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Interventions and Management

1. Arch Phys Med Rehabil. 2012 May;93(5):871-81.

Impact of cerebral palsy on health-related physical fitness in adults: systematic review.

Hombergen SP, Huisstede BM, Streur MF, Stam HJ, Slaman J, Bussmann JB, van den Berg-Emons RJ.

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OBJECTIVE: To conduct a systematic review of the impact of cerebral palsy (CP) on the level of health-related physical fitness (body composition, cardiorespiratory endurance, flexibility, muscular endurance, and strength) in adults with CP compared with able-bodied adults. **DATA SOURCES:** The Cochrane Library, MEDLINE, CINAHL, EMBASE, and PEDro were searched up to December 2010 for relevant comparative studies. **STUDY SELECTION:** Two reviewers independently applied the inclusion criteria (adults, comparative design, components of physical fitness) to select potential relevant studies. **DATA EXTRACTION:** Two reviewers independently extracted the data and assessed the methodological quality. A consensus method was used to solve disagreements. **DATA SYNTHESIS:** Pooling data was not possible, but a best-evidence synthesis was conducted. Also, a description of the level of health-related physical fitness in CP was given (expressed as a percentage of able-bodied controls). Nine case-control studies were included (average age \pm SD of subjects with CP, 21 \pm 3y): 3 investigated body composition; 5, cardiorespiratory endurance; 3, muscular strength; and 1, muscular endurance. Two of the studies investigated multiple fitness components. No studies on flexibility were found. Muscular strength (34%-60%), muscular endurance (27%-52%), and cardiorespiratory endurance (14%) showed significantly lower values in adults with CP compared with able-bodied controls. Studies on body composition reported conflicting results on the impact of CP. **CONCLUSIONS:** The results of this review point to a reduction in 3 components of health-related physical fitness in young adults with CP compared with controls: muscular strength, muscular endurance, and cardiorespiratory endurance. However, the level of evidence varies from moderate (muscular strength) to limited (muscular endurance and cardiorespiratory endurance). Additional studies of high methodological quality are recommended before firm conclusions can be made.

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[PMID: 22541311](https://pubmed.ncbi.nlm.nih.gov/22541311/) [PubMed - in process]

2. J Rehabil Med. 2012 May 2;44(5):385-95. doi: 10.2340/16501977-0983.

The evidence-base for basic physical therapy techniques targeting lower limb function in children with cerebral palsy: A systematic review using the International Classification of Functioning, Disability and Health as a conceptual framework.

Franki I, Desloovere K, De Cat J, Feys H, Molenaers G, Calders P, Vanderstraeten G, Himpens E, Van Broeck C.

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Objective: This systematic review provides an overview of the effectiveness of basic techniques used in lower limb physical therapy of children with cerebral palsy. It aims to support the development of clinical guidelines for evidence-based physical therapy planning for these children. **Data sources and study selection:** A literature search in 5 electronic databases extracted literature published between January 1995 and December 2009. Studies were evaluated using the framework recommended by the American Academy for Cerebral Palsy and Developmental Medicine (AAPDM), which classifies outcomes according to the International Classification of Functioning, Disability and Health. **Data extraction:** Three independent evaluators rated the strength of evidence of the effects according to the AAPDM levels of evidence classification, and the quality of the studies according to the AAPDM conduct score system. **Data synthesis:** A total of 83 studies was selected and divided into categories (stretching, massage, strengthening, electrical stimulation, weight-bearing, balance-, treadmill- and endurance training). Interventions targeting problems at body function and structure level generally influenced this level without significant overflow to activity level and vice versa. **Conclusion:** The more recent studies evaluating strength training mainly demonstrated level II evidence for improved gait and gross motor function. There was limited evidence for specific information on intensity, duration and frequency of training.

