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Interventions and Management

1. Extensor pollicis longus rerouting for thumb-in-palm deformity in cerebral palsy: a biomechanical analysis.

Alewijnse JV, Kreulen M, van Loon J, Smeulders MJC.

J Hand Surg Eur Vol. 2019 Jun 25:1753193419857067. doi: 10.1177/1753193419857067. [Epub ahead of print]

Extensor pollicis longus rerouting is a common procedure to improve thumb abduction in thumb-in-palm deformity seen with spastic cerebral palsy. In 1985, Manske redirected the extensor pollicis longus tendon in this procedure through the first extensor compartment. They also proposed an alternative subcutaneous route around the extensor pollicis brevis and abductor pollicis longus tendons proximal to the extensor compartment. In this study, we performed a three-dimensional analysis of thumb motion on 11 cadaver arms with the subcutaneous route and the first extensor compartment route. We found that with the two different routing methods, the mean difference in thumb radial abduction and retropulsion (0° or 6°, respectively) was very small. Such differences are unlikely to have clinical relevance. We were unable to find significant differences in the motion range of the thumb after these rerouting techniques or sites of insertion. Our biomechanical data support the simpler subcutaneous route.

PMID: [31238779](#)

2. Prevalence and goal attainment with spinal orthoses for children with cerebral palsy.

Pettersson K, Rodby-Bousquet E.

J Pediatr Rehabil Med. 2019 Jun 10. doi: 10.3233/PRM-180596. [Epub ahead of print]

PURPOSE: Analyze the goals for treatment and attained goals for spinal orthoses in children with cerebral palsy (CP), and describe the use of spinal orthoses in relation to age, sex, gross motor function, and scoliosis. **METHODS:** Cross-sectional data for all children born between 2000 and 2014 and registered in the Swedish CP registry were analyzed in relation to age, sex, Gross Motor Function Classification System (GMFCS), and scoliosis. Treatment goals were to 1) prevent deformity; 2) improve stability/positioning; 3) improve head control; and 4) improve arm/hand function. **RESULTS:** Overall, 251 of the 2800 children (9%) used spinal orthoses, and the frequency increased significantly with age and GMFCS level; 147 of the 251 children had scoliosis. Several treatment goals were reported for most children. The most common goal was improved stability/positioning (96%), followed by head control (51%) and arm/hand function (38%). Only one third of the children used spinal orthoses to prevent deformities. The rate of goal attainment was 78-87% for the functional outcomes and 57% for the prevention of deformities. **CONCLUSION:** Although the goal of using spinal orthosis to prevent curvature progression remains important, we found that its functional benefits (stability, head control, arm/hand function) were of greater importance.

PMID: [31227670](#)

3. Trunk Control in Children With Ataxic Cerebral Palsy.

Seyyar GK, Aras B, Aras O.

Percept Mot Skills. 2019 Jun 24:31512519858275. doi: 10.1177/0031512519858275. [Epub ahead of print]

This study aimed to investigate the clinical characteristics of trunk control in children with ataxic cerebral palsy (CP). We included 15 children with ataxic CP with a mean age of 9.46 years (SD = 1.08 years, 5-17 years) and 15 healthy children with a mean age of 9.06 years (SD = 0.84 years, 5-13 years). While the small sample size and large age range used here were not ideal for generalizability, they were made necessary by the rarity of this clinical sample. We used the Gross Motor Function Classification System Expanded and Revised (GMFCS-E&R) to classify the children's functional levels, and we tested trunk control with the Trunk Control Measurement Scale (TCMS). We then used the Gross Motor Function Measurement-88 (GMFM-88) to assess their gross motor functions. We compared the total and subscale scores of the TCMS in healthy children and children with ataxic CP by using the Mann-Whitney U Test. We also analyzed differences between TCMS scores according to the children's GMFCS levels with the Mann-Whitney U Test and also compared TCMS scores with the GMFM-88 by means of Spearman correlation analysis. Spearman correlation analysis was used to compare the scores of the TCMS with the GMFM-88. Our results showed that healthy children showed significantly higher scores than children with ataxic CP in total and subscale scores of TCMS ($p < .05$). There was no significant difference between the TCMS scores in children of different GMFCS levels, but the GMFM-88B subscale was significantly correlated with the static sitting balance ($\rho = .568$, $p < .05$) and dynamic sitting balance ($\rho = .547$, $p < .05$) TCMS subscales and with the TCMS total score ($\rho = .590$, $p < .05$). We concluded that trunk control, especially its dynamic aspects, was impaired in children with ataxic CP.

