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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. Comment on: Efficacy of Armeo® Robotic Therapy Versus Conventional Therapy on Upper Limb Function in Children with Hemiplegic Cerebral Palsy.

Scarpinella K.

Am J Phys Med Rehabil. 2018 Jul 9. doi: 10.1097/PHM.0000000000001000. [Epub ahead of print]

[PMID: 29994795](#)

2. A Portable Passive Rehabilitation Robot for Upper-Extremity Functional Resistance Training.

Washabaugh E, Guo J, Chang CK, Remy D, Krishnan C.

IEEE Trans Biomed Eng. 2018 Jun 21. doi: 10.1109/TBME.2018.2849580. [Epub ahead of print]

Loss of arm function is common in individuals with neurological damage, such as stroke or cerebral palsy. Robotic devices that address muscle strength deficits in a task-specific manner can assist in the recovery of arm function; however, current devices are typically large, bulky, and expensive to be routinely used in the clinic or at home. This study sought to address this issue by developing a portable planar passive rehabilitation robot, PaRRo. We designed PaRRo with a mechanical layout that incorporated kinematic redundancies to generate forces that directly oppose the user's movement. Cost-efficient eddy current brakes were used to provide scalable resistances. The lengths of the robot's linkages were optimized to have a reasonably large workspace for human planar reaching. We then performed theoretical analysis of the robot's resistive force generating capacity and steerable workspace using MATLAB simulations. We also validated the device by having a subject move the end-effector along different paths at a set velocity using a metronome while simultaneously collecting surface electromyography (EMG) and end-effector forces felt by the user. Results from simulation experiments indicated that the robot was capable of producing sufficient end-effector forces for functional resistance training. We also found the endpoint forces from the user were similar to the theoretical forces expected at any direction of motion. EMG results indicated that the device was capable of providing adjustable resistances based on subjects' ability levels, as the muscle activation levels scaled with increasing magnet exposures. These results indicate that PaRRo is a feasible approach to provide functional resistance training to the muscles along the upper extremity. The proposed robotic device could provide a technological breakthrough that will make rehabilitation robots accessible for small outpatient rehabilitation centers and in-home therapy.

[PMID: 29993459](#)

3. Muscle morphology of the lower leg in ambulant children with spastic cerebral palsy.

Pitcher CA, Elliott CM, Valentine JP, Stannage K, Williams SA, Shipman PJ, Reid SL.

Muscle Nerve. 2018 Jul 7. doi: 10.1002/mus.26293. [Epub ahead of print]

This study aims to determine the lower limb morphological characteristics of skeletal muscle of ambulant children with

spastic cerebral palsy (CP) and typically developing (TD) children. Seventeen children with spastic diplegic CP (10 males, 5-12 years, Gross Motor Function Classification System (GMFCS) I & II) and 19 TD children (8 males, 5-11 years) underwent lower limb T1-weighted MRI. Morphological characteristics of the triceps surae including muscle volume, anatomical cross-sectional area, muscle length and subcutaneous adipose tissue were digitally quantified, and the proportional distribution calculated. Children of GMFCS II had significantly reduced muscle volume, cross-sectional area and muscle length and increased subcutaneous fat compared to TD children. Children classified as GMFCS II consistently exhibited the greatest deficits in all morphology variables. Morphological variables were significantly different between the groups. These alterations have the potential to influence the functional capabilities of the triceps surae muscle group.

[PMID: 29981242](#)

4. Age trajectories of musculoskeletal morbidities in adults with cerebral palsy.

Whitney DG, Hurvitz EA, Devlin MJ, Caird MS, French ZP, Ellenberg EC, Peterson MD.

Bone. 2018 Jul 5;114:285-291. doi: 10.1016/j.bone.2018.07.002. [Epub ahead of print]

Individuals with cerebral palsy (CP) are at an increased risk for age-related morbidities due to functional impairments, maladapted growth, and altered body composition. While musculoskeletal (MSK) deficits are present in children, little is understood about MSK morbidity throughout the lifespan in those with CP. The purpose of this study was to examine the age-related trajectories of MSK morbidity and multimorbidity throughout adulthood in those with CP. A clinic-based sample of adults with CP (n = 1395; ≥ 18 years) was examined to determine prevalence of MSK morbidities at the University of Michigan Medical Center. Logistic regression was used to determine the effects of age on individual MSK morbidities and multimorbidity (i.e., ≥ 2 morbidities) after adjusting for sex, race, weight, and smoking. With the 18-30 year age group as the reference, the adjusted odds of osteopenia was lower in the 41-50 and >50 year age groups, the odds of osteoporosis and rheumatoid arthritis was higher in 41-50 and >50 year age groups, and the odds of osteoarthritis was higher in 31-40, 41-50, and >50 year age groups. The adjusted odds of MSK multimorbidity increased substantially with increasing age for 31-40 year olds (OR: 1.919; 95% CI 1.05-3.52), 41-50 year olds (OR: 4.30; 95% CI 2.40-7.69), and >50 year olds (OR: 6.05; 95% CI 3.56-10.27). Adults with CP are at high risk for MSK morbidities across all ages. Future studies are needed to examine the global aging trajectories of MSK health among adults with CP. Study findings highlight the importance of maximizing MSK accretion, and developing programs to assist individuals with CP and their caregivers to maintain MSK mass and function throughout the lifespan.

