

Monday 16 April 2018

Cerebral Palsy Alliance is delighted to bring you this free weekly bulletin of the latest published research into cerebral palsy. Our organisation is committed to supporting cerebral palsy research worldwide - through information, education, collaboration and funding. Find out more at research.cerebralpalsy.org.au

Professor Nadia Badawi AM

Macquarie Group Foundation Chair of Cerebral Palsy

[Subscribe to CP Research News](#)

Please note: This research bulletin represents only the search results for cerebral palsy and related neurological research as provided by the PubCrawler service. The articles listed below do not represent the views of Cerebral Palsy Alliance.

Interventions and Management

1. Enabling physical activity participation for children and youth with disabilities following a goal-directed, family-centred intervention.

Willis C, Nyquist A, Jahnsen R, Elliott C, Ullenhag A.

Res Dev Disabil. 2018 Apr 7;77:30-39. doi: 10.1016/j.ridd.2018.03.010. [Epub ahead of print]

BACKGROUND: There is a paucity of research demonstrating the optimisation and maintenance of participation outcomes following physical activity interventions for children and youth with disabilities. **AIM:** To evaluate changes in physical activity participation in children with disabilities following a goal-directed, family-centred intervention at a healthsports centre, and to identify factors influencing participation following the intervention. **METHODS AND PROCEDURES:** A mixed methods pre-test post-test cohort design was applied. Recruitment occurred over a 12 month period during standard clinical service provision. The Canadian Occupational Performance Measure (COPM) was administered to children and parents pre (T1) and post-intervention (T2), and at 12 weeks follow-up (T3). Goal Attainment Scaling (GAS) was applied to assess outcomes at 12 weeks follow-up (T2-T3). Qualitative inquiry described barriers to goal attainment at T3. **OUTCOMES AND RESULTS:** Ninety two children with a range of disabilities (mean age 11.1yr; 49 males) were included in the study. Statistically significant and clinically meaningful improvements in parent ratings of COPM performance and satisfaction of participation goals were observed following intervention. Ratings at 12 weeks follow-up remained significantly higher than baseline, and 32% of children attained their COPM-derived GAS goal. Environmental factors were the most frequent barrier to goal attainment following intervention. **CONCLUSION AND IMPLICATIONS:** These results provide preliminary evidence for goal-directed, family-centred interventions to optimise physical activity participation outcomes for children with disabilities.

[PMID: 29635224](#)

2. Effects of a School-Based Sports Program on Physical Fitness, Physical Activity, and Cardiometabolic Health in Youth With Physical Disabilities: Data From the Sport-2-Stay-Fit Study.

Zwinkels M, Verschuren O, Balemans A, Lankhorst K, Te Velde S, van Gaalen L, de Groot J, Visser-Meily A, Takken T.

Front Pediatr. 2018 Mar 26;6:75. doi: 10.3389/fped.2018.00075. eCollection 2018.

OBJECTIVE: To investigate the effects of a school-based once-a-week sports program on physical fitness, physical activity, and cardiometabolic health in children and adolescents with a physical disability. **METHODS:** This controlled clinical trial included 71 children and adolescents from four schools for special education [mean age 13.7 (2.9) years, range 8-19, 55% boys]. Participants had various chronic health conditions including cerebral palsy (37%), other neuromuscular (44%), metabolic (8%), musculoskeletal (7%), and cardiovascular (4%) disorders. Before recruitment and based on the presence of school-based sports, schools were assigned as sport or control group. School-based sports were initiated and provided by motivated experienced physical educators. The sport group (n = 31) participated in a once-a-week school-based sports program for 6 months, which included team sports. The control group (n = 40) followed the regular curriculum. Anaerobic performance was assessed by the Muscle Power Sprint Test. Secondary outcome measures included aerobic performance,

VO2 peak, strength, physical activity, blood pressure, arterial stiffness, body composition, and the metabolic profile. RESULTS: A significant improvement of 16% in favor of the sport group was found for anaerobic performance ($p = 0.003$). In addition, the sport group lost 2.8% more fat mass compared to the control group ($p = 0.007$). No changes were found for aerobic performance, VO2 peak, physical activity, blood pressure, arterial stiffness, and the metabolic profile. CONCLUSION: Anaerobic performance and fat mass improved following a school-based sports program. These effects are promising for long-term fitness and health promotion, because sports sessions at school eliminate certain barriers for sports participation and adding a once-a-week sports session showed already positive effects for 6 months. CLINICAL TRIAL REGISTRATION: This trial was registered with the Dutch Trial Registry (NTR4698).

[PMID: 29632853](#)

3. The long-term effects of conductive education courses in young children with cerebral palsy: a randomized controlled trial.

Myrhaug HT, Odgaard-Jensen J, Jahnsen R.

Dev Neurorehabil. 2018 Apr 12:1-9. doi: 10.1080/17518423.2018.1460771. [Epub ahead of print]

PURPOSE: To assess the additional long-term effects of multiple conductive education (CE) courses followed by conventional practice on functional skills and quality of life in children with cerebral palsy (CP) compared to a 4-month CE-course delay including conventional practice. METHODS: Twenty-one children with CP, 3-6 years and varied functional levels, were randomized to 3-week CE course(s) followed by conventional practice or 4 months on a waiting list, including conventional practice and followed by CE-courses. Outcomes were measured 8 and 12 months after baseline. A web-based log collected data on conventional practice. RESULTS: We found no interaction between group assignment and time on functional skills and quality of life in children with CP at 8 and 12 months. Two thirds of the children in both groups performed a large amount of conventional practice. CONCLUSIONS: No added long-term effects of CE courses were found. Larger controlled CE studies are needed.

[PMID: 29648488](#)

4. Trunk control and functionality in children with spastic cerebral palsy.

Kallem Seyyar G, Aras B, Aras O.