PMID: [31234723](#)

4. A study validating the Italian version of the Level of Sitting Scale in children with cerebral palsy.

Tofani M, Candeloro C, Sabbadini M1, Field D, Frascarelli F, Lucibello L, Valente D, Galeoto G, Castelli E.

Clin Rehabil. 2019 Jun 24;269215519858387. doi: 10.1177/0269215519858387. [Epub ahead of print]

OBJECTIVES: To assess measurement properties of the Italian version of the Level of Sitting Scale when classifying sitting ability of children with cerebral palsy. **DESIGN:** Methodological study. **SETTING:** Children's hospital (inpatients and outpatients). **SUBJECTS:** Children 18 years of age or younger with cerebral palsy. **METHODS:** The original English version of the Level of Sitting Scale was translated and culturally adapted for the Italian culture following international guidelines. Examination of reliability and validity of the Italian Level of Sitting Scale was then undertaken. Inter-rater and one-week test-retest reliability were estimated using both intraclass correlation coefficients (ICCs) with 95% confidence intervals and Bland-Altman plots. Construct validity of the Italian Level of Sitting was evaluated using three approaches examining Pearson's correlation coefficient (r) and Mann-Whitney U test (P -value < 0.05). **MAIN MEASURES:** Italian Level of Sitting Scale and Gross Motor Function Classification System. **RESULTS:** The Italian Level of Sitting Scale was administered to 109 subjects. Inter-rater reliability and one-week test-retest showed excellent value with ICCs of 0.99 for both. (1) The Pearson correlation coefficient comparing Italian Level of Sitting Scale with Gross Motor Function Classification System was -0.91 and (2) correlation with total amount of adaptive seating components was -0.90 . Differences in sitting abilities and use/non-use of wheelchair were found. All reported a statistical significance of $P < 0.01$. **CONCLUSION:** Our findings provide evidence of reliability and validity when using the Italian Level of Sitting Scale to classify seated postural abilities in a sample of Italian children with cerebral palsy.

PMID: [31234655](#)

5. Energy Expenditure Index as a measure of efficiency of walking on outdoor uneven surface in individuals with cerebral palsy.

Gupta S, Raja K.

Disabil Rehabil. 2019 Jun 22;1-8. doi: 10.1080/09638288.2019.1630017. [Epub ahead of print]

Purpose: This study aims to validate and report responsiveness of Energy Expenditure Index (EEI) during walking on outdoor uneven surface in individuals with cerebral palsy (CP). **Methods:** Eighty ambulant children with spastic diplegia (Gross Motor Function Classification System II & III) aged between six and 18 years and 58 age matched typically developing children were recruited for ascertaining reliability and validation of EEI during outdoor walking. Responsiveness of EEI was ascertained using anchor-based approach using Functional Mobility Scale in 29 children with CP who were recruited for surgical intervention. **Results:** EEI had acceptable test-retest reliability and agreement in both typically developing and children with CP. Friedman's analysis of variance of 29 children with CP showed a significant difference in EEI ($\chi^2 = 10.15$, $p = 0.006$), Functional Mobility Scale - 50 m ($\chi^2 = 18.77$, $p = 0.000$) and 500 m ($\chi^2 = 40.19$, $p = 0.000$) scores at 6 and 12 months when compared with baseline. The minimal clinical important difference of EEI during walking on uneven outdoor surface with a concomitant change in functional mobility scale (500 m) at 6 and 12 months was 0.29 and 0.37 beats/m, respectively. **Conclusions:** EEI during walking on outdoor uneven surface is a stable, valid and reliable measure of energy efficiency in individuals with CP and is responsive to orthopedic intervention in CP. **IMPLICATIONS FOR REHABILITATION** Energy Expenditure Index during outdoor walking on uneven surface is a valid, reliable and responsive outcome measure for documenting changes in walking efficiency to post-surgical interventions employed to improve walking in individuals with cerebral palsy. Rehabilitation professionals should document the efficiency during outdoor walking on all the post-operative visits. Energy Expenditure Index during outdoor walking can serve as surveillance tool for deterioration in outdoor walking ability.

