Cerebral palsy research news

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Interventions and Management

1. Systematic overviews of partnership principles and strategies identified from health research about spinal cord injury and related health conditions: A scoping review
Femke Hoekstra, Francisca Trigo, Kathryn M Sibley, Ian D Graham, Michael Kennefick, Kelly J Mrklas, Tram Nguyen, Mathew Vis-Dunbar, SC. I. Guiding Principles Consensus Panel; Heather L Gainforth

J Spinal Cord Med. 2022 Mar 9;1-18. doi: 10.1080/10790268.2022.2033578. Online ahead of print.

Study design: Scoping review. Objective: To identify and provide systematic overviews of partnership principles and strategies identified from health research about spinal cord injury (SCI) and related health conditions. Methods: Four health electronic databases (Medline, Embase, CINAHL, PsycINFO) were searched from inception to March 2019. We included articles that described, reflected, and/or evaluated one or more collaborative research activities in health research about SCI, stroke, multiple sclerosis, Parkinson's disease, amputation, cerebral palsy, spina bifida, amyotrophic lateral sclerosis, acquired brain injury, or wheelchair-users. Partnership principles (i.e. norms or values) and strategies (i.e. observable actions) were extracted and analyzed using directed qualitative content analysis. Results: We included 39 articles about SCI (n = 13), stroke (n = 15), multiple sclerosis (n = 5), amputation (n = 2), cerebral palsy (n = 2), Parkinson's disease (n = 1), and wheelchair users (n = 1). We extracted 110 principles and synthesized them into 13 overarching principles. Principles related to building and maintaining relationships between researchers and research users were most frequently reported. We identified 32 strategies that could be applied at various phases of the research process and 26 strategies that were specific to a research phase (planning, conduct, or dissemination). Conclusion: We provided systematic overviews of principles and strategies for research partnerships. These could be used by researchers and research users who want to work in partnership to plan, conduct and/or disseminate their SCI research. The findings informed the development of the new SCI Integrated Knowledge Translation Guiding Principles (www.iktprinciples.com) and will support the implementation of these Principles within the SCI research system.

PMID: 35262473

2. Reliability, minimum detectable change, and minimum clinically important difference of the balance subtest of the Bruininks-Oseretsky test of motor proficiency-second edition in children with cerebral palsy
Seong Gil Kim, Do Hyun Kim

J Pediatr Rehabil Med. 2022 Feb 28. doi: 10.3233/PRM-190639. Online ahead of print.

Purpose: This study aimed to investigate the internal consistency, inter-rater, and test-retest reliability of the balance subtest of the Bruininks-Oseretsky test of motor proficiency-second edition (BOT-2) and to estimate the minimum detectable change (MDC) and minimum clinically important difference (MCID) of the balance subtest of the BOT-2 in children with cerebral palsy (CP). Methods: In total, 20 children with CP participated in the present study. Internal consistency, test-retest, and inter-

rater reliability were computed to establish reliability of the balance subtest of the BOT-2. The MDC95 was estimated from the standard error of measurement (SEM) to determine a real change for an individual child with CP. The anchor- and distribution-based MCID were calculated to determine the smallest change that might be important to clinicians. For concurrent validity, the correlation between the balance subtest of the BOT-2 and the pediatric balance scale (PBS) were calculated using Spearman's correlation. Results: Internal consistency was good (Cronbach's alpha coefficient = 0.89). The BOT-2 had excellent test-retest (ICC = 0.99, $p < 0.001$) and inter-rater reliability (ICC = 0.99, $p < 0.001$). The balance subtest of the BOT-2 had an SEM of 0.70, MDC95 of 9.61, and MCIDs of 2.54 (anchor-based) and 1.38 (distribution-based). Additionally, there was a moderate positive correlation between the balance subtest of the BOT-2 and the PBS (Spearman's rho = 0.629, $p = 0.003$). Conclusions: Our experimental results indicate that the balance subtest of the BOT-2 had good internal consistency, along with excellent test-retest and inter-rater reliability. The change in scores of an individual child with CP should attain 9.61 points on the balance subtest of the BOT-2 to indicate a clinically important change. The MDC95 and MCID values could be helpful in understanding therapeutic effects and evaluating balancing ability using the balance subtest of the BOT-2 in children with CP.

PMID: 35253658

3. A muscle synergy-based method to estimate muscle activation patterns of children with cerebral palsy using data collected from typically developing children
Mohammad Fazle Rabbi, Laura E Diamond, Chris P Carty, David G Lloyd, Giorgio Davico, Claudio Pizzolato

Sci Rep. 2022 Mar 4;12(1):3599. doi: 10.1038/s41598-022-07541-5.

Preparing children with cerebral palsy prior to gait analysis may be a challenging and time-intensive task, especially when large number of sensors are involved. Collecting minimum number of electromyograms (EMG) and yet providing adequate information for clinical assessment might improve clinical workflow. The main goal of this study was to develop a method to estimate activation patterns of lower limb muscles from EMG measured from a small set of muscles in children with cerebral palsy. We developed and implemented a muscle synergy extrapolation method able to estimate the full set of lower limbs muscle activation patterns from only three experimentally measured EMG. Specifically, we extracted a set of hybrid muscle synergies from muscle activation patterns of children with cerebral palsy and their healthy counterparts. Next, those muscle synergies were used to estimate activation patterns of muscles, which were not initially measured in children with cerebral palsy. Two best combinations with three (medial gastrocnemius, semi membranous, and vastus lateralis) and four (lateral gastrocnemius, semi membranous, sartorius, and vastus medialis) experimental EMG were able to estimate the full set of 10 muscle activation patterns with mean (± standard deviation) variance accounted for of 79.93 (± 9.64)% and 79.15 (± 6.40)%, respectively, using only three muscle synergies. In conclusion, muscle activation patterns of unmeasured muscles in children with cerebral palsy can be estimated from EMG measured from three to four muscles using our muscle synergy extrapolation method. In the future, the proposed muscle synergy-based method could be employed in gait clinics to minimise the required preparation time.

