ABSTRACTS

Oral communications

Technology-assisted Rehabilitation

OC-001 | Dynamic standing exercise in a novel assistive device compared with standard care for non-ambulant children with cerebral palsy, regarding quality of life and cost-effectiveness

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Introduction: Children with cerebral palsy who are non-ambulant (CP-NA) cannot stand or walk independently. In Sweden, daily static standing is part of standard care for these children. Static standing is time-consuming and costly, and while it may benefit the well-being of many children, it is inconvenient for others. Therefore, the aim of this study was to compare dynamic standing in a novel assistive device and static standing regarding health related quality of life (HRQOL) and cost-effectiveness.
Patients and Methods: Twenty children with CP-NA were included in this randomized controlled study with a crossover design. They participated in four months of static and four months of dynamic standing. HRQOL was assessed with the Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD), which has shown to be valid and reliable for children with CP-NA. Information about other aspects of quality of life and about cost-effectiveness was collected by study-specific questionnaires.
Results: HRQOL and bowel function improved and the number of pain locations and doses of medicine decreased significantly with dynamic standing. The healthcare costs of dynamic standing were higher compared to standard care, while the costs for the families were lower, due to fewer healthcare visits to adjust the equipment.
Conclusion: From a family perspective, the costs for dynamic standing were lower and the effects higher compared to static standing. From both a healthcare and a societal perspective, dynamic standing is better but more costly than static standing. These findings may contribute to the development of individualized standing recommendations.

OC-002 | Eye-gaze technology for participation in computer activities in young children with complex needs: A single-case research design

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Introduction: Children with complex needs have difficulties to access a computer for play, communication, and learning. Eye-gaze technology offers the opportunity to control a computer through eye movements. This study investigates the impact of eye-gaze technology intervention on children's participation in computer activities and technology usability.
Patients and Methods: This study involved a multiple baseline design across individuals. Four children ages 3 to 6 years, with severe cerebral palsy or neurometabolic disorders and low eye-control skills, took part in a 6-month intervention. Two collaborative team meetings and 12 individual supports were implemented to facilitate the use of eye-gaze technology in daily contexts. Participation in computer activities (diversity, frequency, and duration) were repeatedly measured by a computer use diary. Other outcomes included assessments of goal achievements (Goal Attainment Scaling), and parents' and teachers' ratings on children's performance on computer activities (Canadian Occupational Performance Measure).
Results: Young children increased their diversity of computer activities and their frequency and duration of computer use from baseline to the intervention phase. Design-comparable effect sizes showed a moderate effect (0.76) in the computer use duration. Six of eight predetermined goals in play, communication, and school learning were achieved. Parents' and teachers' ratings on children's performance reached clinical significance.
Conclusion: The findings add knowledge that children with complex needs and low eye-control skills require extended time to learn how to control a computer but benefit from using eye-gaze technology to perform essential activities.

This study strengthens the evidence of the usability of eye-gaze technology in everyday contexts.

OC-003 | Head-mounted VR displays are a promising tool for pediatric neurorehabilitation to train walking activities

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Introduction: Many essential walking activities in daily life, for example, crossing a street, are challenging to practice in conventional therapeutic settings. Virtual environments (VE) would allow such training in a safe and attractive environment. We, therefore, aimed to investigate the usability of an interactive VE experienced through a head-mounted display (VR-HMD) to train everyday life walking activities in pediatric neurorehabilitation.
Patients and Methods: In a cross-sectional study, 21 youths (11.8 years, range 6.8–17.7 years) with neuromotor disorder undergoing neurorehabilitation tested a VE, experienced through the VR-HMD Oculus Quest. Participants, accompanied by their physiotherapists, moved freely around the VE, displaying a magical forest, and interacted with the virtual objects using their hands, represented in VR. Symptoms of cybersickness were checked, and user experience and acceptability were evaluated using customized questionnaires with a visual analog scale for the youths and a 5-point Likert scale for their therapists.
Results: Youths rated comfort (median 10 out of 10) and movement ability (10/10) with the VR-HMD as high. The VE had a realistic appearance (8/10) for the majority, and the participants had a strong feeling of spatial presence (9.5/10). They enjoyed exploring (10/10) and liked this new therapy approach a lot (10/10). Therapists' acceptance of the VR-HMD was high (4/5). They felt that the VR-HMD hardly affected youths' movement behavior or level of support needed, while it seemed to increase their level of therapy engagement.
Conclusion: VR-HMDs are a promising tool to engage youths in the training of everyday walking activities.

OC-004 | Scoping review on neurofeedback training strategies most strongly associated with improved motor function for pediatric neurorehabilitation applications

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Introduction: Neurofeedback is a promising neurorehabilitation strategy emerging from the Brain Computer Interface field. In contrast to bypassing voluntary motor control by linking the brain to a wearable device, neurofeedback harnesses and links brain activity during real or imagined movement to strengthen neural connections and thereby enhance function. Existing neurofeedback paradigms vary considerably as do results, although multiple studies present clinically significant findings from short term training.
Patients and Methods: We performed a scoping review (PRISMA-ScR Checklist) to identify all neurofeedback studies aiming to improve motor function in non-progressive neurological disorders by linking brain activation during attempted movement to training with additional sensory input (e.g. FES). Studies using motor imagery alone were excluded. We further limited studies to those using mobile brain imaging (e.g. EEG, NIRs).
Results: From 5,189 identified studies, 30 met inclusion criteria, all but 1 were in stroke and only 30% had a control group. The primary aim was to extract methodological details and motor outcomes to determine which features were associated with positive functional change. The primary factor that emerged was precise real-time detection and utilization of brain activation during motor onset to control external sensorimotor feedback. EEG with exceptional temporal resolution was the primary modality utilized. FES and robotic devices were the most common feedback types. Several innovative highly technical Methods: were explored across studies to maximize the reliability and accuracy of detecting brain activation, with no single technique yet emerging as superior.
Conclusions: Further development especially for pediatric rehabilitation is highly warranted given reported large effect sizes.

OC-005 | Efficacy of implementing motor skill learning virtual-based sessions in a HABIT-ILE intervention in children with cerebral palsy: a non-inferiority randomized controlled trial

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Introduction: Despite the strong recommendations for intensive interventions, not any virtual therapeutic device has been designed for applying motor skill learning based therapeutic principles. The REAtouch device has been recently designed to allow the application of such principles, notably through tangible objects manipulations. This study tests the efficacy of REAtouch-based sessions in combination with a Hand Arm Bimanual Intensive Therapy including Lower Extremities (HABIT-ILE) intervention.
Patients and Methods: Forty children with unilateral cerebral palsy (5–18 years; MACS I-III; GMFCS I-II) were

randomly allocated to a control "HABIT-ILE" or an experimental "REAtouch" group (i.e. half of the one to one therapeutic time using the REAtouch; ±40 h) for a 90 h HABIT-ILE day-camp intervention (2 weeks). Participants had 3 testing sessions: the week before (T1), after intervention (T2) and at 3 months follow-up (T3). The primary outcome was the Assisting Hand Assessment (T3-T1). Secondary outcomes measured upper extremities motor function, stereognosis, walking endurance, abilities in daily life activities. One-way RMANOVA tested treatments efficacy and non-inferiority analyses tested the non-inferiority of changes in REAtouch compared to HABIT-ILE group.
Results: We observed significant improvements in both groups in most of the outcome measures ($p < 0.05$) except for stereognosis ($p > 0.9$, both groups). REAtouch group showed significant non-inferiority of changes (T3-T1) on upper extremities motor function and abilities in daily life activities ($p < 0.05$), not on walking endurance ($p = 0.26$).
Conclusion: The use of REAtouch during HABIT-ILE camp showed efficacy compared to a usual HABIT-ILE intervention and feasibility to apply motor skill learning based principles using a specifically designed device.

Orthopaedics 1

OC-006 | Two-stage bone lengthening with reuse of a single intramedullary telescopic nail in patients with achondroplasia

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Introduction: Patients with achondroplasia may benefit from limb-lengthening surgery with telescopic intramedullary nails (TIMNs). However, the 5-cm maximum length of the nails used in these patients in their original design may be insufficient. Our aim is to analyze the outcomes and complications after reusing the same TIMN for a second consecutive 5-cm lengthening in these patients.
Methods: Retrospective study of 26 bones (16 femurs and 10 tibias) in 9 patients with achondroplasia treated for bilateral 2-stage sequential lengthening reusing the same TIMN. On completion of a first stage of 5-cm of elongation, the nail was unlocked, retracted, and re-locked; a second stage of 5-cm of distraction followed. Radiologic and clinical parameters were measured pre- and postoperatively, and complications were recorded.
Results: The median age of patients at first surgery was 13.54 (12.9–16.3) years. The median preoperative height was 121 (117.5–127) cm, and the median healing index was 18.12 (14.5–32.8) and 26.96 (23.3–31.6) days/cm, while time to weight bearing was 185.5 (144.8–308.5) and 242.5 (208.5–293.8) days for femurs and tibias, respectively. Femoral procedures had significantly fewer complications than tibial interventions (7 vs 15, $p = 0.03$), whereas patients who underwent lengthening of both segments did not have significantly higher complication rates (14 vs 8, $p = 0.6$).
Conclusions: This is the first report of limb-lengthening in a series of patients with achondroplasia using TIMN with nail reuse to re-lengthen the bone. The complication rate found is acceptable, among which, potential damage to the internal lengthening mechanism must be considered. Overall, nail reuse seems advisable in bone elongation procedures where the size and design of the nail limits the extent of lengthening.

OC-007 | A prospective cohort study on attainment of personal goals in the first year of intrathecal baclofen treatment in dyskinetic cerebral palsy

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Introduction: The primary aim of this study is to assess the effect on attainment of individual treatment goals after nine to twelve months of intrathecal baclofen treatment in patients with dyskinetic cerebral palsy (CP).
Patients and Methods: A multi-center prospective cohort study was conducted in two University Medical Centers in the Netherlands (Amsterdam and Maastricht). Thirty-four patients, aged 4 to 24 years, diagnosed with severe dyskinetic CP, non-walking (Gross Motor Function Classification System IV/V) and receiving intrathecal baclofen treatment (ITB) for nine to twelve months, were included. The primary outcome was attainment of pre-set individual treatment goals, using Goal Attainment Scaling (GAS) at one year after pump implantation. Predictors of GAS results were analyzed.
Results: Seventy-one percent of patients (24 out 34) fully achieved one or more treatment goals at nine to twelve months of ITB treatment. Ninety-seven percent of patients partially achieved one or more treatment goals (e.g. improvement less than desired goal). Two factors were found to contribute to attainment of individual treatment goals: Dyskinesia Impairment Scale (DIS) total baseline score and the difference in pain score between baseline and follow-up. These variables explain 30% of the variance in the outcome.
Conclusion: ITB is effective in achieving individual treatment goals in children and young adults with severe dyskinetic CP after nine to twelve months of ITB treatment. A positive outcome on treatment goals is, for a small part, related to higher level of baseline dyskinesia, and on improvement of pain during treatment.

OC-008 | Postoperative radiological parameters of proximal femur in children with CP

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Introduction: Children with CP are at an increased risk of recurrent hip subluxation. Postoperative changes of the proximal femur are associated with neck-shaft angle (NSA) and angle of anteversion (AA). The purpose of this study is to assess the changes in NSA and AA postoperatively in children with CP in GMFCS IV.
Patients and Methods: We examined 46 children (92 hips) with CP and spastic hip dislocation. NSA and AA were assessed pre- and postoperatively. Children were divided into 2 groups: group 1–6-8 years old and group 2–9-11 years. All of them underwent bilateral surgery: 40 hips in group 1 and 52 in group 2. The main surgical technique was proximal femoral osteotomy.
Results: Preoperatively, NSA and AA were 156 ± 2.4° and 58 ± 2.4°, postoperatively - 106 ± 2.4° and 23 ± 2.4°, respectively in group 1. In 5 years NSA and AA were 146 ± 2.4° and 38 ± 2.4°. In group 2 preoperatively NSA and AA were 152 ± 1.4° and 54 ± 2.1°, postoperatively - 108 ± 2.4° and 21 ± 2.4°, respectively. In 5 years, they became 132 ± 2.4° and 28 ± 2.4°, in group 2. Five patients with recurrent hip subluxation (12.5%) in group 1 and three patients (5.7%) in group 2 required revision surgery in 3–5 years.
Conclusion: Postoperative revalgization and abnormal AA are more common in patients under 9 years. The risk of hip instability, pathological NSA, AA and revision surgery is increased.

OC-009 | Complications of intrathecal baclofen requiring surgery: a 20-year follow-up study in children

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Introduction: Intrathecal baclofen therapy (ITB) with an implanted pump can cause severe complications which require surgical intervention. Over the past years, several measures have been applied to decrease complication rate, including changes in surgical implantation techniques and catheter materials. This study assessed: (1) the type and rate of complications of ITB that require surgical intervention, (2) which risk factors influence the occurrence of these complications.
Patients and Methods: Retrospective study, in which all children (<18 years old) in one university medical center with pump implantation between 2001 and 2017 were included and followed. All complications requiring surgery were analyzed in depth. Risk factors for surgical intervention of complications were determined using multiple logistic regression analysis.
Results: In total, 88 complications of ITB therapy requiring surgery were found in 47 (36.2%) out of 130 children. These included catheter-related complications (55.7% of all complications), pump-infections (21.6%), cerebrospinal fluid leakage (14.8%), and pump-related complications (7.9%). The silicone catheter type, used until 2012, was found to be a significant risk factor for complications (Odds Ratio 3.75; 95% CI: 1.30–10.83). Since the introduction of the coated catheter type, in 2012, the rate of catheter-related complications decreased, from 0.15 to 0.10 complications per pump year.
Conclusion: Most complications were catheter-related. Since the introduction of a new, coated, catheter in 2012, complication rate decreased. With these results we can adequately inform children and their caregivers about the risk of possible complications of ITB.

