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**Professor Nadia Badawi AM**

Macquarie Group Foundation Chair of Cerebral Palsy

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## Interventions and Management

### 1. Phys Occup Ther Pediatr. 2016 Feb 9:1-25. [Epub ahead of print]

#### **Translating Evidence to Increase Quality and Dose of Upper Limb Therapy for Children with Unilateral Cerebral Palsy: A Pilot Study.**

Sakzewski L, Ziviani J, Boyd RN.

**AIMS:** To pilot efficacy of a tailored multifaceted implementation program to change clinical practice of occupational therapists (OTs) providing upper limb (UL) therapy for children with unilateral cerebral palsy (UCP). **METHODS:** This before and after study piloted a multifaceted implementation program comprising audit/feedback, barrier identification, and education. Medical chart audits were conducted prior to and 12 months after the intervention. Primary process outcomes included proportion of children with UCP with (1) goals set; (2) goals measured; (3) received contemporary motor learning approach; (4) an adequate dose (30-40 hours); and (5) measured UL outcomes. **RESULTS:** Three teams of OTs (n = 9) participated. Forty-three audits at baseline and 53 at 12 months postimplementation program were conducted. Average time to complete audits was 10 min and four out of the five evidence criteria had complete data extracted from files. Changes in clinical behavior included greater measurement of goals before (+17%) and after (+22%) therapy; use of constraint therapy (+38%), bimanual therapy (+26%), home programs (+14%); measurement of UL outcomes before (+29%) and after (+23%) therapy. Children receiving the target dose increased from 0 to 10%. **CONCLUSIONS:** A tailored multifaceted implementation program was feasible to implement and led to meaningful changes in clinical practice behavior.

[PMID: 26861242](#)

### 2. Semin Plast Surg. 2016 Feb;30(1):45-50. doi: 10.1055/s-0035-1571253.

#### **Surgical Treatment of Pediatric Upper Limb Spasticity: The Shoulder.**

Seruya M, Johnson JD.

The shoulder joint is essential for placing the hand in a functional position for reach and overhead activities. This depends on the delicate balance between abductor/adductor and internal/external rotator muscles. Spasticity alters this equilibrium, limiting the interaction of the upper limb with the environment. Classically, pediatric patients with upper limb spasticity present with an adduction and internal rotation contracture of the shoulder. These contractures are typically secondary to spasticity of the pectoralis major and subscapularis muscles and sometimes attributed to the latissimus dorsi muscle. Fractional lengthening, Z-step lengthening, or tendon release of the contributing muscle groups may help correct the adduction and internal rotation contractures. With proper

diagnosis, a well-executed surgical plan, and a consistent hand rehabilitation regimen, successful surgical outcomes can be achieved.

[PMID: 26869863](#)

**3. Semin Plast Surg. 2016 Feb;30(1):24-8. doi: 10.1055/s-0036-1571302.**

**Botulinum Toxin in the Treatment of Pediatric Upper Limb Spasticity.**

Schwabe AL.

Botulinum neurotoxin (BoNT) is one of the mainstays in the treatment of pediatric spasticity and dystonia. When considering initiation of BoNT treatment for spasticity, treatment goals and responses to prior conservative measures such as passive range of motion exercises, splinting, and other medication trials should be reviewed. As a general rule, children should be engaged in therapy services around the time of the injections and have a robust home program in place. When managing spasticity in children with BoNT injections, the practitioner should be well versed in functional anatomy with specialized training in injection techniques. Localization techniques in addition to anatomical landmarks are recommended for improved efficacy and include limited electromyography, electrical stimulation, and/or ultrasound guidance. A follow-up visit for the purpose of reassessment during the peak effect of the drug is advised. It is known that BoNT is effective at reducing spasticity and improving range of motion, but it remains to be determined to what degree this translates into improved function, activity, and participation.

[PMID: 26869860](#)

**4. Semin Plast Surg. 2016 Feb;30(1):5-13. doi: 10.1055/s-0035-1571257.**

**Grading and Quantification of Upper Extremity Function in Children with Spasticity.**

Wallen M, Stewart K.

The World Health Organization's International Classification of Functioning, Disability and Health (ICF) provides an ideal framework within which to conceptualize grading and quantification of upper extremity function for children with spasticity. In this article the authors provide an overview of assessments and classification tools used to (1) understand upper extremity function associated with spasticity and the factors that contribute to dysfunction, (2) guide the selection of appropriate interventions, (3) identify specific muscles to target using surgical interventions and botulinum toxin-A injections, and (4) measure the outcomes of upper extremity interventions. Assessments of upper extremity function are briefly described and categorized as to whether they (1) measure children's best ability or actual performance in daily life, (2) are clinician administered or are a child/proxy report, (3) assist in planning intervention and/or measuring outcomes, and (4) evaluate unimanual or bimanual ability. In addition, measures of spasticity and hypertonicity, and classifications of static and dynamic upper extremity postures are summarized.

[PMID: 26869858](#)

**5. Semin Plast Surg. 2016 Feb;30(1):39-44. doi: 10.1055/s-0035-1571255.**

**Spastic Paralysis of the Elbow and Forearm.**

Gharbaoui I, Kania K, Cole P.

As the physiologic recovery period concludes, the patient is evaluated for surgical procedures that may rebalance muscle function and correct deformity. Upper extremity function is the product of complex and highly sophisticated mechanisms working in unison, and a careful, systematic preoperative evaluation is critical. A good function of the hand cannot be achieved without adequate position of the shoulder, elbow, forearm, and wrist. The goals of surgery must be practical and clearly understood by the patient and the family.

[PMID: 26869862](#)

**6. Semin Plast Surg. 2016 Feb;30(1):29-38. doi: 10.1055/s-0035-1571254.**

**Surgical Treatment of Pediatric Upper Limb Spasticity: The Wrist and Hand.**

Seruya M, Dickey RM, Fakhro A.

The wrist and hand are essential in the placement of the upper extremity in a functional position for grasp, pinch, and release activities. This depends on the delicate balance between the extrinsic and intrinsic muscles of the wrist and hand. Spasticity alters this equilibrium, limiting the interaction of the upper limb with the environment. Classically, pediatric patients with upper limb spasticity present with a flexed wrist, thumb-in-palm, and flexed finger posture. These contractures are typically secondary to spasticity of the extrinsic flexor muscles of the wrist and hand and intrinsic muscles of the thumb and digits. Tendon release, lengthening, or transfer procedures may help correct the resultant abnormal postures. A total wrist arthrodesis with or without proximal row carpectomy may help address the severely flexed wrist deformity. With proper diagnosis, a well-executed surgical plan, and a consistent hand rehabilitation regimen, successful surgical outcomes can be achieved.

[PMID: 26869861](#)

**7. Semin Plast Surg. 2016 Feb;30(1):14-23. doi: 10.1055/s-0035-1571256.**

**Review of Therapeutic Interventions for the Upper Limb Classified by Manual Ability in Children with Cerebral Palsy.**

Shierk A, Lake A, Haas T.

The aim of this literature review was to assemble an inventory of intervention strategies utilized for children diagnosed with cerebral palsy (CP) based on the Manual Ability Classification System (MACS). The purpose of the inventory is to guide physicians and therapists in intervention selection aimed at improving upper limb function in children with CP. The following databases were searched: CINAHL (Cumulative Index to Nursing and Allied Health Literature), Cochrane Database of Systematic Reviews, ERIC (Educational Research Information Center), Google Scholar, OTSeeker (Occupational Therapy Systematic Evaluation of Evidence), OVID (Ovid Technologies, Inc.), and PubMed. Inclusion criteria were whether the study (1) identified MACS levels of participants, and (2) addressed the effectiveness of intervention on upper limb function. Overall, 74 articles met the inclusion criteria. The summarized data identified 10 categories of intervention. The majority of participants across studies were MACS level II. The most frequently cited interventions were constraint-induced movement therapy (CIMT), bimanual training, and virtual reality and computer-based training. Multiple interventions demonstrated effectiveness for upper limb improvement at each MACS level. However, there is a need for additional research for interventions appropriate for MACS levels IV and V. To fully develop an intervention inventory based on manual ability, future studies need to report MACS levels of participants, particularly for splinting and therapy interventions used in combination with surgery.

[PMID: 26869859](#)

**8. Sichuan Da Xue Xue Bao Yi Xue Ban. 2015 Nov;46(6):876-9, 925.**

**[The Relationship Between the Damages of Hand Functions and the Type of Cerebral Palsy in Children].**

**[Article in Chinese]**

Shi W, Luo R, Jiang HY, Shi YY, Wang Q, Li N, Ma D, Wang FF.

**OBJECTIVE:** To investigate the relationship between the damages of hand functions and the type of cerebral palsy (CP) in children with CP. **METHODS:** A total of 280 children aged 4-12 years old with CP in the 20 districts of Chengdu were included. The damages of hand functions were assessed with the Chinese Version of Manual Ability Classification System (MACS) and its relationship with the type of CP were analyzed. **RESULTS:** Among the 280 investigated children, there were 195 children with spastic CP, which accounted for the largest proportion (69.64%), wherein the spastic diplegia was most common (56.41%). The classification of MACS was level I-II in 65.13% children with spastic CP, whereas the classification of MACS was level III-V in 84.44% and 80.95% children with

mixed and dyskinetic CP, respectively. With the increase of the degree of cognitive dysfunction in children with CP, the level of MACS was also increased. There was a difference between the classification of MACS and the different type of CP ( $P < 0.05$ ). The children with spastic CP were mostly mild hand dysfunction, while the children with mixed and dyskinetic type of CP were mostly middle and severe hand dysfunction. A positive correlation was found between the MACS and the subtype of spastic CP ( $r = 0.541$ ,  $P < 0.05$ ). In most of the children with diplegia from spastic CP, the hand dysfunction was mild, whereas the children with quadriplegia from spastic CP were mostly middle and severe hand dysfunction. **CONCLUSION:** There was a correlation between the MACS and the type of CP which can be used to determine the damaged condition of hand functions and develop the program of rehabilitation and the measures of classification management for the children with CP.