PMID: 35246590

4. Anthropometry, body composition, and athletic performance in specific field tests in Paralympic athletes with different disabilities
Moncef Cherif, Mohamed Ahmed Said, Karim Bannour, Majed M Alhumaid, Mounira Ben Chaifa, Marwa Khammassi, Abdallah Aouidet

Heliyon. 2022 Feb 25;8(3):e09023. doi: 10.1016/j.heliyon.2022.e09023. eCollection 2022 Mar.

Purpose: The structural appearance of each disabled athlete or the shape of their body, as determined by their individual genotype and influenced by the environment, considerably affects their technical and physical performance. This study sought to examine the morphological characteristics of elite track and field athletes with different disabilities, including their possible effects on physical and physiological performance. Methods: A total of 66 male elite athletes with cerebral palsy (n = 12), upper arm amputation (n = 12), short stature (n = 20), or intellectual disability (n = 22) were included. For each athlete, height, weight, sitting height, arm span and four skin folds were assessed; ape index, body mass index, body fat percentage, fat mass, fat mass index and fat-free mass values were calculated; and vertical jump, drop jump, countermovement jump, squat jump, repeated sprint ability and Yo-Yo Intermittent Recovery Level 1 tests were performed. Results: Significant differences were noticed between short stature and the other groups concerning morphological characteristics, however, the best motor performance was observed in amputees and, to a lesser degree, in short stature. In the top performing athletes, physical performance was significantly correlated with body mass index and fat mass index for amputees, and with arm span, ape index, body fat percentage and fat mass index for short stature. Regression analysis revealed that regardless of disability type, physical and physiological performance (except maximum heart rate) were significantly influenced primarily by adipose tissue-specific

variables. A significant effect of height, weight, fat free mass, arm span, sitting height, and ape index on drop jump performance with left leg, maximal oxygen consumption, and maximum heart rate was also noticed. The type of disability affects performance in the squat jump and vertical jump tests, and to a lesser extent in the countermovement jump test.

PMID: 35252618

5. Dual-task training effect on gait parameters in children with spastic diplegic cerebral palsy: Preliminary results of a self-controlled study
Eda Ozge Okur, Meltem Isintas Arik, Ismail Okur, Hasan Huseyin Gokpinar, Mintaze Kerem Gunel

Gait Posture. 2022 Feb 17;94:45-50. doi: 10.1016/j.gaitpost.2022.02.020. Online ahead of print.

Background: Children with cerebral palsy (CP) may have difficulties under dual-task conditions. Spatiotemporal gait parameters have deteriorated with concurrent tasks in children with CP. However, how dual-task training affects gait parameters in children with spastic diplegic CP has not been clarified. Research question: How does dual-task training program effect gait, functional skills, and health-related quality of life in children with spastic diplegic CP? Methods: Eleven children with spastic diplegic CP (median age 11 y, range 7-16 y; 4 female; 7 male) Gross Motor Function Classification System level 1 -2 and obtained 27 and higher scores from Modified Mini Mental Test included in the study. The study was planned as a self-controlled clinical research design. Children were recruited to conventional physiotherapy program for 8 weeks and dual-task training program added to conventional physiotherapy program for following 8 weeks. Children were evaluated at baseline, after conventional physiotherapy program, and after dual-task training program. Children's gait was evaluated with Zebris™ FDM-2 device and Edinburgh Visual Gait Score, functional mobility skills with 1 min Walk Test (1MWT), and health-related quality of life with the Pediatric Quality of Life Inventory (PedsQL) - CP module. Results: The difference in step length, step time, stride time, cadence and gait speed of spatiotemporal parameters of gait during dual-task performance were found statistically significant in children with spastic diplegic CP, after dual-task training program ($p < 0,05$). After dual-task training, statistically significant gains were found in 1MWT, movement and balance subtitle of PedsQL-CP module Parent Form ($p < 0,05$). Significance: Dual-task training program added to a conventional physiotherapy program provides more gains in terms of functionality of children with spastic diplegic CP will contribute to the improvement of the motor functional level.

PMID: 35247824

6. Effect of Pilates Exercises on Standing, Walking, and Balance in Children With Diplegic Cerebral Palsy
Hanaa Mohsen Abd-Elfattah, Dina Othman Shokri Morsi Galal, Mahmoud Ibrahim Elsayed Aly, Sobhy M Aly, Tamer Emam Elnegamy

Ann Rehabil Med. 2022 Feb;46(1):45-52. doi: 10.5535/arm.21148. Epub 2022 Feb 28.