OC-010 | Difference in intrathecal baclofen in children dosage between children with dyskinetic and spastic cerebral palsy

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Introduction: Literature suggests that dosing is different in children with dyskinetic and spastic cerebral palsy (CP). The aim of this study is to compare dosing of intrathecal baclofen (ITB) in children with CP with predominant dystonia and with predominant spasticity. Furthermore, this study aims to investigate dosing schedule over the day in these two groups.
Patients and method: Thirty children with dyskinetic CP (mean age 13y5m [SD 3y4m], 22 male) and 30 with spastic CP (mean age 12y9m [SD 2y6m], 19 males) using ITB, all GMFCS IV or V, were included. Information on total daily dosage, number and height of boluses dosages per day and reasons to start bolus dosing, was retrospectively extracted from medical charts at 0, 3, 6 and 12 months after ITB initiation.
Results: Total daily dosage of baclofen was significantly higher for the dyskinetic group compared to the spastic group ($p = 0.011$) (212.10 μg/day [SD 197.83] vs 138.30 μg/day [SD 69.98]). Significant differences between groups were found for total number of boluses per day (spastic group mean of 0.84 bolus per day [range 0–3]; dyskinetic group mean of 2.4 bolus per day [range 0–4]; $p = 0.000$) and height of daily bolus dosage (spastic group mean 36 μg; dyskinetic group mean 90 μg; $p = 0.004$). The reasons for starting bolus dosing were similar between groups and focused on caretaking, lack of effect and sleeping problems.
Conclusion: The total daily dosage of intrathecal baclofen and the dosing schedule are different for children with dyskinetic CP compared to children with spastic CP.

OC-011 | Does intrathecal baclofen therapy decrease the progression of hip dysplasia in young patients with cerebral palsy?

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Introduction: Children with Cerebral Palsy frequently have significant spasticity that may contribute to progressive hip dysplasia. Many patients at GMFCS Levels IV and V (at higher risk for hip dysplasia) are treated with intra-thecal baclofen pump (ITBP) to reduce spasticity. The purpose of this study is to evaluate the effects of ITBP therapy in young patients with CP on hip dysplasia.

Patients and Methods: All patients with CP GMFCS levels IV/V who underwent ITBP placement under the age of 8 years old with at least 5 years of follow-up were included. 34 patients were matched to a control group (1:2) based on GMFCS, Ashworth scores, medical comorbidities, and hip MP at the time of ITBP placement. The primary outcome was an assessment of hip dysplasia as measured by the migration percentage (MP) at latest follow up or at the time of hip reconstruction.

Results: The mean follow-up duration was 9.24 (2.8) years for the ITBP group and 9.20 (2.7) for the Control group. There was no statistically significant difference between groups at baseline. Ashworth scales were significantly reduced following ITBP therapy. The MP at last follow-up was not statistically different between groups (ITB: 36.2%, Non-ITB: 44.4%, p = 0.145).

Conclusion: This study demonstrates that the use of ITBP as an early treatment for spasticity did not alter the natural history of hip dysplasia in patients with CP at highest risk for hip disease. (GMFCS IV/V) This study reinforces the growing evidence that progressive musculoskeletal pathology in CP is multi-factorial.

Interventions in Bilateral Cerebral Palsy

OC-012 | Improvement of the integrity of upper and lower extremity fibers of the corticospinal tract in children with bilateral cerebral palsy following intensive therapy

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Introduction: Bilateral early brain injury disrupts the connectivity of the corticospinal tract (CST) producing motor impairments in upper and lower extremities, hence affecting manual dexterity and gross motor function. We aimed to assess changes in the integrity of upper and lower extremities CST fibers in children with bilateral cerebral palsy (BCP) following Hand-and-Arm-Bimanual-Intensive-Therapy-Including-Lower-Extremities (HABIT-ILE).

Patients and Methods: Diffusion tensor imaging (DTI) was performed before and after 13 days of HABIT-ILE (treatment group, n = 15) or twice (13 days apart) without intensive treatment (control group, n = 14). Task fMRI-guided tractography from motor cortex to brainstem was performed, separating the fibers associated to upper and lower extremities. Then, fractional anisotropy (FA), mean (MD), radial (RD), and axial (AD) diffusivities were quantified. Manual dexterity, gait endurance and everyday activities were assessed.

Results: The whole tract analysis showed, for the FA of the CST emerging from the less-affected and more-affected hemispheres (p = 0.032 and p = 0.015, respectively) an increase after therapy in the treatment group compared to controls, as well as a decrease of MD in the less-affected and more-affected CST (p = 0.021 and p = 0.010, respectively). The upper and lower extremities' fiber analysis revealed an increase of FA in the less-affected CST (p = 0.008 and p = 0.027, respectively) and more-affected CST after HABIT-ILE (p = 0.002 and p = 0.036, respectively). A decrease in MD was observed in the upper extremities' CST of the less-affected and more-affected hemispheres (both p <0.001).

Conclusion: For the first time we demonstrate improved integrity of CST fibers in children with BCP after an intensive motor-skill-based intervention.

OC-013 | A randomised controlled study to investigate effects of Bobath trunk control training on motor function of children with cerebral palsy

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Introduction: The aim of this study was to investigate the effects of trunk control on motor function, which plays an important role in the daily activities of children with cerebral palsy (CP) and is often observed as a deficiency in children with CP.

Patients and Methods: Forty children with spastic bilateral CP, aged between 3 to 10 years and with Gross Motor Function Classification System (GMFCS) levels I, II, and III were included in this study. Children were divided into two groups using randomization. In the training and control groups, 6 weeks physiotherapy programs were different and performed 45 minutes, twice a week for each group. Modified Ashworth Scale (MAS), Pediatric Berg Balance Scale (PBBS), Trunk Control Measurement Scale (TCMS), 1 Minute Walking Test (1MWT), Timed Up and Go Test (TUG) were applied to both groups before and after 6 weeks. Moreover, the trunk muscle strength of children was evaluated.

Results: After therapy, differences were found in results of MAS and PBBS, and trunk extensor strength between the training group and the control group in favor of training group ($p < 0.05$). In addition, after treatment, the training group's averages of TCMS, PBBS, 1MWT, YUG test and all trunk muscle strength were higher compared to the ones before treatment ($p < 0.05$).
Conclusion: This study shows that adding exercises that aim trunk to conventional physiotherapy and exercise programs of children with CP, affects motor function positively.

OC-014 | Effect of short-term predictable internal and external focused perturbation training in improving postural control in children with CP

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Introduction: Most of the studies comparing external and internal focus (EF and IF) while performing motor tasks during balance training have been done in healthy and post-stroke individuals. EF was shown to improve postural control in neurological deficits, results for different foci are inconsistent. No study was found that compared different foci training in cerebral palsy (CP). This study aimed to investigate the role of short-term predictable internal and external focused perturbation training (IFPT and EFPT) in improving postural control in CP.
Patients and Methods: Ten CP children (10.1 ± 3.21 year-old, GMFCS levels: I, n = 5; II, n = 5) participated in a single EFPT consisting of catching-throwing a medicine ball, and a single IFPT combining upper extremity movements in a tandem/feet together stance on consecutive days, randomly. They were asked to focus on the ball in EFPT and on body parts in IFPT. Both sessions lasted 20–25 minutes. Before and after the sessions, right/left single leg stance (SLS) and five times sit-to-stand (5TSS) test were applied.
Results: After the EFPT, there was an increase in right/left SLS and 5TSS tests ($p < 0.05$), after the IFPT there was an improvement in only the 5TSS test ($p < 0.05$) and no change in the duration of right/left SLS test ($p > 0.5$).
Conclusion: EFPT may have improved early activation of postural muscles and increased anticipatory postural adjustments (APAs) prior to the predictable external perturbation which could prepare for more advanced compensatory postural adjustments, and increased SLS for longer. APA-focused rehabilitation can be effective in improving postural control and functional balance.

OC-015 | Could HAND-ARM Bimanual Intensive Therapy Including Lower Extremities (HABIT-ILE) deteriorate or improve the range of motion of children with cerebral palsy?

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Introduction: Some concern exists about the potential range of movements (ROM) decrease on patients following intensive interventions due to the use of functional activities rather than mobilization and stretching. We explored the effects of HABIT-ILE on the ROM of upper and lower extremities of children with unilateral (UCP) and bilateral (BCP) cerebral palsy.
Patients and Methods: 49 children (25 UCP/24 BCP) were randomized to a control or HABIT-ILE group. Thereafter, children were assessed first 2 times within the same session and second 3 weeks later. In between, the treatment group received 90 hours of HABIT-ILE while the other continued its conventional treatment. Using a standard goniometer, passive (pROM) and active (aROM) ROM were measured on children's wrists, elbows, knees, and ankles.
Results: Test–retest reliability within session 1 was good (all $p < 0.001$). The two-way (2 groups × 2 assessment times) analysis of variance showed an improvement in ankle dorsiflexion aROM in the HABIT-ILE group on the more-affected joint of UCP ($p = 0.026$) and the less-affected joint of BCP ($p = 0.025$). aROM of wrist extension with finger extended improved in the HABIT-ILE group on the more-affected joint of UCP ($p = 0.010$). In the control group, pROM of wrist extension with finger flexed decreased after 3 weeks on the more-affected joint of BCP ($p = 0.002$). No significant changes were observed on the UCP's less-affected and BCP's more-affected joints on pROM nor aROM.
Conclusions: A 2-week intensive intervention is not deleterious but rather has some positive impact for children with CP regarding their ROMs.

OC-016 | Intensive therapy of the lower limbs and the trunk in children with bilateral spastic cerebral palsy: comparing two approaches

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Introduction: Research on the effects of physiotherapeutic interventions in children with cerebral palsy (CP) has grown

expansively, and shows a wide diversity of techniques and concepts that are used in variable intensity. There is evidence for the effect of intensive training of hand function in children with CP, including short bursts of highly intensive therapy. In contrast, studies on the effect of intensive therapy on gross motor function and trunk control are limited.
Patients and Methods: Thirty-six children with bilateral spastic CP (mean age 8 years 9 months) were randomized into a functional camp (12 participants) or a qualitative functional camp (24 participants). The camps lasted 10 days and children had 4.5 hours therapy per day. Main outcome measures were the Gross Motor Function Measurement (GMFM) and the Quality Function Measure (QFM). Secondary outcome measures were the Trunk Control Measurement scale (TCMS), the one-Minute Walking Test (1MWT) and modified-Timed Up and Go (mTUG) for gait capacity. Assessments were administered at baseline, pre- and post-intervention, and at 6 month follow-up.
Results: Results revealed significant time-by-approach interaction effects for all parameters of the QFM and dimension D and total CDE of the GMFM. Post hoc tests showed immediate gains after intervention in the qualitative functional approach. Those changes were retained after follow-up except for weightshift (QFM) and Total CDE (GMFM).
Conclusion: The qualitative functional approach shows promising results with improvements in movement quality and gross motor function.

Autism and Developmental Conditions

OC-017 | Construct validity of the Autism Classification System of Functioning for social communication across childhood and adolescence

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Introduction: Children with autism spectrum disorder (ASD) have challenges with social communication. Categorization based social communication abilities can inform clinical practice and research. The Autism Classification System of Functioning (ACSF) describes social communication 'Capacity' (best ability) and 'Performance' (everyday function) from Level I (most functional) to V (least functional). This study examined the construct validity of the ACSF.
Patients and Methods: Participants included 117 children with ASD (2–19 years) from Children's Treatment Centers in Canada. The construct validity of ACSF was examined by testing convergent and discriminant validity with subscales of the Social Responsiveness Scale 2nd edition and Behavior Assessment System for Children, 3rd Edition. We used correlation coefficient and eta-squared statistics to quantify construct validity.
Results: We found significant correlations between ACSF and the Social Communication and Interaction (Performance: $r = 0.41$, $p < 0.0001$; Capacity: $r = 0.41$, $p < 0.0001$), Functional Communication (Performance: $r = -0.36$, $p < 0.0001$; Capacity: $r = -0.44$, $p < 0.0001$), and Social Skills (Performance: $r = -0.29$, $p = 0.002$; Capacity: $r = -0.38$, $p < 0.0001$) T-scores. The effect size of these convergent associations ranged from moderate to large for ACSF Performance ($\eta^2 = 0.12–0.22$) and large for Capacity ($\eta^2 = 0.16–0.20$). Discriminant analyses showed weaker correlations between ACSF ratings and comparison measures of Externalizing Problems (Performance: $r = -0.02$, $p = 0.86$; Capacity: $r = 0.005$, $p = 0.96$) and Attention Problems (Performance: $r = -0.03$, $p = 0.73$; Capacity: $r = 0.07$, $p = 0.49$) T-scores. The effect size was small for both Performance and Capacity ($\eta^2 = 0.01–0.03$).
Conclusion: Overall, our findings demonstrate that ACSF can be used as a valid social communication classification system in children with autism 2–19 years of age and its two ratings of Performance and Capacity describe social communication abilities demonstrated within the demands of different contexts.

OC-018 | LILAC: a novel approach to diagnosis and intervention in autistic spectrum disorder

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Introduction: The prevalence of ASD in Ireland is 1.5%, new ASD referrals can wait up to 18 months for review by the Early Intervention Service and a further 18 months for a formal ASD assessment. In Galway City East, the EIS team combatted waiting times by establishing LILAC: an innovative new approach to the assessment, intervention and diagnosis.
Methods: LILAC represents Laughing, Interaction, Listening, Attention and Communication. Sessions comprise activity and strategy based interventions for children and coaching for their parents using evidence based interventions through a family centred approach. Parent education sessions are provided and children undergo a diagnostic process. LILAC runs over three months with sessions taking place weekly. The team incorporates a community nurse, occupational therapist, physiotherapist, psychologist, pre-school liaison teacher, social worker, and speech and language therapist, who liaise with two consultant paediatricians. At the end a diagnostic report is provided to parents, with intervention recommendations. It provides an integrated diagnostic and intervention process. The pilot recruited a cohort of eight children.
Results: Of the eight children and families who participated in the first LILAC, 7/8 received a diagnosis of ASD. Staff

perceptions were overwhelmingly positive. Team members extolled LILAC as a "very effective and efficient method of interdisciplinary service delivery". They lauded the individualized, family-centred approach to healthcare.
Conclusion: Further investigation of the benefits of LILAC is planned, including measurement of parental satisfaction. The programme aims to expand to regional Progressing Disability Services providing a family centred multidisciplinary approach to intervention and diagnosis of ASD.