[PMID: 26867324](#)

**9. Dev Med Child Neurol. 2016 Feb 7. doi: 10.1111/dmcn.13057. [Epub ahead of print]**

**The revised Children's Hand-use Experience Questionnaire: a handy tool for children with unilateral cerebral palsy.**

James S.

This commentary is on the original article by Amer et al.

[PMID: 26853915](#)

**10. Neurorehabil Neural Repair. 2016 Feb 11. pii: 1545968315625838. [Epub ahead of print]**

**Skilled Bimanual Training Drives Motor Cortex Plasticity in Children With Unilateral Cerebral Palsy.**

Friel KM, Kuo HC, Fuller J, Ferre CL, Brandão M, Carmel JB, Bleyenheuft Y, Gowatsky JL, Stanford AD, Rowny SB, Luber B, Bassi B, Murphy DL, Lisanby SH, Gordon AM.

**BACKGROUND:** Intensive bimanual therapy can improve hand function in children with unilateral spastic cerebral palsy (USCP). We compared the effects of structured bimanual skill training versus unstructured bimanual practice on motor outcomes and motor map plasticity in children with USCP. **OBJECTIVE:** We hypothesized that structured skill training would produce greater motor map plasticity than unstructured practice. **METHODS:** Twenty children with USCP (average age 9.5; 12 males) received therapy in a day camp setting, 6 h/day, 5 days/week, for 3 weeks. In structured skill training ( $n = 10$ ), children performed progressively more difficult movements and practiced functional goals. In unstructured practice ( $n = 10$ ), children engaged in bimanual activities but did not practice skillful movements or functional goals. We used the Assisting Hand Assessment (AHA), Jebsen-Taylor Test of Hand Function (JTTHF), and Canadian Occupational Performance Measure (COPM) to measure hand function. We used single-pulse transcranial magnetic stimulation to map the representation of first dorsal interosseous and flexor carpi radialis muscles bilaterally. **RESULTS:** Both groups showed significant improvements in bimanual hand use (AHA;  $P < .05$ ) and hand dexterity (JTTHF;  $P < .001$ ). However, only the structured skill group showed increases in the size of the affected hand motor map and amplitudes of motor evoked potentials ( $P < .01$ ). Most children who showed the most functional improvements (COPM) had the largest changes in map size. **CONCLUSIONS:** These findings uncover a dichotomy of plasticity: the unstructured practice group improved hand function but did not show changes in motor maps. Skill training is important for driving motor cortex plasticity in children with USCP.

[PMID: 26867559](#)

**11. J Physiol. 2016 Feb 4. doi: 10.1113/JP271886. [Epub ahead of print]**

**Spinal inhibition and motor function in adults with spastic cerebral palsy.**

Condliffe EG, Jeffery DT, Emery DJ, Gorassini MA.

Reduced inhibition of spinal motoneurons by sensory pathways may contribute to heightened reflex activity,

spasticity and impaired motor function in individuals with cerebral palsy (CP). To measure if the activation of inhibitory post-synaptic potentials (IPSPs) by sensory inputs is reduced in CP, the tonic discharge rate of single motor units from the soleus muscle was plotted time-locked to the occurrence of a sensory stimulation to produce Peri-Stimulus Frequencygrams (PSFs). Stimulation to the medial arch of the foot was used to activate cutaneomuscular afferents in 17 adults with bilateral spastic CP and 15 neurologically intact (NI) peers. Evidence of IPSP activation from the PSF profiles, namely a marked pause or reduction in motor unit firing rates at the onset of the cutaneomuscular reflex, was found in all NI participants but in only half of participants with CP. In the other half of participants with CP, stimulation of cutaneomuscular afferents produced a PSF profile indicative of a pure excitatory post-synaptic potential (EPSP), with firing rates increasing above the mean pre-stimulus rate for 300 ms or more. The amplitude of motoneuron inhibition during the period of IPSP activation, as measured from the surface electromyogram, was less in participants with poor motor function as evaluated with the Gross Motor Functional Classification System ( $r = 0.72$ ,  $p < 0.001$ ) and the Functional Mobility Scale ( $r = -0.82$ ,  $p < 0.001$ ). These findings demonstrate that in individuals with CP, reduced activation of motoneuron IPSPs by sensory inputs is associated with reduced motor function and may contribute to enhanced reflexes and spasticity in CP. This article is protected by copyright. All rights reserved.

[PMID: 26842905](#)

**12. BMC Neurol. 2016 Jan 31;16(1):15. doi: 10.1186/s12883-016-0538-y.**

**Reliability of timed walking tests and temporo-spatial gait parameters in youths with neurological gait disorders.**

Graser JV, Letsch C, van Hedel HJ.

**BACKGROUND:** The 10-Meter Walk Tests (10MWT) and the 6-Minute Walk Test (6MinWT) are applied to assess gait capacity in paediatric patients. To better objectify changes in qualitative aspects of gait, temporo-spatial parameters like stride length or step symmetry could be simultaneously assessed with a GAITRite system. Reliability has not yet been evaluated in a heterogeneous sample of children with various neurological gait disorders such as is representative for paediatric neuro-rehabilitation. The aim of this study was to assess test-retest reliability of the 10MWT, the 6MinWT and simultaneously recorded gait parameters captured with the GAITRite system in children with neurological gait disorders. **METHODS:** This is a cross-sectional study with two measurement time-points. Thirty participants (9 females; mean (standard deviation) age 13.0 (3.6) years, 10 with cerebral palsy, 6 after stroke, among other diagnoses) performed the 10MWT at preferred (10MWT<sub>pref</sub>) and maximum speed (10MWT<sub>max</sub>) and the 6MinWT on two occasions (mean time interval: 7.0 (1.9) days). Relative reliability was quantified with an intra-class correlation coefficient (ICC); the measurement error reflecting absolute reliability was quantified with the standard error of measurement and the smallest real difference. **RESULTS:** ICCs of timed walking tests (time measured with a stopwatch, step count for the 10MWT and walking distance for the 6MinWT) ranged from 0.89-0.97. ICCs of temporo-spatial gait parameters ranged from 0.81-0.95 (10MWT<sub>pref</sub>), from 0.61-0.90 (10MWT<sub>max</sub>) and from 0.88-0.97 (6MinWT). In general, absolute reliability was greatest in the 6MinWT. **CONCLUSION:** Timed walking tests and temporo-spatial gait parameters obtained from the GAITRite system appear reliable in children with neurological gait disorders. However, especially in children with poorer walking ability, the reliability of temporo-spatial parameters might have been positively influenced, as unclear steps had to be removed using the GAITRite software. As absolute reliability is rather low, the responsiveness of these measures needs to be further evaluated.

[PMID: 26830919](#)

**13. Bone Joint J. 2016 Feb;98-B(2):278-81. doi: 10.1302/0301-620X.98B2.35959.**

**Predictors of outcome after single-event multilevel surgery in children with cerebral palsy: a retrospective ten-year follow-up study.**

Švehlík M, Steinwender G, Lehmann T, Kraus T.

**AIMS:** Single event multilevel surgery (SEMLS) has been shown to improve gait in children with cerebral palsy (CP). However, there is limited evidence regarding long-term outcomes and factors influencing them. **METHODS:**

In total 39 children (17 females and 22 males; mean age at SEMLS ten years four months, standard deviation 37 months) with bilateral CP (20 Gross Motor Function Classification System (GMFCS) level II and 19 GMFCS level III) treated with SEMLS were included. Children were evaluated using gait analysis and the Gait Deviation Index (GDI) before SEMLS and one, two to three, five and at least ten years after SEMLS. A linear mixed model was used to estimate the effect of age at the surgery, GMFCS and follow-up period on GDI. RESULTS: There was a mean improvement of 12.1 (-15.3 to 45.1) GDI points one year after SEMLS ( $p < 0.001$ ) and 10.3 (-23.1 to 44.2) GDI points ten years after SEMLS compared with before SEMLS ( $p < 0.001$ ). GMFCS level III children aged ten to 12 years had the most improvement. The GMFCS III group had more surgical procedures at the index SEMLS ( $p < 0.001$ ) and during the follow-up period ( $p = 0.039$ ). After correcting for other factors, age at surgery was the only factor predictive of long-term results. Our model was able to explain 45% of the variance of the change in GDI at the different time points. TAKE HOME MESSAGE: Children with GMFCS III level aged ten to 12 are the benchmark responders to SEMLS in the long-term. Cite this article: Bone Joint J 2016;98-B:278-81.

[PMID: 26850436](#)

**14. J Phys Ther Sci. 2015 Dec;27(12):3645-9. doi: 10.1589/jpts.27.3645. Epub 2015 Dec 28.**

**Correlation between the selective control assessment of lower extremity and pediatric balance scale scores in children with spastic cerebral palsy.**

Lim H.

[Purpose] The purpose of this study was to investigate the correlation between the Selective Control Assessment of Lower Extremity (SCALE) and Pediatric Balance Scales (PBS) in children with spastic cerebral palsy and further to test whether the SCALE is a valid tool to predict the PBS. [Subjects and Methods] A cross-sectional study was conducted to evaluate the SCALE and PBS in 23 children (9 females, 14 males, GMFCS level I-III) with spastic cerebral palsy. [Results] Both the SCALE and PBS scores for children with spastic hemiplegia were significantly higher than those for children with spastic diplegia. The scores for SCALE items were low for distal parts. The PBS items that were difficult for the participants to perform were items 8, 9, 10, and 14 with the highest difficulty experienced for item 8 followed by items 9, 10, and 14. The correlation coefficient (0.797) between the SCALE and PBS scores was statistically significant. The correlations between each SCALE item and the PBS scores were also statistically significant. SCALE items were significantly correlated with two PBS dimensions (standing and postural change). [Conclusion] In SCALE assessment, more severe deficits were observed in the distal parts. Standing and postural changes in the PBS method were difficult for the participants to perform. The two tests, that is, the SCALE and PBS, were highly correlated. Therefore, the SCALE is useful to prediction of PBS outcomes and is also applicable as a prognostic indicator for treatment planning.