Dev Neurorehabil. 2018 Apr 13:1-6. doi: 10.1080/17518423.2018.1460879. [Epub ahead of print]

PURPOSE: To investigate the relationship between trunk control in sitting and functionality in children with spastic cerebral palsy (CP). METHODS: Fifty-eight children with spastic CP were included in the study. Functional abilities were evaluated with the Gross Motor Function Measurement-88 (GMFM-88) and the Pediatric Evaluation of Disability Inventory Functional Skills domain (PEDI-FSD). Trunk control in sitting was tested with the Trunk Control Measurement Scale (TCMS) and the Trunk Impairment Scale (TIS). The scores of the TCMS and TIS were compared with GMFM-88 and PEDI-FSD with Spearman correlation analysis. RESULTS: The total score of GMFM-88 was significantly correlated with the total score of TCMS ($\rho = 0.90$, $p < 0.01$) and TIS ($\rho = 0.78$, $p < 0.01$). The total score of PEDI-FSD was also significantly correlated with the total score of TCMS ($\rho = 0.76$, $p < 0.01$) and TIS ($\rho = 0.72$, $p < 0.01$). CONCLUSIONS: The evaluation of trunk control can provide valuable information for functional abilities of children with spastic CP.

[PMID: 29652201](#)

5. Are clinic-based walking measures associated with community walking activity in children with cerebral palsy?

Wittry S, Tsao E, Bjornson K.

J Pediatr Rehabil Med. 2018;11(1):23-30. doi: 10.3233/PRM-160425.

PURPOSE: To examine the relationship between clinic-based walking capacity measures and community-based walking activity in ambulatory children with cerebral palsy (CP). METHODS: A secondary analysis of a cross-sectional cohort was employed at tertiary care children's hospital; $n = 128$, ages 2-9 years, Gross Motor Function Classification System (GMFCS) I-III. Walking capacity was captured with 1- and 6-minute walk tests (1MWT, 6MWT), Gross Motor Function Measure-walk/run/jump score (GMFM-E), and Activity Scale for Kids performance version (ASKp-30). Walking activity performance in the community was quantified by StepWatch (SW). RESULTS: Moderate correlations were documented for 6MWT to SW outputs

of walking level, moderate high intensity, 60-minute peak and peak activity index ($r=0.55-0.58$, $p<0.01$). GMFM-E correlated with all SW outputs ($r=0.55-0.69$, $p<0.01$) except 1-minute peak walking rate. Per regression modeling, GMFM-E was associated with walking level and intensity ($p<0.02$) and 6MWT related to high intensity walking ($p<0.4$, $R^2=0.28-0.48$). CONCLUSION: 6MWT and GMFM-E have the strongest associations with level, amount and intensity of walking in daily life. Results suggest that the 6MWT and GMFM-E can be employed to estimate community walking activity in ambulatory children with CP. Future studies should focus on environmental and personal factors that influence community walking performance.

[PMID: 29630560](#)

6. Relationship between habitual physical activity, motor capacity, and capability in children with cerebral palsy aged 4-5 years across all functional abilities.

Keawutan P, Bell KL, Oftedal S, Davies PSW, Ware RS, Boyd RN.

Disabil Health J. 2018 Apr 3. pii: S1936-6574(18)30048-7. doi: 10.1016/j.dhjo.2018.03.006. [Epub ahead of print]

BACKGROUND: Children with cerebral palsy (CP) have lower habitual physical activity (HPA) than their typically developing peers. There are limited studies of HPA in young children with CP under the age of 5 years. OBJECTIVE: To investigate the relationships between HPA, sedentary time, motor capacity and capability in children with CP aged 4-5 years. METHODS: Sixty-seven participants were classified using Gross Motor Function Classification System (GMFCS), assessed for motor capacity using Gross Motor Function Measure (GMFM) and wore accelerometers for three days to measure HPA and sedentary time. Motor capability was assessed using parent-reported Pediatric Evaluation of Disability Inventory (PEDI) functional skills of mobility domain. Mixed-effects regression models were used for analyses. RESULTS: GMFM was positively associated with HPA (mean difference (MD) = 19.6 counts/min; 95%CI = 16.6 to 22.7, $p<0.001$) and negatively associated with sedentary time (MD = -0.6%; 95%CI = -0.7 to -0.5, $p<0.001$). The PEDI was also positively associated with HPA (MD = 16.0 counts/min; 95%CI = 13.1 to 18.8, $p<0.001$) and negatively associated with sedentary time (MD = -0.5%; 95%CI = -0.6 to -0.4, $p<0.001$). After stratification for ambulatory status, GMFM and PEDI were associated with HPA and sedentary time in ambulant participants but not in non-ambulant participants. CONCLUSIONS: Gross motor capacity and motor capability are related to HPA and sedentary time in ambulant children with CP aged 4-5 years.

[PMID: 29628361](#)

7. Effects of Kinesio taping in rectus femoris activity and sit-to-stand movement in children with unilateral cerebral palsy: placebo-controlled, repeated-measure design.

Dos Santos AN, Pessarelli Visicatto L, de Oliveira AB, Rocha NACF.