[PMID: 22549646](#) [PubMed - in process]

3. J Rehabil Med. 2012 May 2;44(5):396-405. doi: 10.2340/16501977-0984.

The evidence-base for conceptual approaches and additional therapies targeting lower limb function in children with cerebral palsy: A systematic review using the ICF as a framework.

Franki I, Desloovere K, De Cat J, Feys H, Molenaers G, Calders P, Vanderstraeten G, Himpens E, Van Broeck C.

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Objective: This systematic review provides an overview of the effectiveness of conceptual approaches and additional therapies used in lower limb physical therapy of children with cerebral palsy and supports the development of clinical guidelines. **Data sources and study selection:** A literature search in 5 electronic databases was performed, extracting literature published between 1995 and 2009. Studies were evaluated using the framework recommended by the American Academy for Cerebral Palsy and Developmental Medicine (AAPDM), which classifies outcomes according to the International Classification of Functioning, Disability and Health (ICF). **Data extraction:** Three evaluators rated the strength of evidence of the effects according to the AAPDM levels of evidence classification, and the quality of the studies according to the AAPDM conduct score system. **Data synthesis:** A total of 37 studies used conceptual approaches (neurodevelopmental treatment (NDT), conductive education, Vojta therapy, sensory integration, functional training and goal-oriented therapy) and 21 studies focused on additional therapies (aquatic therapy and therapeutic horse-riding). **Conclusion:** Level II evidence was found for the effectiveness of therapeutic horse-riding on posture and for NDT and functional training on gross motor function. Goal-oriented therapy and functional training were effective on the attainment of functional goals and participation. With level IV evidence, NDT was effective on all levels of the ICF.

[PMID: 22549647](#) [PubMed - in process]

4. Gait Posture. 2012 Apr 25. [Epub ahead of print]**Crouched posture maximizes ground reaction forces generated by muscles.**

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Crouch gait decreases walking efficiency due to the increased knee and hip flexion during the stance phase of gait. Crouch gait is generally considered to be disadvantageous for children with cerebral palsy; however, a crouched posture may allow biomechanical advantages that lead some children to adopt a crouch gait. To investigate one possible advantage of crouch gait, a musculoskeletal model created in OpenSim was placed in 15 different postures from upright to severe crouch during initial, middle, and final stance of the gait cycle for a total of 45 different postures. A series of optimizations was performed for each posture to maximize transverse plane ground reaction forces in the eight compass directions by modifying muscle forces acting on the model. We compared the force profile areas across all postures. Larger force profile areas were allowed by postures from mild crouch (for initial stance) to crouch (for final stance). The overall ability to generate larger ground reaction force profiles represents a mechanical advantage of a crouched posture. This increase in muscle capacity while in a crouched posture may allow a patient to generate new movements to compensate for impairments associated with cerebral palsy, such as motor control deficits.

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[PMID: 22542242](#) [PubMed - as supplied by publisher]**5. Eur J Phys Rehabil Med. 2012 Mar;48(1):147-53.****Applicability of a new robotic walking aid in a patient with cerebral palsy. Case report.**

Smania N, Gandolfi M, Marconi V, Calanca A, Geroi C, Piazza S, Bonetti P, Fiorini P, Cosentino A, Capelli C, Conte D, Bendinelli M, Munari D, Ianes P, Fiaschi A, Picelli A.

