Cerebral palsy research news

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Interventions and Management

1. Constraint-Induced Movement Therapy for Cerebral Palsy: A Randomized Trial
Sharon Landesman Ramey, Stephanie C DeLuca, Richard D Stevenson, Mark Conaway, Amy R Darragh, Warren Lo, CHAMP

Pediatrics. 2021 Oct 14;e2020033878. doi: 10.1542/peds.2020-033878. Online ahead of print.

Objectives: With the Children with Hemiparesis Arm and Hand Movement Project (CHAMP) multisite factorial randomized controlled trial, we compared 2 doses and 2 constraint types of constraint-induced movement therapy (CIMT) to usual customary treatment (UCT). Methods: CHAMP randomly assigned 118 2- to 8-year-olds with hemiparetic cerebral palsy to one of 5 treatments with assessments at baseline, end of treatment, and 6 months posttreatment. Primary blinded outcomes were the assisting hand assessment; Peabody Motor Development Scales, Second Edition, Visual Motor Integration; and Quality of Upper Extremity Skills Test Dissociated Movement. Parents rated functioning on the Pediatric Evaluation of Disabilities Inventory-Computer Adaptive Test Daily Activities and Child Motor Activity Log How Often scale. Analyses were focused on blinded and parent-report outcomes and rank-order gains across all measures. Results: Findings varied in statistical significance when analyzing individual blinded outcomes. parent reports, and rank-order gains. Consistently, high-dose CIMT, regardless of constraint type, produced a pattern of greatest short- and long-term gains (1.7% probability of occurring by chance alone) and significant gains on visual motor integration and dissociated movement at 6 months. O'Brien's rank-order analyses revealed high-dose CIMT produced significantly greater improvement than a moderate dose or UCT. All CIMT groups improved significantly more in parent-reported functioning, compared with that of UCT. Children with UCT also revealed objective gains (eg, 48% exceeded the smallest-detectable assisting hand assessment change, compared with 71% high-dose CIMT at the end of treatment). Conclusions: CHAMP provides novel albeit complex findings: although most individual blinded outcomes fell below statistical significance for group differences, high-dose CIMT consistently produced the largest improvements at both time points. An unexpected finding concerns shifts in UCT toward higher dosages, with improved outcomes compared with previous reports.

PMID: 34649982

2. Optimizing Constraint-Induced Movement Therapy for Children With Cerebral Palsy
Alyssa E Smith, Bhooma Aravamuthan

Pediatrics. 2021 Oct 14;e2021053121. doi: 10.1542/peds.2021-053121. Online ahead of print.

PMID: 34649981

3. Relationship between the more-affected upper limb function and daily activity performance in children with cerebral palsy: a cross-sectional study
Hyerin Park, Ja Young Choi, Sook-Hee Yi, Eun Sook Park, Dain Shim, Tae Young Choi, Dong-Wook Rha

BMC Pediatr. 2021 Oct 19;21(1):459. doi: 10.1186/s12887-021-02927-2.

Background: There are differences in roles between the more-affected and less-affected upper limb of children with cerebral palsy (CP). However, there is a lack of studies of the relationship between the more-affected limb function and activities of daily living (ADL) in children with CP. Thus, the aim of this prospective cross-sectional study was to investigate the relationship between more-affected upper limb function and ADL in children with CP. Methods: Children with spastic CP (unilateral CP n = 28, bilateral CP n = 31; 34 males, 25 females; mean age ± SD, 6.8 ± 3.1y [range, 3-14y]) participated in this study. Function of the more-affected upper limb was measured using the Melbourne Assessment of Unilateral Upper limb Function, version 2 (MA2) and the Upper Limb Physician's Rating Scale (ULPRS). Performance of daily living activities was measured using the Pediatric Evaluation of Disability Inventory-Computer Adaptive Test (PEDI-CAT). Results: The range, accuracy and fluency dimension of MA2 and ULPRS total scores were moderately correlated with the daily activity domain (r = 0.47, 0.47, 0.56 for MA2 and r = 0.50 for ULPRS, respectively; P < 0.001) rather than the mobility, social/cognitive, and responsibility domains of the PEDI-CAT. ULPRS scores for elbow extension, supination in extension, supination in flexion, and two-handed function were moderately correlated with the PEDI-CAT daily activity domain (r = 0.44, 0.43, 0.41, and 0.49, respectively; P < 0.01). Finger opening and thumb-in-palm deformity of the ULPRS did not correlate with any PEDI-CAT domain. Conclusions: The MA2 range, accuracy, and fluency domains (rather than dexterity) had the strongest correlations with the PEDI-CAT daily activity domain. Elbow extension, forearm supination, and two-handed function (rather than wrist and finger movements) of the ULPRS had the strongest correlations with the PEDI-CAT daily activity domain.

PMID: 34666730

4. Spinal curvatures, deformities, and the level of disability in people with bilateral spastic cerebral palsy living in South Africa; a 6-year follow-up study during adulthood
Robert P Lamberts, Maaike M Eken, Jacques du Toit, Elsabe Botha, Richard V P de Villiers, Nelleke G Langerak

Arch Phys Med Rehabil. 2021 Oct 12;S0003-9993(21)01485-4. doi: 10.1016/j.apmr.2021.09.006. Online ahead of print.

Objective: Determine if spinal curvatures, deformities, as well as level of disability (due to back pain) changes with aging in adults with bilateral spastic cerebral palsy (CP) after receiving orthopaedic interval surgery approach (ISA) treatment in childhood. Design: Consecutive case-series SETTING: Urban South Africa PARTICIPANTS: Twenty-seven ambulatory adults with CP MAIN OUTCOME MEASURES: Spinal curvatures (scoliosis, thoracic kyphosis and lumbar lordosis) and deformities (spondylolysis and spondylolisthesis) were determined with X-rays, while the level of disability was assessed with the Oswestry Disability Index (ODI). Results: The prevalence of spinal abnormalities were: 30% scoliosis (mild: <30°), 0% thoracic hyperkyphosis, 15% lumbar hyperlordosis, 0%; spondylolysis, and 0% spondylolisthesis. No changes in scoliosis and lumbar lordosis angles were observed, while the change in thoracic kyphosis angle was smaller than the minimal clinically important difference and moved closer towards the norm-values for typically developing adults. Level of disability remained similar with 63% reporting minimal disability, 26% moderate disability and 11% severe disability. No associations with spinal curvatures were found. Conclusions: No clinically meaningful changes in spinal curvatures, deformities and level of disability due to pain were seen during the 6 years follow-up period in adults with CP who have been treated with ISA in childhood.

PMID: 34653375

5. Spinal Fusion with Sacral Alar Iliac Pelvic Fixation in Severe Neuromuscular Scoliosis
Krishna V Suresh, Ijezie Ikwuezunma, Adam Margalit, Paul D Sponseller

JBJS Essent Surg Tech. 2021 Aug 16;11(3):e20.00060. doi: 10.2106/JBJS.ST.20.00060. eCollection Jul-Sep 2021.

