identify motor patterns and determining variables. Clinical tests of impairment (muscle strength, selectivity, spasticity) and function (Assisting hand assessment, Abilhand-Kids) were compared between the clusters obtained. **Findings:** Three different motor patterns were identified using the data from all the children: mild, proximal-distal and proximal-distal with trunk. The most important cluster determinants were the Arm Variable Scores for pronation-supination and wrist extension. In the cerebral palsy group, scores of impairments ($p < .01$) and function (Assisting Hand Assessment [$p < .001$] and Abilhand-Kids [$p = .004$]) differed for each motor pattern. Supination and wrist extension deviations differed significantly between the groups ($p < .001$). **Interpretation:** During performance of bimanual tasks, children with unilateral cerebral palsy used distinct motor patterns that each corresponded to a specific clinical profile. Elbow-wrist deviations were the largest and most decisive and were specific to the cerebral palsy group: they should be the target of interventions to enhance bimanual function. **Clinicaltrials:** gov identifier: NCT03888443.

PMID: [35763887](https://pubmed.ncbi.nlm.nih.gov/35763887/)

2. Construct validity, reliability, and responsiveness of the Wrist Position Sense Test for use in children with hemiplegic cerebral palsy

Susan Taylor, Catherine Elliott, Belinda McLean, Richard Parsons, Torbjorn Falkmer, Leeanne M Carey, Eve Blair, Sonya Girdler

Aust Occup Ther J. 2022 Jun 29. doi: 10.1111/1440-1630.12825. Online ahead of print.

Introduction: We investigate the construct validity, test re-test reliability, and responsiveness of the Wrist Position Sense Test (WPST) for children with hemiplegic cerebral palsy (CP). **Methods:** Twenty-eight children with spastic hemiplegic CP [mean age 10.8 years; SD 2.4 years] and 39 typically developing (TD) children [mean age 11 years; SD 2.9 years] participated in a cross-sectional study to investigate construct validity and association with an upper limb activity measure, the Box and Block

Test (BBT). Twenty-two TD children were tested at a second time-point to examine reliability. Test responsiveness was determined by random allocation of 17 children with CP to a treatment (n = 10) or control (n = 7) group with assessments completed at four time-points. Results: Significantly greater differences were observed in mean error of indicated wrist position ($p < 0.01$) in children with CP at baseline ($M = 21.6^\circ$, $SD = 21.6^\circ$) than in TD children ($M = 12.8^\circ$, $SD = 11.0^\circ$). Larger WPST errors were associated with poorer performance on the BBT ($p < 0.01$) indicating a substantial association, and there were no consistent differences between time-points indicating test re-test reliability within a TD population. The WPST demonstrated responsiveness to intervention with a statistically significant reduction in mean error following treatment ($p < 0.001$), not seen in the control group ($p = 0.28$). Conclusion: The WPST demonstrated construct validity in this preliminary study. Scores were associated with an upper limb activity measure, and scores changed significantly following somatosensory training. These findings support further research and future psychometric investigation of the WPST in children with CP. Key points for occupational therapy: This study provides psychometric knowledge about the WPST tool The WPST shows promise as a discriminative measure with preliminary evidence of responsiveness and intra-rater reliability Until further testing, the WPST can be used cautiously in future research studies to measure wrist position sense.

PMID: [35768897](#)

3. Parents' experiences with a home-based upper limb training program using a video coaching approach for infants and toddlers with unilateral cerebral palsy: a qualitative interview study

Anke Pm Verhaegh, Nienke B Nuijen, Pauline Bm Aarts, Maria W G Nijhuis-van der Sanden, Michèl Aap Willemsen, Brenda E Groen, Johanna E Vriezolkolk

BMC Pediatr. 2022 Jun 29;22(1):380. doi: 10.1186/s12887-022-03432-w.

Background: Although early home-based upper limb training programs are promising, in-depth understanding of parents' experiences with these programs is still limited. We developed an early home-based upper limb training program for infants and toddlers (8-36 months) with or at risk of unilateral cerebral palsy using video coaching for parents. The aim of this qualitative study was to evaluate parents' experiences with the home-based training program using a video coaching approach in order to optimize implementation strategies. Methods: We held semi-structured interviews with parents of 13 children with unilateral cerebral palsy, who participated in our program in the period from 2014 - 2017. On average, parents had delivered two training periods of the program at the time of the interviews. Interviews were analyzed using inductive thematic content analysis. Results: We identified three overarching interacting themes that shaped the experiences of parents with the program: 1) Parental learning comprising the subthemes parents' training competencies and the facilitative and reinforcing role of video coaching, 2) Parental load comprising the subthemes flexibility of the program, supportive network, competing demands, and child's mood and functional capacities, and 3) Parental perseverance comprising the subthemes beliefs and expectancies and seeing child's functional improvements. Conclusions: For successful implementation of an early home-based upper limb training program using video coaching, support in delivering home-training from a therapist or from others within parents' social network, is needed to relieve parental load. Seeing functional improvements of their child on the videos increased parents' motivation to continue with the training. Positively phrased feedback from an occupational therapist stimulated parents' perseverance and training competency.

