

Monday 26 August 2013

Cerebral Palsy Alliance is delighted to bring you this free weekly bulletin of the latest published research into cerebral palsy.

Our organisation is committed to supporting cerebral palsy research worldwide - through information, education, collaboration and funding. This free weekly bulletin is just one of our activities. Please find out more at www.cpresearch.org.au

Professor Nadia Badawi

Macquarie Group Foundation Chair of Cerebral Palsy
PO Box 560, Darlinghurst, New South Wales 2010 Australia

Interventions and Management

1. *Dev Med Child Neurol.* 2013 Aug 21. doi: 10.1111/dmcn.12246. [Epub ahead of print]

A systematic review of interventions for children with cerebral palsy: state of the evidence.

Novak I, McIntyre S, Morgan C, Campbell L, Dark L, Morton N, Stumbles E, Wilson SA, Goldsmith S.

Cerebral Palsy Alliance, Sydney, Australia; University of Notre Dame Australia, Sydney, Australia.

AIM: The aim of this study was to describe systematically the best available intervention evidence for children with cerebral palsy (CP). **METHOD:** This study was a systematic review of systematic reviews. The following databases were searched: CINAHL, Cochrane Library, DARE, EMBASE, Google Scholar, MEDLINE, OTSeeker, PEDro, PsycBITE, PsycINFO, and speechBITE. Two independent reviewers determined whether studies met the inclusion criteria. These were that (1) the study was a systematic review or the next best available; (2) it was a medical/allied health intervention; and (3) that more than 25% of participants were children with CP. Interventions were coded using the Oxford Levels of Evidence; GRADE; Evidence Alert Traffic Light; and the International Classification of Function, Disability and Health. **RESULTS:** Overall, 166 articles met the inclusion criteria (74% systematic reviews) across 64 discrete interventions seeking 131 outcomes. Of the outcomes assessed, 16% (21 out of 131) were graded 'do it' (green go); 58% (76 out of 131) 'probably do it' (yellow measure); 20% (26 out of 131) 'probably do not do it' (yellow measure); and 6% (8 out of 131) 'do not do it' (red stop). Green interventions included anticonvulsants, bimanual training, botulinum toxin, bisphosphonates, casting, constraint-induced movement therapy, context-focused therapy, diazepam, fitness training, goal-directed training, hip surveillance, home programmes, occupational therapy after botulinum toxin, pressure care, and selective dorsal rhizotomy. Most (70%) evidence for intervention was lower level (yellow) while 6% was ineffective (red). **INTERPRETATION:** Evidence supports 15 green light interventions. All yellow light interventions should be accompanied by a sensitive outcome measure to monitor progress and red light interventions should be discontinued since alternatives exist.

© 2013 Mac Keith Press.

[PMID: 23962350](https://pubmed.ncbi.nlm.nih.gov/23962350/) [PubMed - as supplied by publisher]

2. Pediatrics. 2013 Aug 19. [Epub ahead of print]**Enriched Environments and Motor Outcomes in Cerebral Palsy: Systematic Review and Meta-analysis.**

Morgan C, Novak I, Badawi N.

School of Medicine and Cerebral Palsy Alliance Research Institute, University of Notre Dame Australia, Darlinghurst, NSW, Australia; Grace Centre for Newborn Care, Children's Hospital Westmead, Westmead; and University of Sydney, NSW, Australia

BACKGROUND AND OBJECTIVES: Neuroplasticity evidence from animals favors an early enriched environment for promoting optimal brain injury recovery. In infants, systematic reviews show environmental enrichment (EE) improves cognitive outcomes but the effect on motor skills is less understood. The objective of this review was to appraise the effectiveness evidence about EE for improving the motor outcomes of infants at high risk of cerebral palsy (CP). **METHODS:** A systematic review was conducted. Cochrane Central Register of Controlled Trials (PubMed), Cumulative Index to Nursing and Allied Health Literature, Education Resource Information Center, SocINDEX, and PsycINFO databases were searched for literature meeting inclusion criteria: randomized controlled trials; high risk of /diagnosis of CP; >25% participants \leq 2 years; parent or infant interventions postdischarge; and motor outcomes reported. Data were extracted using the Cochrane protocol regarding participants, intervention characteristics, and outcomes. Methodological quality was assessed using risk of bias assessment and GRADE. **RESULTS:** A total of 226 studies were identified. After removing duplicates and unrelated studies, 16 full-text articles were reviewed, of which 7 studies met inclusion criteria. The risk of bias varied between studies with the more recent studies demonstrating the lowest risk. Enrichment interventions varied in type and focus, making comparisons difficult. A meta-analysis was conducted of studies that compared enrichment to standard care ($n = 5$), and totaled 150 infants. A small positive effect for enrichment was found; standardized mean difference 0.39 (95% confidence interval 0.05-0.72; $I^2 = 3\%$; $P = .02$). **CONCLUSIONS:** EE looks promising for CP, and therefore high-quality studies with well-defined EE strategies are urgently required.

[PMID: 23958771](#) [PubMed - as supplied by publisher]

3. Semin Pediatr Neurol. 2013 Jun;20(2):100-5. doi: 10.1016/j.spen.2013.06.001.**Intensive upper extremity training for children with hemiplegia: from science to practice.**

Andersen JC, Majnemer A, O'Grady K, Gordon AM.

Department of Pediatrics, University of Alberta, Edmonton, Alberta, Canada; Glenrose Rehabilitation Hospital, Edmonton, Alberta, Canada. Electronic address: John.Andersen@ualberta.ca.

For children with hemiplegic cerebral palsy, bimanual abilities are central to independent function. Over the last decade, considerable attention has been given to 2 forms of extended practice therapy for the upper limb, constraint-induced movement therapy and intensive bimanual training. This article reviews the varying nature of these 2 approaches and the existing scientific rationale supporting them. Comparisons between these 2 intensive upper extremity training approaches indicate similar improvements in unimanual capacity and bimanual performance outcomes; however, when considering participant and caregiver goal achievement, evidence favors a bimanual approach. Careful selection of either therapy for this population requires consideration of individual and contextual factors in relation to treatment goals. The key ingredients and dose responses remain unknown. Treatment intensity, intrinsic motivation, and individualization of treatment are hypothesized as requisite in either approach.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948684](#) [PubMed - in process]

4. Semin Pediatr Neurol. 2013 Jun;20(2):106-15. doi: 10.1016/j.spen.2013.06.011.**Training to enhance walking in children with cerebral palsy: are we missing the window of opportunity?**

Yang JF, Livingstone D, Brunton K, Kim D, Lopetinsky B, Roy F, Zewdie E, Patrick SK, Andersen J, Kirton A, Watt JM, Yager J, Gorassini M.

Department of Physical Therapy, University of Alberta, Edmonton, Alberta, Canada; Center for Neurosciences, University of Alberta, Edmonton, Alberta, Canada. Electronic address: Jaynie.yang@ualberta.ca.

The objective of this paper is to (1) identify from the literature a potential critical period for the maturation of the corticospinal tract (CST) and (2) report pilot data on an intensive, activity-based therapy applied during this period, in children with lesions to the CST. The best estimate of the CST critical period for the legs is when the child is younger than 2 years of age. Previous interventions for walking in children with CST damage were mainly applied after this age. Our preliminary results with training children younger than 2 years showed improvements in walking that exceeded all previous reports. Further, we refined techniques for measuring motor and sensory pathways to and from the legs, so that changes can be measured at this young age. Previous activity-based therapies may have been applied too late in development. A randomized controlled trial is now underway to determine if intensive leg therapy improves the outcome of children with early stroke.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948685](#) [PubMed - in process]

5. J Neuroeng Rehabil. 2013 Jul 30;10:83. doi: 10.1186/1743-0003-10-83.**Monitoring motor capacity changes of children during rehabilitation using body-worn sensors.**

Strohrmann C, Labruyère R, Gerber CN, van Hedel HJ, Arrnrich B, Tröster G.

Wearable Computing Lab, ETH Zurich, Gloriastrasse 35, Zurich, Switzerland. strohrmann@ife.ee.ethz.ch.

BACKGROUND: Rehabilitation services use outcome measures to track motor performance of their patients over time. State-of-the-art approaches use mainly patients' feedback and experts' observations for this purpose. We aim at continuously monitoring children in daily life and assessing normal activities to close the gap between movements done as instructed by caregivers and natural movements during daily life. To investigate the applicability of body-worn sensors for motor assessment in children, we investigated changes in movement capacity during defined motor tasks longitudinally. **METHODS:** We performed a longitudinal study over four weeks with 4 children (2 girls; 2 diagnosed with Cerebral Palsy and 2 with stroke, on average 10.5 years old) undergoing rehabilitation. Every week, the children performed 10 predefined motor tasks. Capacity in terms of quality and quantity was assessed by experts and movement was monitored using 10 ETH Orientation Sensors (ETHOS), a small and unobtrusive inertial measurement unit. Features such as smoothness of movement were calculated from the sensor data and a regression was used to estimate the capacity from the features and their relation to clinical data. Therefore, the target and features were normalized to range from 0 to 1. **RESULTS:** We achieved a mean RMS-error of 0.15 and a mean correlation value of 0.86 ($p < 0.05$ for all tasks) between our regression estimate of motor task capacity and experts' ratings across all tasks. We identified the most important features and were able to reduce the sensor setup from 10 to 3 sensors. We investigated features that provided a good estimate of the motor capacity independently of the task performed, e.g. smoothness of the movement. **CONCLUSIONS:** We found that children's task capacity can be assessed from wearable sensors and that some of the calculated features provide a good estimate of movement capacity over different tasks. This indicates the potential of using the sensors in daily life, when little or no information on the task performed is available. For the assessment, the use of three sensors on both wrists and the hip suffices. With the developed algorithms, we plan to assess children's motor performance in daily life with a follow-up study.