Disabil Rehabil. 2018 Apr 10:1-11. doi: 10.1080/09638288.2018.1458912. [Epub ahead of print]

BACKGROUND: Although it has been commonly used in rehabilitation sets, there is a lack of studies verifying the effects of Kinesio taping to improve functionality in children with Cerebral Palsy (CP). This information would promote evidence-based practice. PURPOSE: To verify the effects of Kinesio taping in the performance of sit-to-stand movement in children with unilateral CP. METHODS AND MATERIALS: A blinded, single placebo-controlled and repeated-measure design. The setting was the rehabilitation clinic of the university and care facilities. A total of 11 children from 6 to 12 years of age (mean: 10.5 years; standard deviation: 2.8 years) and classified as levels I and II by the Gross Motor Function Classification System were included. Kinesio taping was applied over the rectus femoris of the affected limb. Three taping conditions were used: Kinesio taping, without Kinesio taping and placebo. Three seat heights were used: neutral (100%), lowered (80%), and elevated (120%). Muscle activity (electromyography) and trunk and lower limb alignment (kinematics) were evaluated as body structures and function measures. The time required to perform sit-to-stand was used as a functionality measure. Mixed analysis of variation (ANOVA) measured angular variables of the hip, knee, ankle, and rectus femoris activity. Repeated ANOVA measured angular variables of trunk and pelvis and total duration. Significance was accepted for values of $p\leq0.05$. RESULTS: Kinesio taping increased rectus femoris activity, decreased peak flexion of the trunk, knee, hip, and ankle, and increased trunk extension in the end of sit-to-stand when compared with without Kinesio taping and placebo. Total duration was decreased with lower effect sizes. CONCLUSIONS: Immediate application of Kinesio taping modified body structures and function measures during sit-to-stand in children with unilateral CP, but it did not alter functionality. Implications for Rehabilitation Evidence-based practice about the use of Kinesio taping in Cerebral Palsy. Knowledge about alternative rehabilitation techniques in Cerebral Palsy. Knowledge about sensory stimulation in Cerebral Palsy. Effectiveness of Kinesio taping in muscle activation.

[PMID: 29631457](#)

8. Flexed-knee gait in children with cerebral palsy.

Church C, Ge J, Hager S, Haumont T, Lennon N, Niiler T, Hulbert R, Miller F.

Bone Joint J. 2018 Apr 1;100-B(4):549-556. doi: 10.1302/0301-620X.100B4.BJJ-2017-0732.R1.

Aims The purpose of this study was to evaluate the long-term outcome of adolescents with cerebral palsy who have undergone single-event multilevel surgery for a flexed-knee gait, followed into young adulthood using 3D motion analysis. **Patients and Methods** A total of 59 young adults with spastic cerebral palsy, with a mean age of 26 years (sd 3), were enrolled into the study in which their gait was compared with an evaluation that had taken place a mean of 12 years (sd 2) previously. At their visits during adolescence, the children walked with excessive flexion of the knee at initial contact and surgical or therapeutic interventions were not controlled between visits. **Results** Based on the change in flexed-knee gait over approximately ten years, improvements were seen in increased Gait Deviation Index ($p < 0.001$) and decreased flexion of the knee at initial contact ($p < 0.001$). Greater popliteal angle ($p < 0.001$), reduced Gross Motor Function Measure section D ($p = 0.006$), and reduced speed of gait ($p = 0.007$) suggested a mild decline in function. Quality-of-life measures showed that these patients fell within normal limits compared with typical young adults in areas other than physical function. **Conclusion** While some small significant changes were noted, little clinically significant change was seen in function and gait, with gross motor function maintained between adolescence and young adulthood. Cite this article: Bone Joint J 2018;100-B:549-56.

[PMID: 29629589](#)

9. Associations between muscle synergies and treatment outcomes in cerebral palsy are robust across clinical centers.

Shuman BR, Goudriaan M, Desloovere K, Schwartz MH, Steele KM.

Arch Phys Med Rehabil. 2018 Apr 9. pii: S0003-9993(18)30213-2. doi: 10.1016/j.apmr.2018.03.006. [Epub ahead of print]

OBJECTIVE: To determine whether patient-specific differences in motor control quantified using muscle synergy analysis were associated with changes in gait after treatment in cerebral palsy across two clinical centers with different treatments and clinical protocols. **DESIGN:** Retrospective Cohort Study. **SETTING:** Clinical Medical Center. **PARTICIPANTS:** Center 1: 473 children with cerebral palsy and 84 typically-developing children. Center 2: 163 children with cerebral palsy and 12 typically-developing children. **INTERVENTIONS:** Standard clinical care at each center. **OUTCOME MEASURES:** The dynamic motor control index during walking (walk-DMC) was computed from electromyography data during gait using muscle synergy analysis. Regression analysis was used to evaluate whether pre-treatment walking speed or kinematics, muscle synergies, treatment group, prior treatment, or age were associated with post-treatment changes in gait at both clinical centers. **RESULTS:** Walk-DMC was significantly associated with changes in speed and kinematics after treatment with similar regression models at both centers. Children with less impaired motor control were more likely to have improvements in walking speed and gait kinematics after treatment, independent of treatment group. **CONCLUSIONS:** Dynamic motor control evaluated with synergy analysis was associated with changes in gait after treatment at both centers, despite differences in treatments and clinical protocols. This study further supports the finding that walk-DMC provides additional information, not captured in traditional gait analysis, that may be useful for treatment planning.

[PMID: 29649451](#)

10. Dorsal rhizotomy for children with spastic diplegia of cerebral palsy origin: usefulness of intraoperative monitoring.

Georgoulis G, Brinzeu A, Sindou M.