OC-019 | Formal support: expectations and experience of parents raising children with severe or profound intellectual disabilities

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Background: Parents of children with severe and profound intellectual disabilities (SPID) experience an enormous burden of care, which affects family function and wellbeing. Formal support could contribute to family's function, particularly when there is a fit between their needs and the designated services. This study aimed to explore the perceived support of formal services among parents of children with SPID.
Methods: 60 parents of children (Mean ± SD = 8.81 ± 4.62) with SPID (DQ < 40) completed structured questionnaires and open-ended questions regarding formal support and social worker involvement and parental stress index.
Results: Parents rated the importance of disability related services as very high (4.40 ± .94, Range 1–5), yet their opportunities to obtain professional support and the attainment of services as below average (2.47 ± 1.22). Higher socioeconomic status, residency in urban regions and being a part of the dominant ethnicity predicted higher support from services which in turn predicted lower parental stress ($p < 0.01$). Regarding social work involvement, reported experiences were mixed with parents rating social worker involvement as above average (M = 3.41 ± 1.71), yet 37% of parents reported minimal or no involvement of a social worker, and descriptions of services provided ranged from being a valued supporter to a bureaucratic gatekeeper for required services.
Discussion: Findings suggest that disability related services may need to be strengthened and the continuity of therapeutic support should be kept over time, with the goal of better meeting expectations and needs of parents of children with SPID.

OC-020 | Developmental coordination disorder: New insights on underlying mechanisms

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Introduction: Experimental research on mechanisms of DCD continues to evolve at pace. We have the benefit of recent studies that use more integrative approaches, high fidelity neuroimaging tools, and combined behavioural and neural measures. The aim of this meta-analytic study was to synthesise the body of DCD research (child and adult) published since the last International Consensus panel in 2016, and to provide new insight on mechanisms.
Patients and Method: A Cochrane-style systematic review and meta-analysis was conducted on experimental studies of DCD (published after September 2016), covering (1) behavioural and (2) neuroimaging studies. A total of 100 studies with a DCD-Control comparison were included, 83 behavioural and 17 neuroimaging. The pattern of effect sizes (d) was interpreted through the lens of current theory in each performance domain.
Results: A total of 1,374 effect sizes (d) were entered into a multi-level meta-analysis. The most profound deficits were shown in: voluntary gaze control during movement; cognitive-motor integration; constrained motor learning; internal modelling; more variable movement kinematics/kinetics; larger safety margins when locomoting, and atypical neural structure and function across sensori-motor and prefrontal regions.
Conclusion: Taken together, the profile of deficits (highlighted by meta-analysis) reveals a fundamental disruption to visual-motor integration that impacts eye-hand coordination and locomotor navigation. As well, difficulties in cognitive control and its integration with motor planning also impact performance across tasks. These behavioural deficits are associated with atypicality in brain structures and function, particularly cerebellar and parietal networks. Implications for assessment and intervention are discussed.

Movement Analysis

OC-021 | Home-based measurements of upper extremity dystonia using a smartphone, wearable inertial sensors and machine learning

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Introduction: We developed an application (MODYS@home-app) allowing measurement of dystonia in children and adolescents with dyskinetic cerebral palsy (DCP) in their home environment - using wearable sensors (IMUs) and time-synchronized videos. We aimed to train an accurate model for automatic evaluation of the Dyskinesia Impairment Scale (DIS) from sensor data.

Patients and Methods: Six wheelchair-dependent participants with DCP (10–22 years) were included. Participants wore four IMUs around both wrists during seven days, 2–6 hours daily. In addition, parents recorded short videos several times a day using the MODYS@home-app. Upper extremity dystonia was assessed using the DIS by a trained assessor for video time windows of five seconds each. Discriminative movement features were extracted from IMUs and used to train six different types of machine learning algorithms towards the outcome of DIS-scores. Models were trained for each participant individually, with and without forward sequential feature selection and/or hyperparameter optimization. In addition, a generalizable model was trained using all six participants' data. Model performance was compared using classification accuracy of independent test datasets.

Results: Individually trained machine learning models were able to classify the DIS-scores with a mean 85.0% ± 8.0% (SD) accuracy. The accuracy of generalized model was 72.4%.

Conclusion: This work shows that prediction of upper extremity dystonia using home-measured sensor data and machine learning is accurate for individually trained models. More data is needed to determine whether prediction accuracy can be increased within a generalized model. MODYS@home has the potential to be clinically used for frequent monitoring of dystonia in the natural environment.

OC-022 | Automatic differentiation of dystonia and choreoathetosis using machine learning during functional upper limb tasks in the dyskinetic cerebral palsy population

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Introduction: Dystonia and choreoathetosis are dominant movement disorders in dyskinetic cerebral palsy (DCP). Discrimination and evaluation is difficult, impact on functional activities is large and better objective differentiation is needed. This study aimed to use objective 3D upper limb measurements to differentiate dystonia and choreoathetosis in an automated manner in children and youth with DCP.

Patients and Methods: Seventeen children diagnosed with DCP and MACS level I-III were included. Participants performed a reach forward, reach and grasp vertically and reach sideways task. The Dyskinesia Impairment Scale (DIS) scored presence of dystonia and choreoathetosis in the distal arm. Forearm accelerometer and gyroscope data were obtained by inertial measurement units and wrist kinematics by optical motion-capture. 144 time-and-frequency-domain features were calculated and fed to a support vector machine (SVM) multiclass (k = 4) classifier. SVM results were validated against the DIS classification scores using accuracy. Relevant characteristics for each movement disorder were found using a binary classification model.

Results: The multiclass-classifier with 23 features yielded 74.6% accuracy. For the dystonia model, 22 features resulted in 90.3% accuracy with discriminating parameters variance of angular velocity, standard deviation of jerk and minimal wrist flexion angles. The choreoathetosis model obtained 84.7% accuracy including 21 features with maximal velocity, smoothness, and minimum/maximum wrist deviation angles as discriminating parameters.

Conclusion: This study was the first to validate automated dystonia and choreoathetosis discrimination during upper limb tasks. The outcomes are promising, as objective differentiation may lead to better treatment management plans, thereby improving quality of life in patients with DCP.

OC-023 | Use of Actigraph assessment for measuring upper limb daily life activities in children with unilateral cerebral palsy

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Introduction: Recently, there has been a rapid increase in use of wearable technologies, paving the way on monitoring daily living activities (ADLs) to evaluate individuals' ability to lead an independent life. Generally, children with unilateral cerebral palsy (UCP) present an impaired upper limb (UpL) and asymmetric movement patterns, resulting in difficulties in performing bimanual ADLs tasks with a strong impact on their daily life. The daily life activities are commonly assessed by questionnaires, filled in by children and/or their parents. The use of wearable technologies can open new approaches for providing quantitative measurements of ADLs.

Patients and Methods: Thirty-four UCP children (AHA score = 74.4 ± 24.8, age = 11.1 ± 4.4, MACS I:9, II:21, III:4) and twenty-six age matched TD pairs wore Actigraph (wGT3X-BT) wrist-worn sensors on both UpLs during AHA test and then for a week (6 consecutive days). The asymmetry index (AI) detected during the clinical evaluation (AI-AHA) and the AI registered during the daily life (AI-week) have been compared with the AHA units by a linear regression analysis.

Results: Results indicate a significant correlation between the week AI-AHA and the AI-week with the AHA units (Adjusted R-squared = 0.80 and 0.97, respectively, $p < 0.001$).

Conclusion: The present study shows the high relationship between the clinical and the Actigraph data assessment, highlighting the strict correlation between the UpLs behaviours during the clinical assessment and during the ADLs. Further studies will open the possibility of the use of wearable sensors for deeply monitoring the UpLs behaviour in UCP children during the spontaneous and naturalistic context.

OC-024 | Relation between proximal and distal proprioception in the upper limb in unilateral cerebral palsy using robotics

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Although clinical assessments suggest that children with unilateral cerebral palsy (uCP) experience proprioceptive difficulties, little is known about the relationship between proximal and distal proprioception in the upper limb (UL). Our aim was to investigate this relationship using robotics. Eighteen children with uCP (age = 11y6m ± 2y9m, 10 males, 6 right-sided uCP) participated. Proximal proprioception was measured using the position matching task of the Kinarm Exoskeleton Robot. Distal proprioception was quantified with an active task, by moving their index finger to a position indicated on a tablet screen, and passive task, by specifying on a tablet screen the perceived location of their finger, using the ETH MIKE Robot. All tasks were performed without visual feedback. The relation between proximal and distal proprioception parameters was evaluated using Spearman's correlations (r_s). For the affected UL, no significant correlations were found between proximal and active/passive distal proprioception ($r_s = 0.11$-$[-0.34]$, $p > 0.17$). Nevertheless, for the less-affected UL, distal proprioception during the active task showed a strong negative correlation with proximal proprioception ($r_s = -0.80$, $p < 0.001$), indicating that a better proximal proprioception corresponds to better distal proprioception. No significant correlations were found between passive distal and proximal proprioception in the less-affected UL ($r_s = -0.23$–0.41, $p > 0.09$). Quantitative measures of proximal and distal proprioception of the affected UL seem to be relatively independent in children with uCP. Possibly, the brain lesion affects distal proprioception more than proximal proprioception. However, for the less-affected UL, proximal and active distal proprioception seem to be interrelated. Future studies also including typically developing children could confirm these results.

OC-025 | The use of DeepLabCut to detect and quantify mirror movements in children with unilateral cerebral palsy

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Background: Mirror Movements (MM) are clinically evaluated with the ordinal Woods and Teuber scale. Although reliable, it lacks the ability to quantify MM. Here, we developed a video-based detection and quantification of MM using the pose estimation software DeepLabCut.

Patients and Methods: We included three healthy participants (mean age = 14y; SD = 8.5y) and three children with unilateral CP (mean age = 10y; SD = 1y). We used DeepLabCut (an open-source toolbox for 2D markerless pose estimation based on transfer learning with deep neural networks) to track user-defined points of interest on the hands during a finger tapping task (sequentially lifting fingers from the table) to quantify the finger movements from an in-house developed hand model. We extracted the coordinates of selected key points tracked on the fingers and hand and normalized the data between hands. We used cross-correlation Methods: between hands to quantify MM. We implemented this model in a web version of a graphical user interface to be used by clinicians.

Results: In both healthy participants and the children with unilateral CP, the model could track the hand points with low errors (train-error 1.98 pixels; test-error 3.40 pixels) and provide quantification in form of correlation coefficients that can be related to Woods and Teuber scores. The graphical user interface is simple to use and warrants the data protection regulations.

Conclusion: This proof-of-concept algorithm detects and quantifies MM using low-cost 2D video analysis. After validation in different manual ability levels of children with unilateral CP, this method can be easily used in the clinics and research.

OC-026 | Quantitative assessment of trunk movements in functional reaching in children and adolescents with dyskinetic cerebral palsy

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Introduction: Trunk control and upper limb function are often impaired in people with dyskinetic cerebral palsy (DCP), due to presence of dystonia and choreoathetosis. While trunk control is fundamental in functional activities, no research specifically focused on trunk control in DCP. This study aimed to determine which movement characteristics of the trunk differ between participants with DCP and their typically developing (TD) peers during functional reaching tasks.

Patients and Methods: Twenty children with DCP (MACS level I-III [16y6m, STD 5y]) and 20 TD peers (17y2m, STD 4y) were included. Participants performed three tasks: reach forward, reach sideways, and reach and grasp. Movement analyses were executed using 3D Motion Capture and an Inertial Measurement Unit on the trunk. Trunk range of motion (ROM), joint angle at point of task achievement (JAPTA), and peak and range of angular velocity (AV) and linear acceleration (ACC) were obtained and compared between groups using the Mann–Whitney U test.

Results: Children with DCP showed a significantly higher trunk ROM in all planes during reach forward and reach and grasp, and in rotation and lateral flexion during reach sideways, compared with TD. During reach and grasp, JAPTA differed significantly in the rotational plane. Ranges of AV and ACC were higher for all tasks and planes for participants with DCP, as well as for peak values in nearly all planes.

Conclusion: Compared to TD children, children with DCP showed clearly altered trunk movements during functional reaching. Current results provide research insights towards delineated treatment management for trunk control.

Orthopaedics 2

OC-027 | Upper limb passive range of movement over time in children with cerebral palsy, treated or not treated with Botulinum neurotoxin-A - a population-based study

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Introduction: The aim of the study was to investigate passive Range of Motion (pROM) development in children with cerebral palsy, treated or not treated with UL BtA. Furthermore, factors related to pROM deterioration over time was investigated.

Patients and Methods: CPUP registry data for children with spastic and dyskinetic CP, age 1–15 years (317 males, 179 females; mean age 7 year 4 months, [SD 4.1]) between years 2000 and 2017, living in five regions in Sweden were included. Passive ROM was investigated using traffic light categories for three groups of children; not treated with BtA, first time treated 1–3 years or at 4–15 years of age in five UL movements. Linear regression and Mixed model were used.

Results: Almost all children had green values at the first assessment at age 1–15 years. Twenty-two percent of the children received UL BtA. Children never treated with BtA and children receiving their first BtA at 1–3 years of age, kept their pROM measurements within normal range. Children receiving their first BtA at 4–15 years of age developed restricted UL pROM over time compared to children not treated p <0.01 and children first treated at 1–3 years of age p <0.02. The more severe MACS level, the more severe pROM range category at first measurement occasion and a first BtA treatment occasion at 4–15 years of age, the higher the pROM deterioration over time.

Conclusion: Children treated with UL BtA at early age seem to benefit the most from BtA treatment over a time.