[PMID: 23899401](#) [PubMed - in process]

6. Acta Bioeng Biomech. 2013;15(2):105-11.**Integral method (IM) as a quantitative and objective method to supplement the GMFCS classification of gait in children with cerebral palsy (CP).**

Dziuba A, Bober T, Kobel-Buys K, Stempień M.

University School of Physical Education, Institute of Biomechanics, Wrocław, Poland.

Gait analysis is an objective tool for the clinical assessment of locomotor activity in children with cerebral palsy (CP). Correct diagnosis and properly planned rehabilitation are necessary for enhanced motor functions in persons suffering from cerebral palsy. Orthoses, orthopedic operations, medications and physiotherapy are the most common treatments. However, there is still a lack of objective methods for assessing motor behavior and monitoring the progress of recovery. The aim of the study was to use the ground reaction force patterns generated during walking to create the Integral Method (IM), which could become an objective tool that could supplement the functional classification of CP children based on the Gross Motor Function Classification System (GMFCS). A total of 15 healthy children and 34 children with CP who walk independently participated in the study. A Kistler force plate and GRFIntegral software were used. Of the 34 measurements based on the IM for CP children, 17 matched the level assigned by the GMFCS, 2 children were assigned a higher level, and 15 were assigned a lower level. Pearson's correlation coefficient between the IM and the GMFCS was moderate ($r = 0.61$, $p \leq 0.01$). Asymmetry was found in 11 cases. The IM supplements the GMFCS and is an objective and quantitative assessment of motor abilities. The method allows for the detection of asymmetry, diagnosis of the improvement of gait pattern and assessment of foot support technique. With the appropriate software, the IM provides pediatricians, neurologists, orthopedists, surgeons and physiotherapists with a simple and fast way to assess gait.

[PMID: 23952138](#) [PubMed - in process]

7. Gait Posture. 2013 Aug 12. pii: S0966-6362(13)00433-5. doi: 10.1016/j.gaitpost.2013.07.110. [Epub ahead of print]**Categorization of gait patterns in adults with cerebral palsy: A clustering approach.**

Roche N, Pradon D, Cosson J, Robertson J, Marchiori C, Zory R.

Université Versailles Saint Quentin en Yvelines, EA 4497, CIC-IT 805, APHP Service de physiologie et d'exploration fonctionnelle, Hôpital Raymond Poincaré, 92380 Garches, France. Electronic address: roche.nicolas@rpc.aphp.fr.

Gait patterns in adults with cerebral palsy have, to our knowledge, never been assessed. This contrasts with the large number of studies which have attempted to categorize gait patterns in children with cerebral palsy. Several methodological approaches have been developed to objectively classify gait patterns in patients with central nervous system lesions. These methods enable the identification of groups of patients with common underlying clinical problems. One method is cluster analysis, a multivariate statistical method which is used to classify an entire data set into homogeneous groups or "clusters". The aim of this study was to determine, using cluster analysis, the principal gait patterns which can be found in adults with cerebral palsy. Data from 3D motion analyses of 44 adults with cerebral palsy were included. A hierarchical cluster analysis was used to subgroup the different gait patterns based on spatiotemporal and kinematic parameters in the sagittal and frontal planes. Five clusters were identified (C1-C5) among which, 3 subgroups were determined, based on spontaneous gait speed (C1/C2: slow, C3/C4: moderate and C5: almost normal). The different clusters were related to specific kinematic parameters that can be assessed in routine clinical practice. These 5 classifications can be used to follow changes in gait patterns throughout growth and aging as well to assess the effects of different treatments (physiotherapy, surgery, botulinum toxin, etc.) on gait patterns in adults with cerebral palsy.

Copyright © 2013. Published by Elsevier B.V.

[PMID: 23948331](#) [PubMed - as supplied by publisher]

8. NeuroRehabilitation. 2013 Jun 18. [Epub ahead of print]**The associations between motor ability, walking activity and heart rate and heart rate variability parameters among children with cerebral palsy and typically developed controls.**

Kholod H, Jamil A, Katz-Leurer M.

Sackler Faculty of Medicine, Department of Physical Therapy, School of Health Professions, Tel-Aviv University, Tel-Aviv, Israel.

AIMS: To measure heart rate (HR) and heart rate variability (HRV) at rest, during and after walking among children with cerebral palsy (CP) as compared to age matched typically developed (TD) controls. The second aim was to describe the association between HRV and motor performance in children with CP. **METHODS:** Twenty six children with CP (age 8-14 years) and sixteen TD children matched for age assessed during rest, walking and after walking. HR and HRV parameters include: time domain parameters: standard deviation of the R-R interval (SDNN), square root of the mean squared differences of successive R-R differences (RMSSD). **RESULTS:** Children with CP demonstrated higher mean HR values at rest; 98.4 ± 13.9 bpm vs 83.0 ± 11.5 bpm in controls, ($p < 0.05$) and significantly lower time domain measures of HRV; RMSSD was 52.0 ± 19.1 ms and 87.0 ± 39.8 ms respectively ($p < 0.05$). Significant interaction effects were noted for HR and time domain HRV parameters. HR increased and SDNN and RMSSD decreased when children change their activity level from rest to walking and HR decreased and SDNN and RMSSD increased again after walking for TD children but not for children with CP ($p < 0.05$). No association was noted between HRV and motor performance in children with CP. **INTERPRETATION:** The findings of this study suggest that among children with CP, the cardiac autonomic mechanism is less efficient at rest and less adaptive to exercise and activity as compared to TD children.

[PMID: 23949027](#) [PubMed - as supplied by publisher]

9. Int Orthop. 2013 Aug 18. [Epub ahead of print]**Do changes in torsional magnetic resonance imaging reflect improvement in gait after femoral derotation osteotomy in patients with cerebral palsy?**

Braatz F, Wolf SI, Gerber A, Klotz MC, Dreher T.

Department of Trauma Surgery and Orthopaedics, University Medical Center Göttingen, Göttingen, Germany, Braatz@pjh.de.

PURPOSE: Femoral derotation osteotomy (FDO) is commonly used to correct internal rotation gait (IRG) in spastic diplegia. The purpose of this study was to investigate whether the extent of intraoperative derotation is reflected in changes in static (clinical ROM and anteversion angle measured on torsional MRI) and dynamic parameters (transverse plane kinematics in three-dimensional gait analysis) after FDO in children with spastic diplegia. **METHODS:** In a prospective study, 30 children with spastic diplegia and IRG were treated with FDO as part of a multilevel surgery and were examined pre- and postoperatively clinically, by three-dimensional gait analysis and by torsional MRI according to a standardised protocol. **RESULTS:** A correlation ($r = 0.317$, $p = 0.015$) between the extent of intraoperative derotation and mean hip rotation in stance as well as the anteversion angle measured on torsional MRI ($r = 0.454$, $p < 0.001$) was found. However, no significant correlation was observed between anteversion angle (tMRI) and mean hip rotation in stance, either before or after FDO. **CONCLUSIONS:** Significant improvements were found in IRG after FDO, confirming the results of previous studies. There was no correlation between the anteversion measured on MRI and the mean hip rotation in stance in 3D gait analysis before or after FDO. Thus, the data suggest that if the intraoperative extent of derotation is determined only by the anteversion angle, the result will not be better after FDO. It might only help to avoid retroversion and indicate the maximum amount of femoral derotation. In this study the extent of the intraoperative derotation was orientated at the preoperative midpoint of rotation. Based on the small, but significant correlation between the clinical midpoint and the mean hip rotation in stance in the gait analysis, determination of the intraoperative extent of derotation according to the mean hip rotation in stance seems to give the best results.

[PMID: 23955818](#) [PubMed - as supplied by publisher]

10. J Pediatr Orthop B. 2013 Aug 21. [Epub ahead of print]**Muscle-tendon lengths according to sagittal knee kinematics in patients with cerebral palsy: differences between recurvatum and crouch knee.**

Kwak YH, Kim HW, Park KB.

Department of Orthopaedic Surgery, Hallym Sacred Heart Hospital, Hallym University College of Medicine, Anyang.
 Department of Orthopaedic Surgery, Severance Children's Hospital, Yonsei University College of Medicine, Seoul.
 Department of Orthopaedic Surgery, Haeundae Paik Hospital, Inje University College of Medicine, Busan, Korea.