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BACKGROUND: Gait training with the help of assistive technological devices is an innovative field of research in neurological rehabilitation. Most of the available gait training devices do not allow free movement in the environment, which would be the most suitable natural and motivating condition for training children with neurological gait impairment. **AIM:** To evaluate the potential applicability of a new robotic walking aid as a tool for gait training in non-ambulatory children with Cerebral Palsy. **DESIGN:** Single case study **SETTING:** Outpatient regimen **POPULATION:** A 11-years-old child unable to stand and walk independently as a result of spastic tetraplegic cerebral palsy (CP). **METHODS:** The experimental device was a newly actuated version of a dynamic combined walking and standing aid (NF-Walker®) available in the market which was modified by means of two pneumatic artificial muscles driven by a foot-switch inserted in the shoes. The child was tested at baseline (while maintaining the standing position aided by the non-actuated NF-Walker®) and in the experimental condition (while using the actuated robotic aid). The outcome measures were: 2-minute walking test, 10-metre walking test, respiratory and heart parameters, energy cost of locomotion. **RESULTS:** At baseline, the child was unable to perform any autonomous form of locomotion. When assisted by the actuated aid (i.e. during the experimental condition), the child was successful in moving around in his environment. His performance was 19.63 m in the 2-minute walking test and 64 s in the 10-metre walking test. Respiratory and heart parameters were higher than healthy age-matched children both at baseline and in the experimental condition. The energy cost of gait, which was not valuable in the baseline condition, was significantly higher than normality during the experimental condition. **CONCLUSION:** The new robotic walking aid may help children suffering from CP with severe impairment of gait to move around in their environment. **CLINICAL REHABILITATION IMPACT:** This new robotic walking device may have a potential impact in stimulating the development and in training of gait in children with neurological gait impairment. Future studies are warranted in order to test this hypothesis.

[PMID: 22543558](#) [PubMed - in process]

6. Pediatr Phys Ther. 2012 Spring;24(1):69.**Commentary on "Effects of constraint-induced movement therapy on gait, balance, and functional locomotor mobility".**

Yu S, Fetters L.

Comment on

Pediatr Phys Ther. 2012 Spring;24(1):64-8.

[PMID: 22207473](#) [PubMed - indexed for MEDLINE]**7. J Pediatr Rehabil Med. 2012 Jan 1;5(1):15-27.****Effects on motor development of kicking and stepping exercise in preterm infants with periventricular brain injury: A pilot study.**

Campbell SK, Gaebler-Spira D, Zawacki L, Clark A, Boynewicz K, Deregner RA, Kuroda MM, Bhat R, Yu J, Campise-Luther R, Kale D, Bulanda M, Zhou XJ.

Center for Clinical and Translational Science, University of Illinois at Chicago, Chicago, IL, USA Department of Physical Therapy, University of Illinois at Chicago, Chicago, IL, USA.

Background: Preterm infants with periventricular brain injury (PBI) have a high incidence of atypical development and leg movements. Objective: Determine whether kicking and treadmill stepping intervention beginning at 2 months corrected age (CA) in children with PBI improves motor function at 12 months CA when compared with control subjects. Method: In a multi-center pilot study for a controlled clinical trial, sixteen infants with PBI were randomly assigned to home exercise consisting of kicking and treadmill stepping or a no-training control condition. Development was assessed at 2, 4, 6, 10, and 12 months CA with the Alberta Infant Motor Scale (AIMS). At 12 months children were classified as normal, delayed, or with cerebral palsy (CP). Results: At 12 months CA 3 of 7 (43%) of the exercise group children walked alone or with one hand held versus 1 of 9 (11%) in the control group ($p=0.262$), but no significant differences in AIMS scores were found at any age. Half of the subjects had CP or delay; the outcomes of these infants were not improved by exercise. Compliance with the home program was lower than requested and may have affected results. Conclusion: Although not statistically significant with a small sample size, self-produced kicking and treadmill exercise may lower age at walking in infants with normal development following PBI, but improvements of the protocol to increase and document compliance are needed before a larger study is implemented.

[PMID: 22543889](#) [PubMed - in process]**8. Am J Occup Ther. 2012 May-Jun;66(3):348-55.****Qigong massage for motor skills in young children with cerebral palsy and down syndrome.**

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In this article, we present a small randomized controlled study evaluating the effect of a dual parent- and trainer-delivered qigong massage methodology on motor skills and sensory responses in 28 children under age 4 with developmental delay and motor tone abnormalities. Fourteen children had high motor tone as a result of cerebral palsy (CP), and 14 children had low motor tone as a result of Down syndrome. Multivariate analysis and post hoc analysis of variance showed large effect-size improvements in Peabody Gross Motor Scale (PGMS) Object Manipulation scores ($p < .01$) and large effect-size improvements in overall PGMS scores ($p < .04$) in treatment versus control groups after 5 mo intervention. Follow-up evaluation 10 mo from the start indicated continued improvement. Sensory responses showed no treatment effect. The results suggest further investigation of qigong

massage as a promising avenue for research to improve motor skills in young children with CP and Down syndrome.