Objective: To analyze how Pilates exercises affect standing, walking, and balance in children with diplegic cerebral palsy throughout a 10-week program. Methods: We included 40 children aged 7-9 years with diplegic cerebral palsy, and randomly allocated them into two groups of the same size: conventional therapy group (group A) and conventional therapy+Pilates group (group B). We administered the same conventional physical therapy program to both groups for 45 minutes, with group B receiving additional Pilates exercises for 45 minutes. Both groups attended the intervention program three times/week for 10 weeks. We used the Growth Motor Function Measure Scale (GMFM-88) to evaluate standing and walking (Dimensions D and E), and the Pediatric Balance Scale to evaluate balance function before and after treatment. Results: Comparison of the average values of all measured variables before and after therapy showed a statistically significant difference ($p<0.05$) between the two groups. All measured variables showed a significant difference between groups A and B, in favor of group B ($p<0.05$). Conclusion: Pilates exercise in addition to conventional therapy is more effective in improving balance and gross motor function in children with diplegic cerebral palsy than the conventional therapy alone.

PMID: 35272439

7. Comparison of dental treatments performed under general anesthesia for healthy and disabled children
Nasser Kaviani, Maryam Ghafournia, Salim Mirzaali, Shirin Marzoughi, Reza Salari-Moghaddam

Dent Res J (Isfahan). 2021 Dec 10;18:109. eCollection 2021.

Background: This study aimed to assess and compare the type of dental procedures performed under general anesthesia for healthy and disabled children. Materials and methods: This descriptive, cross-sectional study evaluated 361 dental records of children who received dental treatments under general anesthesia in the operating room of Torabinejad Research Center during 2011-2013. Patients with mental or physical disability were categorized as disabled. The age and gender of patients, number of treated teeth, duration of general anesthesia, type of tooth, and type of dental treatment such as extraction, pulp therapy, placement of stainless steel crowns, composite restoration, preventive resin restoration (PRR), fissure sealant treatment, and fluoride therapy were separately recorded for the healthy group and patients with disability. Data were analyzed using one-way ANOVA, and independent sample t-test at $P < 0.05$ level of significance. Results: Of 361 patients, 263 patients were healthy and 102 patients had disability. Of all disabled children, 48% had physical and 52% had mental disability. Among patients with physical disability, allergy (40%), followed by cardiovascular diseases (26%) were the most common. Mental retardation (54%) followed by cerebral palsy (10%) were the most common mental disabilities. Number of extracted teeth was significantly higher in disabled children ($P = 0.006$). Furthermore, disabled children received significantly lower PRR ($P = 0.015$), fissure sealant treatment ($P = 0.003$), fluoride therapy ($P = 0.002$), and pulp therapy ($P < 0.001$) compared with healthy children. Conclusion: Tooth extraction has a higher frequency in disabled children; while, attempts are made to preserve the teeth as much as possible in healthy children.

PMID: 35265292

8. Factors determining the need for general anesthesia to deliver dental treatment for adults with intellectual and developmental disabilities
Abdullah Aloufi, Fawz Alatawi, Faisal F Hakeem, Hassan Abed

Saudi J Anaesth. Jan-Mar 2022;16(1):24-28. doi: 10.4103/sja.sja_296_21. Epub 2022 Jan 4.

Aim: To investigate factors determining the need for general anesthesia (GA) to deliver dental treatment for adult people with intellectual and developmental disabilities (IDD). Methods: This study involved a retrospective review of medical records of adult patients with IDD who received dental treatment under GA at Tabuk Specialist Dental Center, Saudi Arabia, between 2018 and 2020. Demographic characteristics and dental-related details, level of cooperation, and methods of delivering dental treatment were collected. Results: A total of 86 adult patients with IDD were included. The mean age of the study participants was 34.8 years (standard deviation [SD] 6.5), and the majority were males (n = 47, 54.7%). Eighteen patients had aphasia (20.9%), 16 had epilepsy (18.6%), and 10 had cerebral palsy (11.6%). Most dental treatments delivered were complex dental treatments (n = 39, 45.3%) followed by dental extraction (n = 25, 29.1%), and non-surgical periodontal therapy (n = 22, 25.5%). Females had higher odds of undergoing GA compared to males (Odds ratio (OR) =6.79, 95% Confidence intervals (CI): 1.62-28.41). Furthermore, patients who had aphasia had higher odds of undergoing GA compared to patients who had no medical conditions (OR = 14.03, 95% CI: 1.05-186.7). Conclusion: Being female or having aphasia are independent factors related to the need for GA to deliver dental treatment for Saudi adults with IDD.

PMID: 35261584

9. Non-surgical interventions for the treatment of masticatory muscular spasticity in patients with cerebral palsy. Systematic review of randomized clinical trials
Monise Mendes Rocha, Ana Luiza Cabrera Martimbianco, Rafael Zaratin Beltramin, Anna Carolina Ratto Tempestini Horliana, Elaine Marcílio Santos, Raquel Agnelli Mesquita-Ferrari, Kristianne Porta Santos Fernandes, Lara Jansiski Motta, Karina Helga Turcio, Marcela Leticia Leal Gonçalves, Sandra Kalil Bussadori

Review J Bodyw Mov Ther. 2022 Jan;29:68-73. doi: 10.1016/j.jbmt.2021.09.020. Epub 2021 Oct 8.