This study evaluated the differences in muscle-tendon lengths during single limb support between recurvatum and crouch knee in patients with cerebral palsy. Group I consisted of 14 patients who had recurvatum knee, whereas group II consisted of 17 patients who had crouch knee. Compared with group II, group I had decreased ankle power and plantarflexion moment and only the average muscle-tendon lengths of the gluteus medius and vasti was decreased. There were no differences in other muscle-tendon lengths. Recurvatum and crouch knee could occur with similar muscle-tendon lengths of the gastrocnemius, semimembranosus, biceps femoris, and rectus femoris.

[PMID: 23969563](#) [PubMed - as supplied by publisher]

11. BMC Pediatr. 2013 Aug 22;13(1):129. [Epub ahead of print]**Study protocol: precision of a protocol for manual intramuscular needle placement checked by passive stretching and relaxing of the target muscle in the lower extremity during BTX-A treatment in children with spastic cerebral palsy, as verified by means of electrical stimulation.**

Warnink-Kavelaars J, Vermeulen RJ, Becher JG.

BACKGROUND: Intramuscular injection of botulinum toxin type-A given by manual intramuscular needle placement in the lower extremity under general anaesthesia is an established treatment and standard of care in managing spasticity in children with spastic cerebral palsy. Optimal needle placement is essential. However, reports of injection and verification techniques used in previous studies have been partly incomplete and there are methodological shortcomings. This paper describes a detailed protocol for manual intramuscular needle placement checked by passive stretching and relaxing of the target muscle for each individual muscle injection location in the lower extremity during botulinum toxin type-A treatment under general anaesthesia in children with spastic cerebral palsy. It explains the design of a study to verify this protocol, which consists of an injection technique combined with a needle localizing technique, as by means of electrical stimulation to determine its precision. **METHODS:** Setting: University Medical Centre, Department of Paediatric Rehabilitation Medicine, the Netherlands. **DESIGN:** prospective observational study. **Participants:** children with spastic cerebral palsy, aged 4 to 18 years, receiving regular botulinum toxin type-A treatment under general anaesthesia to improve their mobility, are recruited from the Department of Paediatric Rehabilitation Medicine at VU University Medical Centre, Amsterdam, the Netherlands. **METHOD:** a detailed protocol for manual intramuscular needle placement checked by passive stretching and relaxing of the target muscle has been developed for each individual muscle injection location of the adductor brevis muscle, adductor longus muscle, gracilis muscle, semimembranosus muscle, semitendinosus muscle, biceps femoris muscle, rectus femoris muscle, gastrocnemius lateralis muscle, gastrocnemius medialis muscle and soleus muscle. This protocol will be verified as by means of electrical stimulation. **Technical details:** 25 mm or 50 mm Stimuplex-needle and a Stimuplex-HNS-12 electrical stimulator will be used. **DISCUSSION:** Botulinum toxin type-A injected in the intended muscle is expected to yield the greatest effect in terms of activities. Protocols for manual intramuscular needle placement should be described in detail and verified to determine its precision. Detailed and verified protocols are essential to be able to interpret the results of botulinum toxin type-A treatment studies.

[PMID: 23967895](#) [PubMed - as supplied by publisher] [Free full text](#)

12. J Biomech. 2013 Jul 26. pii: S0021-9290(13)00353-9. doi: 10.1016/j.jbiomech.2013.07.028. [Epub ahead of print]**Do skeletal muscle properties recover following repeat onabotulinum toxin A injections?**

Fortuna R, Horisberger M, Vaz MA, Herzog W.

Human Performance Laboratory, Faculty of Kinesiology, University of Calgary, 2500 University Drive NW, Calgary, AB, Canada T2N 1N4.

Onabotulinum toxin A (BTX-A) is a frequently used treatment modality to relax spastic muscles by preventing acetylcholine release at the motor nerve endings. Although considered safe, previous studies have shown that BTX-A injections cause muscle atrophy and deterioration in target and non-target muscles. Ideally, muscles should fully recover following BTX-A treatments, so that muscle strength and performance are not affected in the long-term. However, systematic, long-term data on the recovery of muscles exposed to BTX-A treatments are not available, thus practice guidelines on the frequency and duration of BTX-A injections, and associated recovery protocols, are based on clinical experience with little evidence-based information. Therefore, the purpose of this study was to investigate muscle recovery following a six months, monthly BTX-A injection (3.5U/kg) protocol. Twenty seven skeletally mature NZW rabbits were divided into 5 groups: Control (n=5), zero month recovery - BTX-A+0M (n=5), one month recovery - BTX-A+1M (n=5), three months recovery - BTX-A+3M (n=5), and six months recovery - BTX-A+6M (n=7). Knee extensor strength, muscle mass and percent contractile material in injected and contralateral non-injected muscles was measured at each point of recovery. Strength and muscle mass were partially and completely recovered in injected and contralateral non-injected muscles for BTX-A+6M group animals, respectively. The percent of contractile material partially recovered in the injected, but did not recover in the contralateral non-injected muscles. We conclude from these results that neither target nor non-target muscles fully recover within six months of a BTX-A treatment protocol and that clinical studies on muscle recovery should be pursued.

Copyright © 2013 Elsevier Ltd. All rights reserved.

[PMID: 23953503](#) [PubMed - as supplied by publisher]**13. Spine (Phila Pa 1976). 2013 Aug 16. [Epub ahead of print]****Deep Wound Infections after Spinal Fusion in Children with Cerebral Palsy: A Prospective Cohort Study.**

Sponseller PD, Jain A, Shah SA, Samdani A, Yaszay B, Newton PO, Thaxton LM, Bastrom TP, Marks MC.

From the *Department of Orthopaedic Surgery, The Johns Hopkins University, Baltimore, Maryland; the †Nemours/Alfred I. duPont Hospital for Children, Wilmington, Delaware; ‡Shriner's Hospital, Philadelphia, Pennsylvania; and §Department of Orthopedics, Rady Children's Hospital of San Diego, California.

Study Design. Prospective cohort. **Objective.** To: (1) calculate the rate of deep wound infection in children with cerebral palsy (CP) after spinal fusion surgery; (2) identify factors (patient, laboratory, and surgical) associated with deep wound infection development; and (3) report causative organisms. **Summary of Background Data.** Wound infection after spine fusion for CP is more common than after spine fusion for most other diagnoses. **Methods.** We prospectively gathered data on 204 consecutive pediatric patients with CP who underwent surgery at 7 institutions. Univariate and multivariate regression analysis was performed to analyze patient, laboratory, and surgical characteristics to identify factors that were significantly associated with infection development. Statistical significance was set at a value of P less than 0.05. **Results.** Deep wound infection developed in 13 (6.4%) children. The mean time to infection development was 34.2 ± 60.2 days. On univariate analysis, older age, larger curve size, presence of gastrostomy/gastrojejunostomy tube, higher preoperative serum white blood cell count, and longer operative time were significantly associated with deep wound infection. On multivariate analysis, only the presence of a gastrostomy/gastrojejunostomy tube remained significant (1.9-fold risk of deep wound infection compared with patients without tubes). *Escherichia coli* was the most common organism cultured from the wound sites (5 patients). Other infective agents were: *Pseudomonas aeruginosa* (2), methicillin-susceptible *Staphylococcus aureus* (1), *Proteus mirabilis* (1), and polymicrobial organisms (4). **Conclusion.** Deep wound infection occurred in 6.4% of children with CP after spinal fusion. The presence of a gastrostomy/gastrojejunostomy tube was a significant predictor of infection. Gram-negative organisms were the most common causative agents. Surgeons should be cognizant of these factors when treating children with CP and may consider Gram-negative antibiotic prophylaxis.

[PMID: 23963019](#) [PubMed - as supplied by publisher]

14. J Child Neurol. 2013 Aug 21. [Epub ahead of print]

Botulinum Toxin Type A in Children and Adolescents With Severe Cerebral Palsy: A Retrospective Chart Review.

Mesterman R, Gorter JW, Harvey A, Lockhart J, McEwen-Hill J, Margallo K, Goldie N.

McMaster University, Hamilton, Ontario, Canada.

This retrospective cohort study reviewed set goals and their outcomes of children and adolescents with severe cerebral palsy who received botulinum toxin A in 2008 and 2009. Sixty children (36 male, mean age 9 years) were included. They received on average 4 (range 1-7) treatments, with the dosage varying between 20 and 400 units per treatment (3-21 U/kg/body weight). Mild transient side effects were reported in 12 of 242 treatments with botulinum toxin A. Treatment goals were related to lower limb function (82%), range of motion (68%), positioning (33%), upper limb function (33%), and facilitating ease of care in dressing (30%), toileting, and diapering (22%). The treatment goals were reached in 60% to 85% by report of the parent and child dyad. Our findings suggest that botulinum toxin A should be considered as a treatment option in patients with cerebral palsy within Gross Motor Function Classification System levels IV and V.

[PMID: 23965398](#) [PubMed - as supplied by publisher]

15. J Magn Reson Imaging. 2013 Aug;38(2):spcone. doi: 10.1002/jmri.24377.

Anatomical characterization of athetotic and spastic cerebral palsy using an atlas-based analysis.

Yoshida S, Faria AV, Oishi K, Kanda T, Yamori Y, Yoshida N, Hirota H, Iwami M, Okano S, Hsu J, Li X, Jiang H, Li Y, Hayakawa K, Mori S.