[PMID: 29981509](#)

5. How do postural parameters vary during gait in children with cerebral palsy? A 3D subject-specific skeletal segment registration technique.

Massaad A, Assi A, Bizdikian AJ, Yared F, Bakouny Z, Khalil N, Ghanem I, Pillet H, Bonnet X, Skalli W.

Gait Posture. 2018 Jun 26. pii: S0966-6362(18)30887-7. doi: 10.1016/j.gaitpost.2018.06.130. [Epub ahead of print]

[PMID: 29983301](#)

6. Paediatric reference data are needed to calculate Gait Profile Scores in children, regardless width of age categories.

Wyers L, Verheyen K, Van Crielinge T, Papageorgiou E, Goudriaan M, Desloovere K, Hallemans A, Van de Walle P.

Gait Posture. 2018 Jun 26. pii: S0966-6362(18)30886-5. doi: 10.1016/j.gaitpost.2018.06.129. [Epub ahead of print]

[PMID: 29983302](#)

7. Gait complexity quantified using inertial measurement units in children with cerebral palsy.

Piitulainen H, Rantalainen T, Kulmala JP, Mäenpää H.

Gait Posture. 2018 Jul 3. pii: S0966-6362(18)30983-4. doi: 10.1016/j.gaitpost.2018.06.197. [Epub ahead of print]

Children with cerebral palsy (CP) have gait impairments, and their gait is affected by concurrent tasks. We used inertial measurement units (IMU) to quantify CP-related gait complexity alterations, and identify effects of dual tasks on gait variability from 12 children with CP and 23 typically developed (TD) controls. The data were collected for normal and dual-tasks (motor; carrying a tray, cognitive; word naming) during walking. Step duration and adjusted multiscale entropy (MSE) index were computed. In overall, children with CP had shorter step duration and greater gait complexity than TD. Gait complexity was higher in vertical direction during the cognitive than normal and motor tasks in children with CP. In TD, the

gait complexity was not significantly affected by dual-tasking, although, step duration was longer for the cognitive than normal and motor tasks in both groups. As expected, gait kinematics and complexity differed between single- and dual-tasking in children with CP. The present results indicate that IMUs may provide a low-cost tool to quantify gait complexity.

[PMID: 29983293](#)

8. Factors associated with long-term improvement of gait after selective dorsal rhizotomy.

Oudenhoven LM, van der Krogt MM, Romei M, van Schie PEM, van de Pol LA, van Ouwerkerk WJR, Harlaar Prof J, Buizer AI.

Arch Phys Med Rehabil. 2018 Jul 4. pii: S0003-9993(18)30442-8. doi: 10.1016/j.apmr.2018.06.016. [Epub ahead of print]

To identify factors associated with long-term improvement in gait in children after selective dorsal rhizotomy (SDR). Retrospective cohort study SETTING: University medical center PARTICIPANTS: 36 children (age 4-13y) with spastic diplegia (gross motor classification system level I (n=14), II (n=15) and III (n=7) were included retrospectively from the database of our hospital. Children underwent selective dorsal rhizotomy (SDR) between January 1999 and May 2011. Patients were included if they received clinical gait analysis before and five years post-SDR, age >4 years at time of SDR and if brain MRI-scan was available. Selective dorsal rhizotomy MAIN OUTCOME MEASURES: Overall gait quality was assessed with Edinburgh visual gait score (EVGS), before and five years after SDR. In addition, knee and ankle angles at initial contact and midstance were evaluated. To identify predictors for gait improvement, several factors were evaluated including: functional mobility level (GMFCS), presence of white matter abnormalities on brain-MRI, and selective motor control during gait (synergy analysis). Overall gait quality improved after SDR, with a large variation between patients. Multiple linear regression analysis revealed that worse score on EVGS and better GMFCS were independently related to gait improvement. Gait improved more in children with GMFCS I & II compared to III. No differences were observed between children with or without white matter abnormalities on brain MRI. Selective motor control during gait was predictive for improvement of knee angle at initial contact and midstance, but not for EVGS. Functional mobility level and baseline gait quality are both important factors to predict gait outcomes after SDR. If candidates are well selected, SDR can be a successful intervention to improve gait both in children with brain MRI abnormalities as well as other causes of spastic diplegia.

[PMID: 29981315](#)

9. Crouch gait in children with Cerebral Palsy and the impact on trunk kinematics and lower lumbar spinal loading.

Kiernan D, O'Sullivan R.

Gait Posture. 2018 Jun 27. pii: S0966-6362(18)30768-9. doi: 10.1016/j.gaitpost.2018.06.041. [Epub ahead of print]

[PMID: 29980441](#)

10. Tibialis anterior co-activation during stance phase in gait in children with cerebral palsy.

Gagnat Y, Brændvik SM, Roeleveld K.