[PMID: 26834323](#)

**15. Acta Orthop. 2016 Feb 10:1-7. [Epub ahead of print]**

**Good outcome of total hip replacement in patients with cerebral palsy.**

King G, Hunt LP, Wilkinson JM, Blom AW; National Joint Registry for England, Wales, and Northern Ireland..

Background and purpose - People with cerebral palsy (CP) often have painful deformed hips, but they are seldom treated with hip replacement as the surgery is considered to be high risk. However, few data are available on the outcome of hip replacement in these patients. Patients and methods - We linked Hospital Episode Statistics (HES) records to the National Joint Registry for England and Wales to identify 389 patients with CP who had undergone hip replacement. Their treatment and outcomes were compared with those of 425,813 patients who did not have CP. Kaplan-Meier estimates were calculated to describe implant survivorship and the curves were compared using log-rank tests, with further stratification for age and implant type. Reasons for revision were quantified as patient-time incidence rates (PTIRs). Nationally collected patient-reported outcomes (PROMS) before and 6 months after operation were compared if available. Cumulative mortality (Kaplan-Meier) was estimated at 90 days and at 1, 3, and 5 years. Results - The cumulative probability of revision at 5 years post-surgery was 6.4% (95% CI: 3.8-11) in the CP cohort as opposed to 2.9% (CI 2.9-3%) in the non-CP cohort ( $p < 0.001$ ). Patient-reported outcomes showed that CP patients had worse pain and function preoperatively, but had equivalent postoperative improvement. The

median improvement in Oxford hip score at 6 months was 23 (IQR: 14-28) in CP and it was 21 (14-28) in non-CP patients. 91% of CP patients reported good or excellent satisfaction with their outcome. The cumulative probability of mortality for CP up to 7 years was similar to that in the controls after stratification for age and sex. Interpretation - Hip replacement for cerebral palsy appears to be safe and effective, although implant revision rates are higher than those in patients without cerebral palsy.

[PMID: 26863583](#)

**16. J Pediatr Orthop. 2016 Mar;36(2):e17-24. doi: 10.1097/BPO.0000000000000485.**

**The Frequency of AVN Following Reconstructive Hip Surgery in Children With Cerebral Palsy: A Systematic Review.**

Hesketh K, Leveille L, Mulpuri K.

**BACKGROUND:** Children with cerebral palsy (CP) undergoing reconstructive hip surgery are at risk for developing avascular necrosis (AVN). The purpose of this systematic review was to investigate the reported frequency of AVN, the amount and quality of literature available, and possibly identify risk factors for developing AVN following reconstructive surgery for hip displacement in children with CP. **METHODS:** We performed a review of the literature using EMBASE and MEDLINE databases. Studies investigating the outcome of reconstructive hip surgery in patients with CP that identified the presence or absence of AVN were included. Study quality was assessed using the Methodological Index for Non-Randomized Studies and the Oxford Centre for Evidence-Based Medicine scale. **RESULTS:** Three hundred and ninety-nine articles were identified using our search strategy. Twenty-nine studies were included for data extraction after full-text review. The frequency of AVN ranged from 0% to 46% with an overall rate across studies of 7.5%. Presence of AVN was the primary outcome in 2 studies. The frequency of AVN in these studies was significantly higher than other studies at 37% and 46%. No statistically significant associations were found between age at surgery, severity of hip subluxation, length of follow-up, or type of surgery (combined varus derotation osteotomy and pelvic osteotomy vs. varus derotation osteotomy alone), and the rate of AVN. The majority of studies did not comment on methods used for determining diagnosis or severity of AVN and clinical significance was not well documented. **CONCLUSIONS:** Children with CP undergoing reconstructive hip surgery are at risk of developing AVN. Frequency and severity of this complication is poorly documented in the literature. On the basis of current evidence no significant risk factors were identified; however, it is not possible to draw firm conclusions about them. Incidence of AVN was higher in studies in which AVN was a primary outcome suggesting that the true frequency of AVN may be higher than is currently understood. **LEVEL OF EVIDENCE:** Level IV-systematic review, therapeutic studies.

[PMID: 26849636](#)

**17. Yonsei Med J. 2016 Mar;57(2):496-504. doi: 10.3349/ymj.2016.57.2.496.**

**Botulinum Toxin Type A Injection for Spastic Equinovarus Foot in Children with Spastic Cerebral Palsy: Effects on Gait and Foot Pressure Distribution.**

Choi JY, Jung S, Rha DW, Park ES.

**PURPOSE:** To investigate the effect of intramuscular Botulinum toxin type A (BoNT-A) injection on gait and dynamic foot pressure distribution in children with spastic cerebral palsy (CP) with dynamic equinovarus foot. **MATERIALS AND METHODS:** Twenty-five legs of 25 children with CP were investigated in this study. BoNT-A was injected into the gastrocnemius (GCM) and tibialis posterior (TP) muscles under the guidance of ultrasonography. The effects of the toxin were clinically assessed using the modified Ashworth scale (MAS) and modified Tardieu scale (MTS), and a computerized gait analysis and dynamic foot pressure measurements using the F-scan system were also performed before injection and at 1 and 4 months after injection. **RESULTS:** Spasticity of the ankle plantar-flexor in both the MAS and MTS was significantly reduced at both 1 and 4 months after injection. On dynamic foot pressure measurements, the center of pressure index and coronal index, which represent the asymmetrical weight-bearing of the medial and lateral columns of the foot, significantly improved at both 1 and 4 months after injection. The dynamic foot pressure index, total contact area, contact length and hind foot contact width all increased at 1 month after injection, suggesting better heel contact. Ankle kinematic data were significantly

improved at both 1 and 4 months after injection, and ankle power generation was significantly increased at 4 months after injection compared to baseline data.

**CONCLUSION:** Using a computerized gait analysis and foot scan, this study revealed significant benefits of BoNT-A injection into the GCM and TP muscles for dynamic equinovarus foot in children with spastic CP.

[PMID: 26847306](#)

**18. Bone Joint J. 2016 Feb;98-B(2):282-8. doi: 10.1302/0301-620X.98B2.36122.**

**Multilevel surgery in adults with cerebral palsy.**

Putz C, Döderlein L, Mertens EM, Wolf SI, Gantz S, Braatz F, Dreher T.

**AIMS:** Single-event multilevel surgery (SEMLS) has been used as an effective intervention in children with bilateral spastic cerebral palsy (BSCP) for 30 years. To date there is no evidence for SEMLS in adults with BSCP and the intervention remains focus of debate. **METHODS:** This study analysed the short-term outcome (mean 1.7 years, standard deviation 0.9) of 97 ambulatory adults with BSCP who performed three-dimensional gait analysis before and after SEMLS at one institution. **RESULTS:** Two objective gait variables were calculated pre- and post-operatively; the Gillette Gait Index (GGI) and the Gait Profile Score (GPS). The results were analysed in three groups according to their childhood surgical history (group 1 = no surgery, group 2 = surgery other than SEMLS, group 3 = SEMLS). Improvements in gait were shown by a significant decrease of GPS ( $p = 0.001$ ). Similar results were obtained for both legs (GGI right side and left side  $p = 0.01$ ). Furthermore, significant improvements were found in all subgroups although this was less marked in group 3, where patients had undergone previous SEMLS. **DISCUSSION:** SEMLS is an effective and safe procedure to improve gait in adults with cerebral palsy. However, a longer rehabilitation period is to be expected than found in children. SEMLS is still effective in adult patients who have undergone previous SEMLS in childhood. **TAKE HOME MESSAGE:** Single-event multilevel surgery is a safe and effective procedure to improve gait disorders in adults with bilateral spastic cerebral palsy. Cite this article: Bone Joint J 2016;98-B:282-8.

[PMID: 26850437](#)

**19. Dev Med Child Neurol. 2016 Feb 7. doi: 10.1111/dmcn.13053. [Epub ahead of print]**

**Exercise and physical activity recommendations for people with cerebral palsy.**

Verschuren O, Peterson MD, Balemans AC, Hurvitz EA.

Physical activity and its promotion, as well as the avoidance of sedentary behaviour, play important roles in health promotion and prevention of lifestyle-related diseases. Guidelines for young people and adults with typical development are available from the World Health Organisation and American College of Sports Medicine. However, detailed recommendations for physical activity and sedentary behaviour have not been established for children, adolescents, and adults with cerebral palsy (CP). This paper presents the first CP-specific physical activity and exercise recommendations. The recommendations are based on (1) a comprehensive review and analysis of the literature, (2) expert opinion, and (3) extensive clinical experience. The evidence supporting these recommendations is based on randomized controlled trials and observational studies involving children, adolescents, and adults with CP, and buttressed by the previous guidelines for the general population. These recommendations may be used to guide healthcare providers on exercise and daily physical activity prescription for individuals with CP.

[PMID: 26853808](#)

**20. Eur J Phys Rehabil Med. 2016 Feb 4. [Epub ahead of print]****Effect of suspension training versus treadmill training on gross motor abilities of children with spastic diplegic cerebral palsy: a comparative study.**

Emara HA, El-Gohary T, Al-Johani A.