PMID: [31230483](#)

6. Improving postural symmetry: The effectiveness of the CATCH (combined approach to treatment for children with hemiplegia) protocol.

Holland H, Blazek K, Haynes MP, Dallman A.

J Pediatr Rehabil Med. 2019 Jun 10. doi: 10.3233/PRM-180550. [Epub ahead of print]

PURPOSE: To evaluate postural symmetry in sitting and standing for children with hemiplegic cerebral palsy (hCP) following the Combined Approach to Treatment for Children with Hemiplegia (CATCH) protocol, an intervention combining Constraint Induced Movement Therapy, Bimanual Intensive Therapy and Neuro-Developmental Treatment. **METHODS:** The study included 10 children with a diagnosis of hCP and 10 typically developing age-matched peers. Subjects participated in a CATCH camp for six hours daily for eight consecutive days. Postural symmetry measurements in quiet sitting and standing were obtained using a Boditrak pressure-mapping system at four time points: prior to start of camp (T1), first day of camp (T2), last day of camp (T3), and one month post-camp (T4). **RESULTS:** Significant differences ($p < 0.05$) were found in quiet sitting when comparing postural symmetry pre-intervention and one-month post camp. In quiet standing, significant differences ($p < 0.05$) were found when pre-intervention was compared to one-month post-intervention. One month post-intervention, the intervention group showed no significant difference from the comparison group. **CONCLUSIONS:** Children with hCP demonstrate improvement in postural symmetry in sitting and standing following participation in a CATCH camp. Following the intervention, children with hCP continued to improve postural symmetry and approach age-matched peers.

PMID: [31227666](#)

7. Passive range of motion changes in young children with spastic diplegia. A study during the initial stages of independent walking.

Dimakopoulos R, Syrogiannopoulos G, Youroukos S, Dailiana Z, Spinou A.

J Pediatr Rehabil Med. 2019 Jun 10. doi: 10.3233/PRM-180539. [Epub ahead of print]

PURPOSE: To investigate how the onset of independent walking in children with Cerebral Palsy (CP) influences the Passive Range of Motion (PROM) of lower limb joints. **METHOD:** Sixteen children with CP, GMFCS levels I and II, and 16 Typical Development (TD) children who had just begun independent walking participated in the study. The PROM of the hip abduction and external rotation, knee extension, popliteal angle, and ankle dorsiflexion was recorded with a goniometer at the onset of independent walking and 8 months later. A repeated-measures two-way ANOVA was conducted to compare the main effects of "walking experience" and "group of children" and the interaction effect between them on PROM of lower extremities' joints. **RESULTS:** The effect of "group of children" in the PROM was significant; differences were observed between children with CP and TD children for all joints ($p < 0.05$). The effect of "walking experience" did not have a significant impact on PROM changes and the interaction effect of "group of children" and "walking experience" was also not significant for all the variables. **CONCLUSIONS:** The alternative gait pattern spontaneously adopted by children with CP does not significantly impact their PROM during the initial stages of walking development. The lower PROM in highly functional children with CP compared to TD children cannot be attributed to gait initiation with an "atypical" pattern, but possibly to other factors such as reduced voluntary movement and age.

