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Interventions and Management

1. Conf Proc IEEE Eng Med Biol Soc. 2012 Aug;2012:1936-9. doi: 10.1109/EMBC.2012.6346333.

An upper limb robot model of children limb for cerebral palsy neurorehabilitation.

Pathak Y, Johnson M.

Robot therapy has emerged in the last few decades as a tool to help patients with neurological injuries relearn motor tasks and improve their quality of life. The main goal of this study was to develop a simple model of the human arm for children affected with cerebral palsy (CP). The Simulink based model presented here shows a comparison for children with and without disabilities (ages 6-15) with normal and reduced range of motion in the upper limb. The model incorporates kinematic and dynamic considerations required for activities of daily living. The simulation was conducted using Matlab/Simulink and will eventually be integrated with a robotic counterpart to develop a physical robot that will provide assistance in activities of daily life (ADLs) to children with CP while also aiming to improve motor recovery.

[PMID: 23366294](#) [PubMed - in process]

2. Phys Occup Ther Pediatr. 2013 Feb 1. [Epub ahead of print]

Six Years After a Modified Constraint Induced Movement Therapy (CIMT) Program-What Happens When the Children Have Become Young Adults?

Nordstrand L, Eliasson AC.

Department of Women's and Children's Health , Karolinska Institutet, Stockholm , Sweden.

The aim is to describe the development of hand function in young adults with unilateral cerebral palsy (CP), who participated in a 2-week Constraint Induced Movement Therapy (CIMT) camp 6 years earlier. Eleven participants, 16-21 years at follow-up, were assessed at three occasions during 2005 and once in 2011. At the 6-year follow-up, performance on the Assisting Hand Assessment and the Jebsen-Taylor Hand Function test remained unchanged ($P > 0.05$) from the first assessment before the camp. Grip strength (Gripit®) increased in both the involved (+80.9%) and non-involved hand (+94.4%) ($P < 0.05$), while performance on the Melbourne Assessment tended to decrease (-7%). In conclusion, it seems that young adults with unilateral CP maintain their hand function performance at the same level as in the early adolescent period. Interestingly, the grip strength increased over time also for the involved hand.

[PMID: 23369068](#) [PubMed - as supplied by publisher]

3. J Shoulder Elbow Surg. 2013 Jan 24. pii: S1058-2746(12)00518-6. doi: 10.1016/j.jse.2012.10.043. [Epub ahead of print]

Myotendinous lengthening of the elbow flexor muscles to improve active motion in patients with elbow spasticity following brain injury.

Anakwenze OA, Namdari S, Hsu JE, Benham J, Keenan MA.

The Department of Orthopaedic Surgery, University of Pennsylvania, Philadelphia, PA, USA. Electronic address: oanakwenze@gmail.com.

BACKGROUND: The objective of this study was to evaluate the outcomes of a novel technique of fractional myotendinous lengthening of the elbow flexors in patients with volitional motor control and spastic elbow flexion deformities after brain injury. **METHODS:** A retrospective review of 42 consecutive patients with spastic elbow flexion deformities and upper motor neuron (UMN) syndrome was performed. Each patient had volitional motor control but limited elbow extension and underwent myotendinous lengthening of the elbow flexor muscles. Outcome measures included pre and post-operative active and passive arc of motion, Modified Ashworth Scale (MAS) of spasticity, and complications. **RESULTS:** There were 26 men and 16 women. The etiologies of UMN syndrome were stroke (30 patients), traumatic brain injury (11 patients), and cerebral palsy (1 patient). Average duration between injury and surgery was 6.6 years. At an average follow-up of 14 months, improvements were noted in active extension (42° to 20°; $P < .001$). In addition, active arc of motion increased from 77° (range of motion [ROM]: 42° to 119°) to 113° (ROM: 20° to 133°) ($P < .001$) and passive arc of motion increased from 103° (ROM: 24°-127°) to 131° (ROM: 8°-139°) ($P < .001$). Significant improvement in MAS was also noted after surgery (2.7 to 1.9; $P < .001$). Superficial wound dehiscence occurred in 2 patients and was successfully treated nonoperatively. **CONCLUSION:** In patients with spastic elbow flexion deformities and active motor control, fractional myotendinous lengthening of the elbow flexors safely improves active extension and the overall arc of motion while affording immediate postoperative elbow motion.

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4. Bone Joint J. 2013 Feb;95-B(2):259-65. doi: 10.1302/0301-620X.95B2.30374.