**BACKGROUND:** Suspension training and treadmill training are commonly used for promoting functional gross motor skills in children with cerebral palsy. **OBJECTIVE:** The aim of this study was to compare the effect of body-weight suspension training versus treadmill training on gross motor functional skills. **DESIGN:** Assessor-blinded, randomized, controlled intervention study. **SETTING:** Outpatient rehabilitation facility. **POPULATION:** Twenty children with spastic diplegia (7 boys and 13 girls) in the age ranged from 6 to 8 years old were randomly allocated into two equal groups. All children were assessed at baseline, after 18-session and after 36-session. **METHODS:** During the twelve-week outpatient rehabilitation program, both groups received traditional therapeutic exercises. Additionally, one group received locomotor training using the treadmill while the other group received locomotor training using body-weight suspension through the spider cage. Assessment included dimensions "D" standing and "E" walking of the gross motor function measure, in addition to the 10-meter walking test and the five times sit to stand test. Training was applied three times per week for twelve consecutive weeks. **RESULTS:** No significant difference was found in standing or walking ability for measurements taken at baseline or after 18-session of therapy. Measurements taken at 36-session showed that suspension training achieved significantly ( $P < 0.05$ ) higher average score than treadmill training for dimension D as well as for dimension E. No significant difference was found between suspension training and treadmill training regarding walking speed or sit to stand transitional skills. **CONCLUSION:** Body-weight suspension training is effective in improving walking and locomotor capabilities in children with spastic diplegia. After three month suspension training was superior to treadmill training. **CLINICAL REHABILITATION IMPACT:** Body-weight suspension training promotes adequate postural stability, good balance control, and less exertion which facilitates efficient and safe gait.

[PMID: 26845668](#)

**21. Pediatr Phys Ther. 2016 Feb 11. [Epub ahead of print]****Benefits and Enjoyment of a Swimming Intervention for Youth With Cerebral Palsy: An RCT Study.**

Declerck M, Verheul M, Daly D, Sanders R.

**PURPOSE:** To investigate enjoyment and specific benefits of a swimming intervention for youth with cerebral palsy (CP). **METHODS:** Fourteen youth with CP (aged 7 to 17 years, Gross Motor Function Classification System levels I to III) were randomly assigned to control and swimming groups. Walking ability, swimming skills, fatigue, and pain were assessed at baseline, after a 10-week swimming intervention (2/week, 40-50 minutes) or control period, after a 5-week follow-up and, for the intervention group, after a 20-week follow-up period. The level of enjoyment of each swim-session was assessed. **RESULTS:** Levels of enjoyment were high. Walking and swimming skills improved significantly more in the swimming than in the control group ( $P = .043$ ;  $P = .002$ , respectively), whereas fatigue and pain did not increase. After 20 weeks, gains in walking and swimming skills were retained ( $P = .017$ ;  $P = .016$ , respectively). **CONCLUSION:** We recommend a swimming program for youth with CP to complement a physical therapy program.

[PMID: 26871379](#)

**22. Pediatr Int. 2016 Feb 9. doi: 10.1111/ped.12942. [Epub ahead of print]****The Effects of Nintendo Wii-Fit Video Games on Balance in Children with Mild Cerebral Palsy.**

Tarakci D, Ersoz Huseyinsinoglu B, Tarakci E, Razak Ozdinçler A.

**BACKGROUND:** This study aimed to compare the effects of Nintendo Wii-Fit balance-based video games and conventional balance training in children with mild Cerebral Palsy (CP). **METHODS:** This randomized controlled trial included thirty ambulatory pediatric patients (5 to 18 years) with CP. Participants were randomized to either

conventional balance training group (Control Group) or Wii-Fit balance-based video games group (Wii Group). Both group received Neuro-developmental treatment (NDT) during 24 sessions. In addition, while control group received conventional balance training in each session, Wii group performed Nintendo Wii Fit games like ski slalom, tightrope walk and soccer heading on balance board. Primary outcomes were Functional Reach Test (forward and sideways), Sit-to-Stand Test and Timed Get up and Go Test. Nintendo Wii Fit balance, age and game scores, 10-meter walk test, 10-step climbing test and Wee-Functional Independence Measure (Wee FIM) were secondary outcomes. RESULTS:

After the treatment, changes at balance scores and independence level in activities of daily living were significant ( $p < 0.05$ ) in both groups. Statistically significant improvements were found in Wii-based game group over control group in all balance tests and total Wee FIM score ( $p < 0.05$ ). CONCLUSION: Wii-fit balance based video games are better at improving both static and performance-related balance parameters when combined with NDT treatment in children with mild CP.

[PMID: 26858013](#)

### 23. Phys Occup Ther Pediatr. 2016 Feb 11:1-16. [Epub ahead of print]

#### **Consensus Planning Toward a Community-Based Approach to Promote Physical Activity in Youth with Cerebral Palsy.**

Gorter JW, Galuppi BE, Gulko R, Wright M, Godkin E.

AIMS: To engage researchers and knowledge-users in six Ontario communities in knowledge translation initiatives to identify community-informed elements to guide the development of an optimal physical activity program for youth with cerebral palsy (CP) and to support research efforts. METHODS: The project included three iterative steps, i.e., an environmental scan of five communities, six regional planning meetings, and a member-checking survey, followed by a Delphi survey to reach consensus on the elements deemed most important. RESULTS: Twenty-four elements were identified to include in programs promoting physical activity in youth with CP, which were organized in five categories: raise awareness of the options and opportunities ( $n = 4$ ); pique interest and motivate youth to become and stay active ( $n = 9$ ); ensure community programs are ready for youth with a disability ( $n = 2$ ); be fit, fit in, and finding the best fit ( $n = 5$ ); and explore the layers of physical activity and how they interact ( $n = 4$ ). CONCLUSIONS: The 24 elements established characterize the key concepts that families and community stakeholders value when developing physical activity programs for youth with CP. When incorporated into clinical practice, each of the elements may be used to evaluate key aspects of outcome for individuals with CP.

[PMID: 26865106](#)

### 24. Phys Occup Ther Pediatr. 2016 Feb 11:1-15. [Epub ahead of print]

#### **Current Rehabilitation Practices for Children with Cerebral Palsy: Focus and Gaps.**

Anaby D, Korner-Bitensky N, Steven E, Tremblay S, Snider L, Avery L, Law M.

AIMS: To describe the focus of therapy practices in occupational and physical therapy for school-aged children with cerebral palsy, and better understand whether it is congruent with recommended practices. METHODS: A Canada-wide Web-based survey was completed by 62 occupational and 61 physical therapists to identify problems, assessments, and treatment interventions for two case-based scenarios. Data were coded using the International Classification of Functioning, Disability and Health (ICF) definitions for "body functions and structure," "activity and participation," and "environment." RESULTS: Physical therapists, in comparison to occupational therapists, were more likely to select interventions classed in the "body functions and structure" category (34-42% and 18-20%, respectively). Both professions focused on "activity and participation" (34-61%) when identifying problems, assessing, and intervening; attention, however, was mainly directed towards task-oriented activities such as activities of daily living and mobility. Participation in leisure or community-based activities received less attention (2-15%). The environment received limited attention for problems and assessments (4-25%), though it was an important focus of intervention (19-37%). CONCLUSIONS: While body functions and structure are well-addressed, other ICF elements, specifically participation, are poorly integrated into practice. The emerging focus on the environment in therapy intervention, by modifying the context rather than changing aspects of the child, is

consistent with current approaches and evidence. Knowledge translation implementation initiatives are recommended to bridge identified gaps.

[PMID: 26865220](#)

**25. Res Dev Disabil. 2016 Feb 3;53-54:11-18. doi: 10.1016/j.ridd.2016.01.019. [Epub ahead of print]**

**Walking-induced muscle fatigue impairs postural control in adolescents with unilateral spastic cerebral palsy.**

Vitiello D, Pochon L, Malatesta D, Girard O, Newman CJ, Degache F.

**BACKGROUND:** Fatigue is likely to be an important limiting factor in adolescents with spastic cerebral palsy (CP). **AIMS:** To determine the effects of walking-induced fatigue on postural control adjustments in adolescents with unilateral CP and their typically developing (TD) peers. **METHODS:** Ten adolescents with CP (14.2±1.7yr) and 10 age-, weight- and height-matched TD adolescents (14.1±1.9yr) walked for 15min on a treadmill at their preferred walking speed. Before and after this task, voluntary strength capacity of knee extensors (MVC) and postural control were evaluated in 3 conditions: eyes open (EO), eyes closed (EC) and with dual cognitive task (EODT). **RESULTS:** After walking, MVC decreased significantly in CP (-11%, P<0.05) but not in TD. The CoP area was only significantly increased in CP (90%, 34% and 60% for EO, EC and EODT conditions, respectively). The CoP length was significantly increased in the EO condition in CP and TD (20% and 21%) and was significantly increased in the EODT condition by 18% in CP only. **CONCLUSIONS:** Unlike TD adolescents, treadmill walking for 15min at their preferred speed lead to significant knee extensor strength losses and impairments in postural control in adolescents with unilateral spastic CP.

[PMID: 26851383](#)

**26. Physiother Can. 2015 Aug;67(3):245-7. doi: 10.3138/ptc.2014-34.**

**Evidence-Based Management of Postural Control in a Child with Cerebral Palsy.**

MacKenzie C, McIlwain S.

The authors review and discuss the evidence exploring the use of dynamic compression garments with children with cerebral palsy. The evidence is presented in case-study format with a focus on postural control and impact on involuntary movements.

[PMID: 26839451](#)

**27. J Neuropsychiatry Clin Neurosci. 2016 Winter;28(1):e6-7. doi: 10.1176/appi.neuropsych.15040091.**

**Probable Ketamine-Induced Hypomanic-Like Episode in a Child With Cerebral Palsy.**

Marta CJ, Yudofsky LM, Enenbach MJ.

Letter to the editor.

[PMID: 26844969](#)

**28. Ann Epidemiol. 2016 Jan 12. pii: S1047-2797(16)30008-4. doi: 10.1016/j.annepidem.2016.01.001. [Epub ahead of print]**

**Prevalence of cerebral palsy and intellectual disability among children identified in two U.S. National Surveys, 2011-2013.**

Maenner MJ, Blumberg SJ, Kogan MD, Christensen D, Yeargin-Allsopp M, Schieve LA.