PMID: [31227665](#)

8. Calculating Heart Rate Variability from ECG Data from Youth with Cerebral Palsy During Active Video Game Sessions.

Landis C, O'Neil ME, Finnegan A, Shewokis PA.

J Vis Exp. 2019 Jun 5;(148). doi: 10.3791/59230.

The aim of this study was to generate a method for calculating heart rate variability (HRV) from electrocardiogram (ECG) waveforms. The waveforms were recorded by a HR monitor that participants (youth with cerebral palsy (CP)) wore during active video game (AVG) sessions. The AVG sessions were designed to promote physical activity and fitness (aerobic performance) in participants. The goal was to evaluate the feasibility of AVGs as a physical therapy (PT) intervention strategy. The maximum HR (mHR) was determined for each participant and the Target Heart Rate Zone (THRZ) was calculated for each of three exercise phases in the 20 min AVG session: (warm-up at 40-60% mHR, conditioning at 60-80% mHR, and cool down at 40-60% mHR). Each participant played three 20 min games during the AVG session. All games were played while sitting on a bench because many youth with CP cannot stand for extended periods of time. Each game condition differed with participants using hand icons only, hand and feet icons together or feet icons only to collect objects. The objective of the game (called KOLLECT) is to collect objects to gain points and avoid hazards to not lose points. Hazards were used in the warm-up and cool down phases only to promote slower, controlled movement to maintain HR in the target heart rate zone (THRZ). There were no hazards in the conditioning phase to promote higher levels and more intense physical activity. Analytic methods were used to generate HRV (selected time-domain and frequency-domain measures) from ECG data to examine aerobic workload.

Recent applications of HRV indicate that short-term measurements (5 min bouts) are appropriate and that HRV biofeedback may help improve symptoms and the quality of life in a variety of health conditions. Although HR is a well-accepted clinical measure to examine aerobic performance and intensity in PT interventions, HRV may provide information of the autonomic system functions, recovery and adaptation during AVG sessions.

PMID: [31233014](#)

9. Self-reported physical function is associated with walking speed in adults with cerebral palsy.

Baer HR, Thomas SP, Pan Z, Tagawa A, Carollo J, Heyn PC.

J Pediatr Rehabil Med. 2019 Jun 10. doi: 10.3233/PRM-180585. [Epub ahead of print]

PURPOSE: To understand the relationship of walking speed to self-reported pain, fatigue, and physical function in adults with CP. **METHODS:** Design: Cross-sectional study. **SETTING:** Accredited clinical motion analysis laboratory in a regional children's hospital. **PARTICIPANTS:** 72 ambulatory patients \geq 18 years of age, diagnosed with CP, who previously had \geq 1 prior instrumented gait analysis at our facility. **MAIN OUTCOME MEASURES:** PROMIS-57 pain interference/intensity, physical function, and fatigue measures and walking speed. **RESULTS:** Physical function was significantly lower than able-bodied normal values by 1-2 standard deviations (40.3 ± 8.5). Pain interference (51.4 ± 9.0) and fatigue (50.2 ± 9.2) were not significantly different when compared to able-bodied normal values. Only physical function was statistically correlated with walking speed ($p < 0.001$), while pain interference ($p = 0.39$), pain intensity ($p = 0.36$), and fatigue ($p = 0.75$) were not. Pain interference, pain intensity, and fatigue were not statistically significant factors in the multiple regression of walking speed. Fatigue could significantly predict physical function, pain interference, and pain scores ($p = 0.032$, $p < 0.001$, $p < 0.01$, respectively), however, fatigue did not directly predict walking speed ($p = 0.747$). **CONCLUSIONS:** Self-reported physical function correlates with objectively measured walking speed in young adults with CP, while patient-reported pain and fatigue did not as would be predicted by the literature.

