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Interventions and Management

1. Am J Phys Med Rehabil. 2012 Nov;91(11 Suppl 3):S290-7. doi: 10.1097/PHM.0b013e31826bcd80.

Robotic therapy: the tipping point.

Krebs HI, Hogan N.

From the Department of Mechanical Engineering (HIK, NH) and Department of Brain and Cognitive Science (NH), Massachusetts Institute of Technology, Cambridge; and Department of Neurology and Division of Rehabilitative Medicine, University of Maryland School of Medicine, Baltimore (HIK).

The last two decades have seen a remarkable shift in the neurorehabilitation paradigm. Neuroscientists and clinicians moved away from the perception that the brain is static and hardwired to a new dynamic understanding that plasticity is a fundamental property of the adult human brain and might be harnessed to remap or create new neural pathways. Capitalizing on this innovative understanding, the authors introduced a paradigm shift in the clinical practice in 1989 when they initiated the development of the Massachusetts Institute of Technology-Manus robot for neurorehabilitation and deployed it in the clinic in 1994 (Krebs et al. 1998). Since then, the authors and others have developed and tested a multitude of robotic devices for stroke, spinal cord injury, cerebral palsy, multiple sclerosis, and Parkinson disease. Here, the authors discuss whether robotic therapy has achieved a level of maturity to justify its broad adoption in the clinical realm as a tool for motor recovery.

[PMID: 23080044](#) [PubMed - in process]

2. Am J Phys Med Rehabil. 2012 Nov;91(11 Suppl 3):S280-9. doi: 10.1097/PHM.0b013e31826bcff4.

New horizons for robot-assisted therapy in pediatrics.

Fasoli SE, Ladenheim B, Mast J, Krebs HI.

From the Department of Neurology, Brown University and Providence VA Medical Center, Rhode Island (SEF); Blythedale Children's Hospital, New York Medical College (BL, JM); and Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, and Weill Medical College of Cornell University, New York, New York (HIK).

The field of rehabilitation robotics has grown substantially during the past 15 yrs. Studies of upper limb robot-assisted therapy for adults with moderate to severe hemiparesis after stroke have shown significant gains

compared with usual care in isolated control, coordination, and strength in the paretic arm (J Rehabil Res Dev 2006;43:171-84; Top Stroke Rehabil 2007;14:22-44; Neurorehabil Neural Repair 2008;22:111-21). While attempts to increase the understanding of the key active ingredients of these interventions continue, researchers have recently extended their focus to children with neurologically based movement disorders arising from cerebral palsy and acquired brain injury or stroke. This study's aim was to provide a narrative review that highlights recent pediatric studies of robot-assisted therapies for the upper and lower limbs. Potential benefits will be discussed, as well as challenges and needs for future development.

[PMID: 23080043](#) [PubMed - in process]

3. Dev Med Child Neurol. 2012 Oct 24. doi: 10.1111/j.1469-8749.2012.04442.x. [Epub ahead of print]

Assessment of upper-limb capacity, performance, and developmental disregard in children with cerebral palsy: validity and reliability of the revised Video-Observation Aarts and Aarts module: Determine Developmental Disregard (VOAA-DDD-R).

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Radboud University Nijmegen Medical Centre, Nijmegen Centre for Evidence Based Practice, Department of Rehabilitation, Nijmegen; Department of Pediatric Rehabilitation, Sint Maartenskliniek, Nijmegen; Behavioural Science Institute, Radboud University Nijmegen, Nijmegen, the Netherlands.

Aim: To investigate the validity and reliability of the revised Video-Observation Aarts and Aarts module: Determine Developmental Disregard (VOAA-DDD-R). **Method:** Upper-limb capacity and performance were assessed in children with unilateral spastic cerebral palsy (CP) by measuring overall duration of affected upper-limb use and the frequency of specific behaviours during a task in which bimanual activity was demanded ('stringing beads') and stimulated ('decorating a muffin'). Developmental disregard was defined as the difference in duration of affected upper-limb use between both tasks. Raters were two occupational and one physical therapist who received 3 hours of training. Construct validity was determined by comparing children with CP with typically developing children. Intrarater, interrater, and test-retest reliability were determined using the intraclass correlation coefficient. Standard errors of measurement and smallest detectable differences were also calculated. **Results:** Twenty-five children with CP (15 females, 10 males; mean age 4y 9mo [SD 1y 7mo], range 2y 9mo-8y; Manual Ability Classification System levels I-III) scored lower on capacity ($p=0.052$) and performance ($p<0.001$), and higher on developmental disregard ($p<0.001$) than 46 age- and sex-matched typically developing children (23 males; mean age 5y 3mo [SD 1y 5mo], range 2y 6mo-8y). The intraclass correlation coefficients (0.79-1.00) indicated good reliability. Absolute agreement was high, standard errors of measurement ranged from 4.5 to 6.8%, and smallest detectable differences ranged from 12.5 to 19.0%. **Interpretation:** The VOAA-DDD-R can be reliably and validly used by occupational and physical therapists to assess upper-limb capacity, performance, and developmental disregard in children (2y 6mo-8y) with CP.