Introduction: Muscle disorders caused by cerebral palsy (CP) can affect oral function. The treatment for masticatory muscle spasticity is important to minimize muscle hyperactivity and preclude oral damages. Objectives: To evaluate the efficacy and safety of non-surgical interventions for the treatment of masticatory muscle spasticity in CP patients. Methods: A comprehensive search was performed in the following databases: MEDLINE, Embase, Cochrane Library, LILACS, BBO, PEDro, Clinicaltrials.gov and WHO/ICTRP, without date and language restrictions. Randomized controlled trials (RCT) evaluating non-surgical interventions were considered. Primary outcomes such as masticatory function and adverse events were planned to be assessed. The risk of bias assessment was performed using the Cochrane risk of bias tool. The certainty of the evidence was assessed using the GRADE approach. Results: Three RCT assessing the effects of botulinum toxin, functional masticatory training and neuromuscular electrostimulation (NMES) were included. Evidence with a very low certainty showed: (i) no difference between botulinum toxin and placebo regarding maximum chewing strength, chewing efficiency and global oral health scale; (ii) improvement in masticatory function in favor of functional masticatory training versus conventional exercises, and (iii) in favor of strengthening exercises plus NMES versus placebo. Conclusions: There was insufficient evidence to support the use of botulinum toxin and masticatory muscle strengthening programs alone and associated with

NMES for the treatment of masticatory muscle in patients with PC. The clinical decision must be individualized, and further studies are needed to support or refute the use of different non-surgical interventions for PC. PROSPERO register number CRD42020209761.

PMID: 35248291

10. Longitudinal change in speech classification between 4 and 10 years in children with cerebral palsy
Helen L Long, Tristan J Mahr, Phoebe Natzke, Paul J Rathouz, Katherine C Hustad

Dev Med Child Neurol. 2022 Mar 9. doi: 10.1111/dmcn.15198. Online ahead of print.

Aim: To examine speech impairment severity classification over time in a longitudinal cohort of children with cerebral palsy (CP). Method: A total of 101 children (58 males, 43 females) between the ages of 4 and 10 years with CP participated in this longitudinal study. Speech severity was rated using the Viking Speech Scale (VSS), a four-level classification rating scale, at 4, 6, 8, and 10 years (age 4 years: mean = 52 months [3 SD]; age 6 years: mean = 75 months [2 SD]; age 8 years: mean = 100 months [4 SD]; age 10 years: mean = 125 months [5 SD]). We used Bayesian mixed-effects ordinal logistic regression to model (1) the extent to which speech severity changed over time and (2) patterns of change across age groups and classification rating group levels. Results: VSS ratings decreased (speech severity became less severe) between 4 and 10 years of age. Children who were first classified in VSS levels I, II, or III at age 4 years had a high probability of staying at, or improving to, VSS level I by 10 years. Children who were first classified in VSS level IV at 4 years had a high probability of remaining in VSS level IV at 10 years. Interpretation: Early speech performance is highly predictive of later childhood speech abilities. Children with any level of speech impairment at age 4 years should be receiving speech therapy. Those with more severe speech impairments should be introduced to augmentative and alternative communication as soon as possible.

PMID: 35262181

11. Neuromodulation: A combined-therapy protocol for speech rehabilitation in a child with cerebral palsy
Vania L C Carvalho Lima, Camila Cosmo, Kleber B Lima, Mariana A Martins, Suellen G Rossi, Luanda A Collange Grecco, Mauro Muzskat, Clara R Brandão de Ávila

J Bodyw Mov Ther. 2022 Jan;29:10-15. doi: 10.1016/j.jbmt.2021.09.002. Epub 2021 Sep 25.

Introduction: Transcranial direct current stimulation (tDCS) modulates cortical activity and potentiates functional gains achieved during therapeutic protocols. The aim of Integrative Speech Therapy Protocol is to rehabilitate speech in patients with impairments regarding neuropyschomotor development by combining oral motor stimuli, specific articulatory production, and the stimulation of phonological aspects of language. Objective: Investigate the effect of transcranial direct current stimulation combined to integrative speech therapy in a child with cerebral palsy. Methods: We performed a case study with tDCS and speech therapy in a patient with cerebral palsy and apraxia of speech. To assess the patient's speech, we used a parameterized test for the Brazilian Portuguese speech - ABFW. The CFCS and Vicking Speech Scales presented level IV and III, respectively. The patient underwent two periods with ten stimulation sessions each: first with anodal stimulation over Broca's area; and second over the left dorsolateral prefrontal cortex. Two indices were calculated: the percentage of consonants correct; and percentage of consonants correct-revised. Descriptive statistics were employed for the clinical data. For the outcomes, changes in each score were calculated as the difference in pre-intervention and post-intervention using Wilcoxon-Mann-Whitney test. Results: Increases were found in percentage of correct consonants indices as well as to produce two-syllable and three-syllable words after both types of stimulation, characterized mainly by correct vowels that marked the presence of the syllable. Number of phonemes increased 0 to 4 at first the stimulation and 4 to 10 at the second. Conclusion: The combined-therapy program contributed to improve the speech rehabilitation results in a patient with cerebral palsy.

PMID: 35248256

12. Preliminary testing of eye gaze interfaces for controlling a haptic system intended to support play in children with physical impairments: Attentive versus explicit interfaces
Javier L Castellanos-Cruz, María F Gómez-Medina, Mahdi Tavakoli, Patrick Pilarski, Kim D Adams

J Rehabil Assist Technol Eng. 2022 Feb 28;9:20556683221079694. doi: 10.1177/20556683221079694. eCollection Jan-Dec 2022.