**PURPOSE:** Cerebral palsy (CP) and intellectual disability (ID) are developmental disabilities that result in considerable functional limitations. There are few recent and nationally representative prevalence estimates of CP and ID in the United States. **METHODS:** We used two U.S. nationally representative surveys, the 2011-2012 National Survey of Children's Health (NSCH) and the 2011-2013 National Health Interview Survey (NHIS), to determine the prevalence of CP and ID based on parent report among children aged 2-17 years. **RESULTS:** CP prevalence was 2.6 (95% confidence interval [CI]: 2.1-3.2) per 1000 in the NSCH and 2.9 (95% CI: 2.3-3.7) in the NHIS. ID prevalence was 12.2 (95% CI: 10.7-13.9) and 12.1 (95% CI: 10.8-13.7) in NSCH and NHIS, respectively. For both conditions, the NSCH and NHIS prevalence estimates were similar to each other for nearly all sociodemographic subgroups examined.

**CONCLUSIONS:** Despite using different modes of data collection, the two surveys produced similar and plausible estimates of CP and ID and offer opportunities to better understand the needs and situations of children with these conditions.

[PMID: 26851824](#)

**29. Semin Neurol. 2016 Feb;36(1):64-72. doi: 10.1055/s-0036-1571847. Epub 2016 Feb 11.**

**Botulinum Toxin Treatment of Spasticity in Adults and Children.**

Moeini-Naghani I, Hashemi-Zonouz T, Jabbari B.

Spasticity is a frequent symptom in stroke, multiple sclerosis, cerebral or spinal trauma, and cerebral palsy that affects and disables a large number of adults and children. In this review, we discuss the pathophysiology and nonpharmacologic and pharmacologic treatments of spasticity with emphasis on the role of botulinum neurotoxins (BoNTs). The world literature is reviewed on double-blind and placebo-controlled clinical trials reporting safety and efficacy of BoNT treatment in adult spasticity and spasticity of children with cerebral palsy. The evidence for efficacy is presented from recommendations of the Assessment and Therapeutics subcommittee of the American Academy of Neurology. A technical section describes the techniques and recommended doses of BoNTs in spasticity.

[PMID: 26866498](#)

**30. Voen Med Zh. 2015 Aug;336(8):40-5.**

**[New technologies in diagnostics and health-resort treatment of movement disorder in children with cerebral palsy].**

**[Article in Russian]**

Ponomarenko YN, Vasenko SV, Nenko AM.

The study analyses results of treatment of 196 patients, with cerebral palsy, which underwent a course of health-resort treatment is performed. Past medical history of patients for the last 10 years was also analysed. It was found that the use of botulin toxin <<A>> (BT-A) <<Dysport®>> as a part of complex rehabilitation of the patients significantly improved the effectiveness of the treatment. It was determined that the reasons of the lack of spasticity reduce are caused by degeneration of the muscles. The developed technique of ultrasound exam muscles allowed objectively evaluates the degree of muscle degeneration.

[PMID: 26829869](#)

## Prevention and Cure

31. *Acta Paediatr.* 2016 Feb 2. doi: 10.1111/apa.13352. [Epub ahead of print]

**Grey matter brain injuries are common in Ugandan children with cerebral palsy suggesting a perinatal aetiology in full-term infants.**

Kakooza-Mwesige A, Byanyima RK, Tumwine JK, Eliasson AC, Forssberg H, Flodmark O.

AIM: There is limited literature on brain imaging studies of children with cerebral palsy (CP) in low- and middle-income countries. We investigated neuroimaging patterns of children with CP attending a tertiary referral centre in Uganda in order to determine how they differed from studies reported from high-income countries and their relationship with prenatal and post-natal factors. METHODS: Pre-contrast and post-contrast computed tomography (CT) scans of 78 CP children aged 2-12 years were conducted using a Philips MX 16-slice CT scanner. Two radiologists, blinded to the patient's clinical status, independently reviewed the scans. RESULTS: Abnormal CT scans were detected in 69% of the children sampled, with very few having primary white matter injuries (4%). Primary grey matter injuries (PGMI) (44%) and normal scans (31%) were most frequent. Children with a history of hospital admission following birth were three times more likely to have PGMI (odds ratio [OR] 2.8; 95% CI 1.1- 7.1), suggesting a perinatal period with medical complications. CONCLUSION: Brain imaging patterns in this group of CP children differed markedly from imaging studies reported from high-income countries, suggesting a perinatal aetiology in full-term infants and reduced survival in preterm infants. This article is protected by copyright. All rights reserved.

[PMID: 26836434](#)

32. *Am J Obstet Gynecol.* 2016 Jan 29. pii: S0002-9378(16)00228-3. doi: 10.1016/j.ajog.2016.01.178. [Epub ahead of print]

**Cerebral palsy: causes, pathways, and the role of genetic variants.**

Lim WH.

Letter to the editor.

[PMID: 26829511](#)

33. *Dev Med Child Neurol.* 2016 Feb 10. doi: 10.1111/dmcn.12972. [Epub ahead of print]

**Prognostic factors for cerebral palsy and motor impairment in children born very preterm or very low birthweight: a systematic review.**

Linsell L, Malouf R, Morris J, Kurinczuk JJ, Marlow N.

AIM: There is a large literature reporting risk factor analyses for poor neurodevelopment in children born very preterm (VPT:  $\leq 32$ wks) or very low birthweight (VLBW:  $\leq 1250$ g), which to date has not been formally summarized. The aim of this paper was to identify prognostic factors for cerebral palsy (CP) and motor impairment in children born VPT/VLBW.

METHOD: A systematic review was conducted using Medline, Embase, and Pyscinfo databases to identify studies published between 1 January 1990 and 1 June 2014 reporting multivariable prediction models for poor neurodevelopment in VPT/VLBW children (registration number CRD42014006943). Twenty-eight studies for motor outcomes were identified. RESULTS: There was strong evidence that intraventricular haemorrhage and periventricular leukomalacia, and some evidence that the use of postnatal steroids and non-use of antenatal steroids, were prognostic factors for CP. Male sex and gestational age were of limited use as prognostic factors for CP in cohorts restricted to  $\leq 32$  weeks gestation; however, in children older than 5 years with no major disability, there was evidence that male sex was a predictive factor for motor impairment. INTERPRETATION: This review

has identified factors which may be of prognostic value for CP and motor impairment in VPT/VLBW children and will help to form the basis of future prognostic research.

[PMID: 26862030](#)

**34. Environ Pollut. 2016 Jan 31;212:9-17. doi: 10.1016/j.envpol.2016.01.001. [Epub ahead of print]**

**The use of a physiologically-based extraction test to assess relationships between bioaccessible metals in urban soil and neurodevelopmental conditions in children.**

Hong J, Wang Y, McDermott S, Cai B, Aelion CM, Lead J.

Intellectual disability (ID) and cerebral palsy (CP) are serious neurodevelopment conditions and low birth weight (LBW) is correlated with both ID and CP. The actual causes and mechanisms for each of these child outcomes are not well understood. In this study, the relationship between bioaccessible metal concentrations in urban soil and these child conditions were investigated. A physiologically based extraction test (PBET) mimicking gastric and intestinal processes was applied to measure the bio-accessibility of four metals (cadmium (Cd), chromium (Cr), nickel (Ni), and lead (Pb)) in urban soil, and a Bayesian Kriging method was used to estimate metal concentrations in geocoded maternal residential sites. The results showed that bioaccessible metal concentrations of Cd, Ni, and Pb in the intestinal phase were statistically significantly associated with the child outcomes. Lead and nickel were associated with ID, lead and cadmium was associated with LBW, and cadmium was associated with CP. The total concentrations and stomach concentrations were not correlated to significant effects in any of the analyses. For lead, an estimated threshold value was found that was statistically significant in predicting low birth weight. The change point test was statistically significant ( $p$  value = 0.045) at an intestine threshold level of 9.2 mg/kg (95% confidence interval 8.9-9.4,  $p$  value = 0.0016), which corresponds to 130.6 mg/kg of total Pb concentration in the soil. This is a narrow confidence interval for an important relationship.

[PMID: 26840511](#)

**35. Eur J Paediatr Neurol. 2016 Jan 19. pii: S1090-3798(15)00196-8. doi: 10.1016/j.ejpn.2015.11.013. [Epub ahead of print]**

**Relationship between somatosensory deficit and brain somatosensory system after early brain lesion: A morphometric study.**

Perivier M, Delion M, Chinier E, Loustau S, Nguyen S, Ter Minassian A, Richard I, Dinomais M.

Cerebral Palsy (CP) is a group of permanent motor disorders due to non-progressive damage to the developing brain. Poor tactile discrimination is common in children with unilateral CP. Previous findings suggest the crucial role of structural integrity of the primary (S1) and secondary (S2) somatosensory areas located in the ipsilesional hemisphere for somatosensory function processing. However, no focus on the relationship between structural characteristics of ipsilesional S1 and S2 and tactile discrimination function in paretic hands has been proposed. Using structural MRI and a two-point discrimination assessment (2 PD), we explore this potential link in a group of 21 children (mean age 13 years and 7 months) with unilateral CP secondary to a periventricular white matter injury (PWMI) or middle cerebral artery infarct (MCA). For our whole sample there was a significant negative correlation between the 2 PD and the gray matter volume in the ipsilesional S2 ( $\rho = -0.50$  95% confidence interval [-0.76, -0.08], one-tailed  $p$ -value = 0.0109) and in the ipsilesional S1 ( $\rho = -0.57$ , 95% confidence interval [-0.81, -0.19], one-tailed  $p$ -value = 0.0032). When studying these relationships with regard to the lesion types, we found these correlations were non-significant in the patients with PWMI but stronger in patients with MCA. According to our results, the degree of sensory impairment is related to the spared gray matter volume in ipsilesional S1 and S2 and is marked after an MCA stroke. Our work contributes to a better understanding of why some patients with CP have variable somatosensory deficit following an early brain lesion.

[PMID: 26831357](#)

**36. Neural Plast. 2016;2016:2643491. doi: 10.1155/2016/2643491. Epub 2015 Dec 29.**

**Interpreting Intervention Induced Neuroplasticity with fMRI: The Case for Multimodal Imaging Strategies.**

Reid LB, Boyd RN, Cunnington R, Rose SE.

