Cerebral palsy research news

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Interventions and Management

1. Combined Effects of Mirror Therapy and Exercises on the Upper Extremities in Children with Unilateral Cerebral Palsy: A Randomized Controlled Trial.
Kara OK, Yardimci BN, Sahin S, Orhan C, Livanelioglu A, Soylu AR.

Dev Neurorehabil. 2019 Sep 13:1-12. doi: 10.1080/17518423.2019.1662853. [Epub ahead of print]

Purpose: This study investigated the combined effects of mirror therapy involving power and strength exercises of the upper extremities in children with Unilateral Spastic Cerebral Palsy (USCP). Methods: Thirty children were included in either an experimental group or a control group. All participants were evaluated with the Quality of Upper Extremity Skill Test (QUEST), Canadian Occupational Performance Measure (COPM), and a handheld dynamometer to measure isometric muscle strength. Results: Compared to the control group, greater improvement was found in dissociated movements ($p < .001$, $d = 1.82$), grasp ($p < .001$, $d = 1.38$), weight bearing ($p = .006$, $d = 0.91$), and total scores ($p = .001$, $d = 1.16$) of QUEST; performance ($p < .001$, $d = 2.9$), satisfaction ($p < .001$, $d = 1.91$), and total scores ($p < .001$, $d = 2.87$) of COPM; and isometric muscle strength of the biceps brachii ($p < .001$, $d = 1.27$) and triceps brachii ($p = .002$, $d = 2.22$) of the affected upper limbs in the experimental group. Conclusions: Mirror therapy combined with power and strength exercises is a promising intervention approach to improve activity performance and upper-limb function in children with USCP.

PMID: 31514564

2. Validation of a robot serious game assessment protocol for upper limb motor impairment in children with cerebral palsy.
Dehem S, Montedoro V, Brouwers I, Edwards MG, Detrembleur C, Stoquart G, Renders A, Heins S, Dehez B, Lejeune T.

NeuroRehabilitation. 2019 Sep 3. doi: 10.3233/NRE-192745. [Epub ahead of print]

BACKGROUND: The ROBiGAME project aims to implement serious games on robots to rehabilitate upper limb (UL) motor function in children with cerebral palsy (CP). Serious game characteristics (target position, level of assistance/resistance, level of force) are typically adapted based on the child's assessment before and continuously during the game (measuring UL working area, kinematics and muscle strength). OBJECTIVE: This study developed an UL robotic motor assessment protocol to configure the serious game. METHODS: Forty-nine healthy children and 20 CP children participated in the study. The clinical assessment consisted of the child's UL length and isometric force. The robot assessment consisted of the child's UL working area (WA), the UL isometric and isokinetic force in three directions and the UL kinematics during a pointing task toward targets placed at different distances. RESULTS: Results showed that WA and UL isometric force were moderately to highly correlated with clinical measures. Ratios between the UL isokinetic force generated on three directions were established. The velocity and straightness indexes of all children increased when they had to reach to targets placed more distant. CONCLUSIONS: This protocol can be integrated into different serious games in order to continuously configure the

game characteristics to a child's performance. TRIAL REGISTRATION: The study was registered at ClinicalTrials.gov (NCT02543424), 12 August 2015.

PMID: 31498135

3. Protocol for a multisite randomised trial of Hand-Arm Bimanual Intensive Training Including Lower Extremity training for children with bilateral cerebral palsy: HABIT-ILE Australia.
Sakzewski L, Bleyenheuft Y, Boyd RN, Novak I, Elliott C, Reedman S, Morgan C, Pannek K, Fripp J, Golland P, Rowell D, Chatfield M, Ware RS.

BMJ Open. 2019 Sep 8;9(9):e032194. doi: 10.1136/bmjopen-2019-032194.

INTRODUCTION: Children with bilateral cerebral palsy often experience difficulties with posture, gross motor function and manual ability, impacting independence in daily life activities, participation and quality of life (QOL). Hand-Arm Bimanual Intensive Training Including Lower Extremity (HABIT-ILE) is a novel intensive motor intervention integrating upper and lower extremity training. This study aimed to compare HABIT-ILE to usual care in a large randomised controlled trial (RCT) in terms of gross motor function, manual ability, goal attainment, walking endurance, mobility, self-care and QOL. A within-trial cost-utility analysis will be conducted to synthesise costs and benefits of HABIT-ILE compared with usual care. METHODS AND ANALYSIS: 126 children with bilateral cerebral palsy aged 6-16 years will be recruited across three sites in Australia. Children will be stratified by site and Gross Motor Function Classification System and randomised using concealed allocation to either receiving HABIT-ILE immediately or being waitlisted for 26 weeks. HABIT-ILE will be delivered in groups of 8-12 children, for 6.5 hours per day for 10 days (total 65 hours, 2 weeks). Outcomes will be assessed at baseline, immediately following intervention, and then retention of effects will be tested at 26 weeks. Primary outcomes will be the Gross Motor Function Measure and ABILHAND-Kids. Secondary outcomes will be brain structural integrity, walking endurance, bimanual hand performance, self-care, mobility, performance and satisfaction with individualised goals, and QOL. Analyses will follow standard principles for RCTs using two-group comparisons on all participants on an intention-to-treat basis. Comparisons between groups for primary and secondary outcomes will be conducted using regression models. ETHICS AND DISSEMINATION: Ethics approval has been granted by the Medical Research Ethics Committee of Children's Health Queensland Hospital and the Health Service Human Research Ethics Committee (HREC/17/QRCH/282) of The University of Queensland (2018000017/HREC/17/QRCH/2820), and The Cerebral Palsy Alliance Ethics Committee (2018_04_01/HREC/17/QRCH/282). TRIAL REGISTRATION NUMBER: ACTRN12618000164291.

PMID: 31501133

4. Use of an Accelerated Discharge Pathway in Patients With Severe Cerebral Palsy Undergoing Posterior Spinal Fusion for Neuromuscular Scoliosis.
Bellaire LL, Bruce RW Jr, Ward LA, Bowman CA, Fletcher ND.

Spine Deform. 2019 Sep;7(5):804-811. doi: 10.1016/j.jspd.2019.02.002.

BACKGROUND: Implementation of a coordinated multidisciplinary postoperative pathway has been shown to reduce length of stay after posterior spinal fusion (PSF) for adolescent idiopathic scoliosis. This study sought to compare the outcomes of nonambulatory cerebral palsy (CP) patients treated with PSF and cared for using an accelerated discharge (AD) pathway with those using a more traditional discharge (TD) pathway. METHODS: A total of 74 patients with Gross Motor Function Classification System (GMFCS) class 4/5 CP undergoing PSF were reviewed. Thirty consecutive patients were cared for using a TD pathway, and 44 patients were subsequently treated using an AD pathway. The cohorts were then evaluated for postoperative complications and length of stay. RESULTS: Length of stay (LOS) was 19% shorter in patients managed with the AD pathway (AD 4.0 days [95% CI 2.5-5.5] vs. TD 4.9 days [95% CI 3.5-6.3], p = .01). There was no difference between groups with respect to age at surgery, GMFCS class, preoperative curve magnitude, pelvic obliquity, kyphosis, postoperative curve correction, fusion to the pelvis, or length of fusion between groups. Length of stay remained significantly shorter in the AD group by 0.9 days when controlling for estimated blood loss (EBL) and length of surgery. Complication rates trended lower in the AD group (33% AD vs. 52% TD, p = .12), including pulmonary complications (21% AD vs. 38% TD, p = .13). There was no significant difference in wound complications, return to the operating room, or medical readmissions between groups. CONCLUSIONS: Adoption of a standardized postoperative pathway reduced LOS by 19% in nonambulatory CP patients. Overall, complications, including pulmonary, trended lower in the AD group. Early discharge appears to be possible in this challenging patient population. Although the AD pathway may not be appropriate for all patients, the utility of the AD pathway in optimizing care for more routine PSF for this patient subset appears to be worthwhile. LEVEL OF EVIDENCE: Level III, therapeutic.