J Neurosurg Pediatr. 2018 Apr 13:1-13. doi: 10.3171/2018.1.PEDS17577. [Epub ahead of print]

OBJECTIVE The utility of intraoperative neuromonitoring (ION), namely the study of muscle responses to radicular stimulation, remains controversial. The authors performed a prospective study combining ventral root (VR) stimulation for mapping anatomical levels and dorsal root (DR) stimulation as physiological testing of metameric excitability. The purpose was to evaluate to what extent the intraoperative data led to modifications in the initial decisions for surgical sectioning established by the pediatric multidisciplinary team (i.e., preoperative chart), and thus estimate its practical usefulness. **METHODS** Thirteen children with spastic diplegia underwent the following surgical protocol. First, a bilateral intradural approach was made to the L2-S2 VRs and DRs at the exit from or entry to their respective dural sheaths, through multilevel interlaminar enlarged openings. Second, stimulation-just above the threshold-of the VR at 2 Hz to establish topography of radicular myotome distribution, and then of the DR at 50 Hz as an excitability test of root circuitry, with independent identification of muscle responses by the physiotherapist and by electromyographic recordings. The study aimed to compare the final amounts of root sectioning-per radicular level, established after intraoperative neuromonitoring guidance-with those determined by the multidisciplinary team in the presurgical chart. **RESULTS** The use of ION resulted in differences in the final percentage of root sectioning for all root levels. The root levels corresponding to the upper lumbar segments were modestly

excitable under DR stimulation, whereas progressively lower root levels displayed higher excitability. The difference between root levels was highly significant, as evaluated by electromyography ($p = 0.00004$) as well as by the physiotherapist ($p = 0.00001$). Modifications were decided in 11 of the 13 patients (84%), and the mean absolute difference in the percentage of sectioning quantity per radicular level was 8.4% for L-2 ($p = 0.004$), 6.4% for L-3 ($p = 0.0004$), 19.6% for L-4 ($p = 0.00003$), 16.5% for L-5 ($p = 0.00006$), and 3.2% for S-1 roots ($p = 0.016$). Decreases were most frequently decided for roots L-2 and L-3, whereas increases most frequently involved roots L-4 and L-5, with the largest changes in terms of percentage of sectioning. **CONCLUSIONS** The use of ION during dorsal rhizotomy led to modifications regarding which DRs to section and to what extent. This was especially true for L-4 and L-5 roots, which are known to be involved in antigravity and pelvic stability functions. In this series, ION contributed significantly to further adjust the patient-tailored dorsal rhizotomy procedure to the clinical presentation and the therapeutic goals of each patient.

[PMID: 29652243](#)

11. AbobotulinumtoxinA Efficacy and Safety in Children With Equinus Foot Previously Treated With Botulinum Toxin.

Dabrowski E, Bonikowski M, Gormley M, Volteau M, Picaut P, Delgado MR.

Pediatr Neurol. 2018 Feb 7. pii: S0887-8994(17)31053-6. doi: 10.1016/j.pediatrneurol.2017.12.013. [Epub ahead of print]

BACKGROUND: The effects of botulinum toxin are transient, and repeat injections are required in children with lower-limb spasticity. However, the efficacy of botulinum toxin in patients who have received previous injections has remained largely unexplored. **METHODS:** We present subgroup analyses of a phase III study conducted in ambulatory children (aged two to 17) with spastic equinus foot. Patients were randomized to single doses of abobotulinumtoxinA 10 U/kg/leg, 15 U/kg/leg, or placebo injected into the gastrocnemius-soleus complex (one or both legs). The first analysis was prespecified to review the effect of abobotulinumtoxinA in children previously treated with botulinum toxin versus those children new to the treatment; a second post hoc analysis evaluated the effect of abobotulinumtoxinA in children who changed botulinum toxin formulation. **RESULTS:** Of the 241 randomized patients, 113 had previously received botulinum toxin, including 86 who had been treated with another formulation. In both analyses, muscle tone (Modified Ashworth Scale) and the Physicians Global Assessment, at week 4, improved with abobotulinumtoxinA treatment versus placebo, regardless of baseline botulinum toxin status. Placebo responses in patients new to treatment were consistently higher than in the previously treated group. **CONCLUSIONS:** These results demonstrate similar abobotulinumtoxinA efficacy and safety profiles in children with spasticity who are new to botulinum toxin treatment and those children who were previously treated. The efficacy and safety of abobotulinumtoxinA treatment in these previously treated patients were comparable with the overall trial population, indicating that doses of 10 and 15 U/kg/leg are suitable starting doses for children with spasticity regardless of the previous botulinum toxin preparation used.

[PMID: 29625849](#)

12. [Preliminary study of robot-assisted ankle rehabilitation for children with cerebral palsy].

[Article in Chinese]

Wang RL, Zhou ZH, Xi YC, Wang QN, Wang NH, Huang Z.

Beijing Da Xue Xue Bao Yi Xue Ban. 2018 Apr 18;50(2):207-212.

OBJECTIVE: To propose a kind of robotic ankle-foot rehabilitation system for children with cerebral palsy and to preliminarily verify its feasibility in clinical application. **METHODS:** A robot assisted ankle-foot rehabilitation system was specially designed and developed for children with cerebral palsy and a preliminary clinical study was conducted in Department of Rehabilitation Medicine, Peking University First Hospital. Modified Tardieu Scale and joint biomechanical properties (ankle plantar flexion resistance torque under different ankle dorsiflexion angles) were measured to analyze the muscle tone and soft tissue compliance of the ankle plantar flexors pre- and post-robotic training intervention. Six children with cerebral palsy (4 girls and 2 boys, mean age: 7 years) were recruited in this study. Each subject received 5 session robotic training and each session included 10-cycle passive stretching and static hold. SPSS 19.0 software was used for data statistical analysis. **RESULTS:** Both R1 and R2 angles of Modified Tardieu Scale for ankle plantar flexors after training were significantly higher than those before the treatments (Gastrocnemius: PR1=0.003, PR2=0.029; Soleus: PR1=0.002, PR2=0.034). The difference between R2 and R1 was of no statistical difference before and after the training ($P=0.067$ and $P=0.067$, respectively). After training, the ankle plantar flexion resistance torque under different dorsiflexion angles (0° , 10° , 20° , 30°) were significantly reduced than those before training ($P=0.001$, $P=0.001$, $P=0.014$, $P=0.002$, respectively). **CONCLUSION:** The robot assisted ankle-foot rehabilitation system can improve the contracture and soft tissue compliance of

cerebral palsy children's ankle plantar flexors. All the children in the study were well tolerated and interested with the training, easy to accept and cooperate with it. This device may be suitable for application in the rehabilitation of children with cerebral palsy. However, further randomized clinical trials with larger sample size are still needed to verify the long term efficacy of this device.