Neuromuscular scoliosis is characterized by rapid progression of curvature during growth and may continue to progress following skeletal maturity. Posterior spinal fusion in patients with cerebral palsy and severe scoliosis results in substantial improvements in health-related quality of life. Correction of pelvic obliquity can greatly improve sitting balance, reduce pain,

and decrease skin breakdown. The sacral alar iliac (SAI) technique has key advantages over prior techniques, including the Galveston and iliac-screw techniques. The SAI technique eliminates the need for subcutaneous muscle dissection over the iliac crest, does not require the use of connectors from the rod to the iliac screw, and decreases the risk of implant prominence. Description: We demonstrate how to perform posterior spinal fusion with SAI pelvic fixation in a patient with cerebral palsy. In correcting the scoliosis, we utilize the segmental 3-dimensional technique, which includes compression, distraction, transverse approximation to 1 rod at a time, and derotation around 2 rods. We also demonstrate SAI pelvic fixation with identification of the screw starting point on the lateral-caudal border of the first sacral foramen and trajectory toward the anterior inferior iliac spine. Alternatives: Nonoperative alternatives include bracing, trunk support, contouring of sitting surfaces (such as wheelchairs), and physical therapy to slow curve progression during growth periods and delay the need for surgical treatment. Decision-making is shared with the family following education about the risks and benefits. Families who are satisfied with the function of the child at baseline should not be persuaded into pursuing surgical treatment. Rationale: Neuromuscular scoliosis can include difficulty sitting secondary to increased pelvic obliquity, along with poor trunk control and balance. Surgical intervention is considered in patients with curves exceeding approximately 50°, as these curves will often continue to progress even after maturity. In patients with neuromuscular scoliosis, indications for pelvic fixation include pelvic obliquity of >15°, poor control of the trunk as indicated by lack of independent sitting or standing, and location of the apex of the curve in the lumbar spine. SAI screws are utilized as a low-profile option for pelvic fixation to avoid implant prominence and an increased risk of skin breakdown and infection, which are associated with traditional sacroiliac screws. Expected outcomes: Miyanji et al. reported quality outcomes in patients with cerebral palsy and Gross Motor Function Classification Scores of ≥41. In that study, caregivers completed a validated disease-specific questionnaire grading the health-related quality of life of the patient preoperatively and at 1, 2, and 5 years postoperatively. Complication data were prospectively collected for each patient and preoperative outcome scores were compared at each of the postoperative time points. Survey scores at 1, 2, and 5 years postoperatively were significantly higher compared with baseline preoperative values. Sponseller et al. compared the 2-year postoperative radiographic parameters of 32 pediatric patients who underwent SAI fixation and 27 patients who underwent pelvic fixation with the sacroiliac technique. Among patients who underwent SAI fixation, the mean correction of pelvic obliquity was 20° ± 11° (70% correction) and the mean Cobb angle 42° ± 25° (67%). Among patients who underwent pelvic fixation with the sacroiliac technique, those values were 10° ± 9° (50%) and 46° ± 16° (60%), respectively. SAI screws provided significantly better pelvic obliquity correction ($p = 0.002$) but no difference in Cobb correction or complications compared with other traditional techniques. Important tips: Family discussion prior to surgical treatment is paramount. Perform preoperative neurologic examination. Examine the cranium carefully for a ventriculoperitoneal shunt or prior cranial reconstruction prior to cranial traction. Transcranial neuromonitoring may be useful. Use descending neural motor evoked potentials when no signals from transcranial monitoring are obtained. Sink the SAI screw until it lines up with the S1 screw. Bury the SAI screw so it is not prominent. Measure rods longer in order to ensure adequate length for compression and distraction in correction of the pelvic obliquity. Use a T-square to verify adequate spinopelvic alignment. Postoperatively, the use of incisional vacuum-assisted closure can decrease soiling in these patients.

PMID: 34650826

6. Hip development after surgery to prevent hip dislocation in cerebral palsy: a longitudinal register study of 252 children

Philippe Wagner, Gunnar Hägglund

Acta Orthop. 2021 Oct 18;1-6. doi: 10.1080/17453674.2021.1989563. Online ahead of print.

Background and purpose - Operative treatment of hip displacement in cerebral palsy (CP) includes adductor-psoas lengthening (APL) or varus derotation osteotomy (VDRO) of the proximal femur, sometimes combined with pelvic osteotomy. After both operations, there is a significant risk of relapse and need for reoperation. We used the migration percentage (MP) to compare the development of hip displacement after APL and VDRO. Patients and methods - All reported MP measurements for children treated with APL (n = 158) or VDRO (n = 94) and followed ≥ 3 years were obtained from the Swedish Surveillance Programme for CP. In children treated with bilateral surgery, the hip with the highest preoperative MP was analyzed. A mixed-effects model was used to estimate the development of MP with age for each child and the population mean. Results - The 104 hips that underwent APL without reoperation showed a gradually reduced MP postoperatively. The 54 hips that underwent a 2nd surgery with APL or VDRO because of redisplacement had a higher displacement rate preoperatively and continued displacement postoperatively but at a slower rate. The 94 hips that underwent VDRO showed an instantaneous decrease in MP postoperatively followed by a rate of increasing displacement. The 15 hips that underwent a 2nd VDRO had a higher rate of displacement both pre- and postoperatively. Interpretation - After APL, hip displacement either decreases or continues to increase but at a slower rate. After VDRO, the MP decreases momentarily but then gradually increases. The risk of reoperation is higher in children with a high preoperative displacement velocity and a high preoperative MP.

PMID: 34662250

7. Failure of Hip Reconstruction in Children With Cerebral Palsy: What Are the Risk Factors?
Arya Minaie, J Eric Gordon, Perry Schoenecker, Pooya Hosseinzadeh

J Pediatr Orthop. 2021 Oct 18. doi: 10.1097/BPO.0000000000001989. Online ahead of print.

Background: The rates and risk factors contributing to failure after hip reconstruction among patients with cerebral palsy (CP) are not well established. In analyzing a large cohort of children with CP who underwent hip reconstruction, the objectives of this study are to establish (1) the failure rates and (2) associated risk factors. Methods: This retrospective study included chart and radiographic review of patients between the ages of 1 to 18, with a diagnosis of CP, who underwent a hip reconstructive procedure at a single children's hospital over a 9-year period (2010 to 2018). Patients without at least 2 years of follow-up were excluded. Age at time of surgery, sex, Gross Motor Function Classification System (GMFCS), procedure(s) performed, preoperative migration percentage (MP), neck-shaft angle, and acetabular index (AI) were recorded. Failure was defined as need for revision surgery or a MP >50% on follow-up radiographs. Logistic regression and multiple-variable regression-type models were used to test for significance of risk factors. Results: Of the 291 hips in 179 patients (102 males, 77 females) that met inclusion criteria, 38 hips (13%) failed. Significant differences in the failure group were seen in age at time of surgery (6.2±3.2 vs. 8.1±3.2; P<0.001), preoperative MP (62.3±28.7 vs. 39.9±24.1%; P<0.001) and preoperative neck-shaft angle (164.9±8.2 vs. 157.3±15.6 degrees; P<0.001). Age below 6 at time of surgery significantly increased failure rate (26% vs. 6.3%, P<0.001) as did preoperative MP >70% (28.9% vs. 9.9%, P<0.001). Receiving an acetabular osteotomy was protective against failure (9.1% vs. 16.9%, P=0.048), particularly in patients with a preoperative AI >25° (odds ratio=0.236; confidence interval: 0.090-0.549). Conclusions: In this case series, failure after hip reconstruction for children with CP was determined to be 13.1%. There was a higher risk associated with age under 6 at time of surgery or a preoperative MP >70%. Correction of acetabular dysplasia when AI is more than 25 degrees with acetabular osteotomy at time of hip reconstruction, exerted a protective effect against subsequent failure. Level of evidence: Level III-retrospective case series.