PMID: [35768858](#)

4. Comparison of baseline characteristics and postoperative complications in neuromuscular, syndromic and congenital scoliosis

Lorenzo R Deveza, Barkha N Chhabra, John Heydemann, Chun Hung, Dallas Vanorny, Dion Birhiray, Benny Dahl

J Pediatr Orthop B. 2022 Jun 27. doi: 10.1097/BPB.0000000000000996. Online ahead of print.

Nonidiopathic scoliosis encompasses a group of diagnoses, including neuromuscular scoliosis, syndromic scoliosis and congenital scoliosis. The objective of this study was to compare the preoperative and postoperative clinical differences in pediatric nonidiopathic scoliosis patients with neuromuscular scoliosis vs. syndromic scoliosis/congenital scoliosis. This is a single-center retrospective review of all pediatric patients undergoing spinal instrumentation for nonidiopathic scoliosis during a 5-year period. Neuromuscular scoliosis patients (n = 144), syndromic scoliosis patients (n = 44) and congenital scoliosis patients (n = 52) were compared. Demographics, patient characteristics and outcomes were compared. Neuromuscular scoliosis patients had lower BMI z-scores and were more likely to have pulmonary disease, technology dependence and seizure disorder. Additionally, neuromuscular scoliosis patients underwent bigger procedures with more levels fused and a higher rate of pelvis

fixation. By direct comparison, neuromuscular scoliosis patients tended to have more complications including deep surgical site infections, readmission in 30 days, return to operating room in 90 days and emergency care visits in 90 days. When controlling for the differences in their preexisting conditions and surgical procedure, we found that pelvic fixation was a major confounding factor, whereas the others had no effect. We further subanalyzed cerebral palsy patients and found this group to exhibit no difference in complications compared to other neuromuscular scoliosis subtypes. Neuromuscular scoliosis patients have different characteristics and subsequent postoperative complications than those with syndromic scoliosis and congenital scoliosis. The difference in complication profile is mainly due to differences in surgical procedure and a higher rate of pelvic fixation. This should be considered when planning nonidiopathic scoliosis surgery among multidisciplinary teams.

PMID: [35762668](#)

5. Avascular necrosis of the femoral head in patients with cerebral palsy after hip surgery-incidence and impact on quality of life

Daniela da Silva Gomes, Alexandre Zuccon, Fernando Farcetta, Monica Paschoal Nogueira

Int Orthop. 2022 Jun 28. doi: 10.1007/s00264-022-05481-3. Online ahead of print.

Purpose: This study investigated the incidence of AVN in patients with cerebral palsy who underwent a hip reconstruction surgery (soft tissue release, femur and pelvic osteotomies) and its impact on quality of life. **Methods:** Retrospective study, with clinical and radiographic analysis of 104 patients (128 hips) GMFCS IV and V with a minimum two year follow-up. Reimers migration percentage, the amount of abduction, acetabular index, and the neck-shaft angle were collected before and after surgery. Modified Tönnis classification was used to analyze the hips before surgery, and the Bucholz and Ogden classification was used to identify hips with AVN. Function and quality of life were investigated with the CPCHILD questionnaire after surgery. **Results:** The mean age of participants at surgery was 120.1 months (72-184), and it was not related with AVN ($p = 0.946$). AVN signs were observed in 62 hips (48.5%). The mean pre-op Reimers value was 68.7% (16-100) in normal hips and 83.1% (0-100) in hips with AVN ($p = 0.003$). All hips considered as Tönnis IV before surgery developed AVN ($p = 0.006$). The amount of abduction did not differ between hips that developed AVN and those that did not ($p = 0.313$). Patients who developed AVN had lower scores of quality of life ($p = 0.023$) and comfort ($p = 0.025$) according to the CPCHILD questionnaire. **Conclusion:** We observed a relationship between the greater pre-operative severity according to the Reimers index and the modified Tönnis classification and the development of AVN.

PMID: [35761100](#)

6. Soleus H-reflex modulation in cerebral palsy and its relationship with neural control complexity: a pilot study

Benjamin C Conner, Alyssa M Spomer, Safoura Sadegh Pour Aji Bishe, Katherine M Steele, Zachary F Lerner

Exp Brain Res. 2022 Jun 25. doi: 10.1007/s00221-022-06399-3. Online ahead of print.