The Russell H. Morgan Department of Radiology and Radiological Science, The Johns Hopkins University School of Medicine, Baltimore, Maryland, USA.

PURPOSE: To analyze diffusion tensor imaging (DTI) in two types of cerebral palsy (CP): the athetotic-type and the spastic-type, using an atlas-based anatomical analysis of the entire brain, and to investigate whether these images have unique anatomical characteristics that can support functional diagnoses. **MATERIALS AND METHODS:** We retrospectively analyzed the DTI of seven children with athetotic-type, 11 children with spastic-type, and 20 healthy control children, all age-matched. The severity of motor dysfunction was evaluated with the Gross Motor Function Classification System (GMFCS). The images were normalized using a linear transformation, followed by large deformation diffeomorphic metric mapping. For 205 parcellated brain areas, the volume, fractional anisotropy, and mean diffusivity were measured. Principal component analysis (PCA) was performed for the Z-scores of these parameters. **RESULTS:** The GMFCS scores in athetotic-type were significantly higher than those in spastic-type ($P < 0.001$). PCA extracted anatomical components that comprised the two types of CP, as well as the severity of motor dysfunction. In the athetotic group, the abnormalities were more severe than in the spastic group. In the spastic group, significant changes were concentrated in the lateral ventricle and periventricular structures. **CONCLUSION:** Our results quantitatively delineated anatomical characteristics that reflected the functional findings in two types of CP.

Copyright © 2013 Wiley Periodicals, Inc.

[PMID: 23960008](#) [PubMed - in process]

16. J Med Assoc Thai. 2012 Jan;95 Suppl 1:S166-72.**Effects of mirror neurons stimulation on motor skill rehabilitation in children with cerebral palsy: a clinical trial.**

Mahasup N, Sritipsukho P, Lekskulchai R, Hansakunachai T.

Postgraduate Studies Program, Faculty of Medicine, Thammasat University, Pathumthani, Thailand.

OBJECTIVE: The authors aimed to compare the motor function measured by Gross Motor Function Measure (GMFM-66) between mirror neurons stimulation based VCD program at home and conventional physical therapy in children with cerebral palsy for two months. **MATERIAL AND METHOD:** A randomized controlled trial was performed with thirty children with spastic diplegia aged 2-10 years in Thammasat university hospital and Rajanukul institute. They were randomly assigned to receive either the mirror neurons stimulation based VCD program practice at home (experimental group) or the conventional physical therapy (control group) for two months. Both groups were measured the motor function by GMFM-66 at entry, the first month and the end of the second month. Analysis of covariance was used to compare mean changes of GMFM-66 scores between both groups at the second month after adjusted for the baseline level. **RESULTS:** A total of 30 children with cerebral palsy, aged 2.2-9.5 years (mean age 5.9 +/- 2.2 years). The mean changes of the GMFM scores in experimental group were slightly higher than those in the control group of 2.1 (95% CI: -2.3, 6.5) at the second month after adjusted for the baseline level. The mean GMFM scores were significantly improved in all dimensions except lying and rolling dimension, at the first and second month when compared to the baseline level in both groups. **CONCLUSION:** This pilot study demonstrated the mirror neurons stimulation based VCD program can improve motor function, at least, as much as the conventional physical therapy.

[PMID: 23964461](#) [PubMed - in process]

17. NeuroRehabilitation. 2013 Jun 18. [Epub ahead of print]**The effect of random or sequential presentation of targets during robot-assisted therapy on children.**

Ladenheim B, Altenburger P, Cardinal R, Monterroso L, Dierks T, Mast J, Krebs HI.

Blythedale Children's Hospital, Valhalla NY, USA NY Medical College, Valhalla, NY, USA.

BACKGROUND: Robot assisted upper extremity therapy has been shown to be effective in adult stroke patients and in children with cerebral palsy (CP) and other acquired brain injuries (ABI). The patient's active involvement is a factor in its efficacy. However, this demands focused attention during training sessions, which can be a challenge for children. **OBJECTIVE:** To compare results of training requiring two different levels of focused attention. Differences in short term performance and retention of gains as a function of training protocol as measured by the Fugl-Meyer (FM) were predicted. **METHODS:** Thirty-one children with CP or ABI were randomly divided into two groups. All received 16 one hour sessions of robot-assisted therapy (twice a week for 8 weeks) where they moved a robot handle to direct a cursor on the screen toward designated targets. One group had targets presented sequentially in clockwise fashion, the other presented in random order. Thus, one group could anticipate the position of each target, the other could not. **RESULTS:** Both groups showed significant functional improvement after therapy, but no significant difference between groups was observed. **CONCLUSIONS:** Assist-as-needed robotic training is effective in children with CP or ABI with small non-significant differences attributed to attentional demand.

[PMID: 23949025](#) [PubMed - as supplied by publisher]

18. Semin Pediatr Neurol. 2013 Jun;20(2):139-45. doi: 10.1016/j.spen.2013.06.006.**Robot-assisted and computer-enhanced therapies for children with cerebral palsy: current state and clinical implementation.**

Meyer-Heim A, van Hedel HJ.

Head Division of Paediatric Rehabilitation and Rehabilitation Centre, Rehabilitation Centre Affoltern am Albis,

University Children's Hospital, Zurich, Switzerland. Electronic address: andreas.meyer-heim@kispi.uzh.ch.

The field of pediatric neurorehabilitation has rapidly evolved with the introduction of technological advancements over recent years. Rehabilitation robotics and computer-assisted systems can complement conventional physiotherapeutics or occupational therapies. These systems appear promising, especially in children, where exciting and challenging virtual reality scenarios could increase motivation to train intensely in a playful therapeutic environment. Despite promising experience and a large acceptance by the patients and parents, so far, only a few therapy systems have been evaluated in children, and well-designed randomized controlled studies in this field are still lacking. This narrative review aims to provide an overview about the to-date robot-assisted and computer-based therapies and the current level of evidence and to share the authors experience about the clinical implication of these new technologies available for children with cerebral palsy.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948688](#) [PubMed - in process]

19. Semin Pediatr Neurol. 2013 Jun;20(2):127-38. doi: 10.1016/j.spen.2013.06.003.

Interactive computer play as "motor therapy" for individuals with cerebral palsy.

Fehlings D, Switzer L, Findlay B, Knights S.

Department of Paediatrics, University of Toronto, Toronto, Ontario, Canada; Bloorview Research Institute, Holland Bloorview Kids Rehabilitation Hospital, Toronto, Ontario, Canada. Electronic address: dfehlings@hollandbloorview.ca.

The aim of the study was to evaluate the quality of evidence for interactive computer play (ICP) to improve motor performance (including motor control, strength, or cardiovascular [CVS] fitness) in individuals with cerebral palsy. A computer-assisted literature search was completed, focusing on ICP as a therapeutic modality to improve motor outcomes in individuals of all ages with cerebral palsy with a specific focus on upper and lower extremity motor outcomes and promotion of CVS fitness. Articles were classified according to American Academy of Neurology guidelines and recommendation classifications were given based on the levels of evidence. Seventeen articles underwent full-text review including 6 on upper extremity motor function, 5 on lower extremity motor function, 1 on CVS fitness, and 5 on studies with a combination of upper or lower extremity or CVS fitness focus or both. Overall, there was level B (probable) evidence for ICP interventions to improve lower extremity motor control or function. However, there was inadequate evidence (level U) for ICP interventions improving upper limb motor control or function or CVS fitness. Although promising trends are apparent, the strongest level of evidence exists for the use of ICP to improve gross motor outcomes. Additional evidence is warranted especially when evaluating the effect of ICP on upper limb motor outcomes and CVS fitness.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948687](#) [PubMed - in process]

20. Semin Pediatr Neurol. 2013 Jun;20(2):116-26. doi: 10.1016/j.spen.2013.06.004.

Can noninvasive brain stimulation measure and modulate developmental plasticity to improve function in stroke-induced cerebral palsy?

Kirton A.

Calgary Pediatric Stroke Program, Alberta Children's Hospital Research Institute, Section of Neurology, Departments of Pediatrics and Clinical Neurosciences, University of Calgary, Calgary, Alberta, Canada. Electronic address: adam.kirton@albertahealthservices.ca.

The permanent nature of motor deficits is a consistent cornerstone of cerebral palsy definitions. Such pessimism is disheartening to children, families, and researchers alike and may no longer be appropriate for it ignores the fantastic plastic potential of the developing brain. Perinatal stroke is presented as the ideal human model of

developmental neuroplasticity following distinct, well-defined, focal perinatal brain injury. Elegant animal models are merging with human applied technology methods, including noninvasive brain stimulation for increasingly sophisticated models of plastic motor development following perinatal stroke. In this article, how potential central therapeutic targets are identified and potentially modulated to enhance motor function within these models is discussed. Also, future directions and emerging clinical trials are reviewed.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948686](#) [PubMed - in process]

21. Eur J Paediatr Neurol. 2013 Aug 13. pii: S1090-3798(13)00104-9. doi: 10.1016/j.ejpn.2013.06.004. [Epub ahead of print]

Epilepsy surgery in children with accompanying impairments.