[PMID: 29643516](#)

13. Interventions to improve sensory and motor outcomes for young children with central hypotonia: A systematic review.

Paleg G, Romness M, Livingstone R.

J Pediatr Rehabil Med. 2018;11(1):57-70. doi: 10.3233/PRM-170507.

OBJECTIVE: To evaluate evidence supporting physical and occupational therapy interventions used to improve sensory and motor outcomes for children 0-6 years with central hypotonia. **METHODS:** Four electronic databases were searched from 1996 to March 2017. Level of evidence and study conduct was evaluated using American Academy of Cerebral Palsy and Developmental Medicine criteria. Traffic lighting classification identified interventions that were green (proven effective), yellow (possibly effective) or red (proven ineffective or contraindicated). **RESULTS:** Thirty-seven articles were included. Nine studies measured orthotic interventions while four distinct studies published over nine articles measured treadmill interventions. Remaining studies measured impact of compression garments, massage, motor and sensori-motor interventions, positioning and mobility interventions. **CONCLUSIONS:** Green light evidence supports treadmill training (to promote ambulation and gait characteristics) and massage (to positively affect muscle tone, motor development and use of vision) for infants with Down syndrome. These interventions are considered Yellow (possibly effective) for other populations. Green light evidence supports impact of orthoses on foot alignment for ambulatory children with hypotonia, while impact on gait characteristics is Yellow light and motor development may be negatively impacted (Red light) in pre-ambulatory children. All other interventions rated Yellow (possibly effective) and therapists should monitor using sensitive outcome measures.

[PMID: 29630564](#)

14. Effects of inspiratory muscle training in children with cerebral palsy: a randomized controlled trial.

Keles MN, Elbasan B, Apaydin U, Aribas Z, Bakirtas A, Kokturk N.

Braz J Phys Ther. 2018 Apr 4. pii: S1413-3555(17)30617-2. doi: 10.1016/j.bjpt.2018.03.010. [Epub ahead of print]

BACKGROUND: Respiratory muscle weakness and its relation to other impairments in children with cerebral palsy (CP) have been shown in the latest studies. The effects of inspiratory muscle training (IMT) in this population have not been comprehensively investigated so far. **OBJECTIVES:** To investigate the effects of IMT on trunk control, pulmonary functions, respiratory muscle strength, daily living activities, exercise capacity and quality of life in children with CP. **METHODS:** This was a prospective-randomized controlled trial. Twenty-five children with CP were randomly assigned to the treatment (n=13) or the control group (n=12). The treatment group received IMT at 30% of maximal inspiratory pressure (MIP) and the control group received sham therapy (5% of MIP) for 6 weeks. Also, both groups received routine conventional physical therapy (stretching, strengthening, and functional exercises, etc.) for 6 weeks. The primary outcome measure was trunk control. Secondary outcome measures were pulmonary function, respiratory muscle strength, daily living activities, functional exercise capacity and quality of life. **RESULTS:** The treatment group had better outcome for trunk control (3.87, 95% CI 3.72-4.02). Also, respiratory muscle strength, daily living activities, functional exercise capacity and quality of life were significantly improved in the treatment group compared with controls. No improvements were observed in the pulmonary function test scores between the groups. **CONCLUSION:** Inspiratory muscle training improves trunk control, respiratory muscle strength, daily living activities, functional exercise capacity and quality of life in children with CP and it can be included in the physiotherapy and rehabilitation programs.

[PMID: 29636305](#)

15. Athletes with Brain Injury: Pathophysiologic and Medical Challenges.

Runciman P, Derman W.

Phys Med Rehabil Clin N Am. 2018 May;29(2):267-281. doi: 10.1016/j.pmr.2018.01.004.

Participation in elite sporting activities is becoming increasingly popular for individuals with brain injury. This article outlines the types of brain injury and the associated movement dysfunctions. In addition, specific pathophysiologic and medical challenges facing athletes with brain injury are discussed. Further research conducted using athletes with brain injury will add to the existing literature indicating the benefits of athletic training in this population. Increased scientific study within this area stands to further improve understanding of the complex interaction between neuromuscular impairment and athletic performance.

[PMID: 29627088](#)

16. Advanced Robotic Therapy Integrated Centers (ARTIC): an international collaboration facilitating the application of rehabilitation technologies.

van Hedel HJA, Severini G, Scarton A, O'Brien A, Reed T, Gaebler-Spira D, Egan T, Meyer-Heim A, Graser J, Chua K, Zutter D, Schweinfurter R, Möller JC, Paredes LP, Esquenazi A, Berweck S, Schroeder S, Warken B, Chan A, Devers A, Petioky J, Paik NJ, Kim WS, Bonato P, Boninger M; ARTIC network.

J Neuroeng Rehabil. 2018 Apr 6;15(1):30. doi: 10.1186/s12984-018-0366-y.