Long-term outcome of reconstruction of the hip in young children with cerebral palsy.

Dhawale AA, Karatas AF, Holmes L, Rogers KJ, Dabney KW, Miller F.

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We reviewed the long-term radiological outcome, complications and revision operations in 19 children with quadriplegic cerebral palsy and hip dysplasia who underwent combined peri-iliac osteotomy and femoral varus derotation osteotomy. They had a mean age of 7.5 years (1.6 to 10.9) and comprised 22 hip dislocations and subluxations. We also studied the outcome for the contralateral hip. At a mean follow-up of 11.7 years (10 to 15.1) the Melbourne cerebral palsy (CP) hip classification was grade 2 in 16 hips, grade 3 in five, and grade 5 in one. There were five complications seen in four hips (21%, four patients), including one dislocation, one subluxation, one coxa vara with adduction deformity, one subtrochanteric fracture and one infection. A recurrent soft-tissue contracture occurred in five hips and ten required revision surgery. In pre-adolescent children with quadriplegic cerebral palsy good long-term outcomes can be achieved after reconstruction of the hip; regular follow-up is required. Cite this article: Bone Joint J 2013;95-B:259-65.

[PMID: 23365039](#) [PubMed - in process]

5. Int J Rehabil Res. 2013 Jan 30. [Epub ahead of print]**Backward walking treadmill therapy can improve walking ability in children with spastic cerebral palsy: a pilot study.**

Kim SG, Ryu YU, Je HD, Jeong JH, Kim HD.

Department of Physical Therapy, College of Medical Sciences bDepartment of Pharmacology, College of Pharmacy, Catholic University of Daegu, Gyeongbuk cDepartment of Pharmacology, College of Medicine, Chung-Ang University, Department of Physical Therapy, College of Health Science, Korea University, Seoul, Republic of Korea.

The aim of this study was to determine whether an 8-week period of backward walking (BW) training on the treadmill can improve the gross motor function measure (GMFM), weight-bearing symmetry, and temporospatial gait parameters in individuals with spastic cerebral palsy. Twelve participants aged 5-15 years with spastic cerebral palsy participated in this study. The BW training was conducted on a treadmill for up to 20 min, with three sessions per week for 8 consecutive weeks. Before each treadmill training session, lower limb stretching was included in the session. Interlimb differentials of vertical ground reaction force while standing, temporal-distance gait parameters, and scores of dimension D and dimension E of the GMFM were determined. Participants showed statistically significant improvements in a measure of GMFM ($P < 0.01$) and weight-bearing symmetry value ($P < 0.05$), forward walking velocity ($P < 0.05$), and step/stride length ($P < 0.05$ or $P < 0.01$). This pilot study suggests that BW therapy on a treadmill may help to improve walking abilities and other gross motor skills in this sample of patients.

[PMID: 23370765](#) [PubMed - as supplied by publisher]

6. J Neuroeng Rehabil. 2013 Jan 30;10(1):10. [Epub ahead of print]**Hamstring and psoas length of crouch gait in cerebral palsy: a comparison with induced crouch gait in age - and sex-matched controls.**

Rhie TY, Sung KH, Park MS, Lee KM, Chung CY.

BACKGROUND: Previous studies have shown that hamstring lengths are often not short in patients with cerebral palsy, which raises concerns over the benefits of distal hamstring lengthening in patients with crouch gait. In this study, the authors measured lengths of hamstrings and psoas muscles in normal subjects mimicking crouch gait and compared these with lengths in cerebral palsy patients with crouch gait. **METHODS:** Thirty-six patients with cerebral palsy and crouch gait were included in this study, and in addition, 36 age- and sex-matched normal controls were recruited. Hamstring and psoas muscle lengths in patients were evaluated using gait analysis and interactive musculoskeletal modeling software. Muscle lengths were also measured in the normal control group during normal gait and while mimicking crouch gait, and these were compared with those of cerebral palsy patient with crouch gait. **RESULTS:** No significant differences were observed between maximum hamstring ($p = 0.810$) and maximum psoas ($p = 0.456$) lengths of patients and controls mimicking crouch gait. However, patients showed significantly shorter excursions of hamstring ($p = 0.022$) and psoas ($p = 0.036$) muscles than controls, whereas no significant excursion differences were observed between controls during normal gait and mimicking crouch gait. **CONCLUSIONS:** Normal controls mimicking crouch gait and cerebral palsy patients with crouch gait demonstrate similar muscle length patterns. However, mimicked crouch gait did not reproduce the excursion pattern shown by patients with crouch gait, which suggests that reduced hamstring and psoas excursion is an innate characteristic of pathologic crouch gait.