Gait Posture. 2018 Jul 2. pii: S0966-6362(18)30910-X. doi: 10.1016/j.gaitpost.2018.06.153. [Epub ahead of print]

In children with CP excessive co-activation is often reported. This abstract aimed to compare two indices for co-activation quantification and evaluated the relationship between co-activation and gait velocity and step length. Twelve children with CP and seven TD walked with sEMG measurements from lower limb muscles. Co-activation was calculated during 50-80% of stance phase. Level of co-activation was higher in CP than TD and there were differences between the two indices. There was no relationship between co-activation and gait velocity or step length.

[PMID: 30001967](#)

11. Hip Power and "Stiff Knee" Gait: A Tool for Identifying Appropriate Candidates for Rectus Transfer.

Moreira BL, Karakostas T, Dias LS.

J Pediatr Orthop. 2018 Jul 6. doi: 10.1097/BPO.0000000000001220. [Epub ahead of print]

Rectus femoris transfer (RFT) is performed in children with cerebral palsy to treat stiff-knee gait. However, the results are variable in part because there is no gold standard to identify appropriate candidates. Hip flexion kinematics and kinetics are important factors in the determination of peak knee flexion during gait. This study aimed to evaluate whether a kinetic

preoperative analysis of hip power can be a predictor of RFT outcomes and determine its usability for identifying appropriate candidates for the procedure. Sixteen children with spastic cerebral palsy (20 limbs) GMFCS I/II who underwent RFT for a stiff-knee gait and had preoperative and postoperative 3D gait analyses were retrospectively evaluated. Patient outcomes were classified as "good" or "poor" according to postoperative results. The outcomes were evaluated as a function of (a) 1-parameter criteria-peak hip power (PHP) with a cut-off magnitude ≥ 0.60 W/kg; (b) 2-parameter criteria-PHP (cut-off magnitude ≥ 0.60 W/kg) and the time the PHP occurred during the gait cycle (tPHP), with a cut-off $\leq 68\%$ of the gait cycle. When the 1-parameter criterion was used, 13 limbs met the criterion; of them, 11 had good outcomes. Seven limbs did not meet the criterion; of them, 6 had poor results ($P=0.0049$). When the 2-parameter criterion was used, 11 limbs met the criteria; all had good results. Nine limbs did not meet the criterion; of them, 8 had poor results ($P=0.0002$).

PHP+tPHP had the same sensitivity as PHP alone (91%) but with higher specificity (100%) for predicting outcomes. The positive predictive value of magnitude PHP+tPHP was 100%, whereas the accuracy index was 95%. Preoperative kinetic evaluation of the hip power characteristics from 3D gait analysis appears to be a very important predictor for RFT outcomes and identifying appropriate candidates for the procedure.

[PMID: 29985867](#)

12. The Root-Ely Modified Test of Rectus Femoris Spasticity Has Reliability in Individuals with Cerebral Palsy.

Drefus LC, Clarke S, Resnik K, Koltsov J, Dodwell ER, Scher DM.

HSS J. 2018 Jul;14(2):143-147. doi: 10.1007/s11420-018-9609-5. Epub 2018 Mar 26.

Stiff-knee gait is a common gait deviation in individuals with cerebral palsy (CP) due to rectus femoris (RF) muscle spasticity. The Duncan-Ely test is a velocity-dependent measurement of spasticity that is recorded as positive or negative. At our institution, we use a modification of the Duncan-Ely test, a 5-point ordinal rating scale, which delineates where the catch occurs within the rapid arc of knee flexion. It has been named the Root-Ely test. We sought to determine the intra- and inter-rater reliability of the Duncan-Ely and Root-Ely tests in pediatric patients with CP. A convenience sample of 20 ambulatory subjects was recruited; mean age was 10.5 ± 4.5 years, and the Gross Motor Function Classification System (GMFCS) levels were I-III. Five clinicians measured each individual's RF spasticity using the Root-Ely protocol during a single visit. Simple κ statistics with 95% confidence intervals (CI) were utilized for intra-rater reliability and weighted κ statistics with 95% CI for inter-rater reliability. The Root-Ely scale intra-rater reliability was 0.77 to 0.90 and inter-rater reliability was 0.32 to 0.87. Inter-rater reliability was good to excellent among experienced clinicians and fair to moderate in new clinicians. The Root-Ely 5-point scale has acceptable intra- and inter-rater reliability in pediatric individuals with CP among experienced clinicians. The Root-Ely test allows experienced clinicians to reliably quantify severity of RF spasticity and may give orthopaedic surgeons a clinical tool to better predict ideal candidates for RF transfers in individuals with CP in order to improve stiff-knee gait.

[PMID: 29983655](#)

13. [Consensus statement on botulinum toxin for children with cerebral palsy].Article in Chinese]

Subspecialty Group of Rehabilitation, the Society of Pediatrics, Chinese Medical.

Zhonghua Er Ke Za Zhi. 2018 Jul 2;56(7):484-488. doi: 10.3760/cma.j.issn.0578-1310.2018.07.002.

[PMID: 29996179](#)

14. Intraoperative Traction May Be a Viable Alternative to Anterior Surgery in Cerebral Palsy Scoliosis ≥ 100 Degrees: Erratum.

[No authors listed]

J Pediatr Orthop. 2018 Aug;38(7):e417. doi: 10.1097/BPO.0000000000001224.

[PMID: 29994965](#)

15. An ultrasonographic analysis of the activation patterns of abdominal muscles in children with spastic type cerebral palsy and in typically developing individuals: a comparative study.