BACKGROUND: The application of rehabilitation robots has grown during the last decade. While meta-analyses have shown beneficial effects of robotic interventions for some patient groups, the evidence is less in others. We established the Advanced Robotic Therapy Integrated Centers (ARTIC) network with the goal of advancing the science and clinical practice of rehabilitation robotics. The investigators hope to exploit variations in practice to learn about current clinical application and outcomes. The aim of this paper is to introduce the ARTIC network to the clinical and research community, present the initial data set and its characteristics and compare the outcome data collected so far with data from prior studies. **METHODS:** ARTIC is a pragmatic observational study of clinical care. The database includes patients with various neurological and gait deficits who used the driven gait orthosis Lokomat® as part of their treatment. Patient characteristics, diagnosis-specific information, and indicators of impairment severity are collected. Core clinical assessments include the 10-Meter Walk Test and the Goal Attainment Scaling. Data from each Lokomat® training session are automatically collected. **RESULTS:** At time of analysis, the database contained data collected from 595 patients (cerebral palsy: n = 208; stroke: n = 129; spinal cord injury: n = 93; traumatic brain injury: n = 39; and various other diagnoses: n = 126). At onset, average walking speeds were slow. The training intensity increased from the first to the final therapy session and most patients achieved their goals. **CONCLUSIONS:** The characteristics of the patients matched epidemiological data for the target populations. When patient characteristics differed from epidemiological data, this was mainly due to the selection criteria used to assess eligibility for Lokomat® training. While patients included in randomized controlled interventional trials have to fulfill many inclusion and exclusion criteria, the only selection criteria applying to patients in the ARTIC database are those required for use of the Lokomat®. We suggest that the ARTIC network offers an opportunity to investigate the clinical application and effectiveness of rehabilitation technologies for various diagnoses. Due to the standardization of assessments and the use of a common technology, this network could serve as a basis for researchers interested in specific interventional studies expanding beyond the Lokomat®.

[PMID: 29625628](#)

17. Perceptions of fall circumstances, injuries and recovery techniques among power wheelchair users: a qualitative study.

Rice LA, Sung J, Peters J, Bartlo WD, Sosnoff JJ.

Clin Rehabil. 2018 Apr 1;269215518768385. doi: 10.1177/0269215518768385. [Epub ahead of print]

OBJECTIVE: To understand the circumstances surrounding the worst fall experienced by power wheelchair users in the past year and to examine injuries sustained and recovery methods. **DESIGN:** A qualitative study using a semi-structured interview. **SETTING:** Community. **PARTICIPANTS:** A self-selected volunteer sample of 19 power wheelchair users who utilize their device for at least 75% of mobility. The most common disability represented was cerebral palsy (n = 8). The mean (SD) age of participants was 41.9 (7.6) years, who lived with their disability for a mean (SD) of 20.5 (8.62) years and used their current device for a mean (SD) of 3.9 (1.9) years. **INTERVENTION:** None. **MAIN OUTCOME MEASURES:** A semi-structured interview examined the circumstances surrounding the worst fall experienced in the past year, injuries sustained and recovery techniques used. **RESULTS:** Upon examination of the circumstances of the worst fall, four main themes emerged: (1) action-

related fall contributors, (2) location of falls, (3) fall attributions and (4) time of fall. Each fall described was found to involve multiple factors. As a result of the fall, participants also reported the occurrence of physical injuries and a fear of falling. Physical injuries ranged from skin abrasion and bruises to fractures and head injuries. Participants also reported that fear of falling diminished their desire to participate in activities they enjoyed doing. Finally, most participants reported the need for physical assistance to recover from a fall. **CONCLUSION:** Participant descriptions provide an in-depth description of the circumstances and aftermath of falls experienced by power wheelchair users.

[PMID: 29627995](#)

18. Neurodevelopmental comorbidities and seizure control 24 months after a first unprovoked seizure in children.

Åndell E, Tomson T, Carlsson S, Tedroff K, Åmark P.

Epilepsy Res. 2018 Mar 20;143:33-40. doi: 10.1016/j.eplepsyres.2018.03.015. [Epub ahead of print]

PURPOSE: To follow children with newly diagnosed unprovoked seizures to determine (1) whether the prevalence of neurodevelopmental comorbidities and cerebral palsy (CP) changed after the initial seizure, and (2) the association between studied comorbidities and seizures 13-24 months after seizure onset or initiation of treatment. **METHODS:** Analyses were based on 750 children (28 days-18 years) with a first unprovoked seizure (index) included in a population-based Incidence Registry in Stockholm between 2001 and 2006. The children were followed for two years and their medical records were examined for a priori defined neurodevelopmental/psychiatric comorbidities and CP and seizure frequency. Baseline information was collected from medical records from before, and up to six months after, the index seizure. Odds ratios (OR) of repeated seizures 13-24 months after the first seizure or after initiation of anti-epileptic drug treatment was calculated by logistic regression and adjusted for age and sex. **RESULTS:** At baseline, 32% of the children had neurodevelopmental/psychiatric comorbidities or CP compared to 35%, 24 months later. Children with such comorbidities more often experienced seizures 13-24 months after the index seizure (OR 2.87, CI 2.07-3.99) with the highest OR in those with CP or attention deficit hyperactivity disorder (ADHD). Children diagnosed at age <1 year exhibited the highest prevalence of comorbidities as well as OR for repeated seizures. A combination of young age and comorbidity was associated with an OR for repeated seizures of 5.12 (CI 3.03-8.65). Among the children without comorbidities 76% were seizure free 13-24 months after the index seizure or after initiation of AED treatment compared to 53% of children with comorbidities. **CONCLUSIONS:** This study indicates that neurodevelopmental comorbidities and CP in children with epilepsy tend to be present already at seizure onset and that such comorbidities are strong indicators of poor outcome regarding seizure control with or without treatment.

[PMID: 29653321](#)

19. Reliability and Validity of the European Child Environment Questionnaire (ECEQ) in Children and Adolescents with Cerebral Palsy: Persian Version.

Salavati M, Vameghi R, Hosseini SA, Saeedi A, Gharib M.

Children (Basel). 2018 Apr 9;5(4). pii: E48. doi: 10.3390/children5040048.