OC-028 | Percutaneous lengthening with intramuscular needle of the gastrocsoleus complex improves critical ankle kinematic parameters in resistant equinus: A pilot study

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Introduction: To evaluate the kinematic and kinetic results obtained after percutaneous lengthening with intramuscular needle (PLIN) of the gastrocsoleus complex (GSC) performed outside the operating room, in pediatric patients with equinus gait resistant to non-operative treatment.
Patients and Methods: Retrospective analytical observational study including pediatric patients treated with PLIN of the GSC zones I-II-III while under sedation, on an ambulatory basis, between 2018–2019. Kinematic and kinetic gait analysis was performed prior to treatment and 6 months after in 24 ankles (15 patients), with a median age of 10.11 (2.85) years. Six patients had a diagnosis of idiopathic equinus, 6 spastic hemiplegia, and 3 spastic diplegia. Statistical analyses included pre-post comparison, correlation, and linear regression of critical kinematic and kinetic ankle values.
Results: Significant improvement was observed for the following parameters: ankle angle at initial contact −4.57(10.31)/0.05(3.04)°; maximum ankle dorsiflexion in stance phase (mADFStP) 3.70(7.56)/10.42(4.52)°; and maximum ankle dorsiflexion in swing phase (mADFSwP) -6.54(8.41)/−0.35(6.17)°. In addition, an inversely proportional correlation with the previous values was obtained for these parameters, with rho values of −0.864, −0.755 and − 0.696, respectively. No significant changes in ankle kinetics were evidenced. Linear regression equations allowed estimation of the post-mADFStP with a standard error (SE) = 1.82; $R2 = 0.797$ ($p < 0.0005$), and the post-mADFSwP with SE = 2.376; $R2 = 0.829$ ($p < 0.0005$).
Conclusions: The addition of PLIN of the GSC in patients with resistant equinus significantly improves ankle initial contact, mADFStP, and mADFSwP, with greater changes occurring as the initial values are worse. The regression formulas used to estimate post-procedure results will allow therapeutic indications to be adjusted.

OC-029 | Reliability of assessing proximal femur geometry with Rutz classification schema in patients with cerebral palsy

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Introduction: The purpose of our investigation is to assess the reliability of the femoral head shape classification system devised by Rutz et al. and observe its application in patients with cerebral palsy at different skeletal maturity levels.
Patients and Methods: Four independent observers assessed hip anteroposterior (AP) x-rays of 60 patients who were observed as a result of spastic hip disease due to cerebral palsy, with femoral head shape radiological grading system as described by Rutz et al. All x-rays were gathered from patients with GMFCS IV-V. Twenty x-rays were obtained from patients under eight years of age, between 8 and 12 years old and above 12 years old, respectively. To determine the intraobserver reproducibility, x-rays will be reassessed after a four-week interval. Accuracy was checked by comparing our estimates with the assessment of expert consensus. Validity was checked indirectly by observing relationship between the Rutz grade and the MP.
Results: The evaluation of the femoral head shape classification system described by Rutz and colleagues showed moderate to substantial intra-observer reliability and moderate inter-observer reliability and appeared to be a clinically relevant method in patients with cerebral palsy ($p < 0.05$). The right hip joint evaluation had higher intraobserver reliability when compared to the left. Specialist assessors had slightly higher intraobserver reliability than resident assessors.
Conclusion: Rutz's classification was shown to be valid and reliable, and it can be applied in further studies, especially those involving research on growing hips joints in CP patients.

OC-030 | Talus and calcaneus morphologies and its determinants in children with unilateral cerebral palsy and equinus gait

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Objective: to compare the volumes of talus and calcaneus bones of children with unilateral cerebral palsy and equinus gait to typically developing children. To define predictive factors for variations in the volume of ankle short bones
Materials and method: MRI data were used to provide the ankle short bone morphology of children with cerebral palsy and fixed equinus and typically developing children. Manual segmentation of the entire talus and calcaneus was performed to compute mean statistical shape models of the talus and calcaneus for each group. Strength, spasticity, and amplitude of dorsiflexion were measured for children in both groups and were used for regression analysis
Results: Eleven children with unilateral cerebral palsy (CP) and fixed equinus (Equinus, $n = 11$) and ten typically developing children (control, $n = 10$) were included in this study. The volume of talus (–23%, $p = 0.036$) and calcaneus (–25%, $p = 0.051$) were lower in children with CP and fixed equinus compared to controls. Regression analysis including group (Equinus or control), age, overall spasticity index, overall strength index, and ankle dorsiflexion amplitude as factors explained 64 and 67% of the variation in the talus and calcaneus volume, respectively
Conclusion: this study demonstrates a decrease of the talus and calcaneus volumes in children with unilateral cerebral palsy and with equinus gait. These results are crucial to adjust individualized rehabilitation and surgical programs in order to stimulate children's short bone development with fixed equinus

OC-031 | Long-term outcomes of talonavicular arthrodesis for the treatment of planovalgus foot in children with cerebral palsy

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Introduction: Planovalgus foot (PVF) in cerebral palsy (CP) tends toward progression and rigidity in adolescence, especially in patients with greater functional impairment. This study aims to assess patient or caregiver functional satisfaction and radiographic outcomes of talonavicular arthrodesis (TNA) for PVF in CP patients with assisted ambulation in the long-term.

Patients and Methods: Retrospective comparative study of level-III and level-IV pediatric CP patients who underwent TNA for PVF between 1999–2010 as part of multilevel surgery and with a minimum 10-year follow-up. Radiological correction at 10 years was compared with pre-intervention values, and functional impact at 10 years was measured by the Foot Function Index (FFI); correlation between radiological measurements and FFI were obtained, and complications were recorded.

Results: Forty-nine PVFs in 25 patients with CP (72% level-III and 28% level-IV) were included. The patients had a median age of 12 years at the time of surgery (range 11–15) and 23 years at the time of the study (21–26). Significant ($p < 0.01$) pre-post radiological improvements were obtained in different parameters. At 10 years postoperatively, FFI outcomes were satisfactory (33.9 ± 15.2%) and the mean maximum pain was 3.04. All patients were able to wear an ankle-foot orthosis and 8 no longer needed it. There were 8% cases of screw protrusion and 14% presented pseudarthrosis, most of them asymptomatic.

Conclusions: The adequate functional outcome, as well as the long-term radiological correction and acceptable number of complications, enables us to recommend TNA as an alternative treatment to consider in level-III and -IV CP patients with PVF.

OC-032 | Association of Seudo-Galezzi sign with asymmetric flexor contracture in spastic hip and pelvic obliquity: Management with botulinum toxin on the iliopsoas of the ascended side

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Introduction: In spastic hip, the seudo-Galeazzi sign has been related to ipsilateral adductor or contralateral abductor contracture. We hypothesize that the more affected side has a greater hip flexor contracture leading to a pelvic elevation with lower knee height during the Galeazzi maneuver. Addressing muscle imbalance, the proposed treatment corrects pelvic obliquity (PO) and the seudo-Galeazzi sign, showing the relationship between hip flexors contracture and this clinical test in spastic patients.

Patients and Methods: Prospective study of 30 patients with PO (14 males/16 females) with a mean age of 9.2 (3–17) years, different GMFCS functional levels (3 level-V, 12 level-IV, 4 level-III, 6 level-II and 5 level-I), a Reimer migration index <70% and a mean follow-up of 9 months. The association of PO with seudo-Galeazzi, hip flexion and asymmetry in hip abduction (confirmed by 2 observers) along with the clinical and radiological changes 6 weeks after injection of echo-guided injection of botulinum toxin A on the iliopsoas of the ascended side were evaluated.

Results: In 95% of the times a seudo-Galeazzi was observed as well as hip abduction asymmetry ($p = 0.02$). Clinical seudo-Galeazzi improved in 93% ($p = 0.017$) of the patients. Post-treatment radiological PO decreased by 6.03° (11.37°/5.33°; $p < 0.01$) and there was an increase in clinical hip abduction on the treated side 18° (37.3°/55.33°; $p < 0.01$).

Conclusion: Seudo-Galeazzi sign, due to the asymmetry in the hip flexor involvement, conditions the presence of both PO and decreased hip abduction of the ascended side. The weakening of the predominant iliopsoas decreases PO, improving hip abduction on the ascended side.

Working with Families

OC-033 | Mothers' perspectives on the participation of their child with developmental disabilities

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Background: Young children with developmental disabilities (DD) are at risk for decreased participation. Parenting, usually a rewarding, meaningful, and desired life role, can also present significant challenges for parents of children with DD. Mothers spend a significant amount of time finding, accessing, and retaining services; coordinating services between sectors; advocating for their children; and driving their children to appointments. Involvement with professional supports and services can help mothers to enable their child's participation as parenting stress negatively influences parenting behavior, which in turn has been shown to impact children's development.
Objective: As mothers carry a heavy load in the provision of childcare, the goal of this study was to understand mothers' perceptions of their child's participation. This knowledge is fundamental for designing better strategies to improve the participation of young children with DD.
Method: A thematic inductive approach with in-depth semi-structured interviews was conducted. Eleven mothers, 30–40 years old with a child 4–9 years of age diagnosed with DD, were included.
Results: Concerning the child's participation, we revealed that according to mothers, there are different perspectives amongst mothers and children, mothers and fathers, and mothers and professionals. This information indicates the urge to gather data regarding children's participation from different perspectives. Mothers have the experience that their children are more positive towards their participation. Mothers want clinicians to view their children less from a deficit perspective. Mothers are more worried than fathers and feel that fathers have less understanding of their child's capacity to participate.

OC-034 | Participation of young children with developmental disabilities: Parental needs and strategies, a qualitative thematic analysis

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Objectives: Participation refers to a person's involvement in activities and roles that provide interaction with others as well as engagement in family and community activities. Young children with developmental disabilities (DD) such as attention deficit hyperactive disorder, autism spectrum disorder and developmental coordination disorder are limited in their participation compared with their typically developing peers. This study aimed to obtain information regarding parental needs and strategies used to enable their child's participation.
Design: A thematic inductive approach with in-depth interviews was used to explore parental experiences. Eleven women and two men, between 30 and 40 years of age, who had a child (4–9 years old) with a DD diagnosis based on Diagnostic and Statistical Manual of Mental Disorders criteria, participated in semistructured interviews.
Results: Two central themes emerged: parental needs and parental strategies used to enable their child's participation. Parental needs were the following: increasing awareness, ameliorating parental burden, providing tailored interventions and supporting parents in finding suitable leisure activities. Parental strategies aimed at increasing their child's resiliency, attaining maximal fit between activity requirements and child capacity, and creating inclusive opportunities and awareness.
Conclusions: Understanding what families' needs are and how families use and integrate strategies within the context of their daily lives provides practitioners with insights needed to support families' resiliency in promoting their children's participation. The results have implications for professionals as this information can be used to inform, refine, or tailor participation-based and family-centred services.

OC-035 | Sharing observations: Parent-therapist engagement and learning cycles in early intervention physical therapy for infants with cerebral palsy

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Background: Effective parental engagement and learning is considered integral to early intervention occupational and physiotherapy (EI) delivery for infants with cerebral palsy (CP). The aim of this presentation is to draw attention to the joint therapist-parent practice of sharing observations regarding the infant to promote constructive learning cycles.
Methods: Grounded Theory and video case study (multimodal communication) methodology was used. Participants included 18 parents of infants <24 months and three EI therapists, who were involved in 30 interviews. Additional in-session video case study data (~15 hours) of three parent-therapist pairs was collected and analysed.
Results: A common theme detected in video data and interviews was the importance of parents and therapists sharing observations about the child. Sharing observations has multiple functions and how observations are shared and by whom is pertinent. One purpose is for creating learning opportunities, where a therapist or parent draws attention to an important aspect of the infant's sensorimotor behaviour. This elicitation triggers a learning cycle, which is completed

by sharing reflections and feedback to reinforce an important learning principle (summarised as observation-reflection-feedback cycle; ORF). Parents reflected upon how helpful they find this intentional learning approach and how they can be frustrated when observations are shared but not fully explained. The ORF cycle aligns with education theory of 'triadic dialogue', where the goal is to reach a shared understanding within the learning context.

Conclusion: These findings provide helpful focused understanding of effective learning strategies within the context of therapy sessions for EI therapists.

OC-036 | Improving hospital to home transition for children with medical complexity and their families by understanding parental needs: a meta-aggregation of qualitative studies

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Introduction: Families of children with medical complexity (CMC) have particular needs that extend well beyond the hospital grounds. The gap between a protective hospital environment and home is large, making the hospital-to-home transition challenging. Understanding these needs will help us create more personalized interventions to improve this process of transition in the future. The aim of this review is to systematically identify, appraise and synthesise all existing qualitative evidence regarding the needs and experiences of parents of CMC during transition from hospital towards home.

Methods: An extensive search in Medline, PsychINFO and CINAHL yielded 1515 papers of which 22 proved eligible for final inclusion. All articles were assessed for methodological quality. Data was extracted and pooled. We performed a meta-aggregation method to aggregate our study findings into categories and formulate overarching synthesised findings, which were rated according to their level of credibility, following the CONQual approach.

Results: Meta-aggregation resulted into three synthesised findings. Empowerment, Engagement and Enablement. A total of (346) study findings were extracted from the included 22 articles and were subsequently aggregated into 46 subcategories and 10 main categories. These categories are care coordination, practical preparation for discharge, resources and support system, training, communication, emotional preparation, uncertainty and anxiety, parent-professional relationship, changing perspective and taking responsibility.

Conclusion: CMC families face various and particular transition needs and obstacles Certain overarching themes arise. Identifying them is the first step to creating interventions that are personalized and flexible and stimulate interdisciplinary collaboration to ensure a safe and sustainable transition home.

OC-037 | This is My Baby Interview: An adaptation to the Spanish language and culture

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Introduction: Evaluating the emotional state of the parents is important for determining the intervention in the context of a family with a baby with Down syndrome. "This Is My Baby" is an interview that measures the acceptance, commitment and awareness of influence of parents towards their baby. The Spanish adaptation of this instrument helps to better understand the emotional state of parents of children with developmental disorders.

Patients and Methods: This is a transcultural adaptation and determination of the reliability, sensitivity to change, and internal consistency of the "This Is My Baby" interview. A cross-cultural adaptation and reliability analysis was carried out. A total of 32 families of babies with Down syndrome participated in this multicenter study.

Results: The values obtained for the intraclass correlation coefficient (ICC) indicated a good level of concordance with a significative level of $p < 0.001$, and the values of the standard error of measurement (SEM) and of the minimum detectable change (MDC) were reduced. The weighted Kappa coefficient showed values that were moderate to excellent.

Conclusion: The results suggest that the Spanish version of the This Is My Baby interview is a reliable instrument to measure the levels of acceptance, commitment, and awareness of influence of parents of an infant with Down syndrome.