Individuals with cerebral palsy (CP) display motor control patterns that suggest decreased supraspinal input, but it remains unknown if they are able to modulate lower-limb reflexes in response to more complex tasks, or whether global motor control patterns relate to reflex modulation capacity in this population. Eight ambulatory individuals with CP (12-18 years old) were recruited to complete a task complexity protocol, where soleus H-reflex excitability was compared between bilateral (baseline) and unilateral (complex) standing. We also investigated the relationship between each participant's ability to modulate soleus H-reflex excitability and the complexity of their walking neural control pattern determined from muscle synergy analysis. Finally, six of the eight participants completed an exoskeleton walking protocol, where soleus H-reflexes were collected during the stance phase of walking with and without stance-phase plantar flexor resistance. Participants displayed a significant reduction in soleus H-reflex excitability ($-26 \pm 25\%$, $p = 0.04$) with unilateral standing, and a strong positive relationship was observed between more refined neural control during walking and an increased ability to modulate reflex excitability ($R = 0.79$, $p = 0.04$). There was no difference in neuromuscular outcome measures with and without the ankle exoskeleton (p values all > 0.05), with variable reflex responses to walking with ankle exoskeleton resistance. These findings provide evidence that ambulatory individuals with CP retain some capacity to modulate lower-limb reflexes in response to increased task complexity, and that less refined neural control during walking appears to be related to deficits in reflex modulation.

PMID: [35752662](#)

7. Commentary on "Effect of Motor Intervention for Infants and Toddlers With Cerebral Palsy: A Systematic Review and Meta-analysis"

Catherine Morgan, Amy Jones

Pediatr Phys Ther. 2022 Jul 1;34(3):308. doi: 10.1097/PEP.0000000000000927.

No abstract available

PMID: [35776968](#)

8. Mirror movements and brain pathology in children with unilateral cerebral palsy

Hsing-Ching Kuo, Claudio L Ferre, Karen Y Chin, Kathleen M Friel, Andrew M Gordon

Dev Med Child Neurol. 2022 Jun 24. doi: 10.1111/dmcn.15322. Online ahead of print.

Aim: We systematically examined the relationship between mirror movements and brain lesion type, corticospinal tract (CST) organization, and hand function to determine the relevance between mirror movements, brain lesion, the CST pattern, and hand function in children with unilateral cerebral palsy (CP). **Method:** Forty-eight children (mean age 9y 9mo [SD 3y 3mo], range 6-18y; 30 males, 18 females) with unilateral CP participated. Mirror movements, brain lesion type, CST pattern identified by transcranial magnetic stimulation, and clinical outcomes were evaluated. Children performed four unilateral tasks: hand opening/closing, finger opposition, individuation, and finger 'walking'. Mirror movements induced in the contralateral hand were scored using standardized criteria (scores 0-4 using the Woods and Teuber scale). **Results:** We found that children with periventricular lesion may have stronger mirror movement scores induced in either hand than those with middle cerebral artery lesion (more affected hand: $p=0.02$; less affected hand: $p<0.01$). The highest mirror movement score a child exhibits across the tested tasks (i.e. scores of 3-4 using the Woods and Teuber scoring criteria) may potentially be an indicator of an ipsilateral CST connectivity pattern ($p=0.03$). Significant correlations were observed between higher mirror movement scores when performing hand opening/closing as well as finger walking and better unimanual dexterity (Spearman's rank correlation coefficient $r_s = 0.44$, $p=0.002$; $r_s = 0.46$, $p=0.002$ respectively). **Interpretation:** Brain lesions may be predictive of the strength of mirror movements in either hand in children with unilateral CP. Our findings warrant further studies to extensively investigate the relationship between mirror movements and the underlying brain pathology.

PMID: [35751166](#)

9. The Experience of Physical Activity in Adolescents With Cerebral Palsy

Jeannine Roth, Billie Severtsen, Renee Hoeksels, Linda Eddy

Orthop Nurs. 2022 May-Jun 01;41(3):203-210. doi: 10.1097/NOR.0000000000000850.

For adolescents with cerebral palsy (CP), participating in physical activity (PA) can be difficult due to functional limitations that not only affect an adolescent's ability or willingness to participate in PA but also create particular social concerns. Research in the area of PA and adolescents with CP is limited. This research study utilized hermeneutic phenomenology to gain a more comprehensive understanding of the lived experiences of 14 adolescents with CP who participated in PA. The interpretations of each participant offered common understandings and themes to be identified and warranted as valid by the interpretive team. Common understandings identified were (a) developmental tasks of typical adolescents, (b) place of friends, (c) purpose of PA, (d) importance of support, and (e) wanting to be like the primary researcher. Most of the 14 participants had similar experiences within the identified common understandings and themes. Physical activity, in part, helps adolescents find out about themselves and their place within their community. The experiences of adolescents with CP and PA show that participation in PA is a way to connect with friends, meet new people, and gain a feeling of freedom from their disability. We offer healthcare providers a starting point to talk about PA and to help adolescents with CP find activities within their community.