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9. Arch Phys Med Rehabil. 2012 May;93(5):808-15.

Evaluating intense rehabilitative therapies with and without acupuncture for children with cerebral palsy: a randomized controlled trial.

Duncan B, Shen K, Zou LP, Han TL, Lu ZL, Zheng H, Walsh M, Venker C, Su Y, Schnyer R, Caspi O.

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OBJECTIVE: To compare the outcomes of conventional therapies (physical, occupational, and hydrotherapies) plus acupuncture with those without acupuncture when administered intensely in the management of children with spastic cerebral palsy (CP). **DESIGN:** Evaluation-blind, prospective randomized controlled trial. **SETTING:** Therapies and video-recorded assessments at a children's hospital in Beijing, China, and blind scoring and data analyses at a university in the United States. **PARTICIPANTS:** Children (N=75), 12 to 72 months of age, with spastic CP. **INTERVENTIONS:** Intensely administered (5 times per week for 12wk) physical therapy, occupational therapy, and hydrotherapy either with acupuncture (group 1) or without acupuncture (group 2). To satisfy standard of care, group 2 subsequently received acupuncture (weeks 16-28).

MAIN OUTCOME MEASURES: The Gross Motor Function Measure (GMFM)-66 and the Pediatric Evaluation of Disability Inventory (PEDI) assessments at 0, 4, 8, 12, 16, and 28 weeks. **RESULTS:** At the end of 12 weeks, there was no statistically significant difference between the 2 groups, but when group 2 received acupuncture (16-28wk) there was a shift toward improvement in the GMFM-66 and the PEDI-Functional Skills Self-Care and Mobility domain. When groups were combined, statistically significant improvements after intense therapies occurred from baseline to 12 weeks for each outcome measure at each Gross Motor Function Classification System (GMFCS) level. After adjusting for expected normative maturational gains based on age, the GMFM gains for children with GMFCS II level was statistically significant ($P < .05$) with a mean gain of 6.5 versus a predicted gain of 3.4.

CONCLUSIONS: Intense early administered rehabilitation improves function in children with spastic CP. The contribution from acupuncture was unclear. Children's response varied widely, suggesting the importance of defining clinical profiles that identify which children might benefit most. Further research should explore how this approach might apply in the U.S.

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10. Arch Phys Med Rehabil. 2012 May;93(5):816-21.

Predictors of cardiometabolic risk among adults with cerebral palsy.

Peterson MD, Haapala HJ, Hurvitz EA.

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OBJECTIVE: To examine the independent association between various anthropometric indicators and standard clinical markers of cardiometabolic health risk among adults with cerebral palsy (CP). **DESIGN:** Cross-sectional study. **SETTING:** Clinical center for CP treatment and rehabilitation. **PARTICIPANTS:** Adults with CP (N=43) with a mean age \pm SD of 37.3 ± 13.2 years, and Gross Motor Function Classification System (GMFCS) levels of I-V. **INTERVENTIONS:** Not applicable. **MAIN OUTCOME MEASURES:** Adults with CP were assessed for body mass index (BMI), waist circumference (WC), hip circumference (HC), waist-to-hip ratio (WHR), waist-to-height ratio (WtHR), and serum lipid profiles. Data were analyzed with multiple regression analysis and general linear models, and are reported as means \pm SDs. **RESULTS:** Mean BMI was $29.1 \pm 7.8 \text{ kg/m}^2$. BMI was not associated with any measures of cardiometabolic risk. Using GMFCS categories (2 groups: GMFCS levels I-III and IV-V), BMI was