Low Income Settings

OC-038 | Children with cerebral palsy among Syrian refugees in Turkey: Preliminary report

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Introduction: After the war in Syria, nearly 4 million Syrian refugees immigrated to Turkey. The exact number of Syrian children with cerebral palsy (SCP) in Turkey is unknown. The aim of this study was to investigate the etiological-factors, demographic-characteristics, participation-levels, quality-of-life (QoL) parental-stress; to compare with Turkish children with CP (TCP).

Patients and method: The study was conducted in Hatay province where the third largest refugee population lives. Sixteen SCP (mean-age:7.16 ± 4.16 years, 50% girls) and 16 age and Gross-Motor-Function-Classification-System (GMFCS) levels matched TCP were included (7.09 ± 3.42 years, 55% boys), birth characteristics, CP-type; GMFCS, Manual-Ability-Classification-System (MACS), Eating-Drinking-Abilities-Classification-System (EDACS), Communication-Functions-Classification-System (CFCS), Viking-Speech-Scale levels; and comorbidities were recorded. Participation was evaluated with Child-and-Adolescent-Scale-of-Participation (CASP), QoL with CPQOL, and parental stress with Parental-Stress-Scale (PSS). Mann–Whitney-U-Test was used to compare SCP and TCP. Ethical approval gathered (12.11.2020-13-27).

Results: In SCP, 25% were born at home, 83% at term, 91% were 2800 grams or more at birth, 66% were born with emergency cesarean section, 83% had birth complication, total maternal delivery was 2–8, maternal age: between 18–38 years, 12% used any orthotics, 38% used any assistive device. The main comorbidities: epilepsy (33%), vision problem (25%). The main clinical type: spastic (83%). Majority of functional levels: GMFCS III-V:58%; MACS III-V:75%; EDACS I-II:66%; CFCS III-V:66%; VSS III-V:66%. Lowest score of CASP was community participation domain, total CASP, CPQOL were significantly lower in SCP than TCP; controversy PSS was higher ($p < 0.05$).

Conclusion: These preliminary report shows that SCP have lower participation levels and QoL, and their parents have higher stress levels. Further research is needed with larger populations.

OC-039 | Disability and poverty: A population-based case control study to define these two related conditions in Bangladesh

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Introduction: Data on the social determinants of health provide valuable insights into the relationship between disability and poverty and are crucial for evidence-based intervention towards health equity in low-resource settings. We aimed to explore the relationship between disability and poverty among children in rural Bangladesh.

Participants and Methods: A population-based case–control study was conducted in Shahjadpur, Bangladesh. Children aged <18 years with disability (i.e., case), and their age-sex matched peers without disability (i.e., control) were recruited from their communities using key informant's method. Data on socio-demographic characteristics, type of impairments (for cases), school attendance, and health care utilization were collected. A validated poverty scorecard was used to assess the poverty likelihood and socio-economic status (SES) of the households of participating children.

Results: Between October 2017 and February 2018, 1274 cases and 1303 controls were recruited, mean (SD) age at assessment: 9.6 (4.7) years and 9.0 (4.2) years; female: 53.3%, 43.3% respectively. Poverty likelihood was significantly higher ($p < 0.001$) and the SES level was significantly lower ($p = 0.001$) among children with disability than their peers without disability. Formal health care seeking practices and accessing rehabilitation services were significantly lower among cases with low SES than others in the cohort ($p < 0.001$, $p = 0.03$ respectively). School attendance was significantly lower among cases than control, and was considerably lower among children from low SES when compared with others within the case group.

Conclusion: Our findings can inform intervention programs targeting the most vulnerable groups identified through this work to reduce inequities, ensure better outcomes, and break the cycle of disability and poverty.

OC-040 | Supporting ultra-poor children with cerebral palsy and their families with integrated microfinance/livelihood and community-based rehabilitation program - a cluster randomized controlled trial

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Introduction: This trial aimed to test the efficacy of an "integrated microfinance/livelihood and community-based rehabilitation (CBR)" (IMCBR) program in improving health-related quality of life (HRQoL) and motor function of children with cerebral palsy (CP) from ultra-poor families and social capital gain to those families from such intervention in rural Bangladesh.

Patients and Methods: This was an open-label cluster randomized controlled trial among children with CP aged ≤5 years randomly allocated in three arms; Arm-A: livelihood support and CBR (IMCBR), Arm-B: CBR only and Arm-C: care-as-usual. The CBR was stopped 2.5 months post-enrollment due to the COVID-19 pandemic and was replaced with phone follow-up followed by home-based CBR. The primary outcome was HRQoL of children while Gross Motor Function Classification System (GMFCS) level of children and social capital of their families were the secondary outcomes. Intention-to-treat analysis was performed.

Results: Twenty-four clusters including 251 children-primary caregivers' dyads were assigned to three arms; Arm-A = 80, Arm-B = 82 and Arm-C = 89. Between baseline and endline, the percentage change in mean HRQoL was highest in Arm-A (30.0%) with significant mean differences between Arm-A and Arm-B ($p = 0.015$). The GMFCS level significantly changed both in Arm-A ($p = 0.007$) and Arm-C ($p = 0.011$). Also, the improvement in mean total social capital score was significantly higher in Arm-A compared to Arm-B ($p < 0.001$) and Arm-C ($p < 0.001$).
Conclusion: The findings suggest that IMCBR could improve HRQoL and motor functions of children with CP and social capital of their ultra-poor families. Long-term follow-up of the trial participants and/or future exploration of such interventions are essential.

OC-041 | Access to education among children with cerebral palsy in low-and middle-income countries: findings from the Global LMIC CP Register

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Introduction: Little is known about the educational status of children with cerebral palsy (CP) in low-and middle-income countries (LMICs). We assessed access to education among children with CP in LMICs utilising the Global LMIC CP Register (GLM-CPR).
Patients and Methods: The GLM-CPR is a multi-centre register of children with CP aged <18 years in LMICs. Currently, data from CP registers in Bangladesh, Indonesia, Nepal, and Ghana are contributed to the GLM-CPR following a harmonized protocol. Data are collected on agreed core variables. Descriptive statistics were computed.
Results: Between January-2015 and December-2019, 1980 school-aged children (≥6 years) with CP were registered (Bangladesh, n = 1582, Nepal, n = 143, Indonesia, n = 91, Ghana, n = 164) of which only 26.7% were attending school (22.3% in Bangladesh, 41.5% in Nepal, 9.9% in Indonesia and 29.9% in Ghana). Of the school attendees, the majority (59.1%) were enrolled in the primary level of mainstream school while 30.4% were accessing special school. In this cohort, 56.5% of children at Gross Motor Function Classification System (GMFCS) level I-II had access to education. Frequently reported barriers to education were poverty (36.8%), motor or speech impairment (35.1%) and disability not accepted by schools (25.6%).
Conclusion: The majority of children with CP in this LMIC cohort were not going to school, most importantly those even with mild motor impairments (e.g. GMFCS level I-II). Moreover, access to special education was very poor. A need-based assessment of educational support for children with CP in LMICs and addressing the barriers to increase participation in mainstream and special schools should be a public health priority.

OC-042 | Social capital of primary caregivers of children with and without disability in rural Bangladesh: findings from a population-based case–control study

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Introduction: Social capital refers to networks of relationships among people in a society. Lower social capital could result in social exclusion with negative impact on quality-of-life of people with disability and their families. We aimed to assess the social capital of primary caregivers of children with and without disability in rural Bangladesh.
Patients and Methods: We conducted a population-based case–control study among caregivers of children with disability (i.e. cases) and their age-sex matched peers without disability (i.e. control) in Shahjadpur sub-district, Bangladesh. Social capital of the caregivers were assessed using validated "Short version of the Adapted Social Capital Assessment Tool (SASCAT)". The total and domain specific (group membership, social support, collective action, trust and social cohesion) SASCAT scores were calculated, higher score indicating better social capital status.
Results: Between Oct-17 and Feb-18, 1274 cases and 1303 controls were recruited. The total SASCAT score was significantly lower among caregivers of children with disability than controls (mean [SD]:6.74 [1.95] vs. 7.1 [1.87]; $p < 0.001$). Caregivers of children with disability had significantly lower scores for group membership ($p = 0.021$), social support ($p < 0.001$), collective action ($p = 0.08$), trust ($p = 0.004$) than controls. The scores for group membership and trust domain were significantly lower among caregivers of children with CP than children with other forms of disability (e.g. blindness, hearing impairment, epilepsy; $p = 0.04$, $p < 0.001$ respectively) in the cohort.
Conclusion: The primary caregivers of children with disability have significantly lower social capital compared to their peers without disability in rural Bangladesh. This reflects poor social participation and networking of children with disability and their caregivers with the wider community.

OC-043 | Efficacy of the Hand-Arm Bimanual Intensive Therapy Including Lower Extremities (HABIT-ILE) in young children with bilateral cerebral palsy in a low-income country: a randomized trial

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Introduction: Bilateral cerebral palsy (BCP) is highly prevalent in clinical settings in Sub-Saharan Africa, while there is a paucity of research for adequate rehabilitation interventions. This study investigated the efficacy of Hand-Arm Bimanual Intensive Therapy Including Lower Extremities (HABIT-ILE) as a motor skill learning, evidence-based approach in children with BCP compared to conventional therapy at the same dosage, in Benin, West Africa.
Patients and Methods: Thirty-two children with BCP (2–4 years, Gross Motor Function Classification System III-IV, Manual Ability Classification System I-III, Communication Function Classification System I-IV) were randomly allocated to a two-week (50 hours) camp model of either HABIT-ILE or intensive conventional therapy group. Children were assessed before, after intervention and at two-month follow-up, with the Gross Motor Function Measure (GMFM-66) which was blindly scored, and the Canadian Occupational Performance Measure (COPM). A two (group) × three (testing session) factors repeated analysis of variance was used to investigate interventions effects.
Results: A group × testing-session interaction effect ($p = 0.002$) indicated significant improvements in the HABIT-ILE group sustained at follow-up for the GMFM-66. The conventional group remained unchanged after intervention with a slight improvement at follow-up ($p < 0.05$). Both groups improved for the COPM (goals performance and caregivers' satisfaction), after therapy and at follow-up, with larger improvements in the HABIT-ILE group (interaction effect $p < 0.05$).
Conclusion: HABIT-ILE seems more efficacious in improving motor and functional outcomes in children with BCP in Sub-Saharan Africa highlighting the need to promote evidence-based rehabilitation approaches in these settings.

CP Musculoskeletal Disorders

OC-044 | Ataxic cerebral palsy in Europe: prevalence, clinical profile and origin

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Introduction: Ataxic cerebral palsy (CP) is the least common CP subtype. Therefore, large numbers are needed to explore its specific characteristics. Prevalence over time has not been specifically investigated.
Patients and Methods: We report on children with ataxic CP in the Central database of JRC-SCPE (Joint Research Center-Surveillance of Cerebral Palsy in Europe) born 1980–2010. Prevalence by birth year, associated impairments, birth characteristics, neuroimaging patterns and the presence of syndromes, defined according to validated SCPE guidelines, were analyzed.
Results: In total, 679 children with ataxic CP were identified in 20 European registers, accounting for 4.5% of all children with CP. The proportion of ataxic CP varied from 0% to 13%. Prevalence in time showed a slight decrease. 70% of children with ataxic CP were able to walk, but 40% had severe intellectual impairment and a high impairment index. Children with ataxic CP were in 79% term born and in 77% of normal birth weight. Neuroimaging patterns were in more than 80% non-lesional: 28.5% maldevelopments, 23.5% miscellaneous findings and 27.3% normal imaging.
Conclusions: Even with strict criteria, diagnosis of ataxic CP remains a challenge and there is variation between registers on how to deal with this subtype. Ataxic cerebral palsy differs from other CP subtypes: ataxic CP occurs mostly in term-born children and the origin is rarely lesional. After neuroimaging a comprehensive genetic work-up, which is increasingly discussed for investigating the Background: in CP, is particularly recommended in this CP type.

OC-045 | Acute effects of passive and active stretching exercises on muscle oxygenation in pediatric patients with spastic cerebral palsy

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Introduction: In this study we aimed to evaluate the acute effects of passive and active stretching exercises on the

muscle oxygenation level in medial gastrocinemius in pediatric patients with cerebral palsy (CP).

Patients and Methods: Nine children (4–17 years) with bilateral spastic CP were included in the study. Passive and active stretches were applied to each child at different sessions. For the passive stretch, children lay supine on a foam mat and a physiotherapist stretched the gastrocinemius for 20 sec and rest 60 sec (5 repetitions); for the active (self) stretch, children stood facing the wall and stretched their gastrocinemius for 20 sec and rest 60 sec (5 repetitions). Portable near-infrared spectroscopy was used for monitoring muscle oxygen saturation (SmO_{2live} and $SmO_{2average}$) and total hemoglobin (THB). Evaluations were performed before stretching, during stretching and after stretching.

Results: There were no significant differences between baseline parameters before active and passive stretching ($p > 0.05$). SmO_{2live} and $SmO_{2average}$ parameters during the passive stretching exercise were significantly higher than active stretching ($p = 0.008$, $p = 0.011$). There was a statistically significant increase in THB parameter in active stretching compared to passive stretching ($p = 0.028$). There were no significant difference between recovery parameters after active and passive stretching ($p > 0.05$).

Conclusion: The increase in THB during active stretching may be related to the increase in circulation of the muscle, and the decrease in SMO_2 may be related to the higher oxygen consumption in gastrocinemius compared to passive stretching. Although the clinical benefit of active and passive stretching is discussed, our study results suggest that active stretching may provide more benefits to spastic muscle metabolism.

OC-046 | Children with cerebral palsy show less intramuscular coherence than typically developing children in the first year of life: Sign of impaired corticospinal drive?

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Introduction: Absent fidgety movements (FM) in 3–5 months old children is highly predictive of Cerebral Palsy (CP). Ritterband-Rosenbaum et al. (2017) provided evidence that FM may be associated to oscillatory coupling between cortex and muscle (corticomuscular coherence) and within muscles (intramuscular coherence) in the 10–40 Hz frequency range. In the present study we investigate whether intramuscular coherence is decreased compared to typically developing (TD) children during the period of FM in children with CP.