Introduction: Children with physical impairments may face challenges to play because of their motor impairments, which could lead to negative impacts in their development. The objective of this article was to compare two eye gaze interfaces that identified the desired toy a user wanted to reach with a haptic-enabled telerobotic system in a play activity. Methods: One of the interfaces was an attentive user interface predicted the toy that children wanted to reach by observing where they incidentally focused their gaze. The other was an explicit eye input interface determined the toy after the child dwelled for 500 ms on a selection point. Five typically developing children, an adult with cerebral palsy (CP) and a child with CP participated in this study. They controlled the robotic system to play a whack-a-mole game. Results: The prediction accuracy of the attentive interface was higher than 89% in average, for all participants. All participants did the activity faster with the attentive interface than with the explicit interface. Conclusions: Overall, the attentive interface was faster and easier to use, especially for children. Children needed constant prompting and were not 100% successful at using the explicit interface.

PMID: 35251686

13. Declining trends in birth prevalence and severity of singletons with cerebral palsy of prenatal or perinatal origin in Australia: A population-based observational study
Hayley Smithers-Sheedy, Emma Waight, Shona Goldsmith, Sue Reid, Catherine Gibson, Linda Watson, Megan Auld, Nadia Badawi, Annabel Webb, Leanne Diviney, Sarah Mcintyre, Australian Cerebral Palsy Register Group

Dev Med Child Neurol. 2022 Mar 8. doi: 10.1111/dmcn.15195. Online ahead of print.

Aim: To investigate temporal trends in birth prevalence, disability severity, and motor type for singletons with prenatal or perinatally acquired cerebral palsy (CP). Method: Numerator data, number of children with CP born a singleton between 1995 and 2014, confirmed at 5 years of age, were drawn from three state registers with population-level ascertainment. Birth prevalence estimates and 95% confidence intervals (CI) were calculated per 1000 singleton live births for the three states combined, overall, by gestational age group, by dichotomized disability severity, and spastic laterality. Poisson regression models were used to analyse trends. Using data from all eight registers, trends in the proportional distribution of CP subtypes overall and stratified by gestational age were examined. Results: Birth prevalence of CP declined from 1.8 (95% CI 1.6-2.0) in 1995 to 1996 to 1.2 (95% CI 1.1-1.4) in 2013 to 2014 (average 5% per 2-year epoch, $p < 0.001$). Declines in birth prevalence were observed across all gestational age groups with the largest decline in children born at <28 weeks (average 8% per epoch, $p < 0.001$). Prevalence of moderate-severe disability declined for children born at <28 and ≥37 weeks (average 11% and 7% per epoch respectively, $p < 0.001$). The proportions of bilateral spastic CP declined ($p < 0.001$) at <28 weeks ($p = 0.014$) and ≥37 weeks ($p < 0.001$). The proportion of children with dyskinesia increased (28-31 weeks: $p = 0.021$, 32-36 weeks: $p = 0.001$, and ≥37 weeks: $p < 0.001$). Interpretation: Birth prevalence of CP and moderate-severe disability (<28 and ≥37 weeks) declined in Australian singletons between 1995 and 2014, reflecting changes in prenatal and perinatal care over time.

PMID: 35261024

14. Status Dystonicus in Children: A Cross-Sectional Study and Review of Literature
Arushi Gahlot Saini, Ijas Hassan, Kanika Sharma, Jayashree Muralidharan, Sumeet Dhawan, Lokesh Saini, Renu Suthar, Jitendra Sahu, Naveen Sankhyan, Pratibha Singhi

J Child Neurol. 2022 Mar 7;8830738221081593. doi: 10.1177/08830738221081593. Online ahead of print.

Background: Status dystonicus is a life-threatening, underrecognized movement disorder emergency. We aimed to ascertain the etiology, clinical presentation, complications, and outcomes of status dystonicus in children and reviewed the literature for similar studies. Methods: Records of all children aged <14 years admitted to a single center with status dystonicus between 2014 and 2018 were reviewed. Results: Twenty-four children (75% male) were identified with status dystonicus. The annual incidence rate was 0.05 per 1000 new admissions <12 years of age. The mean age at presentation was 6.3 ± 3.6 years. Median duration of hospital stay was 10.5 days (interquartile range 5-21.7). The severity of dystonia at presentation was grade 3 (n = 9; 37.5%) and 4 (n = 9; 37.5%). The most common triggering factor was intercurrent illness/infection (n = 18; 75%). The most common underlying etiologies were cerebral palsy (n = 8; 33.3%), complicated tubercular meningitis (n = 3; 12.5%), and mitochondrial disorders (n = 3; 12.5%). Basal ganglia involvement was seen in 15 cases (62.5%). Respiratory and/or bulbar compromise (n = 20; 83.3%) and rhabdomyolysis (n = 15; 62.5%) were most commonly seen. Oral trihexyphenidyl (96%) followed by oral or intravenous diazepam (71%), oral baclofen (67%), and midazolam infusion (54%) were the most common drugs used. Clonidine was used in 33% cases, without any significant side effects. Three children died owing to refractory status dystonicus and its complications; the mortality rate was 12.5%. Conclusion Status dystonicus is a neurologic emergency in children with severe dystonia, with significant complications and a high mortality rate. Static and acquired disorders are more common than heredo-familial causes. Identification and treatment of infection in children is important as the majority of cases are triggered by an intercurrent infection.