Adjenti SK, Louw GJ, Jelsma J, Unger M.

Arch Physiother. 2018 Jun 5;8:9. doi: 10.1186/s40945-018-0048-x. eCollection 2018.

Abdominal muscles have stiffer appearance in individuals with spastic type cerebral palsy (STCP) than in their typically developing (TD) peers. This apparent stiffness has been implicated in pelvic instability, mal-rotation, poor gait and locomotion. This study was aimed at investigating whether abdominal muscles activation patterns from rest to activity differ in the two groups. From ultrasound images, abdominal muscles thickness during the resting and active stages was measured in 63 STCP

and 82 TD children. The thickness at each stage and the change in thickness from rest to activity were compared between the two groups. Rectus abdominis (RA) muscle was the thickest muscle at rest as well as in active stage in both groups. At rest, all muscles were significantly thicker in the STCP children ($p < 0.001$). From rest to active stages muscle thickness significantly increased ($p < 0.001$) in the TD group and significantly decreased ($p < 0.001$) in the STCP children, except for RA, which became thicker during activity in both groups. In active stages, no significant differences in the thickness in the four abdominal muscles were found between the STCP and the TD children. Apart from the RA muscle, the activation pattern of abdominal muscles in individuals with STCP differs from that of TD individuals. Further studies required for understanding the activation patterns of abdominal muscles prior to any physical fitness programmes aimed at improving the quality of life in individuals with STCP. HREC REF: 490/2011.

Human Research Ethics Committee, Faculty of Health Sciences, University of Cape Town, South Africa. November 17, 2011.

[PMID: 29992048](#)

16. Changes in trunk sway and impairment during sitting and standing in children with cerebral palsy.

Kim DH, An DH, Yoo WG.

Technol Health Care. 2018 Jun 29. doi: 10.3233/THC-181301. [Epub ahead of print]

Poor postural control constitutes a major impairment in children with cerebral palsy (CP), compromising everyday activities such as sitting- and standing-position. In this study, we measured trunk sway during sitting- and standing-position. Additionally, we assessed trunk control ability using the trunk impairment scale (TIS), trunk control measurement scale (TCMS), and sitting assessment test for children with neuromotor dysfunction (SACND), in children with CP. Fifteen children (10 boys and 5 girls) were recruited for this study. Trunk sway was measured using a triaxial accelerometer that recorded variation in movement acceleration during quiet sitting- and standing-position. Anterior-posterior (AP) acceleration was significantly greater in the standing position than the sitting position ($p = 0.001$). Medio-lateral (ML) acceleration was significantly greater in the standing position than in the sitting position ($p = 0.012$). The TIS total score showed a moderate negative relationship with AP acceleration ($r = -0.635$, $p = 0.011$). The TCMS total score moderately and negatively correlated with AP acceleration ($r = -0.582$, $p = 0.023$). The SACND total score moderately and positively correlated with AP acceleration ($r = 0.670$, $p = 0.006$). Measurement of trunk sway using a triaxial accelerometer revealed a moderate correlation with trunk control test data and excellent reliability. Our findings suggest that measurement of trunk sway using a triaxial accelerometer is not time-consuming, and is simple and easy. Our approach can be applied in clinical settings to gain information on trunk control in children with CP.

[PMID: 29991150](#)

17. Retraining Reflexes: Clinical Translation of Spinal Reflex Operant Conditioning.

Eftekhari A, Norton JJS, McDonough CM, Wolpaw JR.

Neurotherapeutics. 2018 Jul 9. doi: 10.1007/s13311-018-0643-2. [Epub ahead of print]

Neurological disorders, such as spinal cord injury, stroke, traumatic brain injury, cerebral palsy, and multiple sclerosis cause motor impairments that are a huge burden at the individual, family, and societal levels. Spinal reflex abnormalities contribute to these impairments. Spinal reflex measurements play important roles in characterizing and monitoring neurological disorders and their associated motor impairments, such as spasticity, which affects nearly half of those with neurological disorders. Spinal reflexes can also serve as therapeutic targets themselves. Operant conditioning protocols can target beneficial plasticity to key reflex pathways; they can thereby trigger wider plasticity that improves impaired motor skills, such as locomotion. These protocols may complement standard therapies such as locomotor training and enhance functional recovery. This paper reviews the value of spinal reflexes and the therapeutic promise of spinal reflex operant conditioning protocols; it also considers the complex process of translating this promise into clinical reality.

[PMID: 29987761](#)

18. Code-VEP vs. Eye Tracking: A Comparison Study.

Nezamfar H, Mohseni Salehi SS, Higger M, Erdogmus D.

Brain Sci. 2018 Jul 7;8(7). pii: E130. doi: 10.3390/brainsci8070130.

Even with state-of-the-art techniques there are individuals whose paralysis prevents them from communicating with others. Brain-Computer-Interfaces (BCI) aim to utilize brain waves to construct a voice for those whose needs remain unmet.