Patients and Methods: All children in the study were 0–12 months old. 93 data sets from TD children and 19 data sets from CP children were analysed. Electrodes were placed on proximal and distal parts of the Tibialis anterior muscle to calculate intramuscular coherence. Data from the right leg were used unless there was a clear indication that left leg was more affected in the CP children. Data sets were divided into age ranges: 0–6 months (55 datasets of TD children; 10 data sets from CP children) and 7–12 months (38 data sets of TD children; 9 data sets from CP children).

Results: Intramuscular coherence was lower in children with CP than in TD children for the age range 0–6 months ($p = 0.05$), but not for the older children ($p = 0.56$).

Conclusion: The reduction of intramuscular coherence in children with CP as compared to TD children in the period where FM are observed in TD children, supports that intramuscular coherence and FM are associated. However, due to the large variability in intramuscular coherence, this measure cannot be used clinically to predict CP.

OC-047 | Sequence of lower limb contracture development in children with cerebral palsy

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Introduction: To prevent severe contractures and their impact on adjacent joints in children with cerebral palsy (CP), it is crucial to treat the reduced range of motion early and to understand the order by which contractures appear. The aim of this study was to determine how a hip–knee or foot contracture affects the time to and sequence of contracture development in adjacent joints in children with cerebral palsy with GMFCS level I-V.

Patients and Methods: This was a longitudinal study of 1,189 children (711 boys, 478 girls) with CP born 1990 to 2018 who were registered before 5 years of age in the Swedish surveillance program for CP and had a hip, knee or foot flexion contracture of ≥10°. The results were based on 1,636 legs followed for an average of 4.6 years (range 0–17 years). The Cox proportional-hazards model adjusted for GMFCS levels I–V was used to compare the percentage of legs with and without a second contracture

Results: A second contracture developed in 44% of the legs. The frequency of multiple contractures increased with higher GMFCS level. Children with a primary hip or foot contracture were more likely to develop a second knee contracture. Children with a primary knee contracture developed either a hip or foot contracture as a second contracture.

Conclusion: Multiple contractures were associated with higher GMFCS level. Lower limb contractures appeared in specific patterns where the location of the primary contracture and the GMFCS level influenced the contracture development of adjacent joints.

OC-048 | The relationship between postural asymmetries, scoliosis, windswept hips, contractures, and pain for children with cerebral palsy

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Introduction: Postural asymmetries, deformities and contractures can negatively impact the ability to participate in everyday life.

Patients and Methods: Cross-sectional study of 2,450 Swedish children aged 0–18 years reported into the CPUP Cerebral Palsy Registry from 2017 to 2018 investigating both the prevalence and relationship between postural asymmetries, ability to change position, pain, deformities and contractures of the spine, hip and knee, for all ages, Gross Motor Function Classification System (GMFCS) levels, and sex using Pearson's χ^2-test and binary logistic regression analysis.

Results: Deformities and contractures were observed across all age-groups and GMFCS levels; with 0.2% children having dislocated hips, 10.5% scoliosis, 8.7% windswept hips, 6.6% hip flexion and 19.2% knee contractures; and 38% children with reports of pain. Having severe postural asymmetries increased the risk for scoliosis 9 times, 6 to 9 times for windswept hips, and 7 and 12 times for hip and knee flexion contractures respectively, when adjusted for age, sex, and GMFCS level. Hip flexion contractures and windswept hips increased the risk by 1.5 to 1.6 times for having pain. Additionally, children unable to change position had a higher risk of having deformities and contractures.

Conclusion: The risk of having scoliosis, windswept hips, hip and knee flexion contractures is strongly associated with having postural asymmetries; whilst having pain was mainly associated with windswept hip deformity or hip flexion contractures. Therefore, early attention must be given to preventing postural asymmetries, with the intention of reducing the risk of deformities, contractures and pain for children with CP.

OC-049 | Incidence and risk factors of care-related pain in children with motor disabilities in institutional settings

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Introduction: Presence of chronic pain and frequent care interventions place children with motor disabilities at high risk of experiencing induced pain. Objectives: were to determine the incidence of care-related pain in children with physical disabilities in institutional settings, to identify risk factors, and to identify preventative measures used by professionals.

Patients and Methods: 280 children (mean age: 12 years ±4.1; 136 M and 144 F) with physical disabilities followed in pediatric facilities were randomly selected. The FLACC-r scale was used to evaluate pain during each care intervention that required physical contact for 5 consecutive days and 1 night. Demographic and clinical data of children, type of daily care, pain prevention and institutional settings were collected.

Results: 7689 interventions were recorded. Six percent of physical acts induced pain (mean score = 5.3 ± 1.5) and 48% of children experienced at least one painful act during the study period. The most painful physical acts (highest FLACC-r scores) were orthosis molding and fitting, dressings and invasive respiratory interventions. Personal care caused pain in the greatest number of children. Pain prevention Methods: were only used for 26.5% of acts. Age, level of dependence, and type of physical act were all risk factors for care-related pain ($p < 0.01$).

Conclusion: Care-related pain occurs daily. All professionals involved in the care of children with physical disabilities in pediatric rehabilitation and disability centers need to be aware of this fact, especially those who care for young children and severely dependent children.

OC-050 | Reliability of the functional discrepancy in the length of the lower limbs according to the test "level of heels when lying down and sitting"

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Introduction: The degree of the discrepancy in the length of the lower limbs (f-LLD), which is clinically significant for the developing spine during growth, remains controversial. The aim of this study was to determine the reliability of the measurement (f-LLD) according to the test called "level of heels in lying down and sitting down".

Patients and Methods: Sixty-four people aged 8–21 years were tested for lower limb functional length differences. Three researchers performed the experiments three times at intervals of 30 minutes. They independently measured the differences in the level of the patients' heels according to the test scheme "heel level when lying down and sitting down" using a measuring mat with a millimeter scale. The reliability of the f-LLD measurement ($n = 64$), using the "heel level of heels when lying down and sitting down" test, was determined by assessing the interinvestigator correlation. Measurement differences of ≥3 mm were considered significant.

Results: The intraclass correlation coefficients (ICCs) for the intrarater and interrater reliabilities were 0.92 and 0.87, respectively. The measurement error in researchers ranged from 1.6 to 1.8 millimeters.

Conclusions: The f-LLD heel level test is simple to perform and highly reliable. When there is no history of malformation of the lower limbs or pelvis, the f-LLD test is recommended in a clinical trial to assess the effect of the iliac girdle on spinal development for quantification.

Education/Cognitive

OC-051 | Long-term cognitive outcome following pediatric stroke: Associations with age at stroke

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Introduction: Pediatric arterial ischemic stroke is accompanied by an increased risk for cognitive sequelae. However, the association between age at stroke and long-term cognitive outcome remains unclear. Here, we investigated the impact of age at pediatric arterial ischemic stroke on long-term cognitive outcome.

Patients and Methods: This cross-sectional study included patients in the chronic phase of stroke (>2 years after stroke) previously diagnosed with neonatal or childhood arterial ischemic stroke and a control group. Several cognitive domains, including intelligence, executive functions, processing speed, memory, letter fluency, and visual-motor skills were assessed. Cognitive long-term outcome was compared across patients after neonatal stroke (0–28 days), early childhood stroke (29 days – 5 years), and late childhood stroke (6–16 years).

Results: 52 patients after neonatal or childhood arterial ischemic stroke (mean age: 14.82 years, SD = 4.53) and 49 healthy controls (mean age: 14.28 years, SD = 5.36) met the inclusion criteria. Cognitive outcome was significantly worse in the pediatric stroke group compared to the control group. A non-linear effect of age at stroke was found for cognitive flexibility, processing speed, and verbal learning with early childhood stroke (29 days – 5 years) showing significantly worse cognitive outcome compared to neonatal or late childhood stroke (*p* <0.05, FDR-corrected).

Conclusion: Age at stroke is an important factor for post-stroke recovery and modulates long-term cognitive outcome irrespective of lesion size and lesion location. Children after early childhood stroke are at particular risk for alterations in long-term cognitive functions.

OC-052 | Determinants of mathematical performance in children with developmental coordination disorder

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Introduction: Developmental coordination disorder (DCD) is a condition characterized by motor coordination and planning difficulties and affects about 5% of school-aged children. Evidence suggest that DCD interferes with academic activities such as mathematics, which is a necessary skill to participate in many daily activities including driving, shopping and managing time or budget. Therefore, we aim to describe the frequency and nature of mathematical difficulties of children with DCD and their determinants.

Patients and Methods: Mathematical capacity was assessed in 55 school-aged children with DCD using the KeyMath. Standardized assessments were completed to evaluate children's visual-motor integration (VMI) and visual perceptual (VP), motor, and attentional skills. Descriptive statistics were used to characterize the sample, and hierarchical multiple regression models identified the determinants of mathematical capacity.

Results: Children with DCD (n = 55, 9.3 ± 1.9 years of age, 45 males) performed significantly below the normative mean of overall mathematical capacity (d = 0.62SD below mean, p <0.001), with the measurements and geometry subtests particularly affected. Up to 35% of children with DCD (n = 19) performed <15th percentile in mathematical capacity, indicating the presence of significant difficulties. Our hierarchical model included VP skills, inattention, VMI and motor impairments and explained 50.1% of the variance in overall mathematical capacity (F[6,46] = 7.685, p <0.0001).

Conclusion: Our findings suggest that mathematical difficulties are frequent in children with DCD. Due to the importance of mathematics in daily life activities, it is of the utmost importance that we pay more attention to these specific difficulties and address them as part of our interventions with this population.

OC-053 | Inhibition skills in children with and without DCD: response inhibition and interference control

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Introduction: Inhibition is a component of Executive Function consisting of Response Inhibition (RI) - the ability to override prepotent responses, and Interference Control (IC) - the ability to ignore distracting information. Difficulties with Inhibition have been reported in children with Developmental Coordination Disorder (DCD), however, findings have been inconsistent and research has often failed to consider the response modality of tasks (verbal/motor).

Patients and Methods: 25 children with DCD aged 6–10 years, plus 25 age and gender matched typically developing (TD) children participated. An adapted version of the Verbal Inhibition, Motor Inhibition (AdVIMI) task was used to assess motor and verbal RI. Motor IC was assessed using an adapted Flanker Task (AdFlanker) and Verbal IC was assessed using an adaptation of the Intelligence and Development Scales for Children and Adolescents 2nd Edition (IDS-2) Animal Colours task (AdAC).

Results: Children with DCD made more errors on verbal and motor RI, and had slower movement times on motor RI. No significant differences on Reaction Time (RT) were found for verbal or motor RI. Children with DCD had slower RT on motor IC but no difference on error rate, and children with DCD had slower completion times but no difference on error rate for verbal IC.

Conclusion: Children with DCD have difficulties with motor and verbal RI and IC; this could partly explain their motor difficulties. However, differences were not found across all measures and large variation exists, suggesting Inhibition difficulties are not a defining feature of DCD but should be routinely assessed.

OC-054 | Wellbeing and occupational awareness in childhood: a school program

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Introduction: Improving the social and emotional well-being of the child population in vulnerable situations is a priority objective for mental health programs. Our project focused on the development of basic strategies for the improvement of occupational balance and self-regulation in childhood, with the aim of optimizing occupational participation in the school context and improving the emotional well-being of children.

Objective: To improve the occupational awareness of children in primary education, promoting their occupational and emotional well-being.

Method: 72 children, 65 parents and 6 teachers participated in a structured program of 12 sessions, for a duration of 1 hour/week. 10 structured sessions to improve perception and occupational awareness, occupational balance, healthy habits and self-regulation and personal autonomy. The duration of the program was 5 months. The achievement of the Objectives: or effectiveness of the program was evaluated through the pre-post evaluation of each child, both through direct measures with the child himself and through proxies, parents and teachers.

Results: An increase in occupational awareness, occupational balance, temporal awareness and healthy habits was shown in children between 6 and 11 years old. In addition, emotional perception, emotional and the knowledge of self-regulation strategies in daily living improved. Teachers showed improvement in PSAT questionnaire. Parents reported better time management skills in their children after participation in the program.

Conclusion: Programs to improve occupational awareness in the school setting can improve emotional well-being and self-regulation skills.

OC-055 | Introducing Spooniekids to clinical practice in residential neurorehabilitation setting for severe acquired brain injury

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Introduction: Fatigue is often a prevalent and persistent symptom of acquired brain injury (ABI). Spoon Theory was created by Christine Miserando, as an expert by experience, to describe units of energy for adults experiencing fatigue. This concept has been developed into Spooniekids: a service intervention for use with children/families experiencing fatigue.

Aim: To operationalise Spooniekids as a targeted intervention for children/families to use to describe and manage fatigue.

Methods: Spooniekids was co-produced in consultation with disabled children, who have lived experience of fatigue, in a clinical setting. These conversations were adapted by a young person into the illustrations included in the resource.

Results: Further development of the Service user engagement and clinical experience devised a four-stage intervention, which operationalises Spoon Theory for children: Stage 1: Education - creating a shared understanding of concepts and language. Stage 2: Analysis - identifying variability of energy units (spoons) to tasks. Stage 3: Intervention - utilising education and analysis to design/implement fatigue management strategies. Stage 4: Re evaluation - through reflective practise continue to build/adapt Spooniekids toolkit. All four stages remain individualised and are delivered with

emphasis on children developing autonomy and contextual transferability. Feedback and case studies show that Spoonie kids increases participation in daily life.
Conclusion: Spooniekids is a well-received, actively used, promising intervention for disabled children to manage fatigue. Further research is required to explore and evaluate Spooniekids as a fatigue management intervention.