PMID: [35772059](#)

10. NCPD Tests: The Experience of Physical Activity in Adolescents With Cerebral Palsy

No authors listed

Orthop Nurs. 2022 May-Jun 01;41(3):211-212. doi: 10.1097/NOR.0000000000000855.

No abstract available

PMID: [35772060](#)**11. Evidence-based, Implementable Motor Rehabilitation Guidelines for Individuals With Cerebral Palsy**

Anthony Demont, Michel Gedda, Céline Lager, Capucine de Lattre, Yann Gary, Elisabeth Kerouille, Brigitte Feuillerat, Hervé Caudan, Zoé Sancelme, Arnaud Isapof, Elke Viehweger, Matthieu Chatelin, Marianne Hochard, Julia Boivin, Pascale Vurpillat, Nathalie Genès, Xavier de Boissezon, Audrey Fontaine, Sylvain Brochard

Neurology. 2022 Jun 24;10.1212/WNL.000000000200936. doi: 10.1212/WNL.000000000200936. Online ahead of print.

Background: Cerebral palsy is a life-long condition that causes heterogeneous motor disorders. Motor rehabilitation interventions must be adapted to the topography of the symptoms, ambulatory capacity and age of the individual. Current guidelines do not differentiate between the different profiles of individuals with cerebral palsy, which limits their implementation. Objectives: To develop evidence-based, implementable guidelines for motor rehabilitation interventions for individuals with cerebral palsy according to the age, topography of the cerebral palsy and ambulatory capacity of the individual, and to determine a level of priority for each intervention. Methods: We used a mixed methods design that combined a systematic review of the literature on available motor rehabilitation interventions with expert opinions. Based on the French National Authority for Health methodology, recommendations were graded as strong, conditional or weak. Interventions were then prioritized by the experts according to both the evidence and their own opinions on relevance and implementability to provide a guide for clinicians. All recommendations were approved by experts who were independent from the working group. Results: Strong recommendations as first-line treatments were made for gait training, physical activities and hand-arm bimanual intensive therapy for all children and adolescents with cerebral palsy. Moderate recommendations were made against passive joint mobilizations, muscle stretching, prolonged stretching with the limb fixed, and neurodevelopmental therapies for all children and adolescents with cerebral palsy. Strong recommendations as first-line treatments were made for gait training for all adults with cerebral palsy and moderate recommendations as moderate importance interventions for strengthening exercises and ankle-foot orthoses for motor impairment of the feet and the ankles. Discussion: These guidelines, which combine research evidence and expert opinion, could help individuals with cerebral palsy and their families to co-determine rehabilitation goals with health professionals, according to their preferences.

PMID: [35750497](#)**12. A Broader Perspective on Motor Rehabilitation Guidelines for Cerebral Palsy**

Ann Henderson Tilton, Keith Coffman, Bhooma R Aravamuthan

Editorial Neurology . 2022 Jun 24;10.1212/WNL.000000000201048. doi: 10.1212/WNL.000000000201048. Online ahead of print.

PMID: [35750496](#)**13. Perception of massage application among clinicians and parents in spastic cerebral palsy: Qualitative study**

Iqra Tul Hussain, Qurat Ul Ain, Misbah Waris

J Pak Med Assoc. 2022 Jun;72(6):1086-1091. doi: 10.47391/JPMA.2411.

Objective: To explore the perceptions about traditional massage and its modified techniques among clinicians and families of the patients with spastic cerebral palsy. **Methods:** The qualitative, cross-sectional study was conducted from November 2019 to August 2020 in Sialkot, Pakistan, after approval from the ethics review committee of Riphah College of Rehabilitation Sciences, Islamabad, and comprised neuro paediatricians and paediatricians in Group A, parents of children with spastic cerebral palsy aged 8-15 years in Group B, and musculoskeletal physiotherapists and orthopaedic manual physical therapists in Group C. The professionals in groups A and C had a minimum of 5-year paediatric experience in government and teaching hospitals. Data was collected using a semi-structured pilot-tested questionnaire. Qualitative approach and thematic code analysis was used to analyse the collected data. **Results:** Of the 26 subjects, 10(38.5%) were in Group A, 8(30.7%) in Group B and 8(30.7%) in Group C. Overall, there were 16(61.4%) males and 10(38.5%) females. Among the professionals, experience ranged 5-38 years in Group A, and 5-9 years in Group C. The identified themes were reforms in recommendations, and application of massage techniques, with the participants overwhelmingly favouring termination markers to prevent increase in hypertonicity in spastic cerebral palsy. **Conclusions:** Termination markers of massage should be considered in interventions to improve outcomes in children with spastic cerebral palsy.