The aim of this study was to assess the reliability and validity of the Persian version of the European Child Environment Questionnaire (ECEQ) in the Iranian context. In total, 332 parents (20.2% fathers and 79.8% mothers) of children and adolescents with cerebral palsy (CP) with an average age of 12.33 years (min 7.08 to max 18.08) from three provinces in Iran participated in the study. The original version of the questionnaire was translated and back-translated. Confirmatory construct validity was assessed by factor analysis and reliability was evaluated by Cronbach's alpha (N = 332) and after two weeks' test-retest reliability (n = 51) using an intraclass correlation coefficient (ICC). Eleven questions were dropped as they did not fit well into domains in the Persian version ($p > 0.05$). Cronbach's alpha and intraclass correlation coefficient in all domains and overall were acceptable (higher than 0.70) and significant ($p > 0.05$). The Persian version of the ECEQ is suitable for assessing the needs and availability of environmental factors and is reliable and valid for children with CP, as reported by their parents.

[PMID: 29642556](#)

Prevention and Cure

20. A Randomized, Placebo-Controlled Trial of Human Umbilical Cord Blood Mesenchymal Stem Cell Infusion for Children With Cerebral Palsy.

Huang L, Zhang C, Gu J, Wu W, Shen Z, Zhou X, Lu H.

Cell Transplant. 2018 Feb;27(2):325-334. doi: 10.1177/0963689717729379.

Cerebral palsy (CP) is a common disability which results in permanent chronic motor disability appearing in early childhood. Recently human umbilical cord blood mesenchymal stem cell (hUCB-MSC) infusion has emerged as a promising therapeutic strategy for CP, and the treatment efficacy remains to be confirmed by clinical trials. All 54 patients received basic rehabilitation as a background treatment. The infusion group comprising 27 patients received 4 infusions of hUCB-MSCs (intravenous infusions at a fixed dose of 5×10^7) and basic rehabilitation treatment, whereas 27 patients in the control group received 0.9% normal saline and basic rehabilitation treatment. Several indices were tested from baseline up to 24 months posttreatment regarding efficacy and safety evaluations, including the gross motor function measurement 88 (GMFM-88) scores, the comprehensive function assessment (CFA), lab tests, electroencephalogram (EEG), routine magnetic resonance imaging (MRI), and adverse events. The changes in the total proportion of GMFM-88 and total scores of CFA in the hUCB-MSC infusion group were significantly higher than that in control group at 3, 6, 12, 24 months posttreatment. Less diffuse slow waves were noticed after hUCB-MSC infusion in patients with slowing of EEG background rhythms at baseline. Based on the routine MRI exams, improvements in cerebral structures were rare after treatment. Serious adverse events were not observed during the whole study period. The results of the study indicated that hUCB-MSC infusion with basic rehabilitation was safe and effective in improving gross motor and comprehensive functions in children with CP.

[PMID: 29637820](#)

21. Changes in survival and neurodevelopmental outcomes of infants born at <25 weeks' gestation: a retrospective observational study in tertiary centres in Japan.

Kono Y, Yonemoto N, Nakanishi H, Kusuda S, Fujimura M.

BMJ Paediatr Open. 2018 Jan 20;2(1):e000211. doi: 10.1136/bmjpo-2017-000211. eCollection 2018.

OBJECTIVE: To evaluate changes in the outcomes of infants born at <25 weeks' gestation in the past decade. **DESIGN:** Retrospective observational study. **SETTINGS:** A multicentre database of the Neonatal Research Network, Japan. **PATIENTS:** A total of 3318 infants born at 22-24 weeks' gestation between periods 1 (2003-2007) and 2 (2008-2012) from 52 tertiary centres. **MAIN OUTCOME MEASURES:** We compared death and neurodevelopmental impairments (NDIs) at 3 years of age, including cerebral palsy (CP), visual impairments (VIs), hearing impairments (HIs) and the developmental quotient (DQ) of the Kyoto Scale of Psychological Development test <70, between two periods using multivariate logistic regression analyses adjusted for the centre, gender, multiple gestation, maternal age, caesarean delivery, antenatal steroid use, pregnancy-related hypertension, clinical chorioamnionitis, congenital anomalies and birth weight. **RESULTS:** A total of 496/1479 infants (34%) in period 1 and 467/1839 (25%) in period 2 died by 3 years of age (adjusted OR 0.70, 95% CIs 0.59 to 0.83). Follow-up data were collected from 631 infants (64% of survivors) in period 1 and 832 (61% of survivors) in period 2. The proportions of CP with Gross Motor Function Classification System ≥ 2 , VI and HI in the infants evaluated were lower, while that of DQ <70 was higher in period 2 than in period 1. Using multiple imputations to account for missing data, death or NDI decreased from 54% in period 1 to 47% in period 2 (0.83, 0.71 to 0.97). Significant decreases were observed in death or CP (0.65, 0.55 to 0.76), death or VI (0.59, 0.50 to 0.69) and death or HI (0.69, 0.58 to 0.81), but not in death or DQ <70 (0.91, 0.78 to 1.06). **CONCLUSION:** Along with improved survival, CP, VI and HI, but not cognitive impairments decreased in infants born at <25 weeks' gestation between the two periods examined in the last decade. Further strategies are needed to reduce cognitive impairments in these infants.

[PMID: 29637189](#)

22. Bronchopulmonary dysplasia-impact of severity and timing of diagnosis on neurodevelopment of preterm infants: a retrospective cohort study.

Malavolti AM, Bassler D, Arlettaz-Mieth R, Faldella G, Latal B, Natalucci G.

BMJ Paediatr Open. 2018 Jan 9;2(1):e000165. doi: 10.1136/bmjpo-2017-000165. eCollection 2018.