OC-056 | Cognitive outcome is related to functional thalamo-cortical connectivity after pediatric stroke

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Introduction: The thalamus has complex connections with the cortex and is involved in various cognitive processes. Despite increasing interest in the thalamus and the underlying thalamo-cortical interactions, little is known about thalamo-cortical connections after pediatric arterial ischemic stroke (AIS). Therefore, the aim of this study was to investigate thalamo-cortical connections and their association with cognitive performance after AIS.
Methods: Twenty patients in the chronic phase after pediatric AIS (≥2 years after diagnosis, diagnosed <16 years; aged 5–23 years, mean 15.1 years) and twenty age- and sex-matched healthy controls were examined in a cross-sectional study design. Cognitive performance (selective attention, inhibition, working memory, and cognitive flexibility) was assessed using standardized neuropsychological tests. Resting-state functional magnetic resonance imaging was performed to examine functional thalamo-cortical connectivity.
Results: Cognitive performance (selective attention, inhibition and working memory) was significantly reduced in patients compared to controls. Network analyses revealed significantly altered thalamo-cortical connectivity for the motor, auditory, visual, default mode (DMN), salience, left/right executive and dorsal attention network for patients compared to controls. Multivariate linear regression within the patient group revealed significant associations between cognitive performance (selective attention, inhibition, and working memory) and the strength of thalamo-cortical connectivity in the motor, auditory, visual, DMN, posterior DMN, salience, left/right executive, and dorsal attention network.
Conclusion: Our data suggest that the interaction between different sub-nuclei of the thalamus and multiple cortical networks is crucial for post-stroke cognitive functions. The variability in cognitive outcomes after pediatric stroke might partly be explained by functional thalamo-cortical connectivity strength.

OC-057 | Understanding implementation of an innovative language assessment tool: an international clinician survey

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Introduction: The Computer-Based instrument for Low motor Language Testing (C-BiLLT) was created to fill a critical gap in assessments available to reliably measure language comprehension in children with cerebral palsy (CP) who have low speech and motor function. It is the first standardized assessment tool to evaluate a child's comprehension without requiring a spoken or fine motor response. We aimed to evaluate clinicians' experiences using the C-BiLLT in practice and the barriers and facilitators to its use.
Methods: Clinicians in the Netherlands, Norway, and Belgium with experience using the C-BiLLT were invited to participate in an online survey. Participants were asked to report their professional Background: and training, caseload characteristics and details of their assessment practices with the C-BiLLT. They also filled in three standardized measures of implementation outcomes, and were invited to describe the perceived difficulties and successes using it in practice.
Results: Ninety clinicians completed the online survey. Acceptability, appropriateness, and feasibility were rated highly. The C-BiLLT was used most often with children with CP (26% of administrations), but was used with children with a range of disabilities other than speech and motor impairments. Clinicians reported barriers related to the instrument itself (e.g., screen size requirement), children assessed (e.g., testing those with complex visual impairments), clinicians (e.g., technology skills), and the clinical context.
Conclusion: This study indicates that C-BiLLT implementation should be monitored beyond the initial dissemination stages to understand the clinical contexts in which it is being used, and guide further implementation.

COVID-19 and Telerehabilitation

OC-058 | Changes in performance, satisfaction and achievement goals after a family centred telerehabilitation service for children with disabilities

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Introduction: The family-professional collaboration model has only been delivered face-to-face to the patients. The aim of this study was to assess parents' perception of performance, satisfaction and goals achievement after a family centred telerehabilitation service using this model for children with disabilities.

Patient and Methods: A quasi-experimental design, approved by the Ethics and Research Committee (CAAE 44204821. 20000. 5149), was conducted with families of children with disabilities until 12 years. The service was delivered through weekly one hour video calls for nine weeks. Parents' perception of the child's performance and satisfaction was assessed by the Canadian Occupational Performance Measure (COPM) and daily activities and mobility performance was measured by the Pediatric Evaluation of Disability Inventory a Computer Adaptive Test (PEDI-CAT) pre (T1) and post (T2) intervention. The Goal Attainment Scale (GAS) was verified post intervention. A paired t-test was performed ($p < 0.05$).

Results: Seventeen children, with mean age of 22.41 (±25.37) months, participated in the study. There was a significant improvement in the parents' perception of the performance from T1 (3.79 ± 1.46) to T2 (5.97 ± 2.06) ($p < 0.0001$) and in the satisfaction from T1 (4.93 ± 2.64) to T2 (6.88 ± 2.13) ($p = 0.001$). The daily activities (41.25 ± 7.79 versus 43.25 ± 6.99) and mobility (48.06 ± 8.28 versus 50.94 ± 7.20) performance showed significant improvement from T1 to T2. The GAS median was 50.00 (27.20–77.20) post intervention.

Conclusion: Parents showed satisfaction with the improvement of the child's performance after intervention. The children also made progress towards goals achievement indicating the feasibility of offering a family centred telerehabilitation service for children with disabilities.

OC-059 | Promoting telehealth knowledge, attitudes, and practice by an interprofessional online course

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Introduction: The needs and challenges of community-based child development units transitioning to telehealth, starting with the COVID-19 outbreak and later on, led to a collaboration among a governmental, philanthropy, and a non-profit professional organization to develop a practical inter-professional online course. The course aims were to enhance knowledge, attitudes, and willingness to engage in pediatric telehealth and form a professional supporting network.

Participants and Methods: 96 pediatric professionals, including occupational therapists (33%), physical therapists (16%), speech and language pathologists (25%), social workers (17%), and developmental psychologists (9%), responded to a survey before and after participation in a 30-hour online training. The training included best practices in telehealth delivered via lectures followed by online discussions to foster sharing of ideas, networking, and empowering participants to translate actions in practice.

Results: Significant increases ($p < 0.01$) were found in participants' knowledge of best practices, planning and managing care, working with diverse populations, technology, and guidelines. Participants reported a significant increase in positive attitudes and emotions towards telehealth. Most participants (72%) reported that they plan to use telehealth in their routine practice; 27% reported maybe. Feedback on the learning experience was positive, and most learners wrote the course advanced their skills and exceeded their expectations.

Conclusion: Training can. Online learning tailored to the learners' needs can promote knowledge, attitudes, and willingness to incorporate telehealth in routine care and foster networks that empower participants to gain and implement practical skills to improve the quality of care.

OC-060 | Enhancing participation of youth and young adults with disabilities during a global pandemic: The impact of PREP intervention

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Introduction: The COVID-19 pandemic has imposed another layer of complexity on the participation of individuals with disabilities, and little is known about how to improve it during adverse times. We examined the effectiveness of the PREP (Pathways and Resources for Engagement and Participation) on the participation of young people with physical disabilities in an 8-week leisure activity of choice during the pandemic.

Patients and Methods: A 22-week interrupted time-series design with multiple baselines across 15 youth with physical disabilities (9 female, 6 male) aged 16–25 (median = 22) was employed. Each youth participated in their chosen activity for a duration of 8 weeks. All participants engaged in a non-virtual activity of choice done mostly in pairs such as playing badminton, a musical instrument or board games. Change in activity performance and satisfaction was measured weekly using the Canadian Occupational Performance Measure (COPM), providing 30 individual outcome trajectories. Mixed-effect models estimated the overall intervention effect across participants and outcomes. Effect size was also calculated.

Results: Significant immediate post-intervention changes were observed with respect to performance (an average of 1.87 points) and satisfaction (an average of 2.15 points). Effect sizes were large for both performance (1.06) and satisfaction (1.38). COPM scores continued to improve significantly throughout the intervention, with a weekly increase of 0.13 for performance and 0.19 for satisfaction.

Conclusion: Findings lend further support for the effectiveness and versatility of the PREP intervention in improving meaningful engagement during challenging times, when opportunities and resources are limited.

OC-061 | Parents' perspectives of the feasibility of longitudinal and remote functioning's assessment in children with neuromotor disabilities during the COVID-19 pandemic

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Introduction: The COVID-19 pandemic has interrupted face-to-face health services, thus leveraging telehealth strategies. From parents' perspectives, we investigated the feasibility of a remote longitudinal assessment of function (RLAF) in children with neuromotor disabilities (CwND) during the COVID-19 pandemic.

Patients and Methods: Parents of CwND (3–17 years) were invited to respond to a RLAF, including: electronic forms (EFs) assessing sociodemographic and pandemic experience; Social Support Scale; IPAQ-short version; PedsQL-FIM; PedsQl-4.0; feasibility of the RLAF (F-RLAF) according to parents' perspective and voice call (YC-PEM/PEM-CY). The RLAF was performed twice, with 4 month's intervals. We tested correlation between F-RLAF and sociodemographic/pandemic experience ($p \leq 0.05$) for participants who completed booth assessments (AI and AII).

Results: 122 mothers started AI, 59 fully completed the RLAF. Ninety-eight continued to AII, and 66 fully completed it. A total of 94.7% and 95.5% reported no difficulties in accessing/answering the EFs in AI and AII, respectively. Between 81.8–86% considered that RLAF was a good size. All of them classified RLAF as viable in AI, and 98.5% in AII. Considering voice call, 93% (AI) and 89.4% (AII) reported no difficulties. Lower age was associated with greater ($r = -0.269$; $p = 0.021$) and lower ($r = 0.272$; $p = 0.014$) feasibility in AI and AII, respectively. In AII, greater F-RLAF was associated with mothers not social distancing completely ($r = -0.205$; $p = 0.050$) and working in person ($r = 0.231$; $p = 0.031$).

Conclusion: RLAF showed to be feasible for mothers. Feasibility may be associated with experience in digital platforms, with inconclusive results about mothers' age. Mother's interest in participating is greater than the barriers of social distancing and work demands.

OC-062 | Participation of school-aged children with ASD during the pandemic: the unique impact of parents' participation

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Introduction: Participation of children with autism spectrum disorder (ASD) is influenced by child, family, and environmental factors. However, little is known about the impact of parents' own participation on their child's participation, especially during COVID-19. We estimated to what extent complexity of child condition, income, mother's actual participation, and environmental barriers/supports, explains participation (frequency, involvement, and desire for change) of school-aged children with ASD in home and community.

Patients and Methods: Mothers (n = 130) of children with ASD aged 6–13 years (mean = 9.09, SD = 1.89) completed an online survey including the Participation and Environment Measurement for Children and Youth (measuring child participation, environmental barriers/supports), the Health Promoting Activities Scale (assessing mother's participation), a checklist of child's functional issues, and a sociodemographic questionnaire. Multiple linear regressions were conducted and R^2 change was calculated to determine the unique contribution of each factor.

Results: On average, parents desired change in 71% of activities in both settings. Involvement and desire for change at home had the highest variance explained (20.9% and 17.4% respectively), and mother participation was more pronounced for explaining involvement levels ($\beta = 0.34$, $\Delta R^2 = 10.4\%$). Income consistently explained child's frequency ($\Delta R^2 = 41.4\%$) and involvement ($\Delta R^2 = 8.7\%$) in community; other factors had negligible contributions. COVID-19's impact was negatively associated with the child's participation frequency in community ($r = -0.51$, $p < 0.01$), whereas at home, this association was positive ($r = 0.188$, $p < 0.05$).

Conclusion: Mother's own participation positively impacts the involvement of children with ASD at home. This can re-direct clinicians' attention towards improving parental participation. The environment had limited impact on child participation in the community, due in part to the pandemic.

OC-063 | The impact of the COVID-19 pandemic on the field of childhood disability in Belgium: A survey of caregivers and professionals

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Introduction: Belgium was one of the hardest hit countries during the COVID-19 pandemic. Measures and restrictions were imperative to abate spreading of COVID-19. This study aimed to gain insights into the impact of the COVID-19 pandemic and the accompanying restrictions on children with disabilities, their caregivers, and service providers/professionals in Belgium.

Patients and Methods: A retrospective cross-sectional study of two voluntary-response sample surveys was carried out by the European Academy of Childhood Disability. 254 caregivers of individuals with childhood-onset disability and 279 professionals working in this field, living in Belgium, completed an online survey between April–May 2020 on the effects of the COVID-19 pandemic and the accompanying restrictions. Quantitative analyses of survey responses were performed at group level for each survey.

Results: 85% of the caregivers reported a reduced amount of therapy received per week in the survey period compared to before the COVID-19 crisis. 68% of the caregivers stated that less than 1 hour of therapy per week was provided during the survey period, compared to only 5% before the pandemic restrictions. 79% of the professionals noticed a physical health impact and 92% a mental health impact on individuals with a childhood-onset disability.

Conclusion: Caregivers reported a strong decline in the amount of received therapy for people with a childhood-onset disability, while professionals reported noticing a physical and mental health impact. More insights into the (long-term) effects of the COVID-19 pandemic are warranted to provide best possible care and support for future health crises, other serious or daily events.

OC-064 | Exploring challenges and opportunities posed by COVID-19 on team working and the delivery of residential neurorehabilitation to children and young people with acquired brain injury

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Introduction: COVID-19 has placed major demands on healthcare services and practitioners (HCP's). Research has highlighted resilience, new skills and new ways of working. However, little attention has been paid as to whether challenges faced may have demonstrated or influenced effective change in working practices of individuals and teams delivering neurorehabilitation services to children and young people following an acquired brain injury.

Patients and Methods: Exploratory qualitative study. Fourteen HCP's (10 female, 4 male) across 6 occupational disciplines participated in semi-structured interviews (February–May 2021). Transcriptions analysed using thematic content analysis managed in NVivo. Five broad topic areas explored (1) professional roles, role identity and professional autonomy, (2) role boundaries, (3) team working, (4) collective identity in relation to organisational challenges, (5) working practices.

Results: A wealth of data was retrieved, analysis of findings from three of the key theme categories presented: Individual Professionalism, Working as Team and, Delivery of Rehabilitation services. Although there was much uncertainty, rapidly changing information and constraints imposed by the pandemic, the professionalism of the team was evident as HCP's regrouped and reviewed how service provision could continue. Personal and professional growth saw teams collectively flourish. Creative solutions led to teams working differently and more cohesively. A greater appreciation of team roles and goals within the specialist environment of paediatric rehabilitation emerged.

Conclusions: Changes in structure, processes and provision of services necessitated greater interdisciplinary team integration and sharing of skills and expertise. As confidence and competencies of HCP's grew the potential for a more 24/7 approach to rehabilitation gained wide staff acceptance.

TRANSITION AND ADULTS

OC-065 | Access to higher education and employment in young adults with cerebral palsy: An analysis of the SPARCLE study

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Introduction: Although most societies are increasingly inclusive, poor access to higher education and employment is still observed for youth with disabilities. Our Objectives: were (1) to describe the higher education/employment status of young adults with cerebral palsy (CP) without severe or moderate intellectual impairment, (2) to investigate the role of personal, sociodemographic and environmental factors and (3) to determine whether inclusive education in childhood had a significant impact.

Patients and Methods: Young adults with CP, aged 22–27 years, with an IQ≥50, and living in six European regions participated to the third-wave of the SPARCLE study. Their employment and education status were compared to those of the general population. Personal characteristics, environmental items at university/work and history of inclusive education in childhood were analyzed to identify associated factors and predictors of access to higher education and employment.