PMID: [35751314](#)

14. Modeling linkages between self-efficacy, normalization, and well-being factors among Israeli mothers of children with neurodevelopmental disorders

L Hamama

Res Dev Disabil. 2022 Jun 28;128:104295. doi: 10.1016/j.ridd.2022.104295. Online ahead of print.

Background and aims: Parents' well-being may be challenged by the neurodevelopmental disorders (NDs) of their children. This study explored general self-efficacy (personal resource) and normalization (coping strategy) and their possible association with mothers' well-being (satisfaction with life/SWL, positive affect, and presence of meaning in life/P-MIL). **Method:** Data were obtained from 127 Israeli mothers, ages 23-63, of children ($M = 12.08$, $SD = 3.39$) with NDs (autism spectrum disorder, intellectual disability, cerebral palsy). All participants completed online self-report questionnaires. **Results:** After controlling for the effects of group, mother's age, and child's gender, bivariate associations showed that general self-efficacy was positively correlated with SWL ($r = .46$, $p < .001$), positive affect ($r = .43$, $p < .001$), and P-MIL ($r = .37$, $p < .001$). The study's mediation model was partly supported: General self-efficacy was related to normalization, which was related to SWL and positive affect, but not to P-MIL. **Conclusions and implications:** This study contributes to the empirical knowledge on well-being in mothers raising children with NDs. Findings revealed that mothers' general self-efficacy alongside their strategy to adopt normalcy substantially contributed to their well-being. Hence, psychosocial services should strengthen general self-efficacy in this cohort and support their normalization efforts.

PMID: [35777249](#)

15. Feeding tube use is associated with severe scoliosis in patients with cerebral palsy and limited ambulatory ability

Nicholas Yoo, Brian Arand, Junxin Shi, Jingzhen Yang, Garey Noritz, Amanda T Whitaker

Spine Deform. 2022 Jun 28. doi: 10.1007/s43390-022-00540-6. Online ahead of print.

Purpose: Cerebral palsy (CP) is the most common motor disorder in childhood. Scoliosis is a common complication of CP that can reach clinically severe levels, but predictors for scoliosis in CP are not well understood. Some variables identified in the literature involve the severity of the brain injury and the presence of hip deformity. We aimed to identify associations with developing severe scoliosis in a prospective cohort of patients with cerebral palsy at higher risk for severe curve progression. **Methods:** This study reviewed a prospectively collected database at a tertiary children's hospital. We evaluated a panel of potential associations with severe scoliosis-including age, sex, Gross Motor Function Classification System (GMFCS) class, history of hip surgery, epilepsy, and feeding tube presence-in a population of children with limited ambulatory ability defined as GMFCS level IV or V CP. Univariate analysis and multivariate logistic regression with stepwise selection was used for analysis. **Results:** Descriptive analysis showed that female sex, higher GMFCS class, history of hip surgery, non-upright seating, pelvic obliquity, presence of epilepsy, and presence of a feeding tube were associated with an increased risk for scoliosis. Multivariate logistic regression analysis revealed that the presence of a feeding tube was associated with severe scoliosis even when controlling for GMFCS and age. **Conclusions:** Feeding tube use may stratify risk for severe scoliosis progression in patients with GMFCS IV or V CP.

PMID: [35764871](#)

16. Enteral nutrition and the risk of nephrolithiasis in complex pediatric patients

William DeFoor, Edward Nehus, Marion Schulte, Sydney Huesman, Ashleigh Libs, Renee Niehaus, Prasad Devarajan

J Pediatr Urol. 2022 Jun 13;S1477-5131(22)00268-6. doi: 10.1016/j.jpuro.2022.06.003. Online ahead of print.

Purpose: Medically complex, non-ambulatory children can often suffer from nephrolithiasis. The purpose of this study is to determine risk factors which are predictive for recurrent stone formation in this patient population. **Material and methods:** A retrospective cohort study was performed on non-ambulatory patients with cerebral palsy and/or severe developmental delay presenting to a high-volume Pediatric Stone Center from 2015 to 2019. Two 24-hour urine collections were performed as a baseline prior to pharmacotherapeutic and/or dietary intervention. Healthy stone-forming children served as a control group. **Results:** 28 non-ambulatory subjects and 38 healthy controls were evaluated. The study group had a higher rate of bilateral nephrolithiasis but a similar history of previous surgical procedures. 89% of the non-ambulatory children were fed via a gastrostomy. The median calcium excretion was the same in both groups (3.0 mg/kg/day). The median 24-hour excretion of oxalate was significantly increased in the study group (54 vs 31 mg/1.73 m²/day, p = 0.0001). Urinary citrate and phosphorus excretions, and the supersaturations of calcium oxalate and calcium phosphate were similar between study subjects and controls. Calcium oxalate stones were noted in 57% of those with known stone composition in the study group. Enteral feeding formulas were primarily based on soy protein, a known high oxalate food. **Conclusions:** Urinary oxalate excretion is significantly increased in a cohort of medically complex, non-ambulatory stone-forming children. Urinary calcium excretion was not elevated between study subjects and healthy controls. Further analysis is needed to assess if dietary intervention to limit oxalate excretion results in decreased stone formation.