[PMID: 23363928](#) [PubMed - as supplied by publisher]

7. J Neurophysiol. 2013 Jan 30. [Epub ahead of print]**Deficits in anticipatory inhibition of postural muscle activity associated with load release while standing in individuals with spastic diplegic cerebral palsy.**

Tomita H, Fukaya Y, Totsuka K, Tsukahara Y.

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This study aimed to determine whether individuals with spastic diplegic cerebral palsy (SDCP) have deficits in anticipatory inhibition of postural muscle activity. Nine individuals with SDCP (SDCP group, 3 females and 6 males, 13-24 years of age) and 9 age- and gender-matched individuals without disability (control group) participated in this study. Participants stood on a force platform, which was used to measure the position of the center of pressure (CoP), while holding a light or heavy load in front of their bodies. They then released the load by abducting both shoulders. Surface electromyograms were recorded from the rectus abdominis, erector spinae (ES), rectus femoris (RF), medial hamstring (MH), tibialis anterior (TA), and gastrocnemius (GcM) muscles. In the control group, anticipatory inhibition before load release and load-related modulation of the inhibition were observed in all the dorsal muscles recorded (ES, MH, and GcM). In the SDCP group, similar results were obtained in the trunk muscle (ES), but not in the lower limb muscles (MH and GcM), although individual differences were seen, especially in MH. Anticipatory activation of the ventral lower limb muscles (RF and TA) and load-related modulation of the activation were observed in both participant groups. CoP path length during load release was longer in the SDCP group than in the control group. The present findings suggest that individuals with SDCP exhibit deficits in anticipatory inhibition of postural muscles at the dorsal part of the lower limbs, which is likely to result in a larger disturbance of postural equilibrium.

[PMID: 23365180](#) [PubMed - as supplied by publisher]

8. Disabil Rehabil Assist Technol. 2013 Mar;8(2):145-50. doi: 10.3109/17483107.2012.737138.

Comparison of body segmental kinematic characteristics between children with cerebral palsy performing sit-to-stand with and without a walker.

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Faculty of Physical Therapy, Mahidol University , Thailand.

The study investigated how the subjects, 18 children with spastic diplegia aged 7-14 years, attained sit-to-stand (STS). The children were divided into two groups and three STS conditions: 1) those who could attain STS independently (I-STS), 2) those who could not attain STS independently (D-STS), and 3) subjects from the D-STS condition who could successfully attain STS with the walker (W-STS). The results showed that I-STS had more mean maximum horizontal location of the upper body and knee than the hip. All body segments of D-STS followed the same model as the I-STS condition, but they moved with less magnitude than I-STS. W-STS presented both pattern and magnitudes relatively similar to I-STS. Furthermore, I-STS showed the highest mean maximum horizontal and vertical velocities of body segments, when compared with the other STS conditions. W-STS performed the mean maximum horizontal and vertical linear velocities of all selected segments close to D-STS did.

[PMID: 23363018](#) [PubMed - in process]

9. Disabil Rehabil Assist Technol. 2013 Feb 1. [Epub ahead of print]

Construction of an artifact to the suitability of sitting posture in children with cerebral palsy and multiple disabilities.

Schewtschik AC, de Oliveira ES, de Vasconcelos Moreira I, Ribas CG, Cunha Loureiro AP.

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Introduction: Cerebral palsy (CP) may involve muscle imbalance between the spastic muscles and their antagonists leading to weak postural changes, decreased mobility and chest deformities. Objective: To improve postural condition in children with CP using physiotherapy and assistive technology (AT). Materials and methods: Five children with CP and multiple disabilities and postural changes like scoliosis were included in this study. AT involved the use of low-cost custom made cushion seat and backrest for the wheelchairs to achieve 90° of trunk flexion. This was performed in 10 sessions after the beginning of physiotherapy. As evaluation-intervention tool, photographs were taken at the beginning and end of each session, and then analyzed using software for postural

assessment (SAPO). Results: Twenty-five per cent of the participants had an improvement of trunk angulations at the end of the treatment program. Conclusion: The use of AT with physiotherapy treatment proved efficient in the postural alignment of children with CP children in a wheelchair. Implications for Rehabilitation Wheelchairs are manufactured in standard size, which makes difficult the adaptation of individuals with peculiar postures. Even the most sophisticated, with adjustments and special accessories, not always allow adjustments to shape up properly to deformities in children with cerebral palsy. It is hoped that this research will be useful in order to show rehabilitation professionals the ability to minimize the difficulties of keeping children with cerebral palsy and multiple disabilities properly seated in the wheelchair, facilitating posture, movement, breathing and swallowing. The construction of these artifacts has the advantage of being low cost, and must pass through stages of adequacy and modeling in order to replace the seat and side of the wheelchair.