Results: 227 young adults were selected for analysis: 55.9% male, 26.0% unable to walk, 29.0% with IQ 50–70, and 16.4% with unclear/not understandable speech. They were 54.6% in higher education or employed. Preliminary analyses showed that the most impaired had significant restriction in access to higher education and to employment. Young adults who completed higher education had a better access to employment (OR 2.7; 95%CI 1.5–4.9). Individuals who were employed lived significantly more in a big city or suburb and more independently than those who did not access to employment.

Conclusion: This study highlights the needs to update knowledge about access to higher education and employment in young adults with disabilities.

OC-066 | Associations between the physical, social, and attitudinal environment of adolescents with cerebral palsy and their parent-reported quality of life: Results from the SPARCLE Study

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Introduction: An adequate local environment can help to enhance the effective participation to society of people with disabilities, thereby improving their quality of life (QoL). Our objective was to assess the extent to which the QoL of adolescents with cerebral palsy of any severity living in nine European regions was related to their physical, social and attitudinal environments.

Patients and Methods: Adolescents' QoL (using four domains of the Kidscreen-52 generic instrument) and the match to their environmental needs (using the European Child Environment Questionnaire: physical environment, social support and attitudes at home and in the community, and therapy) were collected from the parents. A Partial Least Square path modelling approach was applied to model the relationships between environmental areas and QoL domains adjusted on personal and family characteristics.

Results: 664 adolescents participated: 57.2% male, mean age 15.1 years, 45.1% unable to walk, 45.7% attended mainstream schools. A supportive environment (with increased availability of needed items) significantly improved QoL in the *Physical well-being*, *Psychological well-being*, *Autonomy*, and *School life* domains. The effect of pain, impairments, behavioural problems or parenting stress was higher in magnitude than that of the environment. Positive attitudes of peers, teachers-therapists or family-friends were significantly associated with better *Psychological well-being* and *School life*. *Physical well-being* and *Autonomy* increased with suitable physical environment, social support and therapy.

Conclusion: A supportive environment seems to contribute to higher QoL. This highlights the relevance to ask young people with disabilities about their local environment to find out what matters most to them.

OC-067 | Living conditions and social outcomes in adults with cerebral palsy

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Introduction: Living arrangements, occupation, and interpersonal relationships are among the most important issues to address in young adults with disabilities. The aim was to analyse the living conditions and social outcomes in adults with cerebral palsy (CP).

Patients and Methods: Cross-sectional registry-based study of 1888 adults (1030 males/858 females) with CP, median age 25 years (range 16–78y). Type of housing, occupation, access to personal assistance and having a partner were analysed relative to their age, sex, and the classification systems for Gross Motor Function (GMFCS) and Communication Function (CFCS). Binary logistic regression models were used to calculate odds ratios (OR) for independent living, competitive employment, and having a partner.

Results: Independent living was almost equal in adults at GMFCS levels I (40.2%) and V (38.6%). This parity was explained by access to personal assistance, which increased with higher GMFCS and CFCS levels. Personal assistance of >160 hours/week was associated with a high probability of independent living (OR 57). In the age span 20 to 64 years, 17.5% had competitive employment. In total, 13.4% had a partner and 7.8% lived together. Slightly more women than men had a partner, and most individuals were classified at CFCS level I.

Conclusions: One in eight adults with CP has a partner, and one in six has competitive employment. Access to personal assistance is the most important factor for independent living. It is vital to support adults with CP throughout their lifespan to achieve the best possible outcomes in all aspects of life.

OC-068 | Dysphagia, weight, height and BMI in adults with cerebral palsy

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Introduction: Eating, drinking and swallowing disorders, dysphagia, are common in individuals with cerebral palsy (CP). Dysphagia has been identified as a risk factor for malnutrition in older people, but the knowledge of dysphagia and nutrition in adults with CP is sparse. The aim was to describe eating and drinking ability in adults with cerebral palsy (CP) relative to sex, age, subtype and severity of gross motor and hand function and nutritional status.

Patients and Methods: Cross-sectional study based on data of 2035 adults with CP, median age 26 years (range 18–78 years). The classifications systems for Eating and Drinking Ability Classification System (EDACS), Gross Motor Function Classification System (GMFCS), and Manual Ability Classification System (MACS) were used in addition to body weight, height, Body Mass Index (BMI), skin fold thickness and gastrostomy. Linear regression models were used to estimate associations between body weight and the other variables.

Results: More than half of the adults (52%) eat and drink safely and 32% have dysphagia with limitations to eating and drinking safety. Weight, height and BMI decreased with increasing EDACS levels. At EDACS V 86% had gastrostomy, still 23% at EDACS III-V were underweight, whereas 42% at EDACS I-II had a BMI >25, indicating overweight or obesity. Increasing EDACS levels and need of support during meals were associated with lower body weight.

Conclusions: Adults with CP should be routinely screened and treated for dysphagia to avoid nutritional complications. Being dependent on others during mealtimes is a risk factor for low body weight.

OC-069 | Association between functional and personal factors with the frequency of community services of neuromotor disorders adults

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Introduction: This study aimed to analyze the relationship between sociodemographic and functional variables with participation frequency in community services by adults with neuromotor disorders.

Methods: Respondents (33.4% proxy) fulfilled an online questionnaire corresponding to 57 persons (57.9% male) with neuromotor disorders (68.4% cerebral palsy), mean age of 35y0m ± 14y3m. Items included information about sex, education level, and age, self-classification of functional status (walking ability, hand manipulation, communication), and usual attendance of community services (stores, health services, restaurants, financial services). The level of frequency of community services was calculated by the sum of each item (min = 0; max = 8). Additional information was collected about the use of public transportation services (Buses, Metro and Taxis).

Results: Cronbach's alpha obtained for frequency level was 0.890. The frequency level was high (median = 8; IQ1-IQ3 = [6–8]), although the need for assistance for participation varied between 33.4% for stores and 54.4% for health services. For the level of participation, a correlation was found between education (Spearman r = 0.314; $p < 0.05$), walking ability (Spearman r = −0.283; $p < 0.05$), communication (Spearman r = −0.295; $p < 0.05$). The frequency level of participation was different between those who use or not use buses (7.5 ± 1.1vs5.8 ± 2.8; $p < 0.05$) or metro (7.7 ± 0.8vs4.6 ± 3.0; $p < 0.01$). Running a stepwise hierarchical multiple regression, frequency level of participation in community services was explained by walking ability (r change = 11.7%; $p < 0.01$) and the use of metro (r^2change = 28.9%; $p < 0.001$).

Conclusion: Functional profile has an influence in participation but environmental factors like access to adequate public transportation could play a major role in improving the level of frequency of community services.

OC-070 | The Real Me: Insight into youths' abilities to transition to adulthood through digital images

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Introduction: “The Real Me” is the title chosen by youths participating in the TranXition program for their photo exhibition at the end of their journey in the Photovoice 2.0 research project. TranXition was co-developed by an interdisciplinary team to address the needs of youths (15–25 years) with physical disabilities (motor, language, and sensory) and their families, in order to facilitate transition into adulthood. The project aimed at evaluating the program through these youths' own eyes or ears.
Patients and Methods: Five youths, aged between 18–25 years, provided insight into their real-life experiences through digital images or videos, group discussions, and individual interviews regarding their journey in the TranXition program of the CIUSSS West-Central Montreal (Canada).
Results: These youths presented with diverse clinical profiles and life challenges related to independent living, socialization, and self-awareness. Despite this heterogeneity, they worked together as a group to reach their respective goals, find compensation strategies, and even learn new skills from their peers and advocate for themselves. TranXition can offer sufficient flexibility to balance therapeutic-driven goals within youth-driven activities to provide a safe space to have fun and test personal limits, all the while develop skills through real-life problem solving and peer learning.
Conclusion: Within TranXition, the group's journey contributed to youths' growth towards more active social participation. The digital documentation of this adventure provided group members with a voice to teach others about their experience. As a spin-off, photography is now used as an intervention tool by the TranXition team.

OC-071 | “Just-Like-You”- co-creation of meaningful transition to adulthood information for adolescents with cerebral palsy, spina bifida and (congenital) limb malformations and their parents

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Introduction: Transitioning to adulthood is a process with increasing autonomy for adolescents. For youngsters with a disability growing up brings extra challenges, especially during the transfer from pediatric services to adult (rehab) care. Despite growing attention for the transition process by clinicians, information directed at adolescents with disabilities and adjusted to their specific needs is scarce.
Patients and Methods: The Just-Like-You project was executed with participation of adolescents in all phases of the project. The Design Thinking Method was used to first reveal experiences with transition of care in our clinics at a Children's Hospital and Rehabilitation Centre in Utrecht, The Netherlands. Focus group-sessions were held with 12 adolescents (ages 18–23) with cerebral palsy, spina bifida, (congenital) limb malformations and 4 parents. Thematic analysis was applied. A survey was conducted amongst health care professionals of the participating clinics (n = 36). Subsequently information materials were developed in co-creation sessions.
Results: Both focus groups and the survey with professionals revealed areas of improvement. To meet the needs of the adolescents and parents, a website with practical information seemed the best solution. Information materials for the website were developed to (1) facilitate transfer of care (e.g. road map, information about adult-centered teams), (2) share peer experiences (e.g. blogs and vlogs) and (3) facilitate communication between parents-adolescents-professionals.
Conclusion: The Just-like-You project translated this new knowledge directly into actions. Through co-creation, a website is being developed to allow for sharing practical information and peer experiences, and by doing so to improve the transition experiences and outcomes.

Early Detection/Prematurity

OC-072 | Perinatal and neonatal predictors and neurocognitive profile of children with/at risk for developmental coordination disorder

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Introduction: To evaluate the perinatal and neonatal predictors and the visual-motor, cognitive and language skills of children at risk for developmental coordination disorder (DCD) at preschool age.
Patients and Methods: As a part of the prospective regional longitudinal cohort study of 2193 infants (1535 hospitalized, 658 healthy controls) this study follows these children from birth to preschool, evaluating detailed perinatal and neonatal risk factors. The sample comprised 1505 (94.4% of eligible) children with no severe neurodevelopmental impairments, who completed the neuromotor, visual-motor, cognitive ability, and language tests at mean age 4 years 8 months. 806 were male (53.6%). The neuromotor test result

of the control group's fifth percentile was defined as at risk for DCD (DCD5) and from the fifth to 15th as probably at risk for DCD (DCD15).

Results: Children in the DCD5 group numbered 92 (6.1%) and in the DCD15 group 159 (10.6%). Perinatal variables significantly (all p <0.05) predicting DCD in both groups were male sex and low gestational age. After adjusting for these two variables, significant predictors in the DCD5 group were low maternal education, fetal distress before and during birth, non-optimal Apgar score, intraventricular haemorrhage, and hypoglycaemia. In the DCD15 group, only irregular prenatal care predicted risk. In visual-motor, cognitive ability, and language tests both DCD groups performed significantly (all p <0.001) worse than their peers.

Conclusion: Predictors of DCD in two groups differed. The association of DCD with other neurodevelopmental deficiencies suggests proper multiprofessional evaluation of such children before school age.

OC-073 | Motor, visuospatial and navigation functions in toddlers born preterm: Preliminary analysis of a prospective longitudinal study

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Introduction: Preterm birth is associated with an increased risk of developmental problems, including deficits in attention, visuospatial or movement coordination, linked to learning difficulties at school ages. This study aims to extend our understanding of motor and visuospatial features in preterm children (PTc) during the first years of life and to specifically consider their relation to navigational performance at two years.

Patients and Methods: Seventy PTc were prospectively follow-up from birth until two years of age. Motor development, visuomotor coordination and grasping, preverbal visual abilities, selective attention, and spatial navigation were assessed at 6, 9, 18 and 24 months (M), by the Alberta Infant Motor Scale (AIMS), Peabody Developmental Motor Scale-2nd edition (PDMS-2), Preverbal Visual Assessment (PreVIAS), Teddy Bear Cancellation Test (TBCT) and two adapted versions of the Walking Corsi Test (Adapted and Treasure [A-TWalCT]), respectively.

Results: PTc had significant lower AIMS score at 6 and 9 M which catch up at 18 M. These children showed significant different distributed data of PDMS-2 Fine Motor Quotient percentage, being most of them below average at 9 M (54.4%), 18 M (55.8%) and 24 M (57.95%). While PreVIAS did not point to any difference with respect to normative data, some TBCT, AWalCT, TWalCT variables were significantly different to typically developed children born at term. To mention, correlations were found between visuo-motor and grasping abilities measured at 9, 18 and 24 M and AWalCT at 24 M.

Conclusion: Preliminary analysis suggest that early assessment of visuospatial and movement aspects could help describe navigational/attentional features of 2 years old PTc.

OC-074 | Is the Alberta Infant Motor Scale at 12 months associated with motor and gait outcomes at 4–5 years in children born very preterm?

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Introduction: Very preterm (VP) births (<32 weeks' gestation) are associated with high rates of subsequent motor impairments, with the risk as high as 40%. Children born VP show different gait adaptation patterns than term-born children when walking demand increases. We aimed to examine associations between the Alberta Infant Motor Scale (AIMS) score at 12 months' corrected age (CA) and motor and gait outcomes at 4–5 years' CA in children born VP.

Patients and Methods: A prospective cohort of 149 children born <30 weeks' gestation were recruited at birth. At 12 months' CA, motor development was assessed using the AIMS. At 4–5 years' CA, motor competence was assessed using Movement Assessment Battery for Children-Second edition (MABC-2), and gait using the GAITRite® in various walking conditions.

Results: In 113 participants without cerebral palsy, lower AIMS total scores were associated with lower balance skills (slope coefficient 0.14, 95%confidence interval [CI] 0.07, 0.22), wider base of support in tandem (slope coefficient – 0.05 cm, 95%CI -0.09, –0.001) and higher rates of motor impairment (odds ratio 2.51, 95%CI 2.36, 2.69). AIMS scores ≤5th centile were associated with lower balance skills (mean difference – 1.34; 95%CI -2.27, –0.41) and shorter double support in tandem (mean difference – 1.93; 95%CI -0.09, –0.001). There