PMID: 35253510

15. Physical and occupational therapy utilization and associated factors among adults with cerebral palsy: Longitudinal modelling to capture distinct utilization groups
Benjamin C Conner, Tao Xu, Neil S Kamdar, Heidi Haapala, Daniel G Whitney

Disabil Health J. 2022 Feb 15;101279. doi: 10.1016/j.dhjo.2022.101279. Online ahead of print.

Background: Adults with cerebral palsy (CP) experience functional declines. Clinical rehabilitation may preserve function for this population. Objective: To identify longitudinal physical/occupational therapy use and associated factors among adults with CP, to inform health promotion strategies. Methods: A retrospective cohort study including adults ≥ 18 years of age with CP was performed using a random 20% Medicare fee-for-service dataset. Participants with continuous medicare enrolment from 01/01/2016-12/31/2018 were included: 2016 was the one-year baseline period; 2017-2018 was the two-year follow-up. Therapy included an indication of physical, occupational, or other forms of therapy. Two-year therapy use patterns were identified using group-based trajectory modeling. Multivariable multinomial logistic regression models identified associations between baseline characteristics with trajectory groups. Results: Of 17,441, 7231 (41.5%) adults with CP had therapy use across the three-year period, and six longitudinal therapy trajectories were identified: the majority (42.5%) were low-consistent users, 13.4% moderate-consistent users, 4.4% high-consistent users, and the remaining variable users. Associations between baseline characteristics (e.g., age, sex, comorbidities) with trajectory groups varied. For example, using the low-consistent users as the reference, Black versus White were 49% less likely, Northeast versus South residency were 7.52-fold more likely, and co-occurring neurologic conditions versus CP only were up to 118% more likely to be high-consistent users (all, $P < 0.05$). Bone fragility and some chronic comorbidities were associated with moderate consistent users. Conclusions: The majority of adults with CP were not using physical/occupational therapy. Of those that did, there were unique longitudinal trajectories which associated differently with demographics and comorbidities.

PMID: 35264292

16. PREDICITION OF CEREBRAL PALSY OR DEATH AMONG PRETERM INFANTS WHO SURVIVE THE NEONATAL PERIOD
Alan Peaceman, Lisa Mele, Dwight J Rouse, Kenneth J Leveno, Brian Mercer, Michael Varner, Uma M Reddy, Ronald Wapner, Yoram Sorokin, John M Thorp, Susan Ramin, Fergal Malone, Mary J O'Sullivan, Donald J Dudley, Steve N Caritis

Clinical Trial Am J Perinatol. 2022 Mar 4. doi: 10.1055/a-1788-6281. Online ahead of print.

Objective: To assess whether neonatal morbidities evident by the time of hospital discharge are associated with subsequent CP or death. Study design: This is a secondary analysis of data from a multi-center placebo-controlled trial of magnesium sulfate for the prevention of CP. The association between pre-specified intermediate neonatal outcomes (n=11) and demographic and clinical factors (n=10) evident by the time of discharge among surviving infants (n=1889) and the primary outcome of death or moderate/severe CP at age 2 (n=73) was estimated, and a prediction model was created. Results: Gestational age in weeks at delivery (OR 0.74, 95% CI 0.67-0.83), grade III or IV intraventricular hemorrhage (IVH) (OR 5.3, CI 2.1-13.1), periventricular leukomalacia (PVL) (OR 46.4, CI 20.6-104.6), and male gender (OR 2.5, CI 1.4-4.5) were associated with death or moderate/ severe CP by age 2. Outcomes not significantly associated with the primary outcome included respiratory distress syndrome, bronchopulmonary dysplasia, seizure, necrotizing enterocolitis, neonatal hypotension, 5 minute Apgar score, sepsis, and retinopathy of prematurity. Using all patients, the ROC curve for the final prediction model had an area under the curve of 0.84. Using these data, the risk of death or developing CP by age 2 can be calculated for individual surviving infants. Conclusion: IVH and PVL were the only neonatal complications evident at discharge that contributed to an individual infant's risk of the long-term outcomes of death or CP by age 2. A model that includes these morbidities, gestational age at delivery, and gender is predictive of subsequent neurologic sequelae.

PMID: 35253117

17. Antenatal Betamethasone Every 12 Hours in Imminent Preterm Labour
Natalia Saldaña-García, María Gracia Espinosa-Fernández, Jose David Martínez-Pajares, Elías Tapia-Moreno, María Moreno-Samos, Celia Cuenca-Marín, Francisca Rius-Díaz, Tomás Sánchez-Tamayo

J Clin Med. 2022 Feb 24;11(5):1227. doi: 10.3390/jcm11051227.

Background: Benefits of antenatal corticosteroids have been established for preterm infants who have received the full course.