PMID: [31227669](#)

10. Longitudinal changes in bone density in adolescents and young adults with cerebral palsy: a case for early intervention.

Trinh A, Wong P, Fahey M, Brown J, Strauss BJ, Ebeling PR, Fuller PJ, Milat F.

Clin Endocrinol (Oxf). 2019 Jun 27. doi: 10.1111/cen.14052. [Epub ahead of print]

CONTEXT: Cerebral palsy (CP) is a motor disorder affecting movement, muscle tone and posture due to damage to the fetal or infant brain. The subsequent lack of ambulation, nutritional deficiencies, anticonvulsant use and hormonal deficiencies have been implicated in the low bone mass associated with this condition. **OBJECTIVE:** To assess changes in areal bone mineral density (aBMD) during adolescence and young adulthood in individuals with CP. The effect of ambulation, nutrition, hypogonadism on longitudinal changes in aBMD is also examined. **DESIGN:** Retrospective longitudinal study. **SETTING AND PARTICIPANTS:** Forty-five subjects with CP who had longitudinal dual-energy x-ray absorptiometry (DXA) scans at a single tertiary hospital between 2006 and 2018. **RESULTS:** Mean age at first DXA was 19.4 years (range: 10 - 36 years), 57.8% were male and 80% were non-ambulatory. The mean Z-scores at baseline were < -2.0 at all sites - lumbar spine (LS), femoral neck (FN), total hip (TH) and total body (TB). The median change in aBMD was $+1.2$ - 1.9% /year in all subjects but in those < 20 years of age, the median change was 4 - 8% /year. Z-scores across all sites remained stable over time. Reduced functional state as measured by the gross motor functional classification scale (GMFCS) had a small negative effect on aBMD over time. **CONCLUSION:** In adolescents with CP, low bone mass was evident from the baseline DXA. However, significant bone accrual occurred during the second decade, followed by bone maintenance in young adulthood. Future studies should focus on optimising bone health from early childhood.

PMID: [31246317](#)

11. The eating and drinking ability classification system for cerebral palsy: A study of reliability and stability over time.

Sellers D, Bryant E, Hunter A, Campbell V, Morris C.

J Pediatr Rehabil Med. 2019 Jun 10. doi: 10.3233/PRM-180581. [Epub ahead of print]

AIM: This study evaluated the inter-observer reliability and stability over time of the Eating and Drinking Ability Classification System (EDACS) for children and young people with cerebral palsy (CP). **METHOD:** Case records for 97 children with CP were examined to collect retrospective data about eating and drinking abilities at four time-points with a minimum of 2 years between each time-point. Sex, Gross Motor Function Classification System (GMFCS) level, presence of feeding tube and orthopaedic issues were recorded from case records. One speech and language therapist (SaLT1) classified eating and drinking ability using EDACS for all cases at all time-points; SaLT2 assigned EDACS levels for 50 cases at time-point 1; SaLT3 assigned EDACS levels for 24 cases at all time-points. Inter-observer reliability and stability over time were assessed using the Intraclass Correlation Coefficient (ICC). Associations between EDACS levels and functioning recorded with other Functional Classification Systems (FCSs) were calculated using Kendall's tau (τ).

RESULTS: Out of 97 children, 48 were male, 48 had feeding tubes, and 83 had orthopaedic issues. ICC for EDACS levels recorded by SaLT1 across all time-points was 0.97 (95% CI 0.96-0.98); changes in EDACS levels occurred infrequently and never by more than one level. ICC between SaLT1 and SaLT2 at time-point 1 was 0.8 (95% CI 0.67-0.89); ICC between SaLT1 and SaLT3 across all time-points was 0.95 (95% CI 0.92-0.98). Association between GMFCS and EDACS was moderate ($\tau = 0.58$). **INTERPRETATION:** Retrospective use of EDACS to classify children's eating and drinking abilities appears reliable; EDACS appeared stable over 6 or more years in 86% of the cases.