[PMID: 23368956](#) [PubMed - as supplied by publisher]

10. Conf Proc IEEE Eng Med Biol Soc. 2012 Aug;2012:5726-9. doi: 10.1109/EMBC.2012.6347295.

Surface EMG analysis and changes in gait following electrical stimulation of quadriceps femoris and tibialis anterior in children with spastic cerebral palsy.

Arya BK, Mohapatra J, Subramanya K, Prasad H, Kumar R, Mahadevappa M.

Purpose: To evaluate the clinical feasibility and effect of neuromuscular electrical stimulation (NMES) therapy of quadriceps femoris (QF) and tibialis anterior (TA) muscles on improving gait and functional outcomes in children with spastic cerebral palsy (CP). Method: Ten children with spastic diplegic/hemiplegic CP who were in the age group of 7 to 14 years recruited from a rehabilitation institute were randomly assigned either to a control group or a NMES group. Both groups obtained conventional physiotherapy and muscle strengthening exercises. The NMES group in addition received surface electrical stimulation to QF and TA muscles for four weeks duration. Results: The NMES group showed significant improvements as compared to the control group in walking speed (mean difference: 7.83 meters per min, 95% confidence interval: 3.13 to 12.53, $p < 0.01$) and cadence (mean difference: 23.33 steps per min, 95% confidence interval: 5.90 to 40.77, $p < 0.01$). The NMES group also showed significant reduction in physiological cost index of walking or PCI (mean difference: -1.32 beats per meter, 95% confidence interval: -1.83 to -0.80, $p < 0.001$) indicating greater energy-efficiency of walking. No significant changes were seen in EMG parameters. Conclusions: The findings of this study suggests that NMES therapy together with conventional physiotherapy more efficiently improves walking ability and functional outcomes as compared to conventional physiotherapy alone in children with spastic CP.

[PMID: 23367230](#) [PubMed - in process]

11. Conf Proc IEEE Eng Med Biol Soc. 2012 Aug;2012:5010-3. doi: 10.1109/EMBC.2012.6347118.

A novel sensorized shoe system to classify gait severity in children with cerebral palsy.

Mancinelli C, Patel S, Deming LC, Nimec D, Chu JJ, Beckwith J, Greenwald R, Bonato P.

The clinical management of children with Cerebral Palsy (CP) relies upon periodic assessments of changes in the severity of gait deviations in response to clinical interventions. Current clinical practice is limited to sporadic assessments in a clinical environment and hence it is limited in its ability to estimate the impact of CP-related gait deviations in real-life conditions. Frequent home-based quantitative assessments of the severity of gait deviations would be extremely useful in scheduling clinical visits and gathering feedback about the effectiveness of intervention strategies. The use of a wearable system would allow clinicians to gather information about the severity of gait deviations in the home setting. In this paper, we present ActiveGait, a novel sensorized shoe-based system for monitoring gait deviations. The ActiveGait system was used to gather data, under supervised and unsupervised conditions, from a group of 11 children with various levels of CP-related gait deviation severities. We present a methodology to derive severity measures based on features extracted from Center of Pressure (CoP) trajectories. Results show that a Random Forest classifier is able to estimate severity scores based on the Edinburgh Visual Scale with a level of accuracy $>80\%$ adequate for clinical use.

[PMID: 23367053](#) [PubMed - in process]

12. Dev Med Child Neurol. 2013 Jan 29. doi: 10.1111/dmcn.12083. [Epub ahead of print]**Longitudinal development of gross motor function among Dutch children and young adults with cerebral palsy: an investigation of motor growth curves.**

Smits DW, Gorter JW, Hanna SE, Dallmeijer AJ, Van Eck M, Roebroek ME, Vos RC, Ketelaar M; on behalf of the PERRIN Plus Study Group.

Rudolf Magnus Institute of Neuroscience and Center of Excellence for Rehabilitation Medicine, University Medical Center Utrecht and Rehabilitation Center De Hoogstraat, Utrecht, the Netherlands; Partner of NetChild, Network for Childhood Disability Research, Utrecht, the Netherlands.