Olsson I, Danielsson S, Hedström A, Nordborg C, Viggedal G, Uvebrant P, Rydenhag B.

Department of Paediatrics, Institute of Clinical Sciences at the Sahlgrenska Academy, Gothenburg University, Gothenburg, Sweden. Electronic address: ingrid.b.olsson@vgregion.se.

The aim of this study was to assess seizure outcome 2 years after epilepsy surgery in a consecutive series of paediatric patients, with special focus on children with learning disabilities and other neuroimpairments in addition to the epilepsy. Outcome 2 years after surgery was assessed in 110 of 125 children operated upon for drug resistant epilepsy in Gothenburg 1987-2006. More than half of the children had learning disabilities, 43% motor impairments and 30% a neuropsychiatric diagnosis. Fifty-six per cent of those with an IQ < 70 became seizure-free or had a >75% reduction in seizure frequency, and two thirds if the operation was a resection. The corresponding figure in those with more than 100 seizures per month was 15 out of 31, and another seven had a 50-75% reduction in seizure frequency. The message is that learning disability, motor impairment and psychiatric morbidity should not be contraindications for paediatric epilepsy surgery. More than half of the children with learning disabilities had a worthwhile seizure outcome, with even better results after resective surgery. Children with drug resistant epilepsy and additional severe neurological impairments should have the benefit of referral to a tertiary centre for evaluation for epilepsy surgery.

© 2013 European Paediatric Neurology Society. Published by Elsevier Ltd. All rights reserved.

[PMID: 23948291](#) [PubMed - as supplied by publisher]

22. Int J Pediatr Otorhinolaryngol. 2013 Aug 12. pii: S0165-5876(13)00350-9. doi: 10.1016/j.ijporl.2013.07.017. [Epub ahead of print]

Airway obstruction in children with cerebral palsy: Need for tracheostomy?

Kontorinis G, Thevasagayam MS, Bateman ND.

Department of Otolaryngology, Sheffield Children's Hospital, Sheffield, United Kingdom. Electronic address: gkontorinis@gmail.com.

OBJECTIVE: To examine the progress of the airway obstruction over time in children with cerebral palsy (CP) and the timing of any interventions. **METHODS:** The medical notes of patients with CP younger than 16 years admitted with airway obstruction to a tertiary referral Pediatric Otolaryngology Center from 2006 to 2012 were retrospectively reviewed. The gender, age of referral, co-morbidities, type of surgical intervention and age this was performed and the time interval between sequential surgeries were documented. **RESULTS:** Fifteen children with CP and airway obstruction were admitted, eight boys and seven girls with an average age of referral 8 years (range 3-13.3 years). Adenotonsillectomy was performed in 11/15 patients at a mean age of 9.1 years (range 4.5-14 years). Tracheostomy was performed in 8/15 children at an average age of 11.6 years (range 7.5-15 years). Seven out of 11 patients having undergone adenotonsillectomy, required tracheostomy after an average time interval of 1.9 years (range 0.5-3.5 years). Tracheostomy was performed in 80% of referred patients with CP older than 10 years, while surgical intervention was uncommon in children younger than 5 years. There was a statistically significant

correlation between the age of the children and the performance of a tracheostomy (Pearson's correlation coefficient 0.68, $p=0.005$). CONCLUSIONS: The severity of the airway obstruction in children with CP tends to increase with age. We postulate that this increase results from worsening hypotonia of pharyngeal musculature. Children with CP and severe upper airway obstruction are likely to require tracheostomy as they grow older.

Copyright © 2013. Published by Elsevier Ireland Ltd.

[PMID: 23947996](#) [PubMed - as supplied by publisher]

23. SADJ. 2012 Aug;67(7):308-13.

Dental caries prevalence in children attending special needs schools in Johannesburg, Gauteng Province, South Africa.

Nqcoo CB, Yengopal V, Rudolph MJ, Thekiso M, Joosab Z.

Faculty of Health Sciences, Dept. of Community Dentistry, University of the Witwatersrand, South Africa.
cathrine.nqcoo@wits.ac.za

INTRODUCTION: Anecdotal evidence from clinical data in Johannesburg suggests that there is a high burden of dental caries among children with special health care needs (CSHCN) in Johannesburg. OBJECTIVES: To determine the prevalence of dental caries and Unmet Treatment Needs in children with cerebral palsy, hearing, learning and mental disabilities attending special needs schools in Johannesburg and to compare these with data from the National Children's Oral Health Survey (NCOHS) METHODS: This cross-sectional analytical study comprised of 882 children attending five special needs schools in Johannesburg. Stratified randomised sampling of the participating schools was done and the schools were stratified by disability. Caries status was recorded via the dmft/DMFT index using WHO criteria and guidelines. RESULTS: The mean age of the participants was 10.5 years; with a caries prevalence of 27.55% and 33.56% in the primary and permanent dentition respectively. The highest unmet treatment need of 100% was found in the permanent dentition of the hearing impaired group followed by 90.77% in the primary dentition of the cerebral palsy group. In general no significant difference was found when the dmft/DMFT for CSHCN and NCOHS were compared except in the hearing impaired age groups four to five and six (both primary dentition) where significantly higher dmft scores (3.58 vs. 2.4; 3.85 vs. 2.9; $p < 0.05$) were found. CONCLUSION: Children with special health care needs had lower caries prevalence compared with the general population and higher unmet treatment needs regardless of the type of disability.

[PMID: 23951782](#) [PubMed - in process]

24. Augment Altern Commun. 2013 Sep;29(3):259-71. doi: 10.3109/07434618.2013.813968.

Confirming and Denying in Co-Construction Processes: A Case Study of an Adult with Cerebral Palsy and two Familiar Partners.

Hörmeyer I, Renner G.

Albert-Ludwigs-University of Freiburg.

For individuals with complex communication needs, one of the most frequent communicative strategies is the co-construction of meaning with familiar partners. This preliminary single-case study gives insight into a special sequential pattern of co-construction processes - the search sequence - particularly in relation to the processes of confirming and denying meanings proposed by familiar interaction partners. Five different conversations between an adult with cerebral palsy and complex communication needs and two familiar co-participants were videotaped and analyzed using the methodology of conversation analysis (CA). The study revealed that confirmations and denials are not simply two alternative actions, but that several possibilities to realize confirmations and denials exist that differ in their frequency and that have different consequences for the sequential context. This study of confirmations and denials demonstrates that co-construction processes are more complex than have previously been documented.

[PMID: 23952567](#) [PubMed - in process]

25. J Med Assoc Thai. 2012 Jan;95 Suppl 1:S8-12.**Health-related quality of life in children with chronic diseases at Thammasat University Hospital.**

Sritipsukho P, Poomsitong J.

Department of Pediatrics, Faculty of Medicine, Thammasat University, Pathumthani, Thailand.

paskorn100@yahoo.com

OBJECTIVE: The present study aimed to examine the level of health related quality of life in pediatric patients with common chronic diseases who sought care at Thammasat University Hospital. **MATERIAL AND METHOD:** Cross sectional study in 134 patients aged 2-18, who visited department of pediatrics at Thammasat University Hospital were performed. Health related quality of life was evaluated using Thai version of Pediatric Quality of Life Inventory 4.0 Generic Core Scales (PedsQL 4.0). For children aged 2-4 and 5-18, the questionnaire was answered by their guardians and by themselves and their guardians, respectively. The present study evaluated health related quality of life in four aspects: physical, emotional, social and school functioning. Points were then pooled and divided into three categories, namely total, physical health summary and psychosocial health summary scale scores. Each category could have a maximum score of 100. **RESULTS:** The mean total scale score from the questionnaire answering by guardians was highest in allergic rhinitis (77.6 +/- 12.1). Physical and psychosocial scale scores were 81.7 +/- 16.8 and 75.4 +/- 12.5. Total scale scores in asthma, chronic renal diseases, leukemia and lymphoma, and congenital heart defects were 73.8 +/- 14.7, 73.5 +/- 18.9, 64.5 +/- 14.0 and 76.2 +/- 19.6, respectively. Cerebral palsy had the lowest total scale score of 27.1 +/- 16.7 with physical and psychosocial scale scores of 16.9 +/- 7.5 and 33.0 +/- 23.2, respectively. When patients answered the questionnaire by themselves, it was found that allergic rhinitis had the highest total scale score (79.5 +/- 13.2). Total scale scores in asthma, chronic renal diseases, leukemia and lymphoma, and heart diseases were 75.2 +/- 16.4, 76.3 +/- 16.2, 70.5 +/- 9.4 and 72.4 +/- 22.7, respectively. Cerebral palsy had the lowest scale scores in all categories, with total scale score of 46.1 +/- 14.6, physical scale score of 23.4 +/- 6.6 and psychosocial scale score of 58.3 +/- 18.8. **CONCLUSION:** Among chronic diseases, cerebral palsy has the lowest health related quality of life scale scores in all categories, namely total, physical and psychosocial health summary.

[PMID: 23964437](#) [PubMed - in process]**26. Res Dev Disabil. 2013 Aug 17;34(10):3607-3617. doi: 10.1016/j.ridd.2013.07.022. [Epub ahead of print]****Disability as a risk factor? Development of psychopathology in children with disabilities.**

Bøttcher L, Dammeyer J.