In this paper we compare the efficacy of a BCI input signal, code-VEP via Electroencephalography, against eye gaze tracking, among the most popular modalities used. These results, on healthy individuals without paralysis, suggest that while eye tracking works well for some, it does not work well or at all for others; the latter group includes individuals with corrected vision or those who squint their eyes unintentionally while focusing on a task. It is also evident that the performance of the interface is more sensitive to head/body movements when eye tracking is used as the input modality, compared to using c-VEP. Sensitivity to head/body movement could be better in eye tracking systems which are tracking the head or mounted on the face and are designed specifically as assistive devices. The sample interface developed for this assessment has the same reaction time when driven with c-VEP or with eye tracking; approximately 0.5–1 second is needed to make a selection among the four options simultaneously presented. Factors, such as system reaction time and robustness play a crucial role in participant preferences.

[PMID: 29986504](#)

19. Wearable Haptics and Immersive Virtual Reality Rehabilitation Training in Children With Neuromotor Impairments.

Bortone I, Leonardis D, Mastronicola N, Crecchi A, Bonfiglio L, Procopio C, Solazzi M, Frisoli A.

IEEE Trans Neural Syst Rehabil Eng. 2018 Jul;26(7):1469-1478. doi: 10.1109/TNSRE.2018.2846814.

The past decade has seen the emergence of rehabilitation treatments using virtual reality (VR) environments although translation into clinical practice has been limited so far. In this paper, an immersive VR rehabilitation training system endowed with wearable haptics is proposed for children with neuromotor impairments: it aims to enhance involvement and engagement of patients, to provide congruent multi-sensory afferent feedback during motor exercises and to benefit from the flexibility of VR in adapting exercises to the patient's need. An experimental rehabilitation session conducted with children with cerebral palsy (CP) and developmental dyspraxia (DD) has been performed to evaluate the usability of the system and proof of concept trial of the proposed approach. We compared CP/DD performance with both typically developing children and adult control group. Results show the system was compliant with different levels of motor skills and allowed patients to complete the experimental rehabilitation session, with performance varying according to the expected motor abilities of different groups. Moreover, a kinematic assessment based on the presented system has been designed. Obtained results reflected different motor abilities of patients and participants, suggesting suitability of the proposed kinematic assessment as a motor function outcome.

[PMID: 29985156](#)

20. A Model to Estimate the Optimal Layout for Assistive Communication Touchscreen Devices in Children With Dyskinetic Cerebral Palsy.

Bertucco M, Sanger TD.

IEEE Trans Neural Syst Rehabil Eng. 2018 Jul;26(7):1371-1380. doi: 10.1109/TNSRE.2018.2840445.

Excess involuntary movements and slowness of movement in children with dyskinetic cerebral palsy often result in the inability to properly interact with augmentative and alternative communication (AAC) devices. This significantly limits communication. It is, therefore, essential to know how to adjust the device layout in order to maximize each child's rate of communication. The aim of this paper was to develop a mathematical model to estimate the information rate in children with dyskinetic cerebral palsy and to determine the optimal AAC layout for a touchscreen tablet that results in enhanced speed of communication. The model predicts information rate based on button size, number, spacing between buttons, and the probability of making an error or missing target buttons. Estimation of the information rate confirmed our hypothesis of lower channel capacity in children with dyskinetic cerebral palsy compared with age-matched healthy children. Information rate increased when the AAC layout was customized based on the optimal parameters predicted by the model. In conclusion, this paper quantifies the effect of motor impairments on communication with assistive communication devices and shows that communication performance can be improved by optimally matching the parameters of the AAC touchscreen device to the abilities of the child.

[PMID: 29985146](#)

21. Sustained participation in community-based physical activity by adolescents with cerebral palsy: a qualitative study.

Morris A, Imms C, Kerr C, Adair B.

Disabil Rehabil. 2018 Jul 10:1-9. doi: 10.1080/09638288.2018.1486466. [Epub ahead of print]

Short-term physical activity programs may encourage adolescents with cerebral palsy to participate in physical activity but how to sustain their involvement is not well known.

This qualitative study aimed to identify facilitators that successfully sustain physical activity participation by adolescents with cerebral palsy. Adolescents (12-18 years) with cerebral palsy [Gross Motor Function Classification System (GMFCS) levels I-V, without moderate-severe intellectual disability] who participated in regular physical activity were eligible, as well as one parent and an individual who facilitated their physical activity. Data were gathered using semi-structured interviews; verbatim transcripts were analysed using inductive thematic analysis within individuals (n = 15), triads (n = 5), and across participant groups (adolescents, parents and facilitators). Five triads participated (male adolescents, 13-16 years, GMFCS levels I-III). Seven themes emerged: getting started, wanting to succeed, a sense of belonging, the coach is important, endorsement to continue, endorsement to support and being passionate. The themes were synthesized into the Framework for Sustained Participation, which describes the interaction among themes. The Framework for Sustained Participation highlights strategies that may be useful for adolescents, parents, sports facilitators, clinicians and researchers to help ambulatory male adolescents with cerebral palsy continue to participate in physical activity. Implications for rehabilitation Sustaining participation in physical activity has the potential to enhance long-term health benefits of young people with cerebral palsy. Key facilitators of sustained physical activity in adolescents with cerebral palsy included tailoring the activity, getting the right coach and the adolescents' desire for health and fitness. The Framework of Sustained Participation may assist clinicians and facilitators who work with young people with cerebral palsy to structure their support in ways that will successfully sustain the adolescents' participation in physical activity.