AIM: The aim of this study was to describe patterns for gross motor development by level of severity in a Dutch population of individuals with cerebral palsy (CP). **METHOD:** This longitudinal study included 423 individuals (260 males, 163 females) with CP. The mean age at baseline was 9 years 6 months (SD 6y 2mo, range 1-22y). The level of severity of CP among participants, according to the Gross Motor Function Classification System (GMFCS), was 50% level I, 13% level II, 14% level III, 13% level IV, and 10% level V. Participants had been assessed up to four times with the Gross Motor Function Measure (GMFM-66) at 1- or 2-year intervals between 2002 and 2009. Data were analysed using non-linear mixed effects modelling. For each GMFCS level, patterns were created by contrasting a stable limit model (SLM) with a peak and decline model (PDM), followed by estimating limits and rates of gross motor development. **RESULTS:** The SLM showed a better fit for all GMFCS levels than the PDM. Within the SLM, significant differences between GMFCS levels were found for both the limits (higher values for lower GMFCS levels) and the rates (higher values for GMFCS levels I-II vs level IV and for GMFCS levels I-IV vs level V) of gross motor development. **INTERPRETATION:** The results validate the existence of five distinct patterns for gross motor development by level of severity of CP.

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13. Child Care Health Dev. 2013 Jan 30. doi: 10.1111/cch.12026. [Epub ahead of print]**Rehabilitation service utilization in children and youth with cerebral palsy.**

Majnemer A, Shikako-Thomas K, Lach L, Shevell M, Law M, Schmitz N, Poulin C; QUALA Group.

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AIM: To describe the pattern of use of rehabilitation services in children and adolescents with cerebral palsy (CP), and to identify factors associated with use. **METHODS:** In this study, parents of 91 school-age children and 167 adolescents with CP completed a questionnaire regarding educational and rehabilitation resources received within the last 6 months. Rehabilitation services included occupational therapy (OT), physical therapy (PT), speech language pathology (SLP), psychology and special education. Demographic characteristics were documented and developmental and functional status was assessed. Relationships between service utilization and sociodemographic factors, functioning and school setting were determined. **RESULTS:** Over half of children (53.2%) and adolescents (57.5%) were in regular schools; however, 41% of these required special education resources. The remainder (42.5-46.8%) was in special schools. The majority of children (84.6%) were receiving at least one rehabilitation service although this decreased (68.1%) in adolescence. PT and OT were most common and services were provided predominantly in the school setting. Services were primarily weekly direct interventions at school age, with weekly interventions or consultations most common for adolescents. Younger age was associated with service receipt at school age only. Children with greater motor limitations, lower IQ and greater activity limitations were more likely to receive OT, PT, SLP or special education. Children in segregated schools were significantly more likely to receive rehabilitation services, when compared with children in regular schools. **CONCLUSIONS:** The majority of children and youth received one or more services. Individuals with greater motor or cognitive challenges were more likely to receive a range of school-based services from rehabilitation specialists. When compared with children of school age, adolescents were less likely to receive services and when provided, services were more likely to be consultative. Services may need to be more optimally organized through childhood

to enhance benefits to children with CP across activity limitation profiles.

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14. Srp Arh Celok Lek. 2012 Nov-Dec;140(11-12):746-50.

Aquatic exercise in the treatment of children with cerebral palsy [Article in Serbian]

[No authors listed]

INTRODUCTION: Aquatic exercise is one of the most popular supplementary treatments for children with neuro-motor impairment, especially for cerebral palsy (CP). As water reduces gravity force which increases postural stability, a child with CP exercises more easily in water than on land. **OBJECTIVE:** The aim of the study was to examine aquatic exercise effects on gross motor functioning, muscle tone and cardiorespiratory endurance in children with spastic CP. **METHODS:** The study included 19 children of both sexes, aged 6 to 12 years, with spastic CP. They were included in a 12-week aquatic exercise program, twice a week. Measurements of GMFM (gross motor function measurement), spasticity (MAS-Modified Ashworth Scale), heart rate (HR) and maximal oxygen consumption (VO₂max) were carried out before and after treatment. The measurement results were compared before and after treatment. **RESULTS:** GMFM mean value before therapy was 80.2% and statistically it was significantly lower in comparison to the same value after therapy, which was 86.2% ($p < 0.05$). The level of spasticity was considerably decreased after therapy; the mean value before treatment was 3.21 according to MAS, and after treatment it was 1.95 ($p < 0.001$). After treatment there was a statistically significant improvement of cardiorespiratory endurance, i.e., there was a significant decrease in the mean value of HR and a significant increase of VO₂max ($p < 0.001$). **CONCLUSION:** Aquatic exercise program can be useful in improving gross motor functioning, reducing spasticity and increasing cardiorespiratory endurance in children with spastic CP.