Aarhus University, Department of Education, Tuborgvej 164, 2400 Copenhagen NV, Denmark. Electronic address: Boettcher@dpu.dk.

Empirical research has established that children with disabilities are more likely to develop psychopathology than children without disabilities. But too little is known about the association between disability and psychopathology. The aim of this article is to discuss developmental psychopathological models that conceptualise the connection between childhood disability and psychopathology. Empirical studies of psychopathology among children with a congenital hearing impairment and children with cerebral palsy will be reviewed, representing in-depth examples of association between disability and psychopathology. Both a congenital hearing impairment and cerebral palsy were found to be dominating risk factors for all types of psychopathology, but no relationship was identified between degree of disability and risk of psychopathology. The higher risk cannot be explained by biological impairments alone. To explain the contradictory findings, developmental models of disability and psychopathology are applied. Within a multi-factorial developmental psychopathological perspective and a dialectical model of disability (Vygotsky, 1993), it is suggested that disability can be understood as an incongruence between the individual development of the child and demands and expectations in the specific relations and institutions in which the child participates. This incongruence creates and strengthens negative factors for the child with disability and results in a higher risk of psychopathology.

Copyright © 2013. Published by Elsevier Ltd.

[PMID: 23962606](#) [PubMed - as supplied by publisher]

27. Res Dev Disabil. 2013 Aug 17;34(10):3566-3575. doi: 10.1016/j.ridd.2013.07.023. [Epub ahead of print]

Systematic review of self-concept measures for primary school aged children with cerebral palsy.

Cheong SK, Johnston LM.

School of Psychology, Australian Catholic University, 1100 Nudgee Road, Banyo, Queensland 4014, Australia.
Electronic address: sscheo006@myacu.edu.au.

This study involved a systematic review aimed to identify self-concept measures that provided published psychometrics for primary school aged children (8-12 years) with cerebral palsy (CP). Six electronic databases (PubMed, MEDLINE, CINAHL, PsycINFO, PsycARTICLES and Web of Science) were searched to identify assessments that (1) measured self-concept; (2) in children aged 8-12 years; (3) with CP; (4) with psychometrics available. The Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) checklist was used to evaluate psychometric properties and the CanChild Outcome Measure Rating Form was used to evaluate clinical utility. Search yielded 271 papers, of which five met inclusion criteria. These papers reported five measures of self-concept with psychometric properties for the target population: the Rosenberg Self-Esteem Index, Self-Description Questionnaire-I, Self-Perception Profile for Children (original) and two separate modifications of the Self-Perception Profile for Children. Currently, no self-concept measures published in English had sufficient psychometric data for children with CP. The Self-Description Questionnaire-I and the Self-Perception Profile for Children were promising options. Further research is required (a) to determine self-concept construct components important for children with CP and (b) to examine the relative strength, validity, reliability and clinical utility of self-concept measures for the target population.

Copyright © 2013 Elsevier Ltd. All rights reserved.

[PMID: 23962603](#) [PubMed - as supplied by publisher]

28. Can Nurse. 2013 Jun;109(6):22-3.

Developmental service workers: New members on the team.

Bender D, DeWaard J, Currie-Roy J.

Saint Elizabeth, Markham, Ont.

[PMID: 23862322](#) [PubMed - indexed for MEDLINE]

29. Child Care Health Dev. 2013 Aug 19. doi: 10.1111/cch.12098. [Epub ahead of print]

Young children with cerebral palsy: families self-reported equipment needs and out-of-pocket expenditure.

Bourke-Taylor H, Cotter C, Stephan R.

Occupational Therapy Department, Faculty of Medicine, Nursing and Health Sciences, School of Primary Health Care, Monash University, Frankston, Vic., Australia.

BACKGROUND: Costs to families raising a child with cerebral palsy and complex needs are direct and indirect. This study investigated the self-reported real-life costs, equipment needs, and associated characteristics of children who had the highest equipment and care needs. **METHOD:** The purposive sample (n = 29) were families with a child with cerebral palsy: gross motor function levels 5 (n = 20), level 4 (n = 5), level 3 (n = 4); complex communication needs (n = 21); medical needs (n = 14); hearing impairment (n = 5) and visual impairment (n = 9). Participants completed a specifically designed survey that included the Assistance to Participate Scale. Equipment and technology purchases were recorded in the areas of positioning, mobility, transport, home modifications, communication, splinting and orthoses, self-care, technology, communication devices, medical, adapted toys/leisure items and privately hired babysitters/carers. Descriptive and inferential statistics were used to analyse the data. **RESULTS:** Families had purchased up to 25 items within the areas described. The highest median number of items were recorded for positioning (15 items), mobility devices (9 items) and adapted toys/leisure items (9 items).

Median costs were highest for home modifications (AUD\$23 000), transport (AUD\$15 000), splints and orthoses (AUD\$3145), paid carers (AUD\$3080), equipment for toileting/dressing/bathing (AUD\$2900) and technical/medical items (\$2380). Children who needed more parental assistance to participate in play and recreation also required significantly more equipment overall for positioning, communication, self-care and toys/leisure. **CONCLUSIONS:** The equipment needs of young children with complex disability are extensive and out-of-pocket expenses and parental time to support participation in play/recreation excessive. Substantial financial support to offset costs are crucial to better support families in this life situation.

© 2013 John Wiley & Sons Ltd.

[PMID: 23952344](#) [PubMed - as supplied by publisher]

30. Dev Disabil Res Rev. 2013 Aug;18(1):84-94. doi: 10.1002/ddrr.1131.

Health, functioning, and participation of adolescents and adults with cerebral palsy: A review of outcomes research.

Frisch D, Msall ME.

Center for Developmental and Behavioral Pediatrics, University of Chicago Comer Children's Hospital, JP Kennedy Research Center on Intellectual and Developmental Disabilities, Chicago, Illinois.

With medical advances, more individuals with cerebral palsy (CP) syndromes who reside in developed countries are surviving to adolescence and adulthood. However, there continues to be a paucity of research examining long-term health, functional activities, and participatory outcomes over their life-course. This article reviews the current literature assessing adult outcomes for individuals with CP within the framework of the International Classification of Functioning (ICF), Disability, and Health model of enablement. Preliminary data over the last decade indicate that among adults with cerebral palsy without intellectual disability, 60-80% completed high school, 14-25% completed college, up to 61% were living independently in the community, 25-55% were competitively employed, and 14-28% were involved in long term relationships with partners or had established families. These outcomes occurred with biomedical advances in the management of spasticity, deformity, and medical co-morbidities, as well as with concurrent policy initiatives to increase access to a continuum of habilitative and education services. Although we have incomplete population data to inform comprehensive life-course planning, there are opportunities to create clinical and translational community networks with improved measures of functioning and participation that can better inform us about the factors influencing lifespan development of people with CP. © 2013 Wiley Periodicals, Inc. Dev Disabil Res Rev 2013;18:84-94.

Copyright © 2013 Wiley Periodicals, Inc., a Wiley company.

[PMID: 23949832](#) [PubMed - in process]

31. Semin Pediatr Neurol. 2013 Jun;20(2):154-9. doi: 10.1016/j.spn.2013.06.009.

Perspectives of young adults with cerebral palsy on transitioning from pediatric to adult healthcare systems.

Larivière-Bastien D, Bell E, Majnemer A, Shevell M, Racine E.

Neuroethics Research Unit, Institut de recherches cliniques de Montréal (IRCM), Montréal, Quebec, Canada.

Transition from pediatric to adult healthcare is a well-established challenge for individuals with neurodevelopmental disorders like cerebral palsy. With regard to ethics, some of the key aspects to explore include the following: if and how individuals feel respected during the transition process; if and how their values and preferences are developed and integrated within transition; and if and how young patients are prepared to participate in decision making (to be autonomous) within the transition. We carried out a qualitative study on 14 young adults with cerebral palsy. Some participants reported positive experiences. However, several tension points were identified, including before the transition (e.g. transition envisaged with fear and apprehension); during the transition (e.g. lack of cooperation or communication between providers in the pediatric and adult healthcare systems); and after the transition (e.g.

feelings of abandonment). We discuss the clinical influence and ethical significance of better capturing ethical values within the transition process and preparing young individuals to engage in discussions about their health and disease management.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948690](#) [PubMed - in process]

32. Occup Ther Health Care. 1985;2(3):91-108. doi: 10.1080/J003v02n03_10.

The impact of adolescence on the child with cerebral palsy.

Slominski AH.

Coordinator of Cerebral Palsy Treatment Center, Department of Orthopedics, Indiana University School of Medicine, Indianapolis, IN.

Pre-adolescence is the beginning of self realization that the cerebral palsied child will never be "normal." Leading questions and unexplained anger begin around the age of nine to eleven years, followed by disbelief, denial and family rejection. The occupational therapist may be the first person to whom the child or parent reveal their anxieties and hostile feelings. Counseling for self-esteem, along with an opportunity to meet successful adults who have "survived" their cerebral palsy and achieved success in the "real world," can be most helpful. Life preparation with both the parents and child should begin at about eight years of age (depending upon individual maturation). This kind of joint planning avoids many heartaches by anticipating the social rejection of peers and unrealistic expectations of "normalcy" by either the parents of the disabled child. Treatment goals and career exploration can be directed toward realistic, successful achievements.