PMID: 31495482

5. Whether the newly modified rhizotomy protocol is applicable to guide single-level approach SDR to treat spastic quadriplegia and diplegia in pediatric patients with cerebral palsy?
Zhan Q, Yu X, Jiang W, Shen M, Jiang S, Mei R, Wang J, Xiao B.

Childs Nerv Syst. 2019 Sep 9. doi: 10.1007/s00381-019-04368-w. [Epub ahead of print]

PURPOSE: Our aim was to test whether the newly modified rhizotomy protocol which could be effectively used to guide single-level approach selective dorsal rhizotomy (SL-SDR) to treat spastic hemiplegic cases by mainly releasing those spastic muscles (target muscles) marked pre-operatively in their lower limbs was still applicable in spastic quadriplegic or diplegic cerebral palsy (CP) cases in pediatric population. METHODS: In the current study, we retrospectively conducted a cohort review of cases younger than 14 years of age diagnosed with spastic quadriplegic or diplegic CP who undergone our modified protocol-guided SL-SDR in the Department of Neurosurgery, Children's Hospital of Shanghai since July 2016 to November 2017 with at least 12 months post-op intensive rehabilitation program (pre-op GMFCS level-based). Clinical data including demographics, intra-operative EMG responses interpretation, and relevant assessment of included cases were taken from the database. Inclusion and exclusion criteria were set for the selection of patients in the current study. Muscle tone (modified Ashworth scale) and strength of those spastic muscles (muscle strength grading scale), range of motion (ROM) of those joints involved, the level of Gross Motor Function Classification System (GMFCS), and Gross Motor Function Measure 66 items (GMFM-66) score of those cases were our focus. RESULTS: A total of 86 eligible cases were included in our study (62 boys). Among these patients, 61.6% were quadriplegic. Pre-operatively, almost 2/3 of our cases were with GMFCS levels II and III. Mean age at the time of surgery in these cases was 6.2 (3.5-12) years. Pre-op assessment marked 582 target muscles in these patients. Numbers of nerve rootlets tested during SDR procedure were between 52 and 84 across our cases, with a mean of 66.5 ± 6.7/case. Among those tested (5721 in 86 cases), 47.9% (2740) were identified as lower limb-related sensory rootlets. Our protocol successfully differentiated sensory rootlets which were considered to be associated with spasticity of target muscles across all our 86 cases (ranged from 3 to 21). Based on our protocol, 871 dorsal nerve rootlets were sectioned 50%, and 78 were cut 75%. Muscle tone of those target muscles reduced significantly right after SL-SDR procedure (3 weeks post- vs. pre-op, 1.7 ± 0.5 vs. 2.6 ± 0.7). After an intensive rehabilitation program for 19.9 ± 6.0 months, muscle tone continued to decrease to 1.4 ± 0.5. With the reduction of muscle tone, strength of those target muscles in our cases improved dramatically with statistical significance achieved (3.9 ± 1.0 at the time of last follow-up vs. 3.3 ± 0.8 pre-op), and as well as ROM. Increase in GMFCS level and GMFM-66 score was observed at the time of last follow-up with a mean of 0.4 ± 0.6 and 6.1 ± 3.2, respectively, when compared with that at pre-op. In 81 cases with their pre-op GMFCS levels II to V, 27 (33.3%) presented improvement with regard to GMFCS level upgrade, among which 4 (4.9%) even upgraded over 2 levels. Better results with regard to upgrading in level of GMFCS were observed in cases with pre-op levels II and III when compared with those with levels IV and V (24/57 vs. 3/24). Upgrading percentage in cases younger than 6 years at surgery was significantly greater than in those older (23/56 vs. 4/25). Cases with their pre-op GMFM-66 score ≥ 50 had greater score increase of GMFM-66 when compared with those less (7.1 ± 3.4 vs. 5.1 ± 2.8). In the meanwhile, better score improvement was revealed in cases when SDR performed at younger age (6.9 ± 3.3 in case ≤ 6 years vs. 4.7 ± 2.7 in case > 6 years). No permanent surgery-related complications were recorded in the current study. CONCLUSION: SL-SDR when guided by our newly modified rhizotomy protocol was still feasible to treat pediatric CP cases with spastic quadriplegia and diplegia. Cases in this condition could benefit from such a procedure when followed by our intensive rehabilitation program with regard to their motor function.

PMID: 31502037

6. Bone and joint complications and reduced mobility are associated with pain in children with cerebral palsy.
Schmidt SM, Hägglund G, Alriksson-Schmidt AI.

Acta Paediatr. 2019 Sep 10. doi: 10.1111/apa.15006. [Epub ahead of print]

AIM: To investigate the relationships between pain in the lower extremities and back, and spasticity, bone/joint complications, and mobility. METHODS: Retrospective population-based registry study. Participants (N = 3,256) with cerebral palsy (CP), 2.5-16 years of age, participating in the Swedish Cerebral Palsy Follow-Up Program were included. Spasticity was measured using scissoring and the Modified Ashworth Scale. Bone/joint complications consisted of hip displacement, range of motion, windswept posture, and scoliosis. Mobility was measured using the Functional Mobility Scale (5-, 50-, and 500-meters), wheelchair use (outdoors), and the ability to stand/get up from sitting/use stairs, respectively. Pain was measured as presence of pain in hips, knees, feet, and back. Data were analyzed using structural equation modeling. RESULTS: Bone/joint complications had the strongest direct pathway with pain in the lower extremities (standardized regression coefficient = 0.48), followed by reduced mobility (standardized regression coefficient = -0.24). The pathways between spasticity and pain, and age and pain were not significant. The R2 of the model was 0.15. CONCLUSION: Bone/joint complications and reduced mobility were associated with pain in the lower extremities when controlling for sex. Considering the R2 of the model, other factors not included in the model are also associated with pain in the lower extremities in children with CP.

PMID: 31506983

7. The effect of low-trauma fracture on one-year mortality rate among privately insured adults with and without neurodevelopmental disabilities.
Whitney DG1, Whibley D2, Jepsen KJ3.