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15. Int J Pediatr Otorhinolaryngol. 2013 Jan 25. pii: S0165-5876(13)00009-8. doi: 10.1016/j.ijporl.2013.01.001. [Epub ahead of print]

Tongue base suspension in children with cerebral palsy and obstructive sleep apnea.

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OBJECTIVE: Children with cerebral palsy (CP) are commonly affected by obstructive sleep apnea (OSA). This study examines the efficacy of combined surgical techniques for OSA including tongue base suspension (TBS), using perioperative polysomnograms (PSG) in pediatric patients with CP. **STUDY DESIGN:** Case series with outcome analysis. **SETTING:** University based tertiary care children's hospital. **METHODS:** A 7-year retrospective chart review of children with CP who underwent surgical management for OSA. Surgical procedures, postoperative complications, and perioperative PSG data were examined. Only patients with both preoperative and postoperative PSG results were included in the study. Based upon procedures performed patients fell into 2 equal groups for analysis. **RESULTS:** Fourteen children were identified. Seven patients (mean age=6.0 years) underwent combined adenotonsillectomy (T&A), uvulopalatopharyngoplasty (UPPP), and tongue base suspension (TBS). Another 7 patients (mean age=6.3 years) underwent T&A and UPPP alone. Those who received TBS had a mean preoperative AHI of 27.2 compared to 6.8 in the group that did not have TBS. The AHI decreased by a mean of 16.5 in the TBS group and 5.0 in the non-TBS group. The mean oxygen saturation nadir improved in both the TBS (74.0-84.0) and non-TBS (64.8-84.6) groups. The arousal index also improved in the TBS (33.1-20.7) and non-TBS (11.0-5.8) groups. No surgical complications occurred. **CONCLUSION:**

This study suggests that concomitant surgical approaches for OSA in children with CP are effective. Moderate to severe OSA in this population may safely benefit from the added technique of tongue base suspension.

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16. Disabil Rehabil Assist Technol. 2013 Jan 28. [Epub ahead of print]

A qualitative study of adult AAC users' experiences communicating with medical providers.

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Institute for Healthcare Studies, Northwestern University , Chicago, IL , USA , and.

Purpose: To study the experiences of adults who use augmentative and alternative communication (AAC) systems and methods when interacting with medical providers, specifically primary care providers. **Method:** Individual face-to-face interviews were conducted with 12 participants, four of whom also participated in an online focus group. **Diagnoses** of the participants included cerebral palsy, undifferentiated developmental disability, head and neck cancer, amyotrophic lateral sclerosis and primary lateral sclerosis. Transcripts from the interviews and the focus group were analyzed to create a list of codes. From these codes themes that captured particular concepts discussed were identified. **Results:** Participants described multiple frustrations in communicating with medical care providers. Themes that arose included: planning and preparing for the appointment, time barriers, inappropriate assumptions, relationship building and establishing rapport, medical decision making and implementing the plan. All but one participant reported bringing a caregiver with them to their appointments and this person, whether a family member, friend or paid aide, had a substantial role throughout the appointment. **Conclusions:** The participants' stories highlight important barriers they experience when communicating with medical providers. These barriers bring attention to the need for education for physicians, caregivers and patients with communication disabilities, along with increased research to improve patient-provider communication. **Implications for Rehabilitation** Patients with communication disabilities face multiple barriers to communicating with medical care providers. Patients, caregivers, and medical care providers all play a role in effective and ineffective communication during appointments. Education for medical care providers, caregivers, and patients with communication disabilities, along with increased research is needed to improve patient-provider communication.

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17. J Paediatr Child Health. 2013 Jan 29. doi: 10.1111/jpc.12097. [Epub ahead of print]

Immunisation coverage in children with cerebral palsy compared with the general population.

Greenwood VJ, Crawford NW, Walstab JE, Reddihough DS.

Department of Developmental Medicine.