[PMID: 29987965](#)

22. The quality of life in Chinese population with chronic non-communicable diseases according to EQ-5D-3L: a systematic review.

Zhou T, Guan H, Yao J, Xiong X, Ma A.

Qual Life Res. 2018 Jul 6. doi: 10.1007/s11136-018-1928-y. [Epub ahead of print]

Over the past decade, a changing spectrum of disease has turned chronic non-communicable diseases (CNCDS) into the leading cause of death worldwide. During the 2015 in China, there were more than 6.6 million deaths from NCDs, which was the highest rate around the world. In the present study, we performed a systematic review to analyze the health-related quality of life (HRQoL) according to EQ-5D-3L instrument in patients with different kinds of CNCDS in China. We searched PubMed, Embase, Web of Science, Cochrane Library, VIP, WanFang Data, and CNKI databases up to April 12, 2018, to identify all relevant studies that reported on HRQoL assessed by EQ-5D-3L instrument in Chinese patients with CNCDS. Expert consultation and hand-searching of reference lists from retrieved studies were employed to identify additional references. The variation of mean utility values, EQ-VAS score ranges, and responses for each EQ-5D dimension described in relevant studies were extracted. A total of 5027 English-language articles and 618 Chinese-language articles were identified, among which 38 articles met full inclusion criteria. These 38 studies involved 18 kinds of CNCDS. In this review, the health utility for diabetes mellitus ranged from 0.79 to 0.94 (EQ-5D VAS scores from 61.5 to 78.6), hypertension from 0.78 to 0.93 (70.1-77.4), coronary heart disease from 0.75 to 0.90 (71.0-77.0), chronic obstructive pulmonary disease from 0.64 to 0.80 (55.0-67.0), epilepsy from 0.83 to 0.87 (78.3-79.6), cerebral infarction from 0.51 to 0.75 (49.7-79.0), while children cerebral palsy was 0.44 (27.3). EQ-5D-3L is widely used in studies of HRQoL associated with CNCDS in China. Our results suggest that many factors may influence the measurement results of health utilities, including age, gender, sample source, comorbidities, rural/urban, and EQ-5D-3L value sets.

[PMID: 29980994](#)

23. Use of the ACTIVLIM-CP questionnaire: gauging daily performance in children with cerebral palsy.

Newman CJ.

Dev Med Child Neurol. 2018 Jul 11. doi: 10.1111/dmcn.13970. [Epub ahead of print]

[PMID: 29998486](#)

24. [Evaluation of Organisational Structures of Self-help Groups in the Field of Paediatric Orthopaedics]. [Article in German; Abstract available in German from the publisher]

Peterlein CD, Friedrich S, Daniel H, Malcherczyk D, Ruden J, El Zayat BF.

Z Orthop Unfall. 2018 Jul 11. doi: 10.1055/a-0639-5795. [Epub ahead of print]

There have been few publications on the organisational structures of self-help groups that handle orthopaedic disorders in children. A standardised questionnaire was sent by post to the corresponding support groups. The aim was to evaluate the self-help group's structure, use of social media and financial background.

Support groups for dwarfism, infantile cerebral palsy and Down syndrome responded and sent the questionnaire back to our department. Most self-help groups were incorporated societies and belonged to an umbrella organisation. The founding year was predominantly in the decade 1990-2000 (n = 15). The founders were predominantly parents (n = 28; 77.8%), concerned individuals (n = 11; 30.6%) and - in two cases - physicians (5.6%). 29 support groups (80.6%) received donations for financial support. The aims, activities, and manner of contact were presented in the home page (n = 35; 97.2%). Most self-help group focussing on paediatric orthopaedic disorders cooperate with physicians in different specialisations to obtain information and recommendations. The study presents the first information on self-help groups and documents the multidisciplinary of paediatric orthopaedics. Close collaboration between paediatric orthopaedic surgeons and regional support groups might contribute to the reduction of uncertainty and fears and improve of medical provision. Georg Thieme Verlag KG Stuttgart · New York.

[PMID: 29996166](#)

25. Effectiveness of Animal-Assisted Therapy in the Pediatric Population: Systematic Review and Meta-Analysis of Controlled Studies.

Charry-Sánchez JD, Pradilla I, Talero-Gutiérrez C.

J Dev Behav Pediatr. 2018 Jul 6. doi: 10.1097/DBP.0000000000000594. [Epub ahead of print]

To synthesize the results of controlled studies evaluating the effectiveness of animal-assisted therapy (AAT) in children. Eleven databases were searched following the Preferred Reporting Items for Systematic Reviews and Meta-analyses statement recommendations, and references from included studies and previous reviews were examined. No date or language filters were applied. Only controlled study designs, including those using wait-list controls, that studied a specific condition or illness were included. Study quality was assessed using the Cochrane Risk of Bias Tool. Twenty-six studies that met the inclusion criteria were retrieved. Nine were conducted in children with autism spectrum disorders, 10 in cerebral palsy (CP), 2 in Down syndrome, 3 in pain, and 2 in other conditions. Qualitative synthesis showed a small but significant contribution of AAT to the management of these conditions. Meta-analysis showed a mean difference in improvement in the Gross Motor Function Measure-66 scale in children with CP of 1.61 (95% confidence interval [CI] -2.00 to 5.23) and a mean difference for 5-point pain scales of -0.81 (95% CI -1.32 to 0.30), both favoring AAT. Animal-assisted therapy may be useful as a complementary intervention in the management of children with CP and pain. Although results are in general positive for the management of children with Down syndrome and autism, the diversity of scales used to measure outcomes makes it difficult to establish true effectiveness. The application of simple corrective measures in the randomization process would greatly improve the quality of evidence. It is necessary to reach a consensus between AAT researchers regarding appropriate instruments to provide higher-quality evidence in further studies.