Bone. 2019 Sep 5:115060. doi: 10.1016/j.bone.2019.115060. [Epub ahead of print]

BACKGROUND: Individuals with neurodevelopmental disabilities (NDDs) have poor development and preservation of skeletal health throughout the lifespan, and are especially vulnerable to low-trauma fracture and post-fracture health complications. However, no studies have examined if adults with NDDs have greater post-fracture mortality risk compared to adults without NDDs. The purpose of this study was to determine whether adults with NDDs have greater 12-month mortality rates following a low-trauma fracture compared to adults without NDDs. METHODS: Data from 2011 to 2017 was leveraged from Optum Clinformatics® Data Mart; a nationwide claims database from a single private payer in the U.S. Data were extracted from adults (18+ years) with and without NDDs that sustained a low-trauma fracture between 01/01/2012-12/31/2016, as well as pre-fracture chronic diseases (i.e., cardiovascular diseases, cerebrovascular diseases, diabetes, chronic obstructive pulmonary diseases, cancer). Mortality rate was estimated for adults with and without NDDs, and the mortality rate ratio (RR) and 95% confidence interval (CI) was calculated. Cox regression was used to estimate hazard ratio (HR) and 95% CI for 1-, 3-, 6-, and 12-month post-fracture mortality rates between adults with and without NDDs after adjusting for age, sex, race, U.S. region, and pre-fracture chronic diseases. RESULTS: Mean age (SD) at baseline was 56.7 (20.6) for adults with NDDs (n = 3749; 45.2% men) and 63.9 (19.2) for adults without NDDs (n = 585,910; 34.4% men). During the 12-month follow-up period, 182 adults with NDDs (mean age [SD] = 69.8 [14.7]; 46.2% men) and 25,456 adults without NDDs (mean age [SD] = 78.9 [9.8]; 38.3% men) died. Crude mortality rate was not different between adults with and without NDDs for any time points (e.g., 12-months: 5.40 vs. 4.96 per 100 person years; RR = 1.09; 95% CI = 0.94-1.26); however, it was greater for adults with intellectual disabilities compared to adults without NDDs (RR = 1.46; 95% CI = 1.23-1.79). After adjustments, adults with NDDs had greater post-fracture mortality rates for 3-, 6-, and 12-month time points (e.g., 12-months: HR = 1.46; 95% CI = 1.27-1.69). When stratified by the type of NDD, adults with intellectual disabilities and adults with autism spectrum disorders, but not adults with cerebral palsy, had greater 12-month post-fracture mortality risk. When stratified by fracture location, lower extremities were associated with greater crude mortality rate (RR = 1.69; 95% CI = 1.22-2.35) and adjusted mortality risk (HR = 2.41; 95% CI = 1.73-3.35), while upper extremities were associated with greater adjusted mortality risk (HR = 1.76; 95% CI = 1.23-2.50) for adults with vs. without NDDs. CONCLUSIONS: Among privately insured adults with NDDs, low-trauma fracture is associated with greater mortality risk within 1 year of the fracture event, even after adjusting for pre-fracture chronic diseases. Study findings suggest the need for earlier fracture prevention strategies and improved post-fracture healthcare management.

PMID: 31494304

8. Repetitive Peripheral Magnetic Nerve Stimulation (rPMS) as Adjuvant Therapy Reduces Skeletal Muscle Reflex Activity.
Zschorlich VR, Hillebrecht M, Tanjour T, Qi F, Behrendt F, Kirschstein T, Köhling R.

Front Neurol. 2019 Aug 27;10:930. doi: 10.3389/fneur.2019.00930. eCollection 2019.

Background: The reduction of muscle hypertonia and spasticity, as well as an increase in mobility, is an essential prerequisite for the amelioration of physiotherapeutical treatments. Repetitive peripheral magnetic nerve stimulation (rPMS) is a putative adjuvant therapy that improves the mobility of patients, but the underlying mechanism is not entirely clear. Methods: Thirty-eight participants underwent either an rPMS treatment (N = 19) with a 5 Hz stimulation protocol in the posterior tibial nerve or sham stimulation (N = 19). The stimulation took place over 5 min. The study was conducted in a pre-test post-test design with matched groups. Outcome measures were taken at the baseline and after following intervention. Results: The primary outcome was a significant reduction of the reflex activity of the soleus muscle, triggered by a computer-aided tendon-reflex impact. The pre-post differences of the tendon reflex response activity were -23.7% ($P < 0.001$) for the treatment group. No significant effects showed in the sham stimulation group. Conclusion: Low-frequency magnetic stimulation (5 Hz rPMS) shows a substantial reduction of the tendon reflex amplitude. It seems to be an effective procedure to reduce muscular stiffness, increase mobility, and thus, makes the therapeutic effect of neuro-rehabilitation more effective. For this reason, the 5 Hz rPMS treatment might have the potential to be used as an adjuvant therapy in the rehabilitation of gait and posture control in patients suffering from limited mobility due to spasticity. The effect observed in this study should be investigated conjoined with the presented method in patients with impaired mobility due to spasticity.

PMID: 31507528

9. The effects of anterior seat inclination on movement time, mechanical work and kinematics during sit-to-stand in children with spastic diplegic cerebral palsy.
Boonyong S, Suriyaamarit D.

Disabil Rehabil Assist Technol. 2019 Sep 12:1-4. doi: 10.1080/17483107.2019.1659428. [Epub ahead of print]

Background: Anterior seat inclination has been applied in children with spastic diplegic cerebral palsy (SDCP) to adjust alignment during sitting. However, there has been a lack of evidence reporting the effects of anterior seat inclination on sit-to-stand (STS) performance in children with SDCP. Therefore, the aim of the study was to investigate the effects of anterior seat inclination on STS performance in children with SDCP. Methods: Fourteen children with SDCP (aged 8.74 (1.79) years, GMFCS levels I and II) participated in this study. All participants performed STS in four conditions of the seat including the horizontal seat (HS), anterior seat inclination of 5° (A5), 10° (A10) and 15° (A15). Three-dimensional motion analysis system was used to capture STS movements. Results: The total movement time and total mechanical work during the STS with A5, A10 and A15 were significantly lower than STS with HS. At the beginning of the task, STS with A5, A10 and A15 showed less trunk and hip flexion than HS. Conclusions: Anterior seat inclination with 5°, 10° and 15° could improve STS performance in children with SDCP. Therefore, applying these seats would be another option for children with SDCP to enhance STS performance. IMPLICATIONS FOR REHABILITATION Anterior seat inclination could improve sitting posture in children with diplegia. Children with diplegia spent less time when STS from the anterior seat inclination. Children with diplegia used less energy when STS from the anterior seat inclination.

PMID: 31512537

10. Knee Recurvatum in Children With Spastic Diplegic Cerebral Palsy.
Bauer J, Patrick Do K, Feng J, Pierce R, Aiona M.

J Pediatr Orthop. 2019 Oct;39(9):472-478. doi: 10.1097/BPO.0000000000000985.