AIM: To compare immunisation coverage of a cerebral palsy (CP) cohort with the known general population vaccination coverage statistics. **METHODS:** A cohort of children with CP aged less than 7 years was extracted from the Victorian Cerebral Palsy Register. The vaccination status of these children was compared with the general population using the Australian Childhood Immunisation Register (ACIR). Details that were audited included overall 'up-to-date' status of immunisations and individual vaccines missed. **RESULTS:** The CP cohort consisted of 449 children. Eighty-six or 19.2% (95% confidence intervals 15.6-23.1%) of these children were not 'up to date' (NUTD) with the Australian immunisation schedule at the time of the ACIR data link (13 March 2009). This NUTD result is well above the general population percentage (range 6.4-8%). This group was divided into subgroups based on age, with all groups having significantly lower rates of immunisation, varying from 100% NUTD in the youngest subgroup to 18.6% in the oldest subgroup. The most common vaccine NUTD was MMR (measles, mumps and rubella), followed by polio and DTaP (diphtheria-tetanus-acellular pertussis). **CONCLUSION:** This study demonstrates that children with CP are at high risk of incomplete and delayed immunisation, a significant problem given the increased health-care needs of this patient group and their increased vulnerability to the complications of vaccine-preventable diseases.

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18. Phys Occup Ther Pediatr. 2013 Jan 29. [Epub ahead of print]

Measuring Exertion During Caregiving of Children and Young Adults with Cerebral Palsy Who Require Assistance for Mobility and Self-Care.

Andrews M, Bolt DM, Braun M, Benedict RE.

UW Hospitals & Clinics.

Our purpose was to compare objective and subjective measures of energy exertion during caregiving tasks. Participants were primary caregivers (N = 19) of children and young adults (aged 3 -22 years) with cerebral palsy (CP) who require assistance for mobility and self-care (67% classified in level V on the Gross Motor Function Classification System). Measures of exertion were collected during two caregiving tasks: (1) transfers and (2) dressing. Objective measures included volume of oxygen (VO₂), heart rate (HR), and the subjective measure was a rating of perceived exertion (Borg RPE). Controlling for baseline status, perceived exertion correlated with VO₂ (0.43, p < .01) and HR (0.29, p < .01) during the tasks. Caregivers with high baseline HR and VO₂, had high Borg RPE scores following a task. Correlations were found between HR and VO₂ during caregiving tasks (0.63, p < .01). Patterns of association with caregiver and child characteristics were similar for VO₂ and Borg RPE. Subjective measures of exertion appear to capture the strain of caregiving. Understanding a caregiver's perception of exertion can guide therapists in assessing the need for equipment, pharmacological, or respite interventions.

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Prevention and Cure

19. Am J Perinatol. 2013 Jan 28. [Epub ahead of print]

Impact of Oral versus Intravenous Ibuprofen on Neurodevelopmental Outcome: A Randomized Controlled Parallel Study.

Eras Z, Gokmen T, Erdeve O, Ozyurt BM, Saridas B, Dilmen U.

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Objective: Although neurodevelopmental outcomes related to the management of patent ductus arteriosus with intravenous indomethacin and ibuprofen are known, little data on the long-term effects of oral ibuprofen can be found in the literature. **Method:** A follow-up study of 99 infants with birth weight ≤ 1,500 g and gestational age ≤ 32 weeks who received either oral or intravenous ibuprofen for patent ductus arteriosus was conducted to assess at 18 to 24 months (corrected age), abnormal neurological, neurosensory, and cognitive impairment were defined as follows: neurological outcomes included moderate/severe cerebral palsy, neurosensory outcomes included bilateral hearing loss and blindness in either eye, and cognitive impairment included mental developmental index score < 70. **Results:** The 18- to 24-month (corrected age) long-term outcomes of 30 subjects who received oral ibuprofen were compared with 27 subjects who received intravenous ibuprofen by certified and experienced examiners who were blind to the definitions of the groups. The results revealed that the long-term outcomes of the treatment regimens did not significantly differ. **Conclusions:** Preterm infants who were treated with oral ibuprofen for patent ductus arteriosus had similar neurological, neurosensory, and cognitive outcomes to patients who received intravenous ibuprofen at 2 years of age.