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4. Dev Med Child Neurol. 2012 Oct 24. doi: 10.1111/j.1469-8749.2012.04430.x. [Epub ahead of print]

Assessment of the upper limb in cerebral palsy: validity and reliability of the revised VOAA-DDD.

Bialocerkowski AE.

Griffith Health Institute, Griffith University, Gold Coast, Qld, Australia.

[PMID: 23094963](#) [PubMed - as supplied by publisher]

5. Dev Med Child Neurol. 2012 Oct 24. doi: 10.1111/j.1469-8749.2012.04438.x. [Epub ahead of print]**Efficacy of botulinum toxin A in children with cerebral palsy in Gross Motor Function Classification System levels IV and V: a systematic review.**

Pin TW, Elmasry J, Lewis J.

Kids Rehab Department, The Children's Hospital at Westmead, Westmead, NSW; School of Science and Health, The University of Western Sydney, Penrith, NSW; Faculty of Medicine, University of New South Wales, NSW, Australia.

Aim: Previous studies have shown the efficacy of botulinum toxin type A (BoNT-A) in the management of ambulant individuals with cerebral palsy (CP). There is little evidence on its use in non-ambulant children with CP. This review aimed to investigate indications and efficacy for BoNT-A use in managing pain, care, and comfort, and improving function in children with CP in Gross Motor Function Classification System (GMFCS) levels IV and V. **Method:** Electronic databases were searched from the earliest available date to June 2012 using a combination of subject headings and free text. Inclusion criteria consisted of studies with (1) participants aged 18 or under, (2) participants with CP in GMFCS levels IV and V, (3) participants receiving BoNT-A treatment, and (4) studies published in English-language peer-reviewed journals. **Results:** The search resulted in a total of 814 studies, of which 19 met the inclusion criteria. Eighteen studies provided level IV or V evidence and one level I evidence according to the American Academy for Cerebral Palsy and Developmental Medicine guidelines for the development of systematic reviews. Most of the studies were of weak to moderate methodological quality. **Interpretation:** The evidence that BoNT-A is effective in reducing postoperative pain in children with CP in GMFCS levels IV and V is limited, with only one level I study identified. Remaining indications were general pain reduction, maintaining hip integrity, achieving functional changes, and goal attainment. A high percentage of participants in the studies showed positive changes in these areas. With the poor level of evidence of the included studies, no definite conclusion could be drawn on the indications for BoNT-A use in children with CP in GMFCS levels IV and V. Further investigation by rigorous studies is required.

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6. Radiology. 2012 Nov;265(2):647. doi: 10.1148/radiol.12121223.**Measurement of muscle stiffness in children with spastic cerebral palsy.**

Wu CH, Wang TG, Kwon DR, Park GY.

Department of Physical Medicine & Rehabilitation, National Taiwan University Hospital Yun-Lin Branch, Yunlin, Taiwan, ROC.

[PMID: 23093711](#) [PubMed - in process]

7. PM R. 2012 Oct;4(10):783-6. doi: 10.1016/j.pmrj.2012.04.015.**Identifying loss of function caused by cervical spondylotic myelopathy in young adults with nonathetoid spastic cerebral palsy.**

Meilahn JR.

Department of Physical Medicine and Rehabilitation, Marshfield Clinic, 1000 North Oak Ave, Marshfield, WI 54449. Electronic address: meilahn.jill@marshfieldclinic.org.

[PMID: 23093221](#) [PubMed - in process]

8 . Dev Med Child Neurol. 2012 Oct 25. doi: 10.1111/j.1469-8749.2012.04428.x. [Epub ahead of print]**Accurate assessment of drooling severity with the 5-minute drooling quotient in children with developmental disabilities.**

van Hulst K, Lindeboom R, van der Burg J, Jongerius P.

Radboud University Nijmegen Medical Centre, Nijmegen Centre for Evidence Based Practice, Department of Rehabilitation, Nijmegen; Department of Clinical Epidemiology, Biostatistics and Bioinformatics, Academic Medical Center, Amsterdam; Sint Maartenskliniek Nijmegen, Department of Rehabilitation, Nijmegen; Department of Special Education, Radboud University Nijmegen, Nijmegen, the Netherlands.

Aim: The aims of this study were to examine whether objective measurements of the 10-minute drooling quotient (DQ10) and the 5-minute drooling quotient (DQ5) are interchangeable; to assess agreement between the measurements and their accuracy in classifying drooling severity; and to develop a time-efficient clinical assessment. **Method:** The study cohort included 162 children (61 females, 101 males; mean age 11y 6mo, SD 4y 5mo, range 3y 9mo-22y 1mo) suffering from moderate to profuse drooling. One hundred and twenty-four had cerebral palsy and 38 had other developmental disabilities. Seventy-four of the participants were ambulant and 88 non-ambulant. The original DQ10 was recalculated into a 5-minute score (DQ5). Assessments were undertaken while the participants were in a rest situation (DQ(R)) and while they were active (DQ(A)). Agreement in scores was quantified using intraclass correlations and Bland-Altman plots. To classify drooling, area under the receiver operating characteristic curve analysis was used to compare accuracy of the DQ10 and DQ5 at rest and during activity. **Results:** Agreement between DQ10(A), and DQ5(A) , and between DQ10(R) and DQ5(R) was high (intraclass correlation coefficient >0.90). Moderate agreement existed between DQ(A) and DQ(R) . DQ(A) scores were more accurate in classifying children's drooling behaviour. For DQ5(A) , a cut-off point of 18 or more (drooling episodes/observation time) might indicate 'constant drooling'. **Interpretation:** The DQ10 and DQ5 can be used interchangeably. DQ(A) is most discriminative for drooling severity. For evaluating treatment efficiency the cut-off point can be used. For clinical and research purposes, the DQ5 is time efficient and cost saving while validity, and intratester and interrater reliability are preserved.