BACKGROUND: The purpose of this study is to determine which factors drive patients with diplegic cerebral palsy to walk without knee recurvatum despite hyperextension of the knee on physical examination. METHODS: A retrospective review was conducted of all data collected in the Gait Analysis Laboratory between 1999 and 2014. Patients with spastic diplegic cerebral palsy and at least 5 degrees of knee extension on clinical examination were identified for the study. After IRB approval, a total of 60 children ranging in age from 4 to 17 were included in the study. There were 27 female patients. Gross Motor Function Classification System level was distributed in the population as follows: 34 patients at Gross Motor Function Classification System level I, 18 at level II, and 8 at level III. Patients were excluded from this study if they had extrapyramidal involvement, history of selective dorsal rhizotomy or lower extremity surgery. Patient who received botulinum toxin A injections within 1 year of the study were excluded as well. Patients were divided into 2 groups: children that walked with knee hyperextension (KH) and children that walked without knee hyperextension (KF, "knee flexion"). There were 15 subjects in the KH group and 45 subjects in the KF group. Motion Laboratory evaluation included a comprehensive examination, kinematics, and kinetic analysis with a VICOM system. All data were analyzed with unpaired t test to detect differences between the 2 groups. All statistical analysis was done only for the right legs (unless the right leg did not meet the exclusion then the left leg was analyzed) to meet the statistical requirement for independence. The Pearson correlation was applied to correlate the maximum knee extension in stance with maximum ankle dorsiflexion in stance. RESULTS: The static measurement of dorsiflexion with knee flexed showed statistically significant difference (P=0.004) with KH group having 2.3±11.6 degrees and KF group having 13.1±12.2 degrees. There was also a statistically significant difference in the static measurement of dorsiflexion with knee extended (P=0.0014) with KH group having -3.3±9.0 degrees and KF group having 5.8±9.1 degrees. Maximum dorsiflexion in stance phase also showed significant difference (P=0.0022) with the KH group having 0.1±14.0 degrees and KF group having 11.5±11.2 degrees. Maximum dorsiflexion in stance phase also showed significant difference (P<0.001) with the DH group having 0.1 (SD) 14.0 degrees and KF group having 11.5 (SD) 11.2 degrees. There were no significant differences in popliteal angle measurements or any strength measurement. CONCLUSIONS: Our study shows that the plantar flexion knee extension couple is the major contributing factor to cause patients with passive knee hyperextension to walk in a recurvatum pattern. This would have implications of further treatment of the knee hyperextension in stance. LEVEL OF EVIDENCE: Level III-case-control study.

PMID: 31503235

11. Rectus Femoris Transfer Surgery Worsens Crouch Gait in Children With Cerebral Palsy at GMFCS Levels III and IV.
Sousa TC, Nazareth A, Rethlefsen SA, Mueske NM, Wren TAL, Kay RM.

J Pediatr Orthop. 2019 Oct;39(9):466-471. doi: 10.1097/BPO.0000000000000988.

BACKGROUND: Previous study has shown that children with cerebral palsy (CP) functioning at Gross Motor Function Classification System (GMFCS) levels III and IV do not benefit from distal rectus femoris transfer (DRFT) due to lack of improvement in stance knee extension. The fate of knees in such subjects who do not undergo DRFT is unknown. The purpose of this study was to compare knee kinematic outcomes in patients with CP and stiff knee gait who underwent single-event multilevel surgery with and without DRFT. METHODS: Preoperative and postoperative gait analysis data were retrospectively reviewed for ambulatory (GMFCS levels I to IV) patients with CP with crouch and stiff knee gait whom underwent single-event multilevel surgery, including hamstring lengthening either with DRFT (N=34) or without DRFT (N=40). Statistical analyses included t tests and χ tests, and multiple regression analysis was performed to adjust for covariates. Data were stratified by GMFCS level groups I/II and III/IV. RESULTS: Improved maximum knee extension in stance was seen for both the DRFT (P=0.0002) and no DRFT groups ($P \leq 0.0006$) at GMFCS levels I/II, and the no DRFT group at GMFCS levels III/IV (P=0.02). Excessive stance knee flexion persisted for those at GMFCS level III/IV after DRFT. Maximum knee flexion in swing was maintained after DRFT, but significantly decreased in the no DRFT group ($P<0.002$) for both GMFCS groups. Change in total knee range of motion improved after DRFT only in the GMFCS I/II group subjects with unilateral involvement (P=0.01). Timing of maximum knee flexion in swing improved for all patients regardless of DRFT or GMFCS level group ($P<0.0001$). CONCLUSIONS: In patients with CP functioning at GMFCS levels III and IV, DRFT results in persistent crouch postoperatively. Given the importance of maintaining upright posture in these patients, we do not recommend DRFT in patients functioning at GMFCS levels III and IV. LEVEL OF EVIDENCE: Level III-retrospective comparative study.

PMID: 31503234

12. The validity and usability of an eight marker model for avatar-based biofeedback gait training.
Booth ATC, van der Krogt MM, Buizer AI, Steenbrink F, Harlaar J.

Clin Biomech (Bristol, Avon). 2019 Aug 24;70:146-152. doi: 10.1016/j.clinbiomech.2019.08.013. [Epub ahead of print]

BACKGROUND: Virtual reality presents a platform for therapeutic gaming, and incorporation of immersive biofeedback on gait may enhance outcomes in rehabilitation. Time is limited in therapeutic practice, therefore any potential gait training tool requires a short set up time, while maintaining clinical relevance and accuracy. The aim of this study was to develop, validate, and establish the usability of an avatar-based application for biofeedback-enhanced gait training with minimal set up time. METHODS: A simplified, eight marker model was developed using eight passive markers placed on anatomical landmarks. This allowed for visualisation of avatar-based biofeedback on pelvis kinematics, hip and knee sagittal angles in real-time. Retrospective gait analysis data from typically developing children (n = 41) and children with cerebral palsy (n = 25), were used to validate eight marker model. Gait outcomes were compared to the Human Body Model using statistical parametric mapping. Usability for use in clinical practice was tested in five clinical rehabilitation centers with the system usability score. FINDINGS: Gait outcomes of Human Body Model and eight marker model were comparable, with small differences in gait parameters. The discrepancies between models were <5°, except for knee extension where eight marker model showed significantly less knee extension, especially towards full extension. The application was considered of 'high marginal acceptability' (system usability score, mean 68 (SD 13)). INTERPRETATION: Gait biofeedback can be achieved, to acceptable accuracy for within-session gait training, using an eight marker model. The application may be considered usable and implemented for use in patient populations undergoing gait training.

PMID: 31499394

13. A Scoping Review of Neuromuscular Electrical Stimulation to Improve Gait in Cerebral Palsy: The Arc of Progress and Future Strategies.
Mooney JA, Rose J.

Front Neurol. 2019 Aug 21;10:887. doi: 10.3389/fneur.2019.00887. eCollection 2019.