Direct measurement of recovery from brain injury is an important goal in neurorehabilitation, and requires reliable, objective, and interpretable measures of changes in brain function, referred to generally as "neuroplasticity." One popular imaging modality for measuring neuroplasticity is task-based functional magnetic resonance imaging (t-fMRI). In the field of neurorehabilitation, however, assessing neuroplasticity using t-fMRI presents a significant challenge. This commentary reviews t-fMRI changes commonly reported in patients with cerebral palsy or acquired brain injuries, with a focus on studies of motor rehabilitation, and discusses complexities surrounding their interpretations. Specifically, we discuss the difficulties in interpreting t-fMRI changes in terms of their underlying causes, that is, differentiating whether they reflect genuine reorganisation, neurological restoration, compensation, use of preexisting redundancies, changes in strategy, or maladaptive processes. Furthermore, we discuss the impact of heterogeneous disease states and essential t-fMRI processing steps on the interpretability of activation patterns. To better understand therapy-induced neuroplastic changes, we suggest that researchers utilising t-fMRI consider concurrently acquiring information from an additional modality, to quantify, for example, haemodynamic differences or microstructural changes. We outline a variety of such supplementary measures for investigating brain reorganisation and discuss situations in which they may prove beneficial to the interpretation of t-fMRI data.

[PMID: 26839711](#)

**37. Obstet Gynecol. 2016 Feb 4. [Epub ahead of print]**

**Chorioamnionitis and Neurocognitive Development at Age 2 Years.**

Vander Haar E, Gyamfi-Bannerman C.

**OBJECTIVE:** To evaluate whether chorioamnionitis is associated with decreased Bayley II scores at age 2 years. **METHODS:** We conducted an observational cohort study of women and their offspring enrolled in the Eunice Kennedy Shriver National Institute of Child Health and Development's Maternal-Fetal Medicine Units Network multicenter, randomized controlled trial of magnesium for cerebral palsy prevention in pregnancies at high risk for early preterm delivery. We included nonanomalous singleton gestations and excluded pregnancies missing outcome or exposure data. Our primary exposure was chorioamnionitis, defined by the clinical diagnosis of chorioamnionitis and a maternal fever greater than 100°F. Our primary outcome was a Bayley II Mental Developmental Index score less than 70 or Psychomotor Developmental Index score less than 70 assessed at age 2 years. We also assessed Mental Developmental Index or Psychomotor Developmental Index score less than 85. We conducted bivariate analyses and fit a log-linear regression model, adjusting for related to Mental Developmental Index or Psychomotor Developmental Index score less than 70 or less than 85 with a detectable effect size estimated at a relative risk of 1.5 or greater. **RESULTS:** Of 1,574 patients in our analysis, 194 (12%) had chorioamnionitis and 1,366 (87%) had preterm premature rupture of membranes. The mean gestational age at delivery was 29 3/7 weeks. There were no significant differences in Mental Developmental Index score less than 70 (37 [19.1%] compared with 233 [17%],  $P=.45$ ) or Psychomotor Developmental Index score less than 70 (29 [15%] compared with 195 [14%]  $P=.76$ ) for children born to mothers with or without chorioamnionitis, respectively. After adjusting for confounders, there remained no difference in the proportion of abnormal scores in either group. However, neonates diagnosed with sepsis were found to have significantly decreased Mental Developmental Index scores. **CONCLUSION:** Exposure to chorioamnionitis was not associated with neurocognitive defects as measured by abnormal Bayley II scores.

[PMID: 26855093](#)

**38. *Pediatr Neurol.* 2016 Jan 7. pii: S0887-8994(15)30097-7. doi: 10.1016/j.pediatrneurol.2015.12.018. [Epub ahead of print]**

**Maternal Infections During Pregnancy and Cerebral Palsy in the Child.**

Bear JJ, Wu YW.

**BACKGROUND:** Chorioamnionitis is a risk factor for cerebral palsy. The relationship between extra-amniotic infections and cerebral palsy is less well studied. We examined maternal intra-amniotic and extra-amniotic infections and risk of cerebral palsy in the child. **METHODS:** Among a retrospective cohort of 6 million Californian births, 1991-2001, we analyzed administrative maternal and newborn hospital discharge abstracts linked to records of all children receiving services for cerebral palsy at the California Department of Developmental Services. We identified maternal hospital diagnoses of intra-amniotic (chorioamnionitis) and extra-amniotic (other genitourinary and respiratory) infections occurring up to 12 months before delivery. Using multivariable logistic regression, we determined the independent association between maternal infections and cerebral palsy, adjusting for infant sex, maternal age, race, education, socioeconomic status, and obesity. **RESULTS:** About 5.5% of mothers had a hospital discharge diagnosis of at least one of the following: chorioamnionitis (2.0%), other genitourinary (3.1%), and respiratory infection (0.6%). An infection diagnosis was more common in mothers of the 8473 infants with cerebral palsy than in mothers of unaffected children (13.7% vs 5.5%,  $P < 0.001$ ). All three types of maternal infections (chorioamnionitis, odds ratio [OR] 3.1, 95% confidence interval [CI] 2.9-3.4; other genitourinary infection, OR 1.4, 95% CI 1.3-1.6; and respiratory infection, OR 1.9, 95% CI 1.5-2.2) were associated with cerebral palsy in multivariable analyses. Maternal extra-amniotic infections, whether diagnosed during prenatal or birth hospitalizations, conferred an increased risk of cerebral palsy. **CONCLUSIONS:** Maternal extra-amniotic infections diagnosed in the hospital during pregnancy are associated with a modestly increased risk of cerebral palsy in the child.

[PMID: 26857522](#)

**39. *Pediatr Neurol.* 2016 Feb;55:30-6. doi: 10.1016/j.pediatrneurol.2015.11.010. Epub 2015 Nov 27.**

**Cerebral Hemodynamics in Asphyxiated Newborns Undergoing Hypothermia Therapy: Pilot Findings Using a Multiple-Time-Scale Analysis.**

Chalak LF, Tian F, Tarumi T, Zhang R.

**BACKGROUND:** Improved quantitative assessment of cerebral hemodynamics in newborns might enable us to optimize cerebral perfusion. Our objective was to develop an approach to assess cerebral hemodynamics across multiple time scales during the first 72 hours of life in newborns during hypothermia therapy. **METHODS:** Spontaneous oscillations in mean arterial pressure and regional cerebral tissue oxygen saturation were analyzed using a moving window correlation method with time scales ranging from 0.15 to 8 hours in this pilot methodology study. Abnormal neurodevelopmental outcome was defined by Bayley III scores and/or cerebral palsy by age 24 months using receiver operating curve. **RESULTS:** Multiple-time-scale correlations between the mean arterial pressure and regional cerebral tissue oxygen saturation oscillations were tested in 10 asphyxiated newborns undergoing hypothermia therapy. Large noninduced fluctuations in the blood pressure were observed during cooling in all five infants with abnormal outcomes. Notably, these infants had two distinct patterns of correlation: a positive in-phase correlation at the short time scales (15 minutes) and/or a negative antiphase correlations observed at long time scales (4 hours.). Both the in-phase (area under the curve 0.6, [95% confidence interval 0.2-0.95]) and antiphase correlations (area under the curve 0.75, [95% confidence interval 0.4-0.95]) appeared to be related to an abnormal outcome. **CONCLUSIONS:** Our observations suggest that the time scale is an important factor that needs to be standardized in the assessment of neonatal cerebral hemodynamics.

[PMID: 26858217](#)

**40. Pract Neurol. 2016 Feb 2. pii: practneurol-2015-001184. doi: 10.1136/practneurol-2015-001184. [Epub ahead of print]**

**Cerebral palsy.**

Wimalasundera N, Stevenson VL.

Cerebral palsy has always been known as a disorder of movement and posture resulting from a non-progressive injury to the developing brain; however, more recent definitions allow clinicians to appreciate more than just the movement disorder. Accurate classification of cerebral palsy into distribution, motor type and functional level has advanced research. It also facilitates appropriate targeting of interventions to functional level and more accurate prognosis prediction. The prevalence of cerebral palsy remains fairly static at 2-3 per 1000 live births but there have been some changes in trends for specific causal groups. Interventions for cerebral palsy have historically been medical and physically focused, often with limited evidence to support their efficacy. The use of more appropriate outcome measures encompassing quality of life and participation is helping to deliver treatments which are more meaningful for people with cerebral palsy and their carers.

[PMID: 26837375](#)

**41. World J Clin Pediatr. 2016 Feb 8;5(1):67-74. doi: 10.5409/wjcp.v5.i1.67. eCollection 2016.**

**Short and long term prognosis in perinatal asphyxia: An update.**

Ahearne CE, Boylan GB, Murray DM.

Interruption of blood flow and gas exchange to the fetus in the perinatal period, known as perinatal asphyxia, can, if significant, trigger a cascade of neuronal injury, leading on to neonatal encephalopathy (NE) and resultant long-term damage. While the majority of infants who are exposed to perinatal hypoxia-ischaemia will recover quickly and go on to have a completely normal survival, a proportion will suffer from an evolving clinical encephalopathy termed hypoxic-ischaemic encephalopathy (HIE) or NE if the diagnosis is unclear. Resultant complications of HIE/NE are wide-ranging and may affect the motor, sensory, cognitive and behavioural outcome of the child. The advent of therapeutic hypothermia as a neuroprotective treatment for those with moderate and severe encephalopathy has improved prognosis. Outcome prediction in these infants has changed, but is more important than ever, as hypothermia is a time sensitive intervention, with a very narrow therapeutic window. To identify those who will benefit from current and emerging neuroprotective therapies we must be able to establish the severity of their injury soon after birth. Currently available indicators such as blood biochemistry, clinical examination and electrophysiology are limited. Emerging biological and physiological markers have the potential to improve our ability to select those infants who will benefit most from intervention. Biomarkers identified from work in proteomics, metabolomics and transcriptomics as well as physiological markers such as heart rate variability, EEG analysis and radiological imaging when combined with neuroprotective measures have the potential to improve outcome in HIE/NE. The aim of this review is to give an overview of the literature in regards to short and long-term outcome following perinatal asphyxia, and to discuss the prediction of this outcome in the early hours after birth when intervention is most crucial; looking at both currently available tools and introducing novel markers.