significantly lower among GMFCS levels IV-V ($24.2 \pm 6.2 \text{ kg/m}^2$) versus GMFCS levels I-III ($30.1 \pm 7.6 \text{ kg/m}^2$). WC and WHR were not correlated with any cardiometabolic outcomes. Conversely, measures of WHR were independently associated with various indices of risk, including total cholesterol to high-density lipoprotein (HDL) cholesterol ratio ($r = .45$; $P < .05$), HDL cholesterol ($r = -.51$; $P < .01$), and triglycerides ($r = .40$; $P < .05$), suggesting that greater WHR was indicative of elevated risk. CONCLUSIONS: It is likely that WHR represents a stronger predictor of risk, because this measure was robustly and independently associated with 3 primary clinical markers of cardiometabolic health in adults with CP.

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[PMID: 22541309](#) [PubMed - in process]

11. Int J Ophthalmol. 2012;5(1):113-5. Epub 2012 Feb 18.

Ocular alignment and results of strabismus surgery in neurologically impaired children.

Can CÜ, Polat S, Yaşar M, İlhan B, Altıntaş AG.

Ministry of Health Ulucanlar Eye Education and Research Hospital, 3 Clinic Ankara, Turkey.

AIM: To evaluate ocular alignment and surgical results of strabismus surgery in neurologically impaired children. METHODS: Files of 33 neurologically impaired squint children were evaluated. Twelve patients had cerebral palsy (CP), 4 had CP with mental retardation, the rest had mental-motor retardation of unknown cause. Cycloplegic refractions, type and angle of strabismus, surgeries performed were recorded. RESULTS: Mean follow-up was 34.0 ± 16.5 months. Twenty-three patients had esodeviation, the remaining had exodeviation. In 19 patients, angle of deviations measured at different visits were highly variable. Twelve patients with stable angle of deviations or with unstable but high angle deviations had horizontal muscle surgery. Mean horizontal deviation decreased from 43.75 ± 10.69 D to 12.83 ± 8.38 D with surgery. CONCLUSION: In neurologically impaired strabismic children, surgery is effective in patients with stable deviations or unstable but high angle deviations. Decision for surgery should be made after a long follow up period.

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12. PM R. 2012 Apr;4(4):312-6.

Salivagram after gland injection of botulinum neurotoxin a in patients with cerebral infarction and cerebral palsy.

Park HW, Lee WY, Park GY, Kwon DR, Lee ZI, Cho YW, Ahn SH, Lee DK.

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[PMID: 22541378](#) [PubMed - in process]

Prevention and Cure

13. Am J Obstet Gynecol. 2012 Apr 5. [Epub ahead of print]

Effectiveness of timing strategies for delivery of monochorionic diamniotic twins.

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OBJECTIVE: The purpose of this study was to compare strategies for delivery timing of uncomplicated monochorionic diamniotic twin pregnancies. **STUDY DESIGN:** A decision tree compared 9 strategies that included scheduled delivery between 32 and 38 weeks' gestation, with or without confirmation of fetal lung maturity. Outcomes in the model included fetal death, infant death, respiratory distress syndrome, mental retardation, and cerebral palsy. **RESULTS:** A scheduled delivery at 38 weeks' gestation was the preferred strategy, which resulted in the highest quality adjusted life years under base-case assumptions. Decreased, but comparable, quality adjusted life years estimates resulted from scheduled deliveries at 36 and 37 weeks' gestation, with or without amniocentesis. Sensitivity analyses demonstrated that the optimal gestational age for delivery was always ≥ 36 weeks' gestation. **CONCLUSION:** This decision analysis suggests that, for women with uncomplicated monochorionic twins, delivery between 36 and 38 weeks' gestation is the preferred strategy for timing of delivery.

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