Background: Neuromuscular deficits of children with spastic cerebral palsy (CP) limits mobility, due to muscle weakness, short muscle-tendon unit, spasticity, and impaired selective motor control. Surgical and pharmaceutical strategies have been partially effective but often cause further weakness. Neuromuscular electrical stimulation (NMES) is an evolving technology that can improve neuromuscular physiology, strength, and mobility. This review aims to identify gaps in knowledge to motivate future NMES research. Methods: Research publications from 1990- July 20th 2019 that investigated gait-specific NMES in CP were reviewed using the PubMed and Google Scholar databases. Results were filtered by the National Institute of Neurological Disorder and Stroke common data elements guidelines for CP. The Oxford Centre for Evidence Based Medicine guidelines

were used to determine levels of evidence for each outcome. Gait-specific NMES research protocols and trends are described, with implications for future research. Results: Eighteen studies met inclusion criteria, reporting on 212 participants, 162 of whom received NMES while walking, average age of 9.8 years, GMFCS levels I-III. Studies included 4 randomized control trials, 9 cohort studies and 5 case studies. A historical trend emerged that began with experimental multi-channel NMES device development, followed by the commercial development of single-channel devices with inertial sensor-based gait event detection to facilitate ankle dorsiflexion in swing phase. This research reported strong evidence demonstrating improved ankle dorsiflexion kinematics in swing and at initial contact. Improved walking speed, step length, and muscle volume were also reported. However, improvements in global walking scores were not consistently found, motivating a recent return to investigating multi-channel gait-specific NMES applications. Conclusions: Research on single-channel gait-specific NMES found that it improved ankle motion in swing but was insufficient to address more complex gait abnormalities common in CP, such as flexed-knee and stiff-knee gait. Early evidence indicates that multi-channel gait-specific NMES may improve gait patterns in CP, however significantly more research is needed. The conclusions of this review are highly limited by the low level of evidence of the studies available. This review provides a historical record of past work and a technical context, with implications for future research on gait-specific NMES to improve walking patterns and mobility in CP.

PMID: 31496986

14. Immediate effect of horse riding simulator on adductor spasticity in children with cerebral palsy: A randomized controlled trial.
Hemachithra C, Meena N, Ramanathan R, Felix AJW.

Physiother Res Int. 2019 Sep 10:e1809. doi: 10.1002/pri.1809. [Epub ahead of print]

BACKGROUND: Spastic cerebral palsy (CP) is the most common type of CP. Hip adductor spasticity leads to discomfort, stiffness, and difficulties in doing physical activities such as sitting, transfer, and walking. Management of hip adductor spasticity is still a challenge in the field of rehabilitation. Horse riding simulator (HRS) has been reported to have beneficial effects on spasticity, postural control, and motor function in children with spastic CP. OBJECTIVE: The aim of the study was to determine the immediate effect of HRS on adductor spasticity in children with CP. METHODS: Twenty-four children with CP were selected and were divided into two groups: experimental and control (12 children in each group). Experimental group was exposed to HRS and control group to the corner seat placement. Adductor tone and passive hip abduction range of motion were measured before and after the intervention. RESULTS: Post intervention scores in the group of HRS show significant reduction in adductor spasticity and improvement in hip abduction range of motion, whereas no difference have been reported in the control group. HRS has positive effects on reducing spasticity and improving range of motion in hip joint in spastic CP. CONCLUSION: It was concluded that immediate effect of HRS is successful in reducing the adductor spasticity and improving abduction range of motion in hip, which could be incorporated with regular physiotherapy intervention.

PMID: 31502387

15. The effect of stabilization exercises along with self-care training on transverse abdominal activity, pain, and disability in mothers with low back pain having children with CP: a RCT.
Ahmadizadeh Z, Ehsani F, Samaei SA, Mirmohamadkhani M.

Am J Phys Med Rehabil. 2019 Sep 9. doi: 10.1097/PHM.0000000000001315. [Epub ahead of print]

OBJECTIVE: Many mothers of children with cerebral palsy (CP) experience low back pain (LBP), so the purpose of this study was to investigate the effect of stabilization exercises along with self-care training on transverse abdominal muscle activity, pain, disability and depression in them. DESIGN: In this single-blinded randomised clinical trial, 32 mothers with CP children were selected were randomly divided into two groups. Both groups received self-care training individually. For the experimental group, in addition to the self-care training, 24 sessions of stabilization exercises were held. Outcome measures included Visual Analog Scale, Roland-Morris Disability Questionnaire, Persian version of Beck Depression Inventory-II and ultrasonography. RESULTS: In the experimental group the transverse abdominal muscle activity during abdominal hollowing exercises were significantly increased ($p < 0.05$). There was no significant difference between the two groups in pain, disability and depression ($p > 0.05$). CONCLUSION: Stabilization exercises could improve the voluntary activity of transverse abdominal muscle of mothers of children with cerebral palsy.

PMID: 31503028

16. Empowerment in families raising a child with cerebral palsy during early childhood: Associations with child, family and service characteristics.
Kalleson R, Jahnsen R, Østensjø S.

Child Care Health Dev. 2019 Sep 10. doi: 10.1111/cch.12716. [Epub ahead of print]

BACKGROUND: Insight into family empowerment is important in order to develop and offer services that support and strengthen parents caring for a child with disability. The aims of this study were to describe empowerment trajectories among parents caring for a young child with cerebral palsy (CP) and to explore associations between parental empowerment and characteristics of the child and family and the services they receive. METHODS: 58 children (median age at first assessment 28 months, range 12-57) and their parents were included in a longitudinal cohort study based on registry data from follow-up programs for children with CP in Norway. Parental empowerment trajectories were described by averaging scores in the three subscales of the Family Empowerment Scale (FES) (family, service situations and community) at enrollment and at semi-annual/annual assessments. A linear mixed model was used to explore associations. RESULTS: Parental empowerment scores on the FES in family and service situations were high and stable during early childhood, while considerably lower in the community context. In service situations, perceived empowerment was significantly associated with both child, family and service characteristics, whereas empowerment in family situations was only associated with family characteristics. The service factor having a multidisciplinary support team was positively associated with perceived empowerment in both service situations and in the community. CONCLUSION: Knowledge about parental empowerment in different contexts and associations with characteristics of the child and family and the services they receive can contribute to further reinforcing family empowerment and identifying parents in need of additional support.

PMID: 31503355

17. Anticholinergic medications for reducing drooling in children with developmental disability.
Reid SM, Westbury C, Guzys AT, Reddihough DS.

Dev Med Child Neurol. 2019 Sep 8. doi: 10.1111/dmcn.14350. [Epub ahead of print]

AIM: To determine: the effectiveness of three anticholinergic medications in reducing drooling in children with developmental disabilities (such as cerebral palsy, intellectual disability, and autism spectrum disorder), the frequency and nature of side effects, and their impact on treatment discontinuation. METHOD: After prescription of benzhexol hydrochloride, glycopyrrolate, or scopolamine patches at a tertiary saliva control clinic, all carers of 110 consecutive, eligible patients were recruited over a 5-year period. They provided data for 52 weeks, or until drug discontinuation, on compliance, drooling, adverse effects, and reasons for cessation. We evaluated and compared best drooling response, side effects, and drug cessation rates using survival analysis, and the effect of baseline variables on the discontinuation rate using proportional hazards regression. RESULTS: Among 110 participants (71 males, 39 females; mean age 8y 5mo [SD 4y 3mo], range 1y 11mo-18y 11mo), benzhexol, glycopyrrolate, and scopolamine were prescribed 81, 62, and 17 times respectively, with respective response rates of 85%, 75%, and 65%. Poor head control and poor oromotor function were predictive of poor response. Side effects frequently prompted drug cessation in males more than females (hazard ratio 1.8 [95% confidence interval 1.0-3.2], p=0.048). Glycopyrrolate had the fewest side effects. INTERPRETATION: Benzhexol, glycopyrrolate, and scopolamine reduce drooling, but improvement is offset by adverse side effects. Overall, glycopyrrolate performs best. WHAT THIS PAPER ADDS: In drooling, glycopyrrolate produced the greatest improvement with fewer side effects compared with benzhexol and scopolamine. Poor head control and poor oromotor function were associated with poor response. Medication side effects were common and often led to treatment discontinuation. Behavioural issues instigated cessation of benzhexol more often in males than females.