[PMID: 26862504](#)

**42. Zhongguo Ying Yong Sheng Li Xue Za Zhi. 2015 Sep;31(5):473-6.**

**[Therapeutic effect of acupuncture treatment on ischemic hypoxic neonate rats with cerebral palsy].**

**[Article in Chinese]**

Li SH, Sun HT, Wang YM, Wei ZJ.

**OBJECTIVE:** To explore the mechanisms of acupuncture treatment promoting the motor function recovery of neonate rats with cerebral palsy. **METHODS:** The improved hypoxic-ischemic encephalopathy (HIE) means was performed to establish the model of neonate rats with cerebral palsy. All neonate rats were randomly divided into 3

groups: sham group, model group and acupuncture group (n = 20). We observed and scored motor function of rats, measured the levels of superoxide dismutase (SOD) and malondialdehyde (MDA) in serum, and also measured the expression of synaptophysin (SYP) and growth associated protein-43 (GAP-43) in the diseased region of cerebral tissue. RESULTS:

The motor function scores (11.3 +/- 0.29) and the serum level of SOD (147.1 +/- 12.7) U/ml in acupuncture treatment group were higher than those of model group ( P < 0.05). The serum level of MDA was lower in acupuncture treatment group than that of model group ( P < 0.05). The expression of SYP and GAP-43 in the diseased region of cerebral tissue of acupuncture treatment group were higher than those of model group ( P < 0.05) . CONCLUSION: Acupuncture-therapy could improve the motor function of neonate rats with cerebral palsy by decreasing the content of MDA in serum, increasing the contents of SOD in serum, and prolonging the upregulation of SYP and GAP-43 expressions in hmin tissue.

[PMID: 26827546](#)

## Special Edition - Complete publication of the Australian Cerebral Palsy Register Supplement

### 1. Foreword

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**Christine Cans and Nicole Gerrand**

Wiley Online: <http://onlinelibrary.wiley.com/doi/10.1111/dmcn.13006/abstract>

### 2. Acknowledgements

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Wiley Online: <http://onlinelibrary.wiley.com/doi/10.1111/dmcn.13003/abstract>

### 3. Australia and the Australian Cerebral Palsy Register for the birth cohort 1996-2006

#### Australian Cerebral Palsy Register Group

This is a brief background paper for a supplementary issue of *Developmental Medicine & Child Neurology* by the Australian Cerebral Palsy Register Group. It provides context for the reader of the supplement including a description of the establishment and development of state and territory cerebral palsy registers in Australia.

[PMID: 26806361](#)

### 4. Dev Med Child Neurol. 2016 Jan 13. doi: 10.1111/dmcn.13026. [Epub ahead of print]

#### A special supplement: findings from the Australian Cerebral Palsy Register, birth years 1993 to 2006.

Smithers-Sheedy H, McIntyre S, Gibson C, Meehan E, Scott H, Goldsmith S, Watson L, Badawi N, Walker K, Novak I, Blair E; Australian Cerebral Palsy Register Group.

AIM: To briefly outline the strengths and limitations of cerebral palsy (CP) registers, and to report on findings of the Australian Cerebral Palsy Register (ACPR) pertaining to a population cohort of children with CP. METHOD: De-identified data were extracted from the ACPR for people with CP in birth years 1993 to 2006, from South Australia, Victoria, and Western Australia. Live birth prevalence of CP was estimated and risk factors described. RESULTS: The overall birth prevalence of CP (including those whose CP was postneonatally acquired) for the 1993 to 2006 birth cohort was 2.1 per 1000 live births (95% confidence interval [CI] 2.0-2.2). Excluding cases with a known postneonatal cause, the birth prevalence for pre/perinatally acquired CP was 2.0 per 1000 live births

(95% CI 1.9-2.1). A downward trend in rates of CP in those born extremely preterm was evident over at least three consecutive periods across all three regions. Most (58.6%) children were born at term ( $\geq 37$ wks). Male sex, early gestational age, low birthweight, and multiple birth were risk factors for CP. INTERPRETATION: Overall rates of CP did not change during this period. The proportion of those with CP born extremely preterm decreased. The ACPR Group will investigate whether this pattern continues when data pertaining to the next birth cohort for all three regions becomes available.

[PMID: 26762930](#)

**5. Dev Med Child Neurol. 2016 Jan 19. doi: 10.1111/dmcn.12999. [Epub ahead of print]**

**An international survey of cerebral palsy registers and surveillance systems.**

Goldsmith S, McIntyre S, Smithers-Sheedy H, Blair E, Cans C, Watson L, Yeargin-Allsopp M, Australian Cerebral Palsy Register Group.

AIM: To describe cerebral palsy (CP) surveillance programmes and identify similarities and differences in governance and funding, aims and scope, definition, inclusion/exclusion criteria, ascertainment and data collection, to enhance the potential for research collaboration. METHOD: Representatives from 38 CP surveillance programmes were invited to participate in an online survey and submit their data collection forms. Descriptive statistics were used to summarize information submitted. RESULTS: Twenty-seven surveillance programmes participated (25 functioning registers, two closed owing to lack of funding). Their aims spanned five domains: resource for CP research, surveillance, aetiology/prevention, service planning, and information provision (in descending order of frequency). Published definitions guided decision making for the definition of CP and case eligibility for most programmes. Consent, case identification, and data collection methods varied widely. Ten key data items were collected by all programmes and a further seven by at least 80% of programmes. All programmes reported an interest in research collaboration. INTERPRETATION: Despite variability in methodologies, similarities exist across programmes in terms of their aims, definitions, and data collected. These findings will facilitate harmonization of data and collaborative research efforts, which are so necessary on account of the heterogeneity and relatively low prevalence of CP.

[PMID: 26781543](#)

**6. Dev Med Child Neurol. 2016 Jan 14. doi: 10.1111/dmcn.13000. [Epub ahead of print]**

**Interobserver reliability of the Australian Spasticity Assessment Scale (ASAS).**

Love S, Gibson N, Smith N, Bear N, Blair E; Australian Cerebral Palsy Register Group.

AIM: The aim of this paper is to present the Australian Spasticity Assessment Scale (ASAS) and to report studies of its interrater reliability. The ASAS identifies the presence of spasticity by confirming a velocity-dependent increased response to rapid passive movement and quantifies it using an ordinal scale. METHOD: The rationale and procedure for the ASAS is described. Twenty-two participants with spastic CP (16 males; age range 1y 11mo-15y 3mo) who had not had botulinum neurotoxin-A within 4 months, or bony or soft tissue surgery within 12 months, were recruited from the spasticity management clinic of a tertiary paediatric teaching hospital. Fourteen muscles in each child were assessed by each of three experienced independent raters. ASAS was recorded for all muscles. Interrater reliability was calculated using the weighted kappa statistic (quadratic weighting;  $k_{qw}$ ) for individual muscles, for upper limbs, for lower limbs, and between raters. RESULTS: The weighted kappa ranged between 0.75 and 0.92 for individual muscle groups and was 0.87 between raters. INTERPRETATION: The ASAS complies with the definition of spasticity and is clinically feasible in paediatric settings. Our estimates of interrater reliability for the ASAS exceed that of the most commonly used spasticity scoring systems.

[PMID: 26762706](#)

**7. Dev Med Child Neurol. 2016 Jan 13. doi: 10.1111/dmcn.13001. [Epub ahead of print]****Temporal trends in cerebral palsy by impairment severity and birth gestation.**

Reid SM, Meehan E, McIntyre S, Goldsmith S, Badawi N, Reddiough DS; Australian Cerebral Palsy Register Group.

AIM: Our aim was to build on previous research indicating that rates of cerebral palsy (CP) in the Australian state of Victoria are declining, and examine whether severity of impairments is also decreasing. METHOD: Data on individuals with CP were extracted from the Victorian Cerebral Palsy Register for birth years 1983 to 2009. The yearly rates of dichotomized categories for gross motor function, motor laterality, intellectual impairment, and epilepsy per 1000 neonatal survivors and proportions in the CP cohort were tabulated and plotted by birth gestation. Linear regression modelling was used to fit prediction curves; likelihood ratio tests were used to test for differences in trends between impairment severity groups. RESULTS: Since the mid-1990s, CP rates declined in neonatal survivors of birth at all gestations. Our data suggest that the decreasing CP rates were associated with relatively greater decreases in the rates of Gross Motor Function Classification System levels III to V, bilateral CP, epilepsy, and intellectual impairment (all  $p < 0.005$ ). Some variation was seen between birth gestation groups. INTERPRETATION: Declines in rates of CP of all levels of severity and complexity from the mid-1990s provides 'real-world' support for the effectiveness of concurrent neuroprotective strategies and continual innovation in perinatal practices.

PMID: [26762733](#)

**8. Dev Med Child Neurol. 2016 Jan 19. doi: 10.1111/dmcn.13005. [Epub ahead of print]****Comparing risks of cerebral palsy in births between Australian Indigenous and non-Indigenous mothers.**

Blair E, Watson L, Okearney E, Dantoine H, Delacy M; Australian Cerebral Palsy Register Group.

AIM: To compare proportions of live births subsequently described as having cerebral palsy (CP), the distributions of associated impairments, and the causes of postneonatal CP between Aboriginal and Torres Strait Islander (Indigenous) and non-Indigenous populations in Australia. METHOD: Data from statutory birth records and CP registers for the 1996 to 2005 birth cohort in Queensland, Western Australia, and the Northern Territory were stratified by Indigenous status and whether the CP was acquired pre/perinatally or postneonatally. Relative risks associated with Indigenous status were estimated and the distributions of causes of postneonatal CP compared. RESULTS: Indigenous births had a relative risk of 4.9 (95% confidence interval [CI] 3.0-7.9) for postneonatal CP but only of 1.42 (95% CI 1.2-1.7) for pre/perinatal CP. Almost half of postneonatal CP in Indigenous infants resulted from infection, whereas for non-Indigenous infants the most frequent cause was cerebrovascular accident. The impairments of Indigenous CP and of postneonatally acquired CP tended to be more numerous and more severe. INTERPRETATION: Indigenous children are at significantly greater risk of CP, particularly postneonatal CP. The predominant cause of postneonatal CP in non-Indigenous children has shifted to cerebrovascular accident over time; however, infections followed by head injury are still the most frequent causes in Indigenous infants.