PMID: 34657091

8. Functional assessment of stretch hyperreflexia in children with cerebral palsy using treadmill perturbations
Eline Flux, Marjolein M van der Krogt, Jaap Harlaar, Annemieke I Buizer, Lizeth H Sloot

J Neuroeng Rehabil. 2021 Oct 18;18(1):151. doi: 10.1186/s12984-021-00940-1.

Background: As hyperactive muscle stretch reflexes hinder movement in patients with central nervous system disorders, they are a common target of treatment. To improve treatment evaluation, hyperactive reflexes should be assessed during activities as walking rather than passively. This study systematically explores the feasibility, reliability and validity of sudden treadmill perturbations to evoke and quantify calf muscle stretch reflexes during walking in children with neurological disorders. Methods: We performed an observational cross-sectional study including 24 children with cerebral palsy (CP; 6-16 years) and 14 typically developing children (TD; 6-15 years). Short belt accelerations were applied at three different intensities while children walked at comfortable speed. Lower leg kinematics, musculo-tendon lengthening and velocity, muscle activity and spatiotemporal parameters were measured to analyze perturbation responses. Results: We first demonstrated protocol feasibility: the protocol was completed by all but three children who ceased participation due to fatigue. All remaining children were able to maintain their gait pattern during perturbation trials without anticipatory adaptations in ankle kinematics, spatiotemporal parameters and muscle activity. Second, we showed the protocol's reliability: there was no systematic change in muscle response over time (P = 0.21-0.54) and a bootstrapping procedure indicated sufficient number of perturbations, as the last perturbation repetition only reduced variability by ~ 2%. Third, we evaluated construct validity by showing that responses comply with neurophysiological criteria for stretch reflexes: perturbations superimposed calf muscle lengthening (P < 0.001 for both CP and TD) in all but one participant. This elicited increased calf muscle activity (359 ± 190% for CP and 231 ± 68% for TD, both P < 0.001) in the gastrocnemius medialis muscle, which increased with perturbation intensity (P < 0.001), according to the velocity-dependent nature of stretch reflexes. Finally, construct validity was shown from a clinical perspective: stretch reflexes were 1.7 times higher for CP than TD for the gastrocnemius medialis muscle (P = 0.017). Conclusions: The feasibility and reliability of the protocol, as well as the construct validity-shown by the exaggerated velocity-dependent nature of the measured responses-strongly support the use of treadmill perturbations to quantify stretch hyperreflexia during gait. We therefore provided a framework which can be used to inform clinical decision making and treatment evaluation.

PMID: 34663392

9. [Is the implementation of Vojta therapy associated with faster gross motor development in children with cerebral palsy?][Article in Hu]
Jose Manuel Sanz-Mengibar, Monica Menendez-Pardiñas, Fernando Santonja-Medina

Ideggyogy Sz. 2021 Sep 30;74(9-10):329-336. doi: 10.18071/isz.74.0329.

Background and purpose: Vojta therapy has been reported as clinically beneficial for strength, movement and gross motor activities in individual cases and is being included within the second of three levels of evidence in interventions for cerebral palsy. The goal of this study is to understand the effect of Vojta therapy on the gross motor function. Methods: Our clinical trial followed a one group, pre-post design to quantify rates of changes in GMFM-88 after a two-months period undergoing Vojta therapy. Results: A total of 16 patients were recruited. Post-intervention acceleration rates of GMFM-88-items acquisition (0.005; $p<0.001$) and Locomotor Stages (1.063; $p<0.0001$) increased significatively following Vojta the-rapy intervention. Conclusion: In this study, Vojta therapy has shown to accelerate the acquisition of GMFM-88-items and Loco-motor Stages in children with cerebral palsy younger than 18 months. Because functional training was not utilised, and other non-Vojta therapy intervention did not influence the outcome, Vojta therapy seems to activate the postural control required to achieve uncompleted GMFM-88-items.

PMID: 34657402

10. Physical Activity and the Health of Wheelchair Users: A Systematic Review in Multiple Sclerosis, Cerebral Palsy, and Spinal Cord Injury
Shelley S Selph, Andrea C Skelly, Ngoc Wasson, Joseph R Dettori, Erika D Brodt, Erik Ensrud, Diane Elliot, Kristin M Dissinger, Marian McDonagh

Review Arch Phys Med Rehabil. 2021 Oct 12;S0003-9993(21)01484-2. doi: 10.1016/j.apmr.2021.10.002. Online ahead of print.

Objective: To understand the benefits and harms of physical activity in people who may require a wheelchair with a focus on people with multiple sclerosis (MS), cerebral palsy (CP), and spinal cord injury (SCI). Data sources: Searches were conducted in MEDLINE®, CINAHL®, PsycINFO®, Cochrane CENTRAL, Embase®, (January 2008 through November 2020). Study selection: Randomized controlled trials (RCTs), nonrandomized trials, and cohort studies of observed physical activity (at least 10 sessions on 10 days) in participants with MS, CP, and SCI. Data extraction: We conducted dual data abstraction, quality assessment, and strength of evidence. Measures of physical functioning are reported individually where sufficient data exist and grouped as "function" where data are scant. Data synthesis: No studies provided evidence for prevention of cardiovascular conditions, development of diabetes, or obesity. Among 168 included studies, 44% enrolled participants with MS (38% CP, 18% SCI). Studies in MS found walking ability may be improved with treadmill training and multimodal exercises; function with treadmill, balance exercises, and motion gaming; balance is likely improved with balance exercises and may be improved with aquatic exercises, robot-assisted gait training (RAGT), motion gaming, and multimodal exercises; activities of daily living (ADL), female sexual function, and spasticity may be improved with aquatic therapy, sleep may be improved with aerobic exercises and aerobic fitness with multimodal exercises. In CP, balance may be improved with hippotherapy and motion gaming; function with cycling, treadmill, and hippotherapy. In SCI, ADL may be improved with RAGT. Conclusion: Depending on population and type of exercise, physical activity was associated with improvements in walking, function, balance, depression, sleep, ADL, spasticity, female sexual function, and aerobic capacity. Few harms of physical activity were reported in studies. Future studies are needed to address evidence gaps and to confirm findings.

PMID: 34653376

11. A study of validity and reliability for Subjective Global Nutritional Assessment in outpatient children with cerebral palsy
Tingting Peng, Yiting Zhao, Chaoqiong Fu, Shiya Huang, Hongyu Zhou, Jinling Li, Hongmei Tang, Lu He, Kaishou Xu

Nutr Neurosci. 2021 Oct 18;1-7. doi: 10.1080/1028415X.2021.1990463. Online ahead of print.