[PMID: 23952276](#) [PubMed]

33. Rev Lat Am Enfermagem. 2013 Jul-Aug;21(4):956-63. doi: 10.1590/S0104-11692013000400018.

Experiences from families of children with cerebral paralysis in context of social vulnerability [Article in English, Portuguese, Spanish]

Baltor MR, Dupas G.

Universidade Federal de São Carlos, Departamento de Enfermagem, São CarlosSP, Brazil.

OBJECTIVE: to describe and to analyze the experience from families of children with cerebral paralysis living under circumstances of social vulnerability. METHOD: six resident families in area with this characteristic were interviewed. It was opted to use the Symbolic Interactionism as theoretic reference and the Thematic Content Analysis of Bardin as analysis method for the data. RESULT: the experience of such families is represented in the subjects: Reorganizing the Life, with the categories "Discovering the way" and "Accommodating the routine", and Stopping a Constant Fight with the categories: "Primary Carer being overcharged", "Coexisting with the preconception", "Having locomotion difficulty" and "Living with financial difficulties". CONCLUSION: the social vulnerability influences how the family bears the chronic condition. Professionals and strategies of public health are a power to minimize impacts including those related to the family budget, but they have not been effective. They need to be sensitized to become supporting resources, to offer and to guide the access to the support networks and to spur the social service in action when necessary. This study adds knowledge to the already existing by pointing out peculiarities of the family experience in situations regarding two variables of difficult handling: chronicity and social vulnerability, evidencing the role of the professional in search of the solution for the confrontation of demands and sufferings together with the family.

[PMID: 23970234](#) [PubMed - in process]

34. Dev Disabil Res Rev. 2013 Aug;18(1):6-16. doi: 10.1002/ddrr.1123.

People with intellectual disability: What do we know about adulthood and life expectancy?

Coppus AM.

Dichterbij, Center for the Intellectually Disabled, Medical Center, Gennep, The Netherlands; Nijmegen Department of General Medicine, Radboud University Medical Center, Nijmegen, The Netherlands; Department of Epidemiology, Erasmus University Medical Center, Rotterdam, Rotterdam, The Netherlands.

Increases in the life expectancy of people with Intellectual Disability have followed similar trends to those found in the general population. With the exception of people with severe and multiple disabilities or Down syndrome, the life expectancy of this group now closely approximates with that of the general population. Middle and old age, which until 30 years ago were not recognized in this population, are now important parts of the life course of these individuals. Older adults with Intellectual Disabilities form a small, but significant and growing proportion of older people in the community. How these persons grow older and how symptoms and complications of the underlying cause of the Intellectual Disability will influence their life expectancy is of the utmost importance. © 2013 Wiley Periodicals, Inc. Dev Disabil Res Rev 2013;18:6-16.

Copyright © 2013 Wiley Periodicals, Inc., a Wiley company.

[PMID: 23949824](#) [PubMed - in process]

Prevention and Cure

35. Brain Res. 2013 Aug 13. pii: S0006-8993(13)01114-1. doi: 10.1016/j.brainres.2013.08.011. [Epub ahead of print]

MicroRNA overexpression increases cortical neuronal vulnerability to injury.

Truettner JS, Motti D, Dietrich WD.

Miami Project to Cure Paralysis, Department of Neurological Surgery, University of Miami Miller School of Medicine, Miami, FL 33136-1060, USA.

Previously we reported that several microRNAs (miRNA) are upregulated following experimentally induced traumatic brain injury (TBI) using both in vivo and in vitro approaches. Specific miRNAs were found to be sensitive to therapeutic hypothermia and may therefore be important targets for neuroprotective strategies. In this study we developed plasmid constructs that overexpress temperature sensitive miRNAs: miR-34a, miR-451, and miR-874. These constructs were transfected into cultured cortical neurons that were subjected to stretch injury using a cell injury controller device. Levels of expression of genes associated with stress, inflammation, apoptosis and transcriptional regulation were measured by qRT-PCR. mRNA levels of cytokines interleukin 1- β (IL1- β) and tumor necrosis factor alpha (TNF- α) as well as heat shock protein 70 (HSP70) and Caspase 11 were found to be increased up to 24 fold higher than controls in cells overexpressing these miRNAs. After moderate stretch injury, the expression of IL1- β , TNF- α , HSP70 and Caspase 11 all increased over control levels found in uninjured cells suggesting that overexpression of these miRNAs increases cellular vulnerability. miR-34a directly inhibits Bcl2 and XIAP, both anti-apoptotic proteins. The observed increase in Caspase 11 with over-expression of miR-34a indicates that miR-34a may be inducing apoptosis by reducing the levels of anti-apoptotic proteins. miR-34a is predicted to inhibit Jun, which was seen to decrease in cells overexpressing this miRNA along with Fos. Over expression of several miRNAs found to be induced by TBI in vivo (miR-34a, miR-451 and miR-874) leads to increased vulnerability in transfected neurons. Therapeutic hypothermia blunts the expression of these miRNAs in vivo and antisense silencing could be a potential therapeutic approach to targeting the consequences of TBI.

Copyright © 2013. Published by Elsevier B.V.

[PMID: 23948100](#) [PubMed - as supplied by publisher]

36. Front Cell Neurosci. 2013 Aug 21;7:128. doi: 10.3389/fncel.2013.00128.

Cortical region-specific engraftment of embryonic stem cell-derived neural progenitor cells restores axonal sprouting to a subcortical target and achieves motor functional recovery in a mouse model of neonatal hypoxic-ischemic brain injury.

Shinoyama M, Ideguchi M, Kida H, Kajiwara K, Kagawa Y, Maeda Y, Nomura S, Suzuki M.

Department of Neurosurgery, Yamaguchi University School of Medicine Ube, Japan.

Hypoxic-ischemic encephalopathy (HIE) at birth could cause cerebral palsy (CP), mental retardation, and epilepsy, which last throughout the individual's lifetime. However, few restorative treatments for ischemic tissue are currently available. Cell replacement therapy offers the potential to rescue brain damage caused by HI and to restore motor function. In the present study, we evaluated the ability of embryonic stem cell-derived neural progenitor cells (ES-NPCs) to become cortical deep layer neurons, to restore the neural network, and to repair brain damage in an HIE mouse model. ES cells stably expressing the reporter gene GFP are induced to a neural precursor state by stromal cell co-culture. Forty-hours after the induction of HIE, animals were grafted with ES-NPCs targeting the deep layer of the motor cortex in the ischemic brain. Motor function was evaluated 3 weeks after transplantation. Immunohistochemistry and neuroanatomical tracing with GFP were used to analyze neuronal differentiation and axonal sprouting. ES-NPCs could differentiate to cortical neurons with pyramidal morphology and expressed the deep layer-specific marker, Ctip2. The graft showed good survival and an appropriate innervation pattern via axonal sprouting from engrafted cells in the ischemic brain. The motor functions of the transplanted HIE mice also improved significantly compared to the sham-transplanted group. These findings suggest that cortical region specific engraftment of preconditioned cortical precursor cells could support motor functional recovery in the HIE model. It is not clear whether this is a direct effect of the engrafted cells or due to neurotrophic factors produced by these cells. These results suggest that cortical region-specific NPC engraftment is a promising therapeutic approach for brain repair.

[PMID: 23970853](#) [PubMed] [Free PMC Article](#)

37. Neuroradiology. 2013 Aug 18. [Epub ahead of print]

Limitations of routine neuroimaging in predicting outcomes of preterm infants.

Whyte HE, Blaser S.

Department of Paediatrics, Division of Neonatology, University of Toronto, Rm 38105, 3rd floor Atrium, 555 University Ave, Toronto, ON, M2L1A7, Canada, hiliary.whyte@sickkids.ca.

INTRODUCTION: Preterm births are increasing in number and while the rates of cerebral palsy have declined, there are increasing numbers of infants who survive with handicaps. In some studies, up to 50 % of children will have morbidity when followed up to school age. **METHODS:** A review of current literature was conducted to determine the validity of routine cranial ultrasound scans (CUS) to predict neurodevelopmental outcomes, including motor and cognitive deficits. We also reviewed the additional benefit offered by including MRI scans in scanning protocols to enhance the reliability in predicting the neurodevelopmental sequelae of prematurity. **RESULTS:** CUS is valuable as a screening tool to determine significant brain injury when conducted regularly over the first weeks of life in preterm infants. Subtle changes on CUS are difficult to interpret and more precise information is offered by performing MRI scans. These are most often carried out at term equivalent age but earlier scans may be just as useful in predicting neurocognitive outcomes. When MRI scans are either normal or seriously abnormal, there is a very clear correlation with outcome to 2 years of age. Mild and moderate degrees of injury defined on MRI need more sophisticated scanning sequences to determine the likelihood of associated sequelae. Follow-up to school age is essential to diagnose more subtle cognitive delays. **CONCLUSION:** CUS provides a good screening tool to detect serious brain injury resulting in motor handicaps but MRI scans are complementary and necessary to accurately predict the outcomes of preterm infants, especially cognitive delays.