PMID: 31495925

18. Assessment of orofacial dysfunction using the NOT-S method in a group of Turkish children with cerebral palsy.
Alaçam A, Çalık Yılmaz BC, Incioğlu AS.

Eur Arch Paediatr Dent. 2019 Sep 6. doi: 10.1007/s40368-019-00475-z. [Epub ahead of print]

OBJECTIVES: A healthy determination of orofacial findings of children with cerebral palsy is important as this will lead us to utilize perfect multidisciplinary therapies of orofacial dysfunctions (OFD). Nordic Orofacial Test-Screening (NOT-S) is a comprehensive screening method of OFD which consists of a structured interview and clinical examination. The aim of our

study was to evaluate the orofacial dysfunctions in a group of Turkish children with cerebral palsy using Nordic Orofacial Test-Screening (NOT-S) and find out the factors associated with OFD comparatively with a healthy group. MATERIALS AND METHODS: NOT-S was applied to 84 children aged 3-16 years. Forty-two children with cerebral palsy were included in the study group and 42 healthy children were randomly selected for the control group. Two trained and calibrated examiners who were experienced on NOT-S interview and examination of the validity and reliability of the Turkish version performed screening and interpreted the results. RESULTS: NOT-S interview and clinical examination subscale scores of children with cerebral palsy were higher and found to be statistically significant (Mann-Whitney U test; $p < 0.001$). The total scale score of the cerebral palsy group was also statistically significant ($p < 0.001$). The most common dysfunctions were in the facial expression area (55.9%) and in the chewing and swallowing area (52.4%) following in sensory function area (47.6%). CONCLUSIONS: The results of this study indicated that the NOT-S protocol was an effective and valuable tool for the comprehensive screening of orofacial dysfunctions in a group of Turkish children with cerebral palsy.

PMID: 31493279

19. Long-Term Outcome After Bilateral Perinatal Arterial Ischemic Stroke.
Mineyko A, Kirton A.

Pediatr Neurol. 2019 Aug 2. pii: S0887-8994(19)30587-9. doi: 10.1016/j.pediatrneurol.2019.07.013. [Epub ahead of print]

AIM: We aimed to characterize the phenotype and outcomes of children with bilateral, large vessel perinatal arterial ischemic stroke. METHODS: Patients with bilateral, large vessel perinatal arterial ischemic stroke were identified from a large, population-based cohort (Alberta Perinatal Stroke Project). Subjects were included if stroke involving a major cerebral artery territory was documented in both cerebral hemispheres on magnetic resonance imaging. Standardized variables were extracted from charts including clinical presentations, associated potential risk factors, and outcomes. Outcome measures included the Pediatric Stroke Outcome Measure, Gross Motor Function Classification System, and epilepsy frequency score. Electroencephalographies were reviewed for sleep, epileptiform activity, and background. RESULTS: Of 174 children with perinatal arterial ischemic stroke, eight (5%) had bilateral large artery infarcts. Patients were followed for a mean of 9.7 years (range 1.8 to 14.6 years). One child died. All children had a total Pediatric Stroke Outcome Measure of ≥2 (median 8, range 2 to 10) and Gross Motor Function Classification System ≥ II. Seven of eight (88%) children had a history of epilepsy. CONCLUSIONS: Children with bilateral, large vessel perinatal stroke are at high risk of severe cognitive and motor sequelae. Epilepsy may also be more common than unilateral strokes. Cautious discussions with families regarding prognosis are recommended.

PMID: 31495662

20. Predicting Long-Term Survival Without Major Disability for Infants Born Preterm.
Bourke J, Wong K, Srinivasjois R, Pereira G, Shepherd CCJ, White SW, Stanley F, Leonard H.

J Pediatr. 2019 Sep 4. pii: S0022-3476(19)30964-3. doi: 10.1016/j.jpeds.2019.07.056. [Epub ahead of print]

OBJECTIVE: To describe the long-term neurodevelopmental and cognitive outcomes for children born preterm. STUDY DESIGN: In this retrospective cohort study, information on children born in Western Australia between 1983 and 2010 was obtained through linkage to population databases on births, deaths, and disabilities. For the purpose of this study, disability was defined as a diagnosis of intellectual disability, autism, or cerebral palsy. The Kaplan-Meier method was used to estimate the probability of disability-free survival up to age 25 years by gestational age. The effect of covariates and predicted survival was examined using parametric survival models. RESULTS: Of the 720 901 recorded live births, 12 083 children were diagnosed with disability, and 5662 died without any disability diagnosis. The estimated probability of disability-free survival to 25 years was 4.1% for those born at gestational age 22 weeks, 19.7% for those born at 23 weeks, 42.4% for those born at 24 weeks, 53.0% for those born at 25 weeks, 78.3% for those born at 28 weeks, and 97.2% for those born full term (39-41 weeks). There was substantial disparity in the predicted probability of disability-free survival for children born at all gestational ages by birth profile, with 5-year estimates of 4.9% and 10.4% among Aboriginal and Caucasian populations, respectively, born at 24-27 weeks and considered at high risk (based on low Apgar score, male sex, low sociodemographic status, and remote region of residence) and 91.2% and 93.3%, respectively, for those at low risk (ie, high Apgar score, female sex, high sociodemographic status, residence in a major city). CONCLUSIONS: Apgar score, birth weight, sex, socioeconomic status, and maternal ethnicity, in addition to gestational age, have pronounced impacts on disability-free survival.

PMID: 31493909

21. [Intrauterine Growth Restriction: Transsectoral, Interdisciplinary and Multiprofessional Care for Pregnant Women and Newborns in a Feto-neonatal Pathway: A Project of the Innovationsfonds].
Mense L, Birdir C, Reichert J, Schleußner E, Proquitté H, Schmitt J, Müller G, Rüdiger M.

Z Geburtshilfe Neonatol. 2019 Sep 11. doi: 10.1055/a-0998-4532. [Epub ahead of print] [Article in German; Abstract available in German from the publisher]

Intrauterine growth restriction (IUGR) is present in fetuses that do not achieve their full in-utero growth potential. IUGR needs to be discriminated from small for gestational age (SGA) because IUGR newborns in particular experience long-term side effects from their small growth. IUGR fetuses have a significantly increased risk of prematurity and a distinct risk profile compared to adequate-for-gestational-age preterm newborns. Complications of prematurity are more frequent, including bronchopulmonary dysplasia, intraventricular hemorrhage, and meconium ileus. IUGR newborns are at risk of long-term health issues like cerebral palsy, impaired lung function, and delayed speech development. Interdisciplinary and interprofessional care of IUGR pregnancies in the context of a standardized health care research project is feasible: Pregnant women at risk are identified, early therapy with acetylsalicylic acid is started as indicated, risk-adapted care at level III centers is organized including psychosocial interventions and neonatal consultations. Postnatally, integrated neonatal care focusing on parent-child interaction and optimized nutrition is a hallmark. Afterwards, in-depth pediatric follow-up visits with local pediatricians help to identify growth and neurodevelopment problems early. The effects, acceptance. and cost efficiency of this approach are evaluated prospectively as part of an Innovationsfonds project.