In imminent preterm labours there is no time to administer the second dose 24 h later. Objective: To determine whether the administration of two doses of betamethasone in a 12 h interval is equivalent to the effects of a full maturation. Methods: We performed a retrospective cohort study including preterm infants ≤34 weeks gestational age at birth and ≤1500 g, admitted to an NICU IIIC level in a tertiary hospital from 2015 to 2020. The population was divided into two cohorts: complete maturation (CM) (two doses of betamethasone 24 h apart), or advanced maturation (AM) (two doses of betamethasone 12 h apart). The primary outcomes were mortality or survival with severe morbidities. The presence of respiratory distress syndrome and other morbidities of prematurity were determined. These variables were analysed in the neonates under 28 weeks gestational age cohort. Neurodevelopment at 2 years was evaluated with the validated Ages and Stages Questionnaires®, Third Edition (ASQ®-3). Multiple regression analyses were performed and adjusted for confounding factors. Results: A total of 275 preterm neonates were included. Serious outcomes did not show differences between cohorts, no increased incidence of morbidity was found in AM. A lower percentage of hypotension during the first week ($p = 0.04$), a tendency towards lower maximum $FiO2$ ($p = 0.14$) and to a shorter mechanical ventilation time ($p = 0.14$) were observed for the AM cohort. Similar results were found in the subgroup of neonates under 28 weeks gestational age. There were no differences in cerebral palsy or sensory deficits at 24 months of corrected age, although the AM cohort showed a trend towards better scores on the ASQ3 scale. Conclusions: Administration of betamethasone every 12 h showed similar results to the traditional pattern with respect to mortality and severe morbidities. No deleterious neurodevelopmental effects were found at 24 months of corrected age. Earlier administration of betamethasone at 12 h after the first dose would be an alternative in imminent preterm delivery. Further studies are needed to confirm these results.

PMID: 35268318

18. Role of Nuclear-Receptor-Related 1 in the Synergistic Neuroprotective Effect of Umbilical Cord Blood and Erythropoietin Combination Therapy in Hypoxic Ischemic Encephalopathy
Joo-Wan Choi, Su Jung Kang, Jee In Choi, KyuBum Kwack, MinYoung Kim

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Neonatal hypoxic-ischemic encephalopathy (HIE) results in neurological impairments; cell-based therapy has been suggested as a therapeutic avenue. Previous research has demonstrated the synergistically potentiated therapeutic efficacy of human umbilical cord blood (UCB) by combining recombinant human erythropoietin (EPO) treatment for recovery from HIE. However, its molecular mechanism is not entirely understood. In the present study, we analyzed the mechanisms underlying the effect of combination treatment with EPO and UCB by transcriptomic analysis, followed by gene enrichment analysis. Mouse HIE model of the neonate was prepared and randomly divided into five groups: sham, HIE, and UCB, EPO, and UCB+EPO treatments after HIE. A total of 376 genes were differentially expressed when $|\log2FC| \geq 1$-fold change expression values were considered to be differentially expressed between UCB+EPO and HIE. Further assessment through qRT-PCR and gene enrichment analysis confirmed the expression and correlation of its potential target, Nurr1, as an essential gene involved in the synergistic effect of the UCB+EPO combination. The results indicated the remarkable activation of Wnt/β-catenin signaling by reducing the infarct size by UCB+EPO treatment, accompanied by Nurr1 activity. In conclusion, these findings suggest that the regulation of Nurr1 through the Wnt/β-catenin pathway exerts a synergistic neuroprotective effect in UCB and EPO combination treatment.

PMID: 35270042

19. Brain outcomes in runted piglets: a translational model of fetal growth restriction
Kirat K Chand, Kerstin Pannek, Paul B Colditz, Julie A Wixey

Review Dev Neurosci. 2022 Mar 9. doi: 10.1159/000523995. Online ahead of print.

Fetal growth restriction (FGR) is associated with long-term neurodevelopmental disabilities including learning and behavioural disorders, autism, and cerebral palsy. Persistent changes in brain structure and function that are associated with developmental disabilities are demonstrated in FGR neonates. However, the mechanisms underlying these changes remain to be determined. There are currently no therapeutic interventions available to protect the FGR newborn brain. With the wide range of long-term neurodevelopmental disorders associated with FGR, the use of an animal model appropriate to investigating mechanisms of injury in the FGR newborn is crucial for the development of effective and targeted therapies for babies. Piglets are ideal animals to explore how perinatal insults affect brain structure and function. FGR occurs spontaneously in the piglet, unlike other animal models that require surgical or chemical intervention, allowing brain outcomes to be studied without the confounding impacts of experimental interventions. The FGR piglet mimics many of the human pathophysiological outcomes associated with FGR including asymmetrical growth restriction with brain sparing. This review will discuss the similarities observed in brain outcomes between the human FGR and FGR piglet from a magnetic resonance imaging in the living and a histological perspective. FGR piglet studies provide the opportunity to determine and track mechanisms of brain injury in a clinically relevant animal model of FGR. Findings from these FGR piglet studies may provide critical information to rapidly

translate neuroprotective interventions to clinic to improve outcomes for newborn babies.