Objectives: To investigate the reproducibility, stability, internal consistency and the ability to grade malnutrition of Subjective

Global Nutritional Assessment (SGNA) in outpatient children with cerebral palsy. Methods: This was a part of a larger, cross-sectional study (ChiCTR2000033869) at the outpatient of a tertiary hospital. The recruitment and data collection of children with Cerebral Palsy aged from 1 to 18 years were from August 2020 to March 2021. The concurrent validity, inter-rater reliability, test-retest reliability and internal consistency of SGNA were tested. To analyze data, specificity, sensitivity, Kendall coefficient, Cohen's kappa coefficient, Spearman coefficient and Cronbach's α coefficient were used. Results: The agreement between SGNA and anthropometric data was moderate to strong (k = 0.540-0.821). The sensitivity (71.70% to 89.74%) and specificity (77.67% to 91.03%) of SGNA to identify participants with z-score ≤-2 were good. The sensitivity of SGNA to identify participants with weight for age z-score ≤-3 was poor (30.00%). The interrater reliability (k = 0.703) and test-retest reliability (k = 0.779) were good. The item of edema was with poor agreement to SGNA nutritional grades (rs = 0.072), and after deleting it from SGNA, the Cronbach's α coefficient of SGNA increased from 0.715 to 0.886. Findings: SGNA is good at identifying malnourished outpatient children with cerebral palsy, with excellent reproducibility and short-time stability. However, the ability to grade malnutrition is unsatisfactory. For further application in this group, a more appropriate item should be designed to replace the item of edema.

PMID: 34663203

12. Chronic pain among children with cerebral palsy attending a Ugandan tertiary hospital: a cross-sectional study
Emma Nsalazi Bambi, Angelina Kakooza Mwesige, Hervé Monka Lekuya, Philip Kasirye, Richard Idro

BMC Pediatr. 2021 Oct 18;21(1):456. doi: 10.1186/s12887-021-02928-1.

Background: Children with cerebral palsy (CP) frequently experience chronic pain. The burden and severity of such pain is often underestimated in relation to their other impairments. Recognition and awareness of this chronic pain among children with CP constitute the cornerstone for caretakers and clinicians to improve the quality of life of those children. This study aimed to determine the prevalence of chronic pain among children with CP, and the factors associated. Methods: A cross-sectional study of children with CP, aged 2-12 years, attending the CP rehabilitation clinic and Pediatric Neurology Clinic at Mulago Hospital, Uganda from November 2017 to May 2018. A detailed history and clinical examination were performed and the co-morbidities were determined. CP was classified using the Gross Motor Function Classification System (GMFCS), Manual Ability Classification System, Communication Function Classification System (CFCS), and the Eating and Drinking Ability Classification System (EDACS) and documented with the level of impairment in the different domains. Pain was assessed by using the revised Face, Legs, Activity, Consolability, Cry pain scale. Results: A total of 224 children with CP were enrolled. The prevalence of chronic pain was 64.3%. The majority had spastic bilateral CP (77.8%), moderate pain lasting over 6 months, and none of them was on long-term pain management. Epilepsy (60.9%), behavioral problem (63.2%), hearing impairment (66,7%), learning problem (67,6%), dental caries (75%), gastro-esophageal reflux (75%), sleep disorders (79.5%), vision impairment (80%), and malnutrition (90%) were co- morbid conditions of chronic pain in children with CP in this study. The factors independently associated with chronic pain among children with CP were the GMFCS level IV & V, CFCS level IV & V, EDACS level IV & V, female children, and caretaker aged more than 30 years. Conclusions: Two-thirds of children with CP attending rehabilitation in this hospital had chronic pain. None was receiving pain management. Chronic pain was associated with the presence of multiple co-morbidities and more severe disability. Rehabilitation and care programs for children with CP should include assessment of pain in routine care and provide interventions for pain relief in children with CP even at an early age.

PMID: 34663248

13. Coping strategies of caregivers of persons with a disability attending a special education Center in Abakaliki, Southeast Nigeria: a cross-sectional study
Chinonyelum Thecla Ezeonu, Dorathy Chinwe Obu, Olapeju Wunmi Daniyan, Uzoma Vivian Asiegbu, Oluchukwu Oyim-Elechi, Linda Obianuju Edafioghor, Kenneth Johnson Okoro

Pan Afr Med J. 2021 Aug 18;39:249. doi: 10.11604/pamj.2021.39.249.26884. eCollection 2021.

Introduction: coping strategies are specific efforts that individuals use to tolerate or minimize stressful events. Most caregivers´ of children with disabilities must adjust to their social life to cope with the responsibility of caring for a child with disabilities. This study was carried out to assess caregivers´ coping strategies in raising a child with a disability in a resource-poor country.

Methods: a researcher-administered questionnaire adapted from the standard COPE (Committee on Publication Ethics) inventory was used on consenting respondents recruited from a designated special education school. Coping responses were graded on a five-point Likert scale and data were analyzed using computer software SPSS version 22. Results: the mean age of the respondents was 42.75 years. Males constituted 30% (12/40) whereas females constituted 70% (28/40). The diagnosed disorders amongst their children/wards were speech and hearing impairment (32.5%), cerebral palsy (12.5%), learning disability (10%), autism (10%), Down's syndrome (15%), epilepsy (20%). Most caregivers exhibited active coping (MNR 3-4) especially in areas of planning and seeking professional help. Turning to religion and acceptance of the situation (MNR 4-5) were common emotional coping strategies noted but most of these had no significant relationship with gender or income. Caregivers with lower earnings tend to pay more attention to the child´s disability than concentrating on other activities. Conclusion: the findings support that religious belief provides endurance and resistance to people dealing with stress while low socioeconomic status negatively affects the ability to focus on other activities during stress.

PMID: 34659622

14. Application of Inertial Measurement Units and Machine Learning Classification in Cerebral Palsy: Randomized Controlled Trial
Siavash Khaksar, Huizhu Pan, Bita Borazjani, Iain Murray, Himanshu Agrawal, Wanquan Liu, Catherine Elliott, Christine Imms, Amity Campbell, Corrin Walmsley

JMIR Rehabil Assist Technol. 2021 Oct 20;8(4):e29769. doi: 10.2196/29769.

Background: Cerebral palsy (CP) is a physical disability that affects movement and posture. Approximately 17 million people worldwide and 34,000 people in Australia are living with CP. In clinical and kinematic research, goniometers and inclinometers are the most commonly used clinical tools to measure joint angles and positions in children with CP. Objective: This paper presents collaborative research between the School of Electrical Engineering, Computing and Mathematical Sciences at Curtin University and a team of clinicians in a multicenter randomized controlled trial involving children with CP. This study aims to develop a digital solution for mass data collection using inertial measurement units (IMUs) and the application of machine learning (ML) to classify the movement features associated with CP to determine the effectiveness of therapy. The results were calculated without the need to measure Euler, quaternion, and joint measurement calculation, reducing the time required to classify the data. Methods: Custom IMUs were developed to record the usual wrist movements of participants in 2 age groups. The first age group consisted of participants approaching 3 years of age, and the second age group consisted of participants approaching 15 years of age. Both groups consisted of participants with and without CP. The IMU data were used to calculate the joint angle of the wrist movement and determine the range of motion. A total of 9 different ML algorithms were used to classify the movement features associated with CP. This classification can also confirm if the current treatment (in this case, the use of wrist extension) is effective. Results: Upon completion of the project, the wrist joint angle was successfully calculated and validated against Vicon motion capture. In addition, the CP movement was classified as a feature using ML on raw IMU data. The Random Forrest algorithm achieved the highest accuracy of 87.75% for the age range approaching 15 years, and C4.5 decision tree achieved the highest accuracy of 89.39% for the age range approaching 3 years. Conclusions: Anecdotal feedback from Minimising Impairment Trial researchers was positive about the potential for IMUs to contribute accurate data about active range of motion, especially in children, for whom goniometric methods are challenging. There may also be potential to use IMUs for continued monitoring of hand movements throughout the day. Trial registration: Australian New Zealand Clinical Trials Registry (ANZCTR) ACTRN12614001276640, https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=367398; ANZCTR ACTRN12614001275651, https://www.anzctr.org.au/Trial/Registration/TrialReview.aspx?id=367422.