PMID: [31227668](#)

12. Total and regional body fat status among children and young people with cerebral palsy: A scoping review.

Whitney DG, Gross-Richmond P, Hurvitz EA, Peterson MD.

Clin Obes. 2019 Jun 24:e12327. doi: 10.1111/cob.12327. [Epub ahead of print]

The purpose of our scoping review was to determine if children and young people with cerebral palsy (CP) have elevated total or regional body fat compared to children and young people without CP. Databases (Ovid MEDLINE, Embase Ovid, CINAHL and Scopus) were systematically searched from 1 January 1993 to 7 December 2018 in order to identify articles that compared weight status, total body fat or regional body fat (eg, abdominal) between children and young people (0-21 years) with and without CP. Extracted data included country, subject characteristics, group sample sizes and matching strategies, methods/measures for weight status/fat depot, fat depot(s) assessed and key findings. Twenty-two studies were included. Of these, 19 studies examined total body fat; the most common method was use of anthropometrics and the more common measures were body mass index and skin-fold thickness. Twelve studies examined at least one regional fat depot; the most common method was use of anthropometrics and the most common measure was skin-fold thickness. Findings were inconsistent across studies. Further, among 10 studies that examined total and regional body fat depots, 8 found differences across fat depots within the same children and young people (eg, no difference in total body fat but higher abdominal fat). This review provides a summary of inconsistent findings from published studies on body fat comparisons between children and young people with vs without CP, highlights limitations for evaluating body fat for children with CP and discusses future research directions.

PMID: [31237080](#)

13. Steering towards collaborative assessment: a qualitative study of parents' experiences of evidence-based assessment practices for their child with cerebral palsy.

O'Connor B, Kerr C, Shields N, Adair B, Imms C.

Disabil Rehabil. 2019 Jun 23:1-10. doi: 10.1080/09638288.2019.1629652. [Epub ahead of print]

Purpose: To understand parents' experiences of evidence-based assessment by health professionals for their child with cerebral palsy. **Methods:** A qualitative interpretive description study was undertaken. Primary carers of children with cerebral palsy (aged 3-18 years) from south-eastern Australia were invited to participate. Face-to-face interviews were held using a semi-structured topic guide and data analyzed inductively. Credibility was ensured through: journal reflections; co-author review; audit trail; and, participant member-checking. **Results:** Fourteen parents of children with cerebral palsy, representing Gross Motor Functional Classification System levels I-V, participated. Six themes emerged: (1) Protection; (2) Positively Framed; (3) Bridging the Gap; (4) Involvement; (5) Finding Worth; and (6) Trust. Central to parents' experience was protection of their child's identity and personal self. Assessment can be emotionally confronting, at any stage. Representing the child positively and highlighting possibilities was deemed essential. Parents' involvement ranged from being overlooked spectators to being instigators of assessment. Evidence-based assessment was worthwhile when relevant to parents' direction and family context. The researchers' interpretive description generated a schema and metaphor-the Steering Wheel for Collaborative Assessment. **Conclusions:** A strengths-based approach to diagnosis and assessment is essential. The resulting interpretive description may assist health professionals align evidence-based assessment practices with family-centred care. Implications for rehabilitation Parents of children who have cerebral palsy describe having to protect their child's identity and representation, and their own personal well-being, through evidence-based assessment and diagnostic processes. Involving parents in the process of evidence-based assessment and adopting a strengths-based approach is essential. The interpretive description developed-the Steering Wheel for Collaborative Assessment-may assist health professionals to implement evidence-based assessment tools in ways consistent with family-centred care principles.

PMID: [31230482](#)

14. Identifying cerebral palsy from routinely-collected data in England and Wales.

Carter B, Verity Bennett C, Bethel J, Jones HM, Wang T, Kemp A.

Clin Epidemiol. 2019 Jun 5;11:457-468. doi: 10.2147/CLEP.S200748. eCollection 2019.