PMID: 31509873

22. Diffusion Tensor Imaging is associated with motor outcomes of very preterm born children at 11 years of age.
Lahti K, Saunavaara V, Munck P, Uusitalo K, Koivisto M, Parkkola R, Haataja L; PIPARI Study Group.

Acta Paediatr. 2019 Sep 10. doi: 10.1111/apa.15004. [Epub ahead of print]

AIM: Very preterm children born less than 32 weeks of gestation are at risk for motor difficulties such as cerebral palsy and developmental coordination disorder. This study explores the association between diffusion tensor imaging metrics at term and motor outcomes at 11 years of age. METHODS: A cohort of 37 very preterm infants (mean gestational age 29 4/7, SD 2 0/7) born in 2004-2006 in Turku University Hospital underwent diffusion tensor imaging at term. A region-of-interest analysis of fractional anisotropy and mean diffusivity was performed. Motor outcomes at 11 years of age were measured with the Movement Assessment Battery for Children - Second Edition. RESULTS: The diffusion metrics of the corpus callosum (genu p=0.005, splenium p=0.049), the left corona radiata (p=0.035) and the right optic radiation (p=0.017) were related to later motor performance. Mean diffusivity decreased and fractional anisotropy increased in proportion to the improving performance. CONCLUSION: The diffusion metrics of the genu and splenium of the corpus callosum, the left corona radiata and the right optic radiation at term were associated with motor skills at 11 years of age. Diffusion tensor imaging should be further studied as a potential tool in recognising children at risk for motor impairment.

PMID: 31505069

23. Airway Clearance Management with Vaküm Technology in Subjects with Ineffective Cough: A Pilot Study on the Efficacy, Acceptability Evaluation, and Perception in Children with Cerebral Palsy.
Bertelli L, Bardasi G, Cazzato S, Di Palmo E, Gallucci M, Ricci G, Pession A.

Pediatr Allergy Immunol Pulmonol. 2019 Mar 1;32(1):23-27. doi: 10.1089/ped.2018.0933. Epub 2019 Mar 22.

Background: In the medical complexity of a children with cerebral palsy, impaired airway clearance represents a major problem, leading to significative respiratory morbidity and mortality. Its management is difficult because of limited cooperation and poor tolerance to invasive treatments. Free Aspire® (FA) is a device designed to remove bronchial secretions noninvasively, without generating cough. Methods: The aim of our pilot prospective study is to assess the efficacy and acceptability of FA in removing airway obstruction in subjects with cerebral palsy and ineffective cough. We enrolled 11 subjects. At enrollment and after 3, 6, and 12 months, we collected data regarding health care resources use for respiratory exacerbations, perceived efficacy, and acceptability of treatment. Results: We observed a reduction in emergency room (ER) accesses, home pharmacological treatment, hospitalizations number, and hospital stay length. In particular after 12 months we observed a reduction of 74% in ER accesses and home pharmacological treatment, 38% in hospitalizations number, and 17% in hospital stay length for respiratory exacerbations. The 100% of caregivers considered the treatment effective and simple to use

and noted an improvement in subjects' general condition. They also reported good treatment tolerance of subjects, with an overall good compliance. Conclusion: The study demonstrates that FA is an effective device for the removal of bronchial secretions, with a positive caregivers' perception, that favored a good long-term compliance.

PMID: 31508252

24. National Trends in the Prevalence, Treatment, and Associated Spinal Diagnoses Among Pediatric Spondylolysis Patients.
Horn SR, Shepard N, Poorman GW, Bortz CA, Segreto FA, Janjua MB, Diebo BG, Vira S, Passias P.

Bull Hosp Jt Dis (2013). 2018 Dec;76(4):246-251.

INTRODUCTION: Spondylolysis is an increasingly common diagnoses for young individuals and presents with a wide range of pathological and clinical findings. Most patients are treated conservatively, and surgery is reserved for severe cases. This is a populations study defining the incidence of spondylolysis in the Kids' Inpatient Database (KID) and assess trends in diagnoses, causes, and treatments. METHODS: Retrospective analysis of the prospectively collected information in KID was performed for the years 2003 through 2012. Patients with a diagnosis of spondylolysis (ICD-9-CM 756.11) between the ages of 0 and 20 years in the KID were identified. Incidence of spondylolysis was established using KID-supplied hospital- and year-adjusted trend weights. Demographics including age, race, gender, and Charlson Comorbidity Index were assessed for all spondylolysis patients. Primary outcome measures were yearadjusted and hospital-adjusted incidence of spondylolysis. Secondary outcome measures were concurrent diagnoses and surgical details. RESULTS: Six hundred and sixteen patients with a diagnosis of spondylolysis (329 with primary diagnosis) were identified (female: 53.8%; age: 15.27 ± 3.32 years). The incidence of spondylolysis is 7 per 100,000 patients nationally. Spondylolysis incidence has increased over time ($p < 0.001$) though the operative rate for spondylolysis has remained the same in the last decade (70% average, $p = 0.52$). The average CCI is 0.234, the average length of stay is 3.76 days and 92.4% of patients were discharged home. The etiology of the spondylolysis was trauma in 8.6% of patients (3.2% car crash, 1.9% pedestrian, 1.3% fall, 1.3% assault, 1.1% other transport, 1.0% sports, 0.3% motorcycle, 0.2% firearm, 0.2% bicycle; 1.9% reported multiple trauma etiologies). The most common concurrent diagnoses for all spondylolysis patients were spondylolisthesis (28%), idiopathic scoliosis (4.4%), cerebral palsy (1.9%), and spina bifida (1.8%). Four hundred and thirty patients with spondylolysis underwent surgical treatment and 40% of the surgically treated patients had spondylolisthesis. The rate of fusions was 54.9% fusions and 21% decompression, though the rate of fusions or decompressions being performed for spondylolysis has remained the same in the last decade (average fusion rate: 55%; average decompression rate: 18%; both $p > 0.05$). Levels fused and complications did not differ depending on whether or not decompression was performed ($p > 0.05$). The posterior-only approach was used in 62.2% of surgeries and were mostly 2 to 3 level procedures (63.5%). Perioperative complications occurred in 8.1% of patients, with the most common complications being device-related (2.3%), respiratory (1.5%), and digestive (1.5%). CONCLUSIONS: The national incidence of spondylolysis has increased over time, and the surgical rate and treatment techniques have remained constant. The most common concurrent diagnoses were idiopathic scoliosis, cerebral palsy, and spina bifida. Further work is required to determine the significance of these trends and associations.