PMID: 34668870

15. Using both electromyography and movement disorder assessment improved the classification of children with dyskinetic cerebral palsy
Jakob Lorentzen, Alfred Peter Born, Christian Svane, Christian Forman, Bjarne Laursen, Annika Reynberg Langkilde, Peter Uldall, Christina Engel Hoei-Hansen

Acta Paediatr. 2021 Oct 16. doi: 10.1111/apa.16152. Online ahead of print.

Aim: Children with dyskinetic cerebral palsy (CP) are often severely affected and effective treatment is difficult, due to different underlying disease mechanisms. Comprehensive systematic movement disorder evaluations were carried out on

patients with this disorder. Methods: Patients born from1995-2007 were identified from the Danish Cerebral Palsy Register and referrals to the neuropaediatric centre, Rigshospitalet, Copenhagen. They were classified by gross motor function, manual functional ability, communication ability, dystonia and spasticity. Electromyography was carried out on the upper and lower limbs. Magnetic resonance imaging scans were revised and aetiological searches for underlying genetic disorders were performed. Results: We investigated 25 patients with dyskinetic CP at a mean age of 11.7 years. Dystonia, spasticity and rigidity were found in the upper limbs of 21, four and six children, respectively, and in the lower limbs of 18, 18 and three children. The mean total Burke Fahn Marsden score for dystonia was 45.02 and the mean Disability Impairment Scale level was 38% for dystonia and 13% for choreoathetosis. Sustained electromyography activity was observed in 20/25 children. Stretching increased electromyography activity more in children with spasticity. There were 10 reclassifications. Conclusion: The children had heterogenic characteristics and 40% were reclassified after systematic movement disorder evaluation.

PMID: 34655503

16. Changing Perspectives of Electronic Fetal Monitoring
Mark I Evans, David W Britt, Shara M Evans, Lawrence D Devoe

Review Reprod Sci. 2021 Oct 18;1-21. doi: 10.1007/s43032-021-00749-2. Online ahead of print.

The delivery of healthy babies is the primary goal of obstetric care. Many technologies have been developed to reduce both maternal and fetal risks for poor outcomes. For 50 years, electronic fetal monitoring (EFM) has been used extensively in labor attempting to prevent a large proportion of neonatal encephalopathy and cerebral palsy. However, even key opinion leaders admit that EFM has mostly failed to achieve this goal. We believe this situation emanates from a fundamental misunderstanding of differences between screening and diagnostic tests, considerable subjectivity and inter-observer variability in EFM interpretation, failure to address the pathophysiology of fetal compromise, and a tunnel vision focus. To address these suboptimal results, several iterations of increasingly sophisticated analyses have intended to improve the situation. We believe that part of the continuing problem is that the focus of EFM has been too narrow ignoring important contextual issues such as maternal, fetal, and obstetrical risk factors, and increased uterine contraction frequency. All of these can significantly impact the application of EFM to intrapartum care. We have recently developed a new clinical approach, the Fetal Reserve Index (FRI), contextualizing EFM interpretation. Our data suggest the FRI is capable of providing higher accuracy and earlier detection of emerging fetal compromise. Over time, artificial intelligence/machine learning approaches will likely improve measurements and interpretation of FHR characteristics and other relevant variables. Such future developments will allow us to develop more comprehensive models that increase the interpretability and utility of interfaces for clinical decision making during the intrapartum period.

PMID: 34664218

17. Examination of fetal well-being evaluation metrics for fetal growth restriction as seen from Japan Obstetric Compensation Cause Analysis Report data
Mika Sugihara, Nobuya Unno, Hideaki Suzuki, Akihiko Sekizawa, Hiroaki Tanaka, Keiya Fujimori, Tomoaki Ikeda, Koichiro Shimoya, Japan Society of Obstetrics and Gynecology Perinatal Committee, Committee on Evaluation of Perinatal Brain Disorders and Fetal Health

J Obstet Gynaecol Res. 2021 Oct 18. doi: 10.1111/jog.15067. Online ahead of print.

Advances in perinatal care have improved the prognoses of both mothers and neonates; however, cerebral palsy continues to occur. In this study, we examined methods for the intragestational evaluation of the health of infants who later developed cerebral palsy. A retrospective review was conducted on light-for-dates cases among the 2113 cause analysis reports issued by the Japan Obstetric Compensation System between January 2009 and September 2018. In our examination, we determined that non-stress tests and ultrasonic Doppler tests were used to evaluate fetal well-being. Moreover, we observed cases in which additional testing was not performed even when fetal growth restriction (FGR) was identified. Appropriate management of FGR may help reduce the incidence of cerebral palsy.

PMID: 34664338

18. Retrospective comparison of death or neurodevelopmental outcomes in extremely low birth weight preterm infants following different management options of haemodynamically significant patent ductus arteriosus
Jania Jia-Ying Wu, Krishnamoorthy Niduvaje, Le Ye Lee, Zubair Amin

BMC Pediatr. 2021 Oct 19;21(1):457. doi: 10.1186/s12887-021-02920-9.

Background: Optimal management of haemodynamically significant patent ductus arteriosus (HsPDA) in premature babies remains controversial. Our aim is to compare death and/or adverse neurodevelopmental outcomes in extremely low birth weight (ELBW) infants with HsPDA who were managed with conservative [C], medical [M] and/or surgical [S] treatment, with secondary aim to examine short-term morbidities among [S] and [C] groups. The study also compared outcomes in very low birth weight (VLBW) infants with HsPDA and non-HsPDA. Methods: A retrospective study of VLBW preterm infants born before 29 weeks in Singapore from 2007 to 2016 was conducted. Results: A total of 474 VLBW infants were admitted in NUH from 2007 to 2016. Infants aged between 24 + 0 and 28 + 6 weeks of gestation, weighing ≤1500 g and diagnosed with patent ductus arteriosus (PDA) were included in the study, of which 172 infants (124 HsPDA and 48 non-HsPDA) were analyzed. Among infants with HsPDA, 17 infants were managed with [C], 83 with [M] and 24 with [S]. Mortality was not increased regardless of the presence of HsPDA or treatment received. Infants with non-HsPDA were less likely to have isolated speech delay ($p < 0.05$), but not global developmental delay (GDD). No significant differences in neurodevelopmental outcomes such as hearing loss, cerebral palsy (CP) and speech delay were found. [M + S] infants were at a higher risk of developing chronic lung disease (CLD) (OR 6.83, $p < 0.05$) and short-term growth failure compared to [C] infants. They were significantly shorter and had a smaller head circumference at discharge ($p < 0.05$). [M + S] infants also had elevated creatinine compared to those in group [C] (81.1 ± 24.1 vs 48.3 ± 11.8 umol/L, $p < 0.000$). Conclusions: Compared to conservative management, infants requiring [M + S] treatment for HsPDA were more likely to have short-term complications such as CLD, elevated creatinine, and poorer growth. Despite a more turbulent postnatal course, death and/or adverse neurodevelopmental outcomes were not worse in infants managed with [M + S].