[PMID: 23955300](#) [PubMed - as supplied by publisher]

38. *Pediatr Neurol.* 2013 Sep;49(3):149-55. doi: 10.1016/j.pediatrneurol.2013.04.005.

The babkin reflex in infants: clinical significance and neural mechanism.

Futagi Y, Yanagihara K, Mogami Y, Ikeda T, Suzuki Y.

Department of Pediatric Neurology, Osaka Medical Center and Research Institute for Maternal and Child Health, Osaka, Japan. Electronic address: jqfkk025@yahoo.co.jp.

BACKGROUND: There have been very few studies concerning the Babkin reflex-opening of the mouth and flexion of the arms in response to stimulation of the palms. We attempted to clarify the clinical significance and neural mechanism of the reflex through systematic review. **METHODS:** Searches were conducted on Medline, Embase, and Google Scholar from their inception through August 2012. **RESULTS:** In normal term infants, the Babkin reflex can be elicited from the time of birth, becomes increasingly suppressed with age, and disappears in the great majority by the end of the fifth month of age. A marked response in the fourth or fifth month of age and persistence of the reflex beyond the fifth month of age are generally regarded as abnormal. On the other hand, because there are some normal infants showing no response during the neonatal period or early infancy, the absence of the response during these periods is not necessarily an abnormal finding. **CONCLUSIONS:** Infants with these abnormal findings should be carefully observed for the appearance of neurological abnormalities including cerebral palsy and mental retardation. It is most likely that the Babkin reflex is mediated by the reticular formation of the brainstem, which receives inputs from the nonprimary motor cortices. On the basis of the hand-mouth reflex, more adaptive movement develops as control of the nonprimary motor cortices over the reflex mechanism in the reticular formation increases. Soon it evolves into the voluntary eye-hand-mouth coordination necessary for food intake as the control of the prefrontal cortex over the nonprimary motor cortices becomes predominant.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23953951](#) [PubMed - in process]

39. *PLoS One.* 2013 Aug 7;8(8):e68593. doi: 10.1371/journal.pone.0068593. eCollection 2013.

Assessment of structural connectivity in the preterm brain at term equivalent age using diffusion MRI and t2 relaxometry: a network-based analysis.

Pannek K, Hatzigeorgiou X, Colditz PB, Rose S.

The University of Queensland, School of Medicine, Brisbane, Australia ; The University of Queensland, Queensland Cerebral Palsy and Rehabilitation Research Centre, Brisbane, Australia.

Preterm birth is associated with a high prevalence of adverse neurodevelopmental outcome. Non-invasive techniques which can probe the neural correlates underpinning these deficits are required. This can be achieved by measuring the structural network of connections within the preterm infant's brain using diffusion MRI and tractography. We used diffusion MRI and T2 relaxometry to identify connections with altered white matter properties in preterm infants compared to term infants. Diffusion and T2 data were obtained from 9 term neonates and 18 preterm-born infants (born <32 weeks gestational age) at term equivalent age. Probabilistic tractography incorporating multiple fibre orientations was used in combination with the Johns Hopkins neonatal brain atlas to calculate the structural network of connections. Connections of altered diffusivity or T2, as well as their relationship with gestational age at birth and postmenstrual age at the time of MRI, were identified using the network based statistic framework. A total of 433 connections were assessed. FA was significantly reduced in 17, and T2 significantly increased in 18 connections in preterm infants, following correction for multiple comparisons. Cortical networks associated with affected connections mainly involved left frontal and temporal cortical areas: regions which are associated with working memory, verbal comprehension and higher cognitive function - deficits which are often observed later in children and adults born preterm. Gestational age at birth correlated with T2, but not diffusion in several connections. We found no association between diffusion or T2 and postmenstrual age at the time of MRI in preterm infants. This study demonstrates that alterations in the structural network of connections can be identified in preterm infants at term equivalent age, and that incorporation of non-diffusion measures such as T2 in the connectome framework provides complementary information for the assessment of brain development.

[PMID: 23950872](#) [PubMed - in process] [PMCID: PMC3737239](#) [Free PMC Article](#)

40. Semin Pediatr Neurol. 2013 Jun;20(2):146-53. doi: 10.1016/j.spen.2013.06.002.**The potential for stem cells in cerebral palsy-piecing together the puzzle.**

Faulkner SD, Ruff CA, Fehlings MG.

Division of Genetics and Development, Toronto Western Research Institute, Toronto, Ontario, Canada; Institute of Medical Science, University of Toronto, Toronto, Ontario, Canada; Spinal Program, University Health Network, Toronto Western Hospital, Toronto, Ontario, Canada.

The substantial socioeconomic burden of a diagnosis of cerebral palsy, coupled with a positive anecdotal and media spin on stem cell treatments, drives many affected families to seek information and treatment outside of the current clinical and scientific realm. Preclinical studies using several types of stem and adult cells-including mesenchymal stem cells, neural precursor cells, olfactory ensheathing glia and Schwann cells-have demonstrated some regenerative and functional efficacy in neurologic paradigms. This paper describes the most common cell types investigated for transplant in vivo and summarizes the current state of early-phase clinical trials. It investigates the most relevant and promising coadministered therapies, including rehabilitation, drug targeting, magnetic stimulation, and bioengineering approaches. We highlight the need for adjunctive combinatorial strategies to successfully transfer stem cell treatments from bench to bedside.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948689](#) [PubMed - in process]

41. Semin Pediatr Neurol. 2013 Jun;20(2):75-83. doi: 10.1016/j.spen.2013.06.010.**Evidence for therapeutic intervention in the prevention of cerebral palsy: hope from animal model research.**

Nguyen A, Armstrong EA, Yager JY.

Department of Pediatrics, University of Alberta, Edmonton, Alberta, Canada.

Knowledge translation, as defined by the Canadian Institute of Health Research, is defined as the exchange, synthesis, and ethically sound application of knowledge-within a complex system of interactions among researchers and users-to accelerate the capture of the benefits of research through improved health, more effective services and products, and a strengthened healthcare system. The requirement for this to occur lies in the ability to continue to determine mechanistic actions at the molecular level, to understand how they fit at the in vitro and in vivo levels, and for disease states, to determine their safety, efficacy, and long-term potential at the preclinical animal model level. In this regard, particularly as it relates to long-term disabilities such as cerebral palsy that begin in utero, but only express their full effect in adulthood, animal models must be used to understand and rapidly evaluate mechanisms of injury and therapeutic interventions. In this review, we hope to provide the reader with a background of animal data upon which therapeutic interventions for the prevention and treatment of cerebral palsy, benefit this community, and increasingly do so in the future.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948682](#) [PubMed - in process]

42. Semin Pediatr Neurol. 2013 Jun;20(2):65-74. doi: 10.1016/j.spen.2013.06.007.**Brain development in infants born preterm: looking beyond injury.**

Duerden EG, Taylor MJ, Miller SP.

Neurosciences & Mental Health, Research Institute, Hospital for Sick Children, Toronto, Ontario, Canada; Department of Paediatrics, Hospital for Sick Children, Toronto, Ontario, Canada. Electronic address: emma.duerden@sickkids.ca.

Infants born very preterm are high risk for acquired brain injury and disturbances in brain maturation. Although survival rates for preterm infants have increased in the last decades owing to improved neonatal intensive care, motor disabilities including cerebral palsy persist, and impairments in cognitive, language, social, and executive functions have not decreased. Evidence from neuroimaging studies exploring brain structure, function, and metabolism has indicated abnormalities in the brain development trajectory of very preterm-born infants that persist through to adulthood. In this chapter, we review neuroimaging approaches for the identification of brain injury in the preterm neonate. Advances in medical imaging and availability of specialized equipment necessary to scan infants have facilitated the feasibility of conducting longitudinal studies to provide greater understanding of early brain injury and atypical brain development and their effects on neurodevelopmental outcome. Improved understanding of the risk factors for acquired brain injury and associated factors that affect brain development in this population is setting the stage for improving the brain health of children born preterm.

Copyright © 2013 Elsevier Inc. All rights reserved.

[PMID: 23948681](#) [PubMed - in process]

43. Semin Pediatr Neurol. 2013 Jun;20(2):60-4. doi: 10.1016/j.spen.2013.06.008.

The epidemiology of cerebral palsy: new perspectives from a Canadian registry.

Shevell M, Dagenais L, Oskoui M.

Department of Neurology/Neurosurgery, McGill University, Montreal, Quebec Canada; Department of Pediatrics, McGill University, Montreal, Quebec Canada; Division of Pediatric Neurology, Montreal Children's Hospital, McGill University Health Centre, Montreal, Quebec Canada. Electronic address: michael.shevell@muhc.mcgill.ca.

[PMID: 23948680](#) [PubMed - in process]

Subscribe to CP Research News

To subscribe to this research bulletin, please complete the online form at www.cpresearch.org/subscribe/researchnews. You can bookmark this form on the home screen of your smart phone and also email the link to a friend.

To unsubscribe, please email researchnews@cerebralpalsy.org.au with 'Unsubscribe' in the subject line, and your name and email address in the body of the email.