[PMID: 29994814](#)

Prevention and Cure

26. Bihemispheric alterations in myelination in children following unilateral perinatal stroke.

Yu S, Carlson HL, Mineyko A, Brooks BL, Kuczynski A, Hodge J, Dukelow S, Kirton A.

Neuroimage Clin. 2018 Jun 27;20:7-15. doi: 10.1016/j.nicl.2018.06.028. eCollection 2018.

Stroke is a leading cause of perinatal brain injury with variable outcomes including cerebral palsy and epilepsy. The biological processes that underlie these heterogeneous outcomes are poorly understood. Alterations in developmental myelination are recognized as a major determinant of outcome in preterm brain injury but have not been explored in perinatal stroke. We aimed to characterize myelination in hemiparetic children after arterial perinatal stroke, hypothesizing that ipsilesional myelination would be impaired, the degree of which would correlate with poor outcome. Retrospective, controlled cohort study. Participants were identified through the Alberta Perinatal Stroke Project (APSP), a population-based research cohort (n > 400). Inclusion criteria were: 1) MRI-confirmed, unilateral arterial perinatal stroke, 2) T1-weighted MRI after 6 months of age, 3) absence of other neurological disorders, 4) neurological outcome that included at least one of the following tests - Pediatric Stroke Outcome Measure (PSOM), Assisting Hand Assessment (AHA), Melbourne Assessment (MA), neuropsychological evaluation (NPE), and robotic sensorimotor measurements. FreeSurfer software measured hemispheric asymmetry in myelination intensity (primary outcome). A second method using ImageJ software validated the detection of myelination asymmetry. A repeated measures ANOVA was used to compare perilesional, ipsilesional remote, and contralesional homologous region myelination between stroke cases and typically developing controls. Myelination metrics were compared to clinical outcome measures (t-test, Pearson's correlation). Twenty youth with arterial stroke (mean age: 13.4 ± 4.2yo) and 27 typically developing controls (mean age: 12.5 ± 3.7yo) were studied in FreeSurfer. Participants with stroke demonstrated lower myelination in the ipsilesional hemisphere (p < 0.0001). Myelination in perilesional regions had lower intensity compared to ipsilesional remote areas (p < .00001) and contralesional homologous areas (p < 0.00001).

Ipsilesional remote regions had decreased myelination compared to homologous regions on the contralesional hemisphere ($p=0.016$). Contralesional myelination was decreased compared to controls ($p<0.00001$). Myelination metrics were not strongly associated with clinical motor, robotic sensorimotor, or neuropsychological outcomes though some complex tests requiring speeded responses had moderate effect sizes. Myelination of apparently uninjured brain in both the ipsilesional and contralesional hemispheres is decreased after perinatal stroke. Differences appear to radiate outward from the lesion. Further study is needed to determine clinical significance.

[PMID: 29988959](#)

27. Serum-based phospho-neurofilament-heavy protein as theranostic biomarker in three models of traumatic brain injury: an Operation Brain Trauma Therapy (OBTT) study.

Yang Z, Zhu T, Mondello S, Akel M, Wong AT, Kothari IM, Lin F, Shear DA, Gilsdorf J, Leung LY, Bramlett HM, Dixon CE, Dietrich WD, Hayes RL, Povlishock J, Tortella FC, Kochanek PM, Wang KKW.

J Neurotrauma. 2018 Jul 10. doi: 10.1089/neu.2017.5586. [Epub ahead of print]

Glial fibrillary acidic protein (GFAP) and ubiquitin C-terminal hydrolase (UCH-L1), markers of glial and neuronal cell body injury respectively, have been previously selected by the Operation Brain Trauma Therapy (OBTT) pre-clinical therapy and biomarker screening consortium as drug development tools. However, traumatic axonal injury (TAI) also represents a major consequence and determinant of adverse outcomes following traumatic brain injury (TBI). Thus, biomarkers capable of assessing TAI are much needed. Neurofilaments (NFs) are found exclusively in axons. Here, we evaluated phospho-neurofilament-H (pNF-H) protein as a possible new TAI marker in serum and cerebrospinal fluid (CSF) across three rat TBI models in studies carried out by the OBTT consortium, namely, controlled cortical impact (CCI), parasagittal fluid percussion (FPI) and penetrating ballistics-like brain injury (PBBI). We indeed found that CSF and serum pNF-H levels are robustly elevated by 24 h post injury in all three models. Further, in prior studies by OBTT, levetiracetam showed the most promising benefits, while nicotinamide showed limited benefit only at high dose (500 mg/kg). Thus, serum samples from the same repository collected by OBTT were evaluated. Treatment with 54 mg/kg IV of levetiracetam in the CCI model and 170 mg/kg in the PBBI model significantly attenuated pNF-H levels at 24 h post-injury as compared to respective vehicle groups. In contrast, nicotinamide (50 mg/kg or 500 mg/kg) showed no reduction of pNF-H-levels in CCI or PBBI models. Our current study suggests that pNF-H is a useful theranostic blood-based biomarker for TAI across different rodent TBI models. In addition, our data support levetiracetam as the most promising TBI drug candidate screened by OBTT to date.