PMID: 34663266

19. Regional oxygenation, perfusion and body and/or head position: Are preterm infants adversely impacted? A systematic review
Pranav Jani, Hannah Skelton, Traci-Anne Goyen, Dominic A Fitzgerald, Karen Waters, Nadia Badawi, Mark Tracy

Review Paediatr Respir Rev. 2021 Sep 23;S1526-0542(21)00092-0. doi: 10.1016/j.prrv.2021.09.004. Online ahead of print.

This review addresses regional oxygenation and perfusion changes for preterm infants and changes with body position, with or without head rotation. Future directions for improving neurodevelopmental and clinical outcomes are suggested. The MEDLINE, Embase and Scopus databases were searched up to July 2021. Fifteen out of 470 studies met the inclusion criteria. All were prospective, observational studies with a moderate risk of bias. Significant variation was found for the baseline characteristics of the cohort, postnatal ages, and respiratory support status at the time of monitoring. When placed in a non-supine position, preterm infants showed a transient reduction in cardiac output and stroke volume without changes to heart rate or blood pressure. No studies reported on long-term neurodevelopmental outcomes. Overall, side lying or prone position does not appear to adversely affect regional, and specifically cerebral, oxygenation or cerebral perfusion. The effect of head rotation on regional oxygenation and perfusion remains unclear.

PMID: 34654646

20. Involuntary movements as a prognostic factor for acute encephalopathy with biphasic seizures and late reduced diffusion
Yosuke Miyamoto, Tohru Okanishi, Masanori Maeda, Tatsuya Kawaguchi, Sotaro Kanai, Yoshiaki Saito, Yoshihiro Maegaki

Brain Dev. 2021 Oct 13;S0387-7604(21)00184-4. doi: 10.1016/j.braindev.2021.09.011. Online ahead of print.

Background: Acute encephalopathy with biphasic seizures and late reduced diffusion (AESD) is characterized by biphasic seizures and white matter lesions with reduced diffusion, which are often accompanied by involuntary movements. The neurological outcomes of AESD vary from normal to mild or severe sequelae, including intellectual disability, paralysis, and

epilepsy. The present study aimed to clarify the prognostic factors of AESD, including involuntary movements. Methods: We enrolled 29 patients with AESD admitted to Tottori University Hospital from 1991 to 2020 and retrospectively analyzed their clinical data. Neurological outcomes were assessed by the Pediatric Cerebral Performance Category score and cerebral paralysis as neurological sequelae. Results: Of the 29 patients, 12 had favorable outcomes and 17 had unfavorable outcomes. Univariate analysis revealed that the presence of underlying diseases, a decline in Glasgow Coma Scale (GCS) score 12-24 h after early seizures, and involuntary movements were associated with unfavorable outcomes. In multivariate analysis, a decline in GCS score and involuntary movements were associated with unfavorable outcomes. The sensitivities and specificities of underlying diseases, a decline of ≥ 3 points in GCS score 12-24 h after early seizures, and involuntary movements for unfavorable outcomes were 53% and 92%, 92% and 65%, and 59% and 92%, respectively. Conclusions: The appearance of involuntary movements may be associated with unfavorable outcomes of AESD. The prognostic factors identified herein are comparable with previously known prognostic factors of consciousness disturbances after early seizures.

PMID: 34656360

21. The limits of small-for-gestational-age as a high-risk category
Allen J Wilcox, Marianna Cortese, D Robert McConnaughey, Dag Moster, Olga Basso

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SGA (small for gestational age) is widely used to identify high-risk infants, although with inconsistent definitions. Cut points range from 2.5th to 10th percentile of birthweight-for-gestational age. We used receiver operator characteristic curves (ROC) to identify the cut point with maximum sensitivity and specificity (Youden Index), and the area under the curve (AUC), which assesses overall discriminating power. Analysis was conducted on 3,836,034 US births (2015) and 292,279 Norwegian births (2010-14). Birthweight percentiles were calculated using exact birthweights at each week of gestational age, and then summarized across gestational ages. We also conducted a companion analysis of gestational age itself to consider the predictive power of gestational week of birth. Outcomes were neonatal mortality and cerebral palsy, both strongly associated with birthweight. Birthweight percentiles performed poorly in all analyses. The AUC for birthweight percentiles as a discriminator of neonatal mortality was 60% (where 50% is no better than a coin-toss). At such low discrimination, the Youden Index provides no useful SGA cut point. Results in Norway were virtually identical, with an AUC of 58%. The AUC with cerebral palsy as the outcome was even lower, at 54%. In contrast, gestational age had an AUC of 85% as a predictor of neonatal mortality, with < 37 weeks as the optimum cut point. SGA provides surprisingly poor identification of at-risk infants, while gestational age performs well. Similar results in two countries that differ in mean birthweight, percent preterm, and neonatal mortality suggest robustness across populations.

PMID: 34661814

22. Breastfeeding Insufficiencies: Common and Preventable Harm to Neonates
Vera K Wilde

Review Cureus. 2021 Oct 4;13(10):e18478. doi: 10.7759/cureus.18478. eCollection 2021 Oct.

Insufficient milk intake in breastfed neonates is common, frequently missed, and causes preventable hospitalizations for jaundice/hyperbilirubinemia, hypernatremia/dehydration, and hypoglycemia - accounting for most U.S. neonatal readmissions. These and other consequences of neonatal starvation and deprivation may substantially contribute to fully preventable morbidity and mortality in previously healthy neonates worldwide. Previous advanced civilizations recognized this problem of breastfeeding insufficiencies and had an infrastructure to solve it: Wetnursing, shared nursing, and prelacteal feeding traditions used to be well-organized and widespread. Modern societies accidentally destroyed that infrastructure. Then, modern reformers missing a few generations of direct knowledge transmission about safe breastfeeding invented a new, historically anomalous conception of breastfeeding defined in terms of exclusivity. As that new intervention has become increasingly widespread, so too have researchers widely reported associated possible harms of the longer neonatal starvation/deprivation and later infant under-nutrition periods that it creates when breastfeeding is insufficient. Early insufficient nutrition/hydration has possible long -term effects including neurodevelopmental consequences such as attention deficit hyperactivity disorder, autism, cerebral palsy, cognitive and developmental delay, epilepsy, hearing impairment, kernicterus, language disorder, mood disorders, lower IQ, and specific learning disorder. Current early infant feeding guidelines conflict with the available evidence. Recent reform efforts have tended to focus on using more technology and measurement to harm fewer neonates instead of proposing the indicated paradigm shift in early infant feeding to prevent more harm. The scientific evidence is already sufficient to mandate

application of the precautionary principle to feed neonates early, adequate, and often milk before mothers' milk comes in and whenever signs of hunger persist, mitigating possible risks including death or disability. In most contexts, the formula is the best supplementary milk for infants at risk from breastfeeding insufficiencies. National-level reviews of scientific evidence, health policy, and research methods and ethics are needed to initiate the early infant feeding paradigm shift that the data already support. Policy experiments and related legislative initiatives might also contribute to the shift, as insurers might decline or be required by law to decline reimbursing hospitals for costs of this type of preventable hospitalization, which otherwise generates profit.