OBJECTIVE: To assess the contribution of the severity of bronchopulmonary dysplasia (BPD) and the time point of its diagnosis to the prediction of neurodevelopmental impairment (NDI) at corrected age of 2 years in preterm infants. **DESIGN:** Retrospective cohort study. **SETTING:** Level-III perinatal centre. **PATIENTS AND OUTCOME MEASURES:** Infants born in 2000-2013 with gestational age <30 weeks. BPD was defined as $FiO_2 > 21\%$ for ≥ 28 days and its severity classified as mild,

FiO₂=21%; moderate, FiO₂ <30% and severe, FiO₂ ≥30% and/or positive pressure support. We applied these criteria at two time points: 36 and 40 weeks' postmenstrual age (PMA). Multivariable regression models were used to estimate the association (OR (95% CI)) between BPD characteristics and NDI defined as cognitive or motor development score <2 SD; severe cerebral palsy; deafness and blindness. RESULTS: Of 610 (81% of cohort) children assessed at 2 years, 357 (58%) had BPD and 98 (16%) had NDI. Neither FiO₂ >21% for ≥28 days nor mild or moderate BPD at either 36 or 40 weeks' PMA was associated with NDI, but severe BPD was (at 36 weeks' PMA 5.6 (2.0 to 16.0) and at 40 weeks' PMA 16.6 (4.6 to 59.9)). Infants with severe BPD at both 36 and 40 weeks' PMA had lower mental (mean difference -11.4 (-18.5 to -4.3), -25.7(-35.9 to -15.5), respectively) and motor (-7.8 (-14.9 to -0.6), -20.1(-30.7 to -9.5), respectively), developmental scores than infants without BPD. CONCLUSION: In this cohort, severe BPD was a better independent predictor of NDI at 2 years than mild or moderate BPD. BPD diagnosed at 40 weeks' PMA might allow better identification of infants at highest risk for NDI.

[PMID: 29637181](#)

23. Umbilical cord mesenchymal stem cell (UC-MSC) transplantations for cerebral palsy.

Dong H, Li G, Shang C, Yin H, Luo Y, Meng H, Li X, Wang Y, Lin L, Zhao M.

Am J Transl Res. 2018 Mar 15;10(3):901-906. eCollection 2018.

This study reports a case of a 4-year-old boy patient with abnormalities of muscle tone, movement and motor skills, as well as unstable gait leading to frequent falls. The results of the electroencephalogram (EEG) indicate moderately abnormal EEG, accompanied by irregular seizures. Based on these clinical characteristics, the patient was diagnosed with cerebral palsy (CP) in our hospital. In this study, the patient was treated with umbilical cord mesenchymal stem cell (UC-MSC) transplantation therapy. This patient received UC-MSC transplantation 3 times (5.3*10⁷) in total. After three successive cell transplantations, the patient recovered well and showed obvious improvements in EEG and limb strength, motor function, and language expression. However, the improvement in intelligence quotient (IQ) was less obvious. These results indicate that UC-MSC transplantation is a promising treatment for cerebral palsy.

[PMID: 29636880](#)

24. The impact of time of delivery on gestations complicated by preterm premature rupture of membranes: daytime versus nighttime.

Moussa H, Hosseini Nasab S, Fournie D, Ontiveros A, Alkawas R, Chauhan S, Blackwell S, Sibai B.

J Matern Fetal Neonatal Med. 2018 Apr 9;1-161. doi: 10.1080/14767058.2018.1463363. [Epub ahead of print]

BACKGROUND: Perinatal death, in particular intrapartum stillbirth and short-term neonatal death, as well as neonatal short term and long term morbidity have been associated with the time of day that the birth occurs. Indeed, evening and nighttime deliveries were associated with an increased risk of an adverse perinatal outcome when compared to similar daytime deliveries. Impact of shift change, as well as time of day delivery have been extensively studied in the context of maternal and neonatal complications of cesarean delivery, however, no studies were previously performed on timing of delivery and its effect on the outcome of pregnancies complicated by preterm premature rupture of membranes. OBJECTIVE: Our objective was to compare obstetric, neonatal as well as long-term outcomes between women delivered in the daytime versus nighttime, in singleton gestations whose pregnancies were complicated by preterm premature rupture of membranes. STUDY DESIGN: This was a secondary analysis of a trial of the Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network "A Randomized Clinical Trial of the Beneficial Effects of Antenatal Magnesium Sulfate for the Prevention of Cerebral Palsy". For this analysis, the time of delivery was divided into the daytime, from 07:01 to 19:00, and the nighttime, from 19:01 to 07:00. Epidemiological, obstetric characteristics as well as neonatal and long-term outcomes were compared between deliveries occurring during the daytime versus the nighttime periods. Inclusion criteria consisted of singleton gestations diagnosed with preterm premature rupture of membranes (PPROM). Multifetal gestations and pregnancies with preterm labor without preterm premature rupture of membranes were excluded. RESULTS: A total of 1752 patients met inclusion criteria, 881 delivering during the daytime, while 871 during the nighttime. There were no differences in demographic maternal variables. There were no differences in the number of patients receiving steroids and the doses of steroids. Antibiotic prophylaxis was also equal in both groups. Postpartum endometritis, chorioamnionitis and the latency to delivery were also equivalent between both groups. Cesarean delivery for distress was the only different outcome, more prevalent in daytime deliveries (157 (44.7%) versus 108 (35.9%) of the nighttime ones p = 0.02). Neonatal adverse outcomes as well as long-term outcomes similar between the two groups. CONCLUSION: In the setting of delivery at a tertiary care center, and in the era of universal use of steroids, and latency antibiotics for the management of preterm premature of membranes, there is no marked difference in pregnancy, neonatal as well as long-term outcomes for infants delivered in the daytime versus nighttime.

[PMID: 29631461](#)