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20. J Matern Fetal Neonatal Med. 2013 Jan 29. [Epub ahead of print]**Echogenicity changes in the fetal brain, a six year follow-up study.**

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Objective: To assess the relation between echogenicity changes in the fetal brain and neurodevelopmental outcome until 6 years of age. **Methods:** Fetuses (n=124) from pregnancies affected by hypertensive disorders (n=64) or preterm labor (n=60) at risk for preterm birth (26-34 weeks gestation) were studied. Moderate echogenicity changes (periventricular grade IB, II; intraventricular grade II-III; local basal ganglia/thalami) in the fetal and neonatal brain were related to neurological outcome and Griffiths mental developmental scales quotients at 1, 2 and 6 years. Multiple regression analysis tested the influence of moderate echogenicity changes and perinatal clinical characteristics on composite outcome (death or abnormal neurodevelopment). **Results:** Moderate echogenicity changes were present in 37/124 (30%) fetuses. Median gestational age and weight at birth were respectively 31 weeks (range 26-43), and 1314g (range 550-4330), mortality was 19%, follow-up loss 10%. Composite outcome was abnormal in 47/124 (38%). Fetal and neonatal moderate intraventricular echodensities were related to cerebral palsy at 6 year (p<0.04). In the multiple regression analysis only gestational age was related to composite outcome (p= 0.005). **Conclusions:** Moderate intraventricular echodensities in the fetal brain related to cerebral palsy at 6 years of age. Gestational age at birth was the main predictor of abnormal composite outcome.

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21. J Transl Med. 2013 Jan 26;11(1):21. [Epub ahead of print]**Neural stem cell-like cells derived from autologous bone mesenchymal stem cells for the treatment of patients with cerebral palsy.**

Chen G, Wang Y, Xu Z, Fang F, Xu R, Wang Y, Hu X, Fan L, Liu H.

BACKGROUND: Stem cell therapy is a promising for the treatment for cerebral palsy, which refers to a category of brain diseases that are associated with chronic motor disability in children. Autologous MSCs may be a better cell source and have been studied for the treatment of cerebral palsy because of their functions in tissue repair and the regulation of immunological processes. **METHODS:** To assess neural stem cell-like (NSC-like) cells derived from autologous marrow mesenchymal stem cells as a novel treatment for patients with moderate-to-severe cerebral palsy, a total of 60 cerebral palsy patients were enrolled in this open-label, non-randomised, observer-blinded controlled clinical study with a 6-months follow-up. For the transplantation group, a total of 30 cerebral palsy patients received an autologous NSC-like cells transplantation (1-2x10⁷ cells into the subarachnoid cavity) and rehabilitation treatments whereas 30 patients in the control group only received rehabilitation treatment. **RESULTS:** We recorded the gross motor function measurement scores, language quotients, and adverse events up to 6 months post-treatment. The gross motor function measurement scores in the transplantation group were significantly higher at at month 3 (the score increase was 42.6, 95% CI: 9.8-75.3, P=.011) and month 6 (the score increase was 58.6, 95% CI: 25.8-91.4, P=.001) post-treatment compared with the baseline scores.. The increase in the Gross Motor Function Measurement scores in the control group was not significant. The increases in the language quotients at months 1, 3, and 6 post-treatment were not statistically significant when compared with the baseline quotients in both groups.. All the 60 patients survived, and none of the patients experienced serious adverse events or complications. **CONCLUSION:** Our results indicated that NSC-like cells are safe and effective for the treatment of motor deficits related to cerebral palsy. Further randomised clinical trials are necessary to establish the efficacy of this procedure.

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22. Neuroepidemiology. 2013 Jan 24;40(4):264-268. [Epub ahead of print]**Prevalence of Cerebral Palsy in Quebec: Alternative Approaches.**

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Aim: To provide an estimate of the period prevalence of cerebral palsy (CP) in the province of Quebec. **Methods:** Children with CP were identified from three consecutive birth cohorts (1999-2001) from the Quebec CP Registry, covering 6 of the 17 administrative health regions of the province. Two inferential approaches were applied for period prevalence estimation, frequentist and bayesian. **Results:** 228 children were identified with CP. Using a frequentist approach, the overall prevalence of CP was 1.84 per 1,000 children aged 9-11 years living in those areas in 2010 (95% CI 1.60-2.08). Using a bayesian approach taking into account the uncertainty about the registry's sensitivity in capturing all cases, the overall prevalence is higher at 2.30 per 1,000 children with a 95% CI (1.99-2.65). **Conclusion:** Using a bayesian approach to adjust for the registry's known high specificity and lower sensitivity, the prevalence estimate is in concordance with worldwide estimates and estimates using administrative databases in western Canadian provinces. Future studies are needed to validate the diagnosis of CP within administrative databases and to evaluate possible regional trends across Canada in both prevalence and health service utilization, which may highlight disparities in healthcare delivery.

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