PMID: 34659917

23. A pilot study of the General Movement Optimality Score detects early signs of motor disorder in neonates with arterial ischemic stroke
Huanhuan Yin, Xinrui Wang, Hong Yang, Xiaoyun Zhu, Jun Wang, Zhihua Li

Early Hum Dev. 2021 Oct 7;163:105484. doi: 10.1016/j.earlhumdev.2021.105484. Online ahead of print.

Aim: To explore whether the General Movement Optimality Score (GMOS) could help to identify asymmetric movement in infants with neonatal arterial ischemic stroke (NAIS) in the early stage. Method: Twenty-seven infants with NAIS (16 males, 11 females) were enrolled. The general movement video was recorded approximately one month after birth. The GMOS focused separately on the neck and trunk and the upper and lower extremities. The differences between the ipsilesional and contralesional limbs were analyzed. Results: Eight infants who developed cerebral palsy (CP) had middle cerebral artery (MCA) infarction involving the main branch. By GMOS evaluation, the scores of the contralesional upper and/or lower limbs were lower than those of the ipsilesional side ($p < 0.05$). In the contralesional limbs, the CP group had a lower GMOS than the non-CP group. Distal rotatory components of the contralesional upper limbs and tremulous movement of the lower limbs showed significant differences. Interpretation: The GMOS could help to quantitatively find and assess the asymmetric movement of global and contralesional limbs. Distal rotatory movement of the upper limbs could be an early sign of abnormal motor function in infants with NAIS.

PMID: 34655917

24. Predictive value of brain MRI at term-equivalent age in extremely preterm children on neurodevelopmental outcome at school-age
Aurélie Garbi, Gaelle Sorin, Stéphanie Coze, Noémie Resseguier, Véronique Brévaut-Malaty, Stéphane Marret, Jean-Baptiste Muller, Barthélémy Tosello, Catherine Gire, for the GPQOL study Group

Brain Imaging Behav. 2021 Oct 18. doi: 10.1007/s11682-021-00559-9. Online ahead of print.

This study's objective was to correlate the abnormalities in brain MRIs performed at corrected-term age for minor or moderate neurocognitive disorders in children school-age born extremely premature (EPT) and without serious sequelae such as autism, cerebral palsy, mental impairment. Data were issued from a cross-sectional multicenter study (GP-Qol study, number NCT01675726). Clinical examination and psychometric assessments were performed when the children were between 7 and 10 years old during a day-long evaluation. Term-equivalent age brain MRIs on EPT were analyzed with a standardized scoring system. There were 114 children included in the study. The mean age at the time of evaluation, was 8.47 years old (± 0.70). 59% of children with at least one cognitive impairment and 53% who had a dysexecutive disorder. Only ten EPT (8.7%) presented moderate to severe white and grey matter abnormalities. These moderate to severe grey matter abnormalities were associated with at least two abnormal executive functions [OR 3.08 (95% CI 1.04-8.79), $p = 0.04$] and language delay [OR 3.25 (95% CI 1.03-9.80), $p = 0.04$]. These results remained significant in the multivariate analysis. Moderate to severe ventricular dilatation abnormalities (15%, $n = 17$) were associated with ideomotor dyspraxia [OR 7.49 (95% CI 1.48-35.95), $p = 0.02$] and remained significant in multivariate analysis [OR 11.2 (95% CI 1.45-131.4), $p = 0.02$]. Biparietal corrected diameters were moderate abnormal in 20% of cases ($n = 23$) and were associated to visuo spatial integration delay [OR 4.13 (95% CI 1.23-13.63), $p = 0.02$]. Cerebral MRI at term-equivalent age with scoring system analysis can provide information on long-term neuropsychological outcomes at school-age in EPTs children having no severe disability.

PMID: 34661873

25. Two-year follow-up of children with congenital Zika syndrome: the evolution of clinical patterns
Erica Conti Rua, Solange Artimos de Oliveira, Renata Artimos de Oliveira Vianna, Luis Antonio Bataglin Dalcastel, Teresa Cristina de Castro Sarmet Dos Santos, Claudete Aparecida Araújo Cardoso, Alexandre Ribeiro Fernandes

Eur J Pediatr. 2021 Oct 18. doi: 10.1007/s00431-021-04280-z. Online ahead of print.

The aim of the study was to describe neurological manifestations in children with congenital Zika syndrome (CZS) in the first 2 years of age. In this prospective observational study, children with CZS treated at a university hospital received a neurological assessment and were evaluated using two neurodevelopmental scales (the Denver II test and the assessment of gross motor development of the World Health Organization) by a pediatric neurologist on admission to the study and at 4, 8, 12, 18, and 24 months of age. The data collected were stored in Microsoft Excel version 14.6.3. Thirty-eight children (27 males and 11 females; a median age of 4.3 months (interquartile range (IQR): 1.6-11.4)) with CZS were evaluated. Irritability was present in 50% and 27% of the children at 8 months and 24 months, respectively. Axial hypertonia was highly prevalent at 4 months (77%), with a decrease to 50% at 24 months. At all ages, spastic tetraparesis was the most common motor abnormality (> 80%). Twenty-seven (71%) participants were diagnosed with epilepsy, and the median age at seizure onset was 6 months (IQR: 3.5-8). The most frequent types of seizures were focal seizures and spasms, with spasms being the most frequent in the first year of life (52%) and focal crises being the most frequent in the second year of life (50%).Conclusion: This study allowed observation of neurological abnormalities over time, the evolution of epileptic manifestations, and recognition of new patterns of clinical neurological abnormalities, helping clinicians to recognize CZS earlier, minimizing the impact of new outbreaks. What is Known: • Clinical patterns of SZC patients at pre-established ages or date of data collection • More frequent studies with data collection of clinical-radiological features of patient's over his first year of life What is New: • Comprehensive clinical neurological progression data regarding CZS in the first 2 years of life, recognizing patterns • Hypothesis including a new CZS spectrum with milder clinical-radiological features.

PMID: 34661750

26. Parent-Infant Interactions Among Infants With High Risk of Cerebral Palsy: A Protocol for an Observational Study of Infant and Parental Factors for Dyadic Reciprocity
Katrine Røhder, Maria Willerslev-Olse, Jens Bo Nielsen, Gorm Greisen, Susanne Harder

Front Psychiatry. 2021 Sep 29;12:736676. doi: 10.3389/fpsyt.2021.736676. eCollection 2021.