PMID: [35760671](#)**17. Post-neonatal cerebral palsy in Australia: Through the lens of intersectionality**

Maureen S Durkin

Dev Med Child Neurol. 2022 Jun 27. doi: 10.1111/dmcn.15328. Online ahead of print.

No abstract available

PMID: [35758144](#)**18. Prevalence and temporal trends of cerebral palsy in children born from 2002 to 2017 in Ontario, Canada: Population-based cohort study**

Asma Ahmed, Laura C Rosella, Maryam Oskoui, Tristan Watson, Seungmi Yang

Dev Med Child Neurol. 2022 Jun 30. doi: 10.1111/dmcn.15324. Online ahead of print.

Aim: To examine the prevalence and temporal trends of cerebral palsy (CP) overall and by population characteristics. **Method:** We identified 2 110 177 live births born in the province of Ontario, Canada, between 2002 and 2017 using administrative health data and estimated CP prevalence in children aged 0 to 16 years overall and by specific population characteristics. We also examined temporal trends in CP rates - overall and by characteristics - in young children (0-4 years) by their year of birth between 2002 and 2013 (n=1 587 087 live births) to allow for an equal follow-up time (4 years and 364 days) for all children. **Results:** Overall CP prevalence among children aged 0 to 16 years was 2.52 (95% confidence interval 2.45-2.59) per 1000 live births. CP rates in ages 0 to 4 years peaked at 2.86 in 2007 births, but steadily declined afterwards to 1.94 per 1000 live births in 2013. CP rates were higher in children born preterm, small for gestational age, males, multiples, children with congenital malformations, and in children of young (<20 years), old (≥40 years), primiparous, or grand multiparous (≥4) mothers; differences by these characteristics decreased over time. We observed socioeconomic disparities in CP rates that persisted over time. **Interpretation:** Despite the decreasing trend of CP rates overall, CP rates varied by the child and maternal characteristics over time.

PMID: [35771681](#)

19. Participation of children and young people with cerebral palsy in activities of daily living in rural Uganda

Carin Andrews, Lukia Hamid Namaganda, Christine Imms, Ann-Christin Eliasson, Elizabeth Asige, Godfrey Wanjala, Angelina Kakooza-Mwesige, Hans Forsberg

Dev Med Child Neurol. 2022 Jun 26. doi: 10.1111/dmcn.15323. Online ahead of print.

Aim: To compare the participation attendance and involvement of children and young people with and without cerebral palsy (CP) in a low-resource area of Uganda. **Method:** Eighty-two children and young people with CP aged 6 to 22 years (49 males, 33 females) and 81 age- and sex-matched peers without CP (6 to 22 years; 48 males, 33 females) participated in this population-based, cross-sectional study. Data on attendance and involvement in 20 home and community activities were obtained using Picture My Participation, an instrument intended to measure participation in children with disabilities, particularly in low- and middle-income countries. Non-parametric statistical methods were used to assess between-group differences. Effect size estimates were calculated. **Results:** Pooled attendance across all activities was lower in children and young people with CP than in children and young people without CP ($p < 0.001$) and for each activity item ($p = 0.004$ to $p < 0.001$). The effect sizes for each activity were 0.2 to 0.7. Between-group differences were larger for community activities than for home activities. Pooled involvement across all activities was less in the group with CP ($p < 0.001$) and for each activity ($p = 0.014$ to $p < 0.001$). The effect sizes for each activity were 0.2 to 0.5. Children and young people in Gross Motor Function Classification System (GMFCS) levels I and II had higher attendance ($p < 0.001$) and involvement ($p = 0.023$) than those in GMFCS levels III to V. **Interpretation:** Participation of young people living with CP in Uganda was restricted, especially for community activities. There is a need to identify context-specific participation barriers and develop strategies to overcome them.

PMID: [35754006](#)

20. Is it time to rename hereditary cases of cerebral palsy?

Anamarija Kavcic

Brain. 2022 Jul 1;awac230. doi: 10.1093/brain/awac230. Online ahead of print.