Purpose: An observational study using routinely-collected health care data to describe the extent to which children and young people (CYP) with cerebral palsy (CP) can be identified and the prevalence of CP can be estimated.

Patients and methods: Routinely-collected anonymized data, for CYP (aged 0-25 years old between 1 January 2004 and 31 December 2014) were analyzed in two linked datasets, from England and Wales respectively. Datasets included National Health Service; General Practitioner (GP), inpatients, outpatients, and national mortality records. CP was identified using ICD-10 codes G80.0-G83.3 and equivalent Read v2 codes. Ascertainment rates of CP were identified for each data source and compared between countries. Frequency and consistency of coding were investigated, and prevalence of CP estimated. Results: A total of 7,113 and 5,218 CYP with CP were identified in the English and Welsh datasets respectively. Whilst the majority of CYP with CP would be expected to attend their GP, 65.3% (4,646/7,113) of English and 65.1% (3,396/5,218) of Welsh cases were ascertained from GP datasets. Further cases were identified solely in inpatient datasets (2,410 in England, 1,813 in Wales). Few cases were coded for CP within outpatient datasets. Four character codes that specified CP type were rarely used; one in five health care records were coded both with G80 codes (explicitly CP) and with G81-83 codes (other paralytic syndromes) or equivalent Read codes. Estimated period prevalence of CYP with CP was 2.5-3.4 per 1,000 in England and 2.4-3.2 per 1,000 in Wales. Conclusion: In England and Wales, coding of CP in routine data is infrequent, inconsistent, non-specific, and difficult to isolate from conditions with similar physical signs. Yet the prevalence estimates of CP were similar to those reported elsewhere. To optimize case recognition we recommend improved coding quality and the use of both primary and secondary care datasets as a minimum.

PMID: [31239784](#)

15. Prevalence, Patterns, and Cost of Care for Children with Cerebral Palsy Enrolled in Medicaid Managed Care.

Pulgar S, Bains S, Gooch J, Chambers H, Noritz GH, Wright E, Sawhney TG, Pyenson B, Ferro C.

J Manag Care Spec Pharm. 2019 Jul;25(7):817-822. doi: 10.18553/jmcp.2019.25.7.817.

BACKGROUND: In the United States, many children with cerebral palsy (CP) obtain health care coverage through managed Medicaid, but little is known about the current demographics or management of this high-need, complex population. OBJECTIVE: To develop U.S. population-level information about the prevalence of CP, management patterns, and costs. METHODS: Data (2013-2015) were analyzed from a managed Medicaid database with coverage of children and adolescents in 15 states. Analyses included demographic information and use of 10 prespecified CP management options often used to manage spasticity. Code-based algorithms were applied to indicate presence of spasticity and determine the likely ambulatory status. RESULTS: In this claims analysis, the prevalence estimate of CP was 1.78 per 1,000 patients. Most (69.8%) children with CP had spasticity, of which 20.8% had hemiplegia, 15.6% diplegia, 32.9% quadriplegia, and 30.5% CP unspecified. Overall, 42.4% of children with CP were not treated with any of the 10 CP management options via Medicaid. Among treated children, the most common management options were physical therapy (37.1%), orthotics (29.9%), oral baclofen (13.5%) and botulinum toxins (9.4%). Overall annualized Medicaid costs were higher for children with CP versus children in the overall database population (\$22,383 vs. \$1,358). Within the CP population, costs were higher for those children who were likely nonambulatory than for those who were likely ambulatory (\$43,687 vs. \$10,368, respectively). CONCLUSIONS: Most children with CP have spasticity, and the costs of care are high. This study highlights wide variation in the way CP is managed, with many young patients not receiving CP management options via Medicaid.

PMID: [31232210](#)

16. Cerebral Palsy: Diagnosis, Epidemiology, Genetics, and Clinical Update.

Michael-Asalu A, Taylor G, Campbell H, Lelea LL, Kirby RS.