PMID: 31513509

25. Developing a cerebral palsy-specific preference-based measure for a six-dimensional classification system (CP-6D): protocol for a valuation study.
Bahrampour M, Norman R, Byrnes J, Downes M, Scuffham PA.

BMJ Open. 2019 Sep 12;9(9):e029325. doi: 10.1136/bmjopen-2019-029325.

INTRODUCTION: Cerebral palsy (CP) is a lifelong condition. The CP quality of life (CPQOL) instrument is a frequently used disease-specific instrument to assess health-related quality of life (HRQoL) in people with CP, but it cannot be used to generate quality-adjusted life years (QALY) which are the basis of cost utility analysis (CUA). Generic utility instruments (such as the EQ-5D or SF-6D) that are used to value HRQOL may be insensitive to small but important health changes in children with CP. This study aims to generate a preference-based scoring algorithm for the CP six dimensions (CP-6D), a classification system developed from the CPQOL. METHODS AND ANALYSIS: A discrete choice experiment with duration (DCEtto) will be administrated to value health states described by the CP-6D classification system. These health states will be presented to members of Australian general population and parents of children with CP via an online survey. Conditional logit regression will be used to produce the utility algorithm for CP-6D. ETHICS AND DISSEMINATION: The Griffith University Human Research Ethics Committee approved for the study (reference HREC/number 2018/913). The developed algorithm can be applied to previous and future economic evaluation of interventions and treatments targeting people with CP which have used either the CPQOL or CP-6D.

PMID: 31515422

26. Hospital admissions in children with developmental disabilities from ethnic minority backgrounds.
Abdullahi I, Wong K, de Klerk N, Mutch R, Glasson EJ, Downs J, Cherian S, Leonard H.

Dev Med Child Neurol. 2019 Sep 9. doi: 10.1111/dmcn.14348. [Epub ahead of print]

AIM: To compare hospital admission patterns after the first year of life in Australian children with developmental disabilities and children with no known disability, according to maternal country of birth and Indigenous status. METHOD: This was a retrospective cohort study using linked data across health, disability, and hospital admission databases. The study investigated 656 174 children born in Western Australia between 1983 and 2008 with a total of 1 091 834 records of hospital admissions. RESULTS: Children with no known disability born to Indigenous mothers had the highest rate of hospital admissions compared to children of non-Indigenous mothers. Children of foreign-born mothers from low-income countries had the highest rate of hospital admissions if disability was present. Children with cerebral palsy (CP) with or without associated intellectual disability had the highest rate of hospital admissions among children with developmental disability, especially if mothers were foreign-born. INTERPRETATION: Children with CP and intellectual disability, particularly from minority backgrounds (Indigenous Australian and foreign-born mothers), were at higher risk of being admitted to hospital after the first year of life. WHAT THIS PAPER ADDS: Hospital admissions in Australian children with and without disabilities differ according to maternal country of birth. Hospital admission rates in children without a developmental disability were greatest for Australian-born Indigenous children. Disabled Australian-born children of foreign-born mothers from low-income countries had the highest hospital admission rates. Hospital admission risk was greatest for Australian-born children with cerebral palsy, especially if mothers were foreign-born.

PMID: 31498429

27. Nutritional Status of Children with Cerebral Palsy-Findings from Prospective Hospital-Based Surveillance in Vietnam Indicate a Need for Action.
Karim T, Jahan I, Dossetor R, Giang NTH, Van Anh NT, Dung TQ, Chau CM, Van Bang N, Badawi N, Khandaker G, Elliott E.

Nutrients. 2019 Sep 6;11(9). pii: E2132. doi: 10.3390/nu11092132.

BACKGROUND: Lack of evidence on the burden and risk factors for malnutrition among children with cerebral palsy (CP) in Vietnam limits evidence-based interventions. We aimed to define the nutritional status of children with CP in Vietnam. MATERIALS AND METHODS: The study utilized data from active prospective hospital-based surveillance modelled on the Pediatric Active Enhanced Disease Surveillance system. Children (0-18 years) with CP attending the National Children's Hospital Hanoi, Vietnam between June-November 2017 were included. Data on demographic, clinical and rehabilitation status were collected following detailed neurodevelopmental assessment. Anthropometric measurements were taken. Nutritional status was determined using the World Health Organization guideline. RESULTS: Of 765 children (the mean (SD) age was 2.6 (2.5) years; 35.8% were female), 28.9% (n = 213) were underweight and 29.0% (n = 214) stunted. The odds of underweight were significantly higher among children aged >5 years and/or having a monthly family income of <50 USD. Underweight and/or stunting was high among children with quadriplegia (81%, n = 60 and 84.5%, n = 87) and/or Gross Motor Functional Classification System (GMFCS) level IV-V (62.5%, n = 45 and 67.0%, n = 67). Nearly one-third of intellectually impaired and more than half of hearing-impaired children were underweight and/or stunted. CONCLUSIONS: Poor economic status and increased motor severity increased vulnerability to malnutrition. Our findings will inform nutritional rehabilitation programs among these vulnerable children.

PMID: 31500109

Prevention and Cure

28. Vitamin B1 and B12 mitigates neuron apoptosis in cerebral palsy by augmenting BDNF expression through MALAT1/miR-1 axis.
Li EY, Zhao PJ, Jian J, Yin BQ, Sun ZY, Xu CX, Tang YC, Wu H.

Cell Cycle. 2019 Sep 10:1-11. doi: 10.1080/15384101.2019.1638190. [Epub ahead of print]

Through the roles of vitamin B1 and B12 in neuroprotection and in improving cerebral palsy symptoms have been previously

noticed, the action mechanism is still unclear. This study aims to investigate the protective effect of vitamin B1 and B12 on neuron injury in cerebral palsy and to clarify the mechanism of vitamin B1 and B12 inhibiting neurons apoptosis, and to focus on the role of lncRNA MALAT1 in this process. In order to investigate the effect of vitamin B1 and B12 on neurons injury in vivo and on neuron apoptosis in vitro, we, respectively, introduced vitamin B1 and B12 into cerebral palsy rat and in apoptosis-induced N2A neurons by Oxygen Glucose Deprivation/reoxygenation (OGD/R). Our results demonstrated that vitamin B1 and B12 treatment improved the motor and memory functions and ameliorated the neurons injury in cerebral palsy rats. OGD/R treatment repressed the expression of MALAT1 and BDNF and the phosphorylation of PI3K and Akt, and enhanced the miR-1 expression, which were all reversed by vitamin B1 and B12 treatment in N2A neurons. Vitamin B1 and B12 inhibited miR-1 expression through MALAT1, promoted BDNF expression and activated PI3K/Akt signaling through the MALAT1/miR-1 axis. Vitamin B1 and B12 suppressed neuron apoptosis by up-regulating BDNF via MALAT1/miR-1 pathway. MALAT1 interference abolished the neuroprotective effect of vitamin B1 and B12 in cerebral palsy rats. Collectively, vitamin B1 and B12 up-regulates BDNF and its downstream PI3K/Akt signaling through MALAT1/miR-1 axis, thus suppressing neuron apoptosis and mitigating nerve injury in cerebral palsy rats.

PMID: 31500509