[PMID: 29987972](#)

28. Systematic review of the economic impact of cerebral palsy.

Tonmukayakul U, Shih STF, Bourke-Taylor H, Imms C, Reddihough D, Cox L, Carter R.

Res Dev Disabil. 2018 Jun 28;80:93-101. doi: 10.1016/j.ridd.2018.06.012. [Epub ahead of print]

Cerebral palsy (CP) and its associated conditions can pose a significant economic burden on families, the health care system and the general economy. The boundary for inclusion of costs in research can vary substantially across studies. To summarize the evidence for burden of disease for CP including the impacts on the health system, the community and carers. Literature was identified from Ovid Medline, Embase, CINAHL, PsycInfo, Econlit, Health Economic Evaluation Database (HEED) and NHS Economic Evaluation Database (NHS EED) in the Cochrane Library. The search was restricted to articles published in English between 1970 and April 2016. All costs were converted to \$USD 2016 price. Twenty-two articles were included. Studies varied from snapshot cost descriptions to more complex lifetime estimates, from prevalence-based to incidence-based studies, and from inclusion to exclusion of non-medical costs. There was a strong positive relationship between CP severity and expenditure. Significant costs were incurred by families and the welfare system to facilitate school and community engagement. Facilitating participation for people with CP involves substantial expense. The size, nature and distribution of the economic burden emphasises the importance of finding effective strategies to reduce the risk and severity of CP, together with how it is financed.

[PMID: 29981952](#)

29. Cranial ultrasound and neurophysiological testing to predict neurological outcome in infants born very preterm.

Franckx H, Hasaerts D, Huysentruyt K, Cools F.

Dev Med Child Neurol. 2018 Jul 7. doi: 10.1111/dmcn.13961. [Epub ahead of print]

Infants born preterm are at risk of cerebral palsy (CP) and motor or cognitive developmental delay. For clinicians, it is essential to know the relative predictive accuracy of the most commonly used neuroimaging and neurophysiological tests for the early prediction of adverse neurodevelopmental outcome. The aim of this study was to compare the accuracy of these tests in

A retrospective cohort study was performed in 163 children born before 32 weeks gestational age. We compared the accuracy in predicting adverse neurodevelopmental outcome at the age of 2 years 6 months of early and late cranial ultrasound (CUS), magnetic resonance imaging, somatosensory evoked potentials after stimulation of the posterior tibial nerve, and electroencephalography by calculating positive and negative likelihood ratios. An abnormal early CUS is the best predictor of the presence of CP (positive likelihood ratio 6.09), motor developmental delay (positive likelihood ratio 3.11), and cognitive developmental delay (positive likelihood ratio 5.66). Overall, negative likelihood ratios were poor, ranging between 0.49 and 0.98, meaning that a normal test result had only minimal influence on the probability of adverse neurological outcome. None of the diagnostic tests had a good performance in predicting future neurodevelopmental problems in infants born preterm. A normal test result provided very little clinically useful information. What this paper adds An abnormal early cranial ultrasound (positive test result) is the best predictor of adverse neurodevelopmental outcome. All negative results have poor predictive value of future neurodevelopmental problems.

[PMID: 29981239](#)

30. A Collaborative Approach to Decision Making Through Developmental Monitoring to Provide Individualized Services for Children With Cerebral Palsy.

Bartlett DJ, McCoy SW, Chiarello LA, Avery L, Galuppi B; On Track Study Team.

Phys Ther. 2018 Jul 5. doi: 10.1093/ptj/pzy081. [Epub ahead of print]

In this Perspective, we suggest a process to improve physical and occupational therapists' and families' collaboration to provide appropriate, efficient, and effective evidence-based services to improve motor function, self-care performance, and participation in family and recreation activities for children with cerebral palsy (CP). This process is informed by two multisite prospective cohort studies (Move & PLAY and On Track). The heterogeneity of children with CP is described, limiting the utility of evidence from randomized controlled trials and systematic reviews to inform service planning for children with CP. An evidence-based alternative using prospective cohort studies that produce knowledge of determinants of outcomes important to children and families and methods for developmental monitoring using longitudinal developmental and reference percentile curves to inform individualized care is suggested. Guiding questions are provided to explore how knowledge of determinants and developmental monitoring can inform family-centered, collaborative, strengths-based and focused service programs to support early development and function. Although this perspective paper is focused on children with CP, the research approach described for collection of useful information and the clinical method of data use may be helpful for people with other heterogeneous chronic health conditions in which physical and occupational therapists face similar challenges.

[PMID: 29982806](#)