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9. Epilepsy Behav. 2012 Oct 20. pii: S1525-5050(12)00534-3. doi: 10.1016/j.yebeh.2012.08.016. [Epub ahead of print]**Treatment of interictal epileptiform discharges (IEDs) in patients with cerebral palsy for an improved prognostic outcome and quality of life: Emerging evidence.**

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[PMID: 23092695](#) [PubMed - as supplied by publisher]

10. Obes Rev. 2012 Oct 23. doi: 10.1111/j.1467-789X.2012.01052.x. [Epub ahead of print]**Chronic disease risk among adults with cerebral palsy: the role of premature sarcopenia, obesity and sedentary behaviour.**

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Premature declines in function among adults with cerebral palsy (CP) are generally attributed to weakness, spasticity and orthopaedic abnormalities, as well as chronic pain and fatigue. Very little research or clinical attention

has been devoted to the confluence and consequences of early muscle wasting and obesity as mediators of secondary comorbidity in this population, and perhaps more importantly, to the role of lifestyle to potentiate these outcomes. At present, there are no national surveillance programmes that monitor chronic health in adults with CP; however, mortality records have demonstrated a greater prevalence of coronary heart disease as compared with the general population. Although by definition, CP is a 'non-progressive' condition, secondary factors such as habitual sedentary behaviour, obesity, and premature sarcoopenia may increase the severity of functional impairment throughout adulthood, and lead to cardiometabolic disease, fragility and/or early mortality. Herein we describe the heightened health risk represented in adults with CP, and discuss the hallmark phenotypic features that coincide with ageing, obesity and cardiometabolic disorders. Moreover, we provide discussion regarding the protective role of habitual physical activity to stimulate anti-inflammatory pathways and to ameliorate global risk. Although physical therapeutic modalities are already widely acknowledged as a vital component to improve movement quality in CP, the purpose of this review was to present a compelling case for the value of lifelong physical activity participation for both function and cardiometabolic health preservation.

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11. Zhongguo Dang Dai Er Ke Za Zhi. 2012 Oct;14(10):759-62.

Treatment of cerebral palsy with transplantation of human neural progenitor cells [Article in Chinese]

Liu WP, Qu SQ, Luan Z, Gong XJ, Wang ZY.

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OBJECTIVE: To study the clinical efficacy of transplantation of human neural progenitor cells (hNPCs) in the treatment of severe cerebral palsy (CP) in children. **METHODS:** Forty-five children with CP were voluntarily accepted transplantation of hNPCs. The cells obtained from the forebrain of 10 to 12-week-fetus were cultured and amplified into hNPCs. Then the hNPCs were injected into the cerebral ventricle of the patients with the supersonic guidance. **RESULTS:** Dyssomnia, irritability and muscular tension were improved in one patient 3 days after transplantation. The clinical improvements were observed in the majority of the patients 1 month after transplantation. The therapeutic effects slowed down 3 to 6 months after transplantation. One year after transplantation the gross and fine motor skills and the cognition ability in the transplantation group were considerably surpassed to those in the control group. No delayed severe complications were observed after transplantation. No tumorigenesis was noted 5 years after transplantation. **CONCLUSIONS:** The transplantation of hNPCs as a novel therapy is effective and safe for severe CP. Many investigations are needed to evaluate the effect of the therapy.

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Prevention and Cure

12. *Semin Perinatol.* 2012 Jun;36(3):201-12. doi: 10.1053/j.semperi.2012.02.005.

Neurodevelopmental outcomes of twins.

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In population-based studies, the prevalence of neurodevelopmental disability is consistently higher in twins than singletons. This is largely because birth weight and gestational age (GA) distributions of twin births are shifted to the left when compared with singleton births, and lower birth weight and lower GA are associated with increased risk of neurodevelopmental disability. From a pathophysiologic perspective, a question of interest is whether neurodevelopmental outcomes of twins differ from singletons after controlling for covariates. If significant differences in outcomes persist, this would suggest that the twinning process itself or something intrinsic to shared life in the womb may be responsible for observed differences. From a clinical perspective, when counseling parents at risk for preterm delivery of twins, it is useful to understand how twin outcomes compare relative to singleton outcomes at the same birth weight or GA. The purpose of this review is to examine the long-term neurodevelopmental outcomes of twins compared with singletons with control for important covariates.

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