No abstract available

PMID: [35776103](#)

21. Reply: Is it time to rename hereditary cases of cerebral palsy?

Hao Hu, Kaishou Xu

Brain. 2022 Jul 1;awac231. doi: 10.1093/brain/awac231. Online ahead of print.

No abstract available

PMID: [35776105](#)

22. Protecting the brain of the micropremie

S M Boyd, S J Tapawan, N Badawi, H Papat

Review Semin Fetal Neonatal Med. 2022 Jun 18;101370. doi: 10.1016/j.siny.2022.101370. Online ahead of print.

Advances in perinatal care have seen substantial improvements in survival without disability for extremely preterm infants. Protecting the developing brain and reducing neurodevelopmental sequelae of extremely preterm birth are strategic priorities

for both research and clinical care. A number of evidence-based interventions exist for neuroprotection in micropreemies, inclusive of prevention of preterm birth and multiple births with implantation of only one embryo during in vitro fertilisation, as well as antenatal care to optimize fetal wellbeing, strategies for supporting neonatal transition, and neuroprotective developmental care. Avoidance of complications that trigger ischemia and inflammation is vital for minimizing brain dysmaturation and injury, particularly of the white matter. Neurodevelopmental surveillance, early diagnosis of cerebral palsy and early intervention are essential for optimizing long-term outcomes and quality of life. Research priorities include further evaluation of putative neuroprotective agents, and investigation of common neonatal interventions in trials adequately powered to assess neurodevelopmental outcome.

PMID: [35752599](#)

23. Cerebral palsy in term gestations: Complication of delivery or a delivery complicated?

Samantha E Parker

Paediatr Perinat Epidemiol. 2022 Jul;36(4):588-589. doi: 10.1111/ppe.12908.

No abstract available

PMID: [35768343](#)

24. Development and Validation of a Prediction Model for Perinatal Arterial Ischemic Stroke in Term Neonates

Ratika Srivastava, Mary Dunbar, Michael Shevell, Maryam Oskoui, Anna Basu, Michael John Rivkin, Eilon Shany, Linda S de Vries, Deborah Dewey, Nicole Letourneau, Michael D Hill, Adam Kirton

JAMA Netw Open. 2022 Jun 1;5(6):e2219203. doi: 10.1001/jamanetworkopen.2022.19203.

Importance: Perinatal arterial ischemic stroke (PAIS) is a focal brain injury in term neonates that is identified postnatally but is presumed to occur near the time of birth. Many pregnancy, delivery, and fetal factors have been associated with PAIS, but early risk detection is lacking; thus, targeted treatment and prevention efforts are currently limited. **Objective:** To develop and validate a diagnostic risk prediction model that uses common clinical factors to predict the probability of PAIS in a term neonate. **Design, setting, and participants:** In this diagnostic study, a prediction model was developed using multivariable logistic regression with registry-based case data collected between January 2003, and March 2020, from the Alberta Perinatal Stroke Project, Canadian Cerebral Palsy Registry, International Pediatric Stroke Study, and Alberta Pregnancy Outcomes and Nutrition study. **Criteria for inclusion** were term birth and no underlying medical conditions associated with stroke diagnosis. Records with more than 20% missing data were excluded. **Variable selection** was based on peer-reviewed literature. **Data** were analyzed in September 2021. **Exposures:** Clinical pregnancy, delivery, and neonatal factors associated with PAIS as common data elements across the 4 registries. **Main outcomes and measures:** The primary outcome was the discriminative accuracy of the model predicting PAIS, measured by the concordance statistic (C statistic). **Results:** Of 2571 term neonates in the initial analysis (527 [20%] case and 2044 [80%] control individuals; gestational age range, 37-42 weeks), 1389 (54%) were male, with a greater proportion of males among cases compared with controls (318 [60%] vs 1071 [52%]). The final model was developed using 1924 neonates, including 321 cases (17%) and 1603 controls (83%), and 9 clinical factors associated with risk of PAIS in term neonates: maternal age, tobacco exposure, recreational drug exposure, preeclampsia, chorioamnionitis, intrapartum maternal fever, emergency cesarean delivery, low 5-minute Apgar score, and male sex. The model demonstrated good discrimination between cases and controls (C statistic, 0.73; 95% CI, 0.69-0.76) and good model fit (Hosmer-Lemeshow $P = .20$). Internal validation techniques yielded similar C statistics (0.73 [95% CI, 0.69-0.77] with bootstrap resampling, 10-fold cross-validated area under the curve, 0.72 [bootstrap bias-corrected 95% CI, 0.69-0.76]), as did a sensitivity analysis using cases and controls from Alberta, Canada, only (C statistic, 0.71; 95% CI, 0.65-0.77). **Conclusions and relevance:** The findings suggest that clinical variables can be used to develop and internally validate a model to predict the risk of PAIS in term neonates, with good predictive performance and strong internal validity. Identifying neonates with a high probability of PAIS who could then be screened for early diagnosis and treatment may be associated with reductions in lifelong morbidity for affected individuals and their families.