Background: An early diagnosis of chronic disability, such as risk of Cerebral Palsy (CP), is likely to affect the quality of parent-infant interactions by affecting both infant and parental factors. Due to adverse perinatal events, infants at high risk of CP may exhibit less engagement in interactions, while parents may experience increased mental health problems and disrupted parental representations that can have a negative effect on parental sensitivity. Recent clinical guidelines on early intervention among families with infants at risk of CP recommends supporting parental sensitivity and mutual enjoyable interactions more research is needed to inform such interventions. This includes understanding how infant and parental risk as well as resilience factors impact parent-infant interactions and how existing parenting programs developed among typical developing infants should be adapted to families with infants at risk of CP. In addition, as majority of research on infant neurohabilitation focus on improving motor and cognitive outcomes research on infant emotional development is needed. The study aim is to assess the quality of early parent-infant interactions in families with high-risk infants, compared to families with low-risk infants, and to explore how interaction quality is affected by infant and parental factors. Three potential mediating factors explaining the association between CP risk and less optimal parent-infant interactions will be explored: infant interactional capacities, parental mental health and well-being, and parents' representations of their child. Methods: The prospective, longitudinal design will follow infants at high risk for CP and their parents and a control group at three time points from 15 weeks to 15 months corrected infant age (CA). Measures comprise infant developmental assessments, questionnaires and interviews with both parents, and global ratings of video-recorded parent-infant interactions. Discussion: Study results will enhance our understanding of how parent-infant interactions may be affected by perinatal neurological risk and identify potential important mechanisms for observed associations. This knowledge could assist in planning future early screening and intervention programs and identifying families who should be offered targeted psychological interventions in addition to neurohabilitation programs.

PMID: 34658969

27. Cognitive Orientation to daily Occupational Performance (CO-OP) Intervention for People with Cerebral Palsy: A Systematic Review with Meta-Analysis.
Gimeno H, Jackman M, Novak I.

J Pediatr Perinatol Child Health. 2021 Sep 6; 5(3):177-193. doi: 10.26502/jppch.74050077

Cognitive Orientation to daily Occupational Performance (CO-OP) was originally designed for children with Developmental Coordination Disorder but has more recently been applied to the cerebral palsy population who also have disorders of motor function and executive function. The aim of this review was to examine the feasibility, acceptability, and effectiveness of CO-OP in the cerebral palsy population. A systematic literature review was carried out to identify studies on CO-OP for people with cerebral palsy, using the Medline, CINAHL and ERIC databases between 22 June and 30 June 2021. The search elicited 44 citations, of which 8 studies met eligibility. Five were observational studies (three of five Single Case Experimental Design), three were randomized controlled trials (RCTs), measuring the effects of CO-OP in 100 people with cerebral palsy. Since CO-OP was repurposed to cerebral palsy, initial studies focused on feasibility, acceptability and preliminary efficacy, and consequently sample sizes were small with high risk of bias. Pooled findings from RCTs indicate CO-OP produces greater gains in goal achievement than to body functions and structure intervention (Standardised Mean Difference 0.86 [95% Confidence Interval 0.20-1.52]). Findings suggest preliminary efficacy of CO-OP for cerebral palsy compared to body functions and structure interventions for goal attainment, with CO-OP having comparable efficacy to other activities-based interventions. More clinical trials with adequate power and an individual patient meta-analysis are recommended.

NLM ID: 101772401

28. Clinical bone health among adults with cerebral palsy: moving beyond assessing bone mineral density alone
Daniel G Whitney, Michelle S Caird, Gregory A ClineS, Edward A Hurvitz, Karl J Jepsen

Dev Med Child Neurol. 2021 Oct 17. doi: 10.1111/dmcn.15093. Online ahead of print.

Aim: To understand associations among bone mineral density (BMD), bone mineral content (BMC), and bone area, and their association with fractures in adults with cerebral palsy (CP). Method: This retrospective cohort study included 78 adults with CP with a hip dual energy X-ray absorptiometry (DXA) from 1st December 2012 to 3rd May 2021 performed at the University of Michigan. Data-driven logistic regression techniques identified which, if any, DXA-derived bone traits (e.g. age/sex/ethnicity-based z-scores) were associated with fracture risk by sex and severity of CP. BMC-area associations were examined to study the structural mechanisms of fragility. Results: Femoral neck area was associated with lower age-adjusted odds ratios (ORs) of fracture history (OR 0.72; 95% confidence interval [CI] 0.49-1.06; p=0.098), while higher BMD was associated with higher odds of incident fracture (OR 3.08; 95% CI 1.14-8.33; p=0.027). Females with fracture had lower area than females without fracture but similar BMC, whereas males with fracture had larger area and higher BMC than males without fracture. The paradoxical BMD-fracture association may be due to artificially elevated BMD from BMC-area associations that differed between females and males (sex interaction, p<0.05): males had higher BMC at lower area values and lower BMC at higher area values compared to females. Interpretation: BMD alone may not be adequate to evaluate bone strength for adults with CP. Further research into associations (or integration) between BMC and area is needed.

PMID: 34658010

29. Sustained peripheral immune hyper-reactivity (SPIHR): an enduring biomarker of altered inflammatory responses in adult rats after perinatal brain injury
Yuma Kitase, Eric M Chin, Sindhu Ramachandra, Christopher Burkhardt, Nethra K Madurai, Colleen Lenz, Alexander H Hoon Jr, Shenandoah Robinson, Lauren L Jantzie

J Neuroinflammation. 2021 Oct 19;18(1):242. doi: 10.1186/s12974-021-02291-z.

Background: Chorioamnionitis (CHORIO) is a principal risk factor for preterm birth and is the most common pathological abnormality found in the placentae of preterm infants. CHORIO has a multitude of effects on the maternal-placental-fetal axis including profound inflammation. Cumulatively, these changes trigger injury in the developing immune and central nervous systems, thereby increasing susceptibility to chronic sequelae later in life. Despite this and reports of neural-immune changes in

children with cerebral palsy, the extent and chronicity of the peripheral immune and neuroinflammatory changes secondary to CHORIO has not been fully characterized. Methods: We examined the persistence and time course of peripheral immune hyper -reactivity in an established and translational model of perinatal brain injury (PBI) secondary to CHORIO. Pregnant Sprague-Dawley rats underwent laparotomy on embryonic day 18 (E18, preterm equivalent). Uterine arteries were occluded for 60 min, followed by intra-amniotic injection of lipopolysaccharide (LPS). Serum and peripheral blood mononuclear cells (PBMCs) were collected at young adult (postnatal day P60) and middle-aged equivalents (P120). Serum and PBMCs secretome chemokines and cytokines were assayed using multiplex electrochemiluminescent immunoassay. Multiparameter flow cytometry was performed to interrogate immune cell populations. Results: Serum levels of interleukin-1β (IL-1β), IL-5, IL-6, C -X-C Motif Chemokine Ligand 1 (CXCL1), tumor necrosis factor-α (TNF-α), and C-C motif chemokine ligand 2/monocyte chemoattractant protein-1 (CCL2/MCP-1) were significantly higher in CHORIO animals compared to sham controls at P60. Notably, CHORIO PBMCs were primed. Specifically, they were hyper-reactive and secreted more inflammatory mediators both at baseline and when stimulated in vitro. While serum levels of cytokines normalized by P120, PBMCs remained primed, and hyper-reactive with a robust pro-inflammatory secretome concomitant with a persistent change in multiple T cell populations in CHORIO animals. Conclusions: The data indicate that an in utero inflammatory insult leads to neural-immune changes that persist through adulthood, thereby conferring vulnerability to brain and immune system injury throughout the lifespan. This unique molecular and cellular immune signature including sustained peripheral immune hyper-reactivity (SPIHR) and immune cell priming may be a viable biomarker of altered inflammatory responses following in utero insults and advances our understanding of the neuroinflammatory cascade that leads to perinatal brain injury and later neurodevelopmental disorders, including cerebral palsy.

PMID: 34666799