Adv Pediatr. 2019 Aug;66:189-208. doi: 10.1016/j.yapd.2019.04.002. Epub 2019 May 15.

PMID: [31230694](#)

17. Safety of combined salivary gland and multilevel intramuscular onabotulinumtoxinA injections with and without ethanol in pediatric patients with cerebral palsy: A retrospective study.

Shoval H, Levin J, Friel K, Kim H.

J Pediatr Rehabil Med. 2019 Jun 10. doi: 10.3233/PRM-180552. [Epub ahead of print]

OBJECTIVE: To evaluate the safety of combining salivary gland onabotulinumtoxinA (BTX-A) injections for sialorrhea with intramuscular BTX-A injections for spasticity in the same procedure. DESIGN: A retrospective cohort study in a tertiary hospital center. Patients selected were younger than 20 years, diagnosed with cerebral palsy, and received their first salivary gland BTX-A injection between March 2011 and July 2015. Chart reviews and telephone interviews were performed. The primary outcome measure was the rate of adverse events after combined BTX-A injections into salivary glands and muscles. The secondary outcome measure was the efficacy of injections, as reported by patients. RESULTS: Twenty-five of the 52 selected patients received salivary gland BTX-A injections only, and 27 received concurrent salivary gland and multi-level intramuscular chemodenervation with BTX-A injections. The rate of adverse events was < 10% in both groups: 4% in "salivary only" group and 7% in the group with salivary + multi-level intramuscular chemodenervation with BTX-A (with or without alcohol). Both approaches were equally effective in meeting their goals of salivary injections (> 50% improvement for at least two months).

In the "salivary only" and in the "salivary + multi-level intramuscular" group, 76 and 85% of the patients reached their goals respectively. CONCLUSIONS: Combining BTX-A injections for sialorrhea with multilevel intramuscular BTX-A injections (with or without alcohol) appears to be safe and effective and allows treatment of patients for both conditions simultaneously.

PMID: [31227667](#)

Prevention and Cure

18. Late-Onset Circulatory Collapse and Risk of Cerebral Palsy in Extremely Preterm Infants.

Yasuoka K, Inoue H, Egami N, Ochiai M, Tanaka K, Sawano T, Kurata H, Ichiyama M, Fujiyoshi J, Matsushita Y, Sakai Y, Ohga S; Neonatal Research Network of Japan.

J Pediatr. 2019 Jun 19. pii: S0022-3476(19)30599-2. doi: 10.1016/j.jpeds.2019.05.033. [Epub ahead of print]

OBJECTIVE: To investigate whether the development of postnatal, late-onset refractory hypotension, referred to as late-onset circulatory collapse, was associated with an increased risk of developing cerebral palsy (CP) at 3 years of age in extremely preterm infants. **METHODS:** In this historical cohort study, infants who were born at 22-27 weeks of gestation from 2008 to 2012 in the Neonatal Research Network of Japan were eligible. The study sample consisted of 3474 infants (45.6% of 7613 potentially eligible infants) who were evaluated at 36-42 months of age. Late-onset circulatory collapse was defined as a clinical diagnosis of late-onset circulatory collapse requiring treatment with corticosteroids. We compared the neurodevelopmental outcomes between infants with and without late-onset circulatory collapse. **RESULTS:** Late-onset circulatory collapse was diagnosed in 666 of the infants studied. Infants with late-onset circulatory collapse had a higher incidence of CP than those without late-onset circulatory collapse (18.0% vs 9.8%; $P < .01$). In multivariable logistic analysis, late-onset circulatory collapse was independently associated with CP (aOR, 1.52; 95% CI, 1.13-2.04) and developmental quotient score of <50 (OR, 1.83; 95% CI, 1.23-2.72). **CONCLUSIONS:** Late-onset circulatory collapse may be a relatively common event occurring in extremely preterm infants and an independent risk factor for CP at 3 years of age.

PMID: [31229321](#)