PMID: [35767262](#)

25. Relationship Between TNF- α and the Risk of Cerebral Palsy: A Systematic Review and Meta-Analysis

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Front Neurol. 2022 Jun 13;13:929280. doi: 10.3389/fneur.2022.929280. eCollection 2022.

Objective: We performed a meta-analysis to investigate the relationship between blood tumor necrosis factor-alpha (TNF- α) levels and the risk of cerebral palsy (CP) in children. Methods: PubMed, Web of Science, Cochrane Library and Ovid databases were searched from the date of database inception to 26 April 2022. Data were extracted and pooled from observational studies related to TNF- α and the risk of CP in children. Quality was assessed using the Newcastle-Ottawa Scale. We used the inverse variance method with a random-effects model to estimate the odds ratios with 95% confidence intervals (CIs), and stratified analyses and sensitivity analysis were utilized to analyse heterogeneity. Results: Nine studies with 1,117 cases and 3,563 controls were included in our meta-analysis. The quality of the literature was good, and no publication bias was noted. According to the random-effects model, blood TNF- α levels were associated with the risk of CP (OR 1.82; 95% CI, 1.25-2.66) in a heterogeneous set of studies ($I^2 = 81.2\%$, $p = 0.000$). Conclusion: Our findings indicate that elevated TNF- α levels in the blood are associated with an increased risk of CP. The association of TNF- α with CP requires further investigation.

PMID: [35769363](#)**26. Accuracy of the Hammersmith infant neurological examination for the early detection of neurological changes in infants exposed to Zika virus: A case-cohort study**

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Medicine (Baltimore). 2022 Jun 24;101(25):e29488. doi: 10.1097/MD.00000000000029488.

The Hammersmith infant neurological examination (HINE) is a highly predictive tool for the easy and low-cost detection of cerebral palsy. Between 2015 and 2016, the rapid spread of the Zika virus (ZIKV) in Brazil was responsible for an increase in microcephaly cases. This study aimed to verify the accuracy of the HINE for the early detection of neurological problems in Brazilian babies exposed to ZIKV. This was a cross sectional case-control study of children exposed to ZIKV. This study was part of the Jundiaí ZIKV Cohort. Of a total sample of 782 children, 98 were evaluated (26 in the exposed group and 63 in the control group). We included late preterm infants and term infants who were exposed to the ZIKV and were participants in the ZIKV Cohort study. Student's t-test and stepwise multivariate logistic regression were used to compare groups. Of the 26 items evaluated in the five scored categories of the HINE (cranial nerve function, posture, movements, tone, reflexes, and reactions), only the difference in ankle dorsiflexion between the exposed and the control groups was statistically significant. However, some items showed a significant trend in relation to the control group. Our results demonstrated the importance of early neurological assessment of infants exposed to ZIKV, even in those without a microcephaly diagnosis.

PMID: [35758386](#)**27. The professional network underlying cerebral palsy intervention research based on systematic reviews and meta-analyses published in international journals: authors' communities, institutional networks, and international collaboration**

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Heliyon. 2022 Jun 12;8(6):e09718. doi: 10.1016/j.heliyon.2022.e09718. eCollection 2022 Jun.

Cerebral palsy (CP) is a well-researched area of medical science, health science and special education. The growing number of publications every year makes difficult to monitor the progress of this research domain, therefore there is a broad interest for conducting systematic reviews and meta-analyses of interventions in international peer-reviewed scientific journals. Our goal is to analyze the scientific activity of authors who published systematic reviews and meta-analyses of CP intervention studies. To identify the active researchers, institutions, and countries, we used scientometric and bibliometric indicators that assess their productivity, collaborations, and the citations (utilization/usefulness of their studies), also paying attention to the institutional background and the network structure of national and international collaboration. We used Scopus to search for articles and

included systematic reviews and meta-analyses of intervention studies, a total of 180 works, in our sample. Our results showed active and large communities of prolific authors and groups of authors with diverse institutional background. Most institutions are universities, hospitals, but we found various other organizations among them. Most of the universities are leading educational institutions according to international rankings; some of them are among the top-ranking ones. In geographical terms, the North American, Australian, and European regions are the most active and most interconnected ones. We assume organizations other than scientific collaboration networks also play a major role in the productivity and dissemination of scientific knowledge in this research area. As an example, we could mention the network, including the US, Australian and European registers. Authors living and working in the Far East, the Middle East or in South America also started to publish relevant articles in the 2010s. The research network structuring scientific knowledge in this area is flourishing.

PMID: [35761937](#)