PMID: 35263744

20. Dysregulation of multiple signaling pathways: A possible cause of cerebral palsy
Jyoti Upadhyay, Mohd Nazam Ansari, Abdul Samad, Ashutosh Sayana

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Cerebral palsy (CP) is a lifelong disability characterized by the impairment of brain functions that result in improper posture and abnormal motor patterns. Understanding this brain abnormality and the role of genetic, epigenetic, and non-genetic factors such as signaling pathway dysregulation and cytokine dysregulation in the pathogenesis of CP is a complex process. Hypoxic-ischemic injury and prematurity are two well-known contributors of CP. Like in the case of other neurodevelopmental disorders such as intellectual disability and autism, the genomic constituents in CP are highly complex. The neuroinflammation that is triggered by maternal cytokine response plays a critical role in the pathogenesis of fetal inflammation response, which is one of the contributing factors of CP, and it continues even after the birth of children suffering from CP. Canonical Wnt signaling pathway is important for the development of mammalian fetal brain and it regulates distinct processes including neurogenesis. The glycogen synthase kinase-3 (GSK-3) antagonistic activity in the Wnt signaling pathway plays a crucial role in neurogenesis and neural development. In this review, we investigated several genetic and non-genetic pathways that are involved in the pathogenesis of CP and their regulation, impairment, and implications for causing CP during embryonic growth and developmental period. Investigating the role of these pathways help to develop novel therapeutic interventions and biomarkers for early diagnosis and treatment. This review also helps us to comprehend the mechanical approach of various signaling pathways, as well as their consequences and relevance in the understanding of CP.

PMID: 35253451

21. Maternal Cigarette Smoke Exposure Exaggerates the Behavioral Defects and Neuronal Loss Caused by Hypoxic-Ischemic Brain Injury in Female Offspring
Taida Huang, Xiaomin Huang, Hui Li, Junhua Qi, Nan Wang, Yi Xu, Yunxin Zeng, Xuewen Xiao, Ruide Liu, Yik Lung Chan, Brian G Oliver, Chenju Yi, Dan Li, Hui Chen

Front Cell Neurosci. 2022 Feb 18;16:818536. doi: 10.3389/fncel.2022.818536. eCollection 2022.

Objective: Hypoxic-ischemic encephalopathy affects ~6 in 1,000 preterm neonates, leading to significant neurological sequela (e.g., cognitive deficits and cerebral palsy). Maternal smoke exposure (SE) is one of the common causes of neurological disorders; however, female offspring seems to be less affected than males in our previous study. We also showed that maternal SE exaggerated neurological disorders caused by neonatal hypoxic-ischemic brain injury in adolescent male offspring. Here, we aimed to examine whether female littermates of these males are protected from such insult. Methods: BALB/c dams were exposed to cigarette smoke generated from 2 cigarettes twice daily for 6 weeks before mating, during gestation and lactation. To induce hypoxic-ischemic brain injury, half of the pups from each litter underwent left carotid artery occlusion, followed by exposure to 8% oxygen (92% nitrogen) at postnatal day (P) 10. Behavioral tests were performed at P40-44, and brain tissues were collected at P45. Results: Maternal SE worsened the defects in short-term memory and motor function in females with hypoxic-ischemic injury; however, reduced anxiety due to injury was observed in the control offspring, but not the SE offspring. Both hypoxic-ischemic injury and maternal SE caused significant loss of neuronal cells and synaptic proteins, along with increased oxidative stress and inflammatory responses. Conclusion: Oxidative stress and inflammatory response due to maternal SE may be the mechanism of worsened neurological outcomes by hypoxic-ischemic brain injury in females, which was similar to their male littermates shown in our previous study.

PMID: 35250486

22. Postmortem Diagnostic Overshadowing: Reporting Cerebral Palsy on Death Certificates
Scott D Landes, J Dalton Stevens, Margaret A Turk

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Postmortem diagnostic overshadowing-defined as inaccurately reporting a disability as the underlying cause of death-occurs for over half of adults with cerebral palsy. This practice obscures cause of death trends, reducing the effectiveness of efforts to

reduce premature mortality among this marginalized health population. Using data from the National Vital Statistics System 2005 to 2017 U.S. Multiple Cause of Death files (N = 29,996), we identify factors (sociodemographic characteristics, aspects of the context and processing of death, and comorbidities) associated with the inaccurate reporting of cerebral palsy as the underlying cause of death. Results suggest that inaccurate reporting is associated with heightened contexts of clinical uncertainty, the false equivalence of disability and health, and potential racial-ethnic bias. Ending postmortem diagnostic overshadowing will require training on disability and health for those certifying death certificates and efforts to redress ableist death certification policies.

PMID: 35266426

23. Analysis of Informative Content on Cerebral Palsy Presented in Brazilian-Portuguese YouTube Videos
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Phys Occup Ther Pediatr. 2022 Mar 6;1-15. doi: 10.1080/01942638.2022.2046677. Online ahead of print.

Aims: To describe the characteristics of the most accessed YouTube videos in Brazilian-Portuguese on cerebral palsy (CP), and to analyze content of informational videos about this topic.Methods: This was a cross-sectional study. Searching on YouTube website was conducted by two independent examiners between November and December 2019, using the keywords "Paralisia Cerebral" sorted by videos' number of views. Videos that did not present content related to CP or duplicate videos were excluded. The interaction parameters and content characteristics of the included videos were extracted. To access the trustworthiness and quality of informational videos, the modified Discern checklist and the Global Quality Score was used.Results: Following the eligibility criteria 90 videos were included. Fifty-three (53) were classified as experiential videos and 37 as informational videos. Informational videos presented multi-topics about different aspects of CP. This group of videos presented moderate trustworthiness due to the lack of scientific evidence content. Informational videos had good quality and generally good flow.Conclusion: YouTube presented a large number of videos about CP in Brazilian-Portuguese. Informational videos are useful for patients and healthcare providers; however, it is necessary to included information about scientific evidence, as a strategy to facilitate and promote knowledge translation.

PMID: 35253603