PMID: [26781773](#)

**9. Dev Med Child Neurol. 2016 Jan 14. doi: 10.1111/dmcn.13021. [Epub ahead of print]****Biological sex and the risk of cerebral palsy in Victoria, Australia.**

Reid SM, Meehan E, Gibson CS, Scott H, Delacy M; Australian Cerebral Palsy Register Group.

AIM: Males typically outnumber females in cerebral palsy (CP) cohorts. To better understand this 'male disadvantage' and provide insight into causal pathways to CP, this study used 1983 to 2009 Australian CP and population birth cohorts to identify associations and trends with respect to biological sex and CP. METHOD: Within birth gestation groups, sex ratios were calculated to evaluate any male excess in the CP cohort compared with livebirths, neonatal deaths, neonatal mortality and survival rates, neonatal survivors, and CP rates in survivors. Sex- and gestation-specific trends in neonatal mortality, CP rates, and CP sex ratios were assessed by plotting their annual frequencies and fitting quadratic curves. RESULTS: Over-representation of males in preterm live births

partly explained the male excess in the CP cohort after preterm birth, especially at 28 to 31 weeks. Higher CP rates in male neonatal survivors also contributed to the male excess in CP, particularly at <28 and 37+ weeks. Higher neonatal mortality rates in males at all gestations had little impact on the CP sex ratio. There was no clearly discernible change over time in the CP sex ratio. INTERPRETATION: Gestation-specific associations between sex and CP provide insight into causal pathways to CP and suggest sex-specific differences in response to neuroprotective strategies.

[PMID: 26762863](#)

**10. Dev Med Child Neurol. 2016 Jan 17. doi: 10.1111/dmcn.13012. [Epub ahead of print]**

**Profile of associated impairments at age 5 years in Australia by cerebral palsy subtype and Gross Motor Function Classification System level for birth years 1996 to 2005.**

DeLacy MJ, Reid SM; Australian cerebral palsy register group.

AIM: To describe the distribution of impairments among persons with cerebral palsy (CP) in a large Australian cohort. METHOD: Records of persons on the Australian Cerebral Palsy Register (ACPR) (n=3466) born from 1996 to 2005 were reviewed to extract year of birth, sex, CP subtype, Gross Motor Function Classification System (GMFCS) level, and impairments in vision, hearing, speech, intellect, and epilepsy. The distributions of GMFCS levels and CP subtype were plotted, and the proportions of each level of impairment were tabulated and presented as stacked graphs within the GMFCS and CP subtype distributions. RESULTS: The proportions of persons with CP with each associated impairment increased with increasing GMFCS level. Compared with other spastic CP subtypes, individuals with spastic quadriplegia had higher frequencies of all associated impairments. Other than epilepsy, which was most prevalent in persons with spastic quadriplegia (53%), all impairments were most frequent in non-spastic CP subtypes. Hearing impairment was recorded for 21% of persons with dyskinesia whereas the hypotonic subtype had the highest prevalence of visual impairment (57%), intellectual impairment (90%), and speech impairment (95%). INTERPRETATION: Distributions of associated impairments across all GMFCS levels and CP subtypes in a large cohort are presented in formats suitable for clinical use and discussion with families.

[PMID: 26777873](#)

**11. Dev Med Child Neurol. 2016 Jan 14. doi: 10.1111/dmcn.13020. [Epub ahead of print]**

**Strabismus, a preventable barrier to social participation: a short report.**

Blair E, Smithers-Sheedy H; Australian Cerebral Palsy Register Group.

Isolated strabismus does not significantly impair visual functionality and has traditionally been considered a primarily cosmetic defect of little importance. However, even in the absence of strabismus amblyopia, manifest strabismus and its non-surgical treatments can render the person less socially acceptable, creating a barrier to participation and resulting in psychosocial disadvantage that has been documented in the typically developing population. The Australian Cerebral Palsy Register traditionally recorded strabismus only if it were not accompanied by visual impairment; however, even these data indicate that the proportion of cerebral palsy registrants with strabismus is many times higher than in comparable population samples, compounding their challenges to achieve participation. It is therefore inappropriate to continue to consider strabismus as merely a cosmetic defect, but one that deserves surgical correction early in life.

[PMID: 26762817](#)

**12. Dev Med Child Neurol. 2016 Feb;58 Suppl 2:60-5. doi: 10.1111/dmcn.13013. Epub 2016 Jan 14.**

**Change in residential remoteness during the first 5 years of life in an Australian cerebral palsy cohort.**

DeLacy MJ, Louca C, Smithers-Sheedy H, McIntyre S; Australian Cerebral Palsy Register Group.

AIM: To determine if families of children with cerebral palsy living in Australia move to less remote areas between birth and 5 years. METHOD: Children on the Australian Cerebral Palsy Register (n=3399) born 1996 to 2005, were assigned a remoteness value for family residence at birth and 5 years using a modification of the Australian Statistical Geography Standard. Each value at birth was subtracted from the value at 5 years yielding a positive difference if they moved more remotely, negative difference if they moved less remotely and a value of zero if they did not move or moved to an equally remote residence. RESULTS: The small net increase in remoteness across this cohort was non-significant (p=0.43). Fifty-seven per cent of families changed postcode but only 20% changed remoteness, 11% more remotely, and 9% less remotely. There was a small trend for families with a child with more impaired gross motor function (Gross Motor Function Classification System levels IV and V) to move to a less remote area. INTERPRETATION: This cohort of families with children with cerebral palsy did not appear to move to less remote areas by age 5 years. Remoteness at birth and level of gross motor function seem to have little effect.

[PMID: 26857827](#)

**13. Dev Med Child Neurol. 2016 Jan 19. doi: 10.1111/dmcn.13007. [Epub ahead of print]**

**The National Disability Insurance Scheme: a time for real change in Australia.**

Reddihough DS, Meehan EM, Stott NS, Delacy M; Australian Cerebral Palsy Register Group.

In Australia, the supports and services for persons with disabilities have long been underfunded and fragmented. Often, individuals did not receive the services they needed, but rather the services they were entitled to based on how or when they acquired their disability. As a result, there was an increasing reliance on ageing carers, a lack of permanent and respite accommodation, and reduced employment and educational opportunities. Individuals with disabilities and their families were often isolated and financially disadvantaged. In March 2013, legislation was passed in Australia to establish a National Disability Insurance Scheme, a radical new way of funding disability services. No longer would funding be directed to agencies, but rather to individuals who would make their own plan and select their preferred services and service providers, giving them more control over the services and supports they receive. The hope is that this change from a welfare-driven to an insurance-based model will improve equity of service delivery, levels of participation, and overall quality of life among Australians with disabilities and their families.

[PMID: 26782069](#)

**14. Dev Med Child Neurol. 2016 Jan 14. doi: 10.1111/dmcn.13015. [Epub ahead of print]**

**Congenital anomalies in cerebral palsy: where to from here?**

McIntyre S, Blair E, Goldsmith S, Badawi N, Gibson C, Scott H, Smithers-Sheedy H; Australian Cerebral Palsy Register Group.

Proportions of cases of cerebral palsy (CP) with congenital anomalies recorded in Australian CP registers range from 15% to 40%. The anomalies seen in CP are extremely variable. We have identified that CP registers often do not have quality data on congenital anomalies, necessitating linkage with congenital anomaly registers. However, a lack of unified processes and definitions in congenital anomaly registers and data collections means that linkages are complex, need to be carefully planned, and limitations acknowledged. Historically in CP research, congenital anomalies have been classified by International Classification of Disease codes, then combined into brain and other major and minor anomalies. Systems have been developed to classify congenital anomalies into aetiologically related groups, but such a classification has yet to be trialled in CP. It is anticipated that primary prevention of a small proportion of cases of CP is possible through the primary prevention of congenital anomalies, especially those due to teratogens. Owing to the anticipated low prevalence of each subgroup, global collaboration will be

required to further these lines of enquiry.

[PMID: 26762782](#)

**15. Dev Med Child Neurol. 2016 Jan 14. doi: 10.1111/dmcn.13014. [Epub ahead of print]**

**Cerebral palsy and perinatal mortality after pregnancy-induced hypertension across the gestational age spectrum: observations of a reconstructed total population cohort.**

Blair E, Watson L; Australian Cerebral Palsy Register Group.

**AIM:** Pregnancy-induced hypertension/pre-eclampsia (PIH/PE) is associated with cerebral palsy (CP) in term births but if sufficiently severe to necessitate preterm delivery predicts a lower risk of CP than observed in gestational peers. We investigated whether this apparent 'protection' was attributable to inappropriately chosen comparison groups and/or an increased risk of perinatal death. **METHOD:** Perinatal information was collected from medical records of children with CP, individually matched neonatal survivors without CP, and representative samples of perinatal deaths of Western Australian birth cohorts from 1980 to 1995. Compared with these data, the sensitivity of statutorily collected PIH/PE data was assessed for each outcome group. Using these sensitivities, the estimated risks of death and CP in births to all women with and without PIH/PE were compared. **RESULTS:** Sensitivity of statutory PIH/PE data decreased with increasingly poor outcome. Reconstructed cohorts showed that PIH/PE increased the risks both of CP and of perinatal death in births at lower gestations except in births <27 weeks, where the risk of perinatal death only increased greatly. **INTERPRETATION:** PIH/PE does not protect against poor outcome at any gestational age. Previously reported protective effects originate from inappropriate control for gestational age and not from higher gestation-specific perinatal mortality.

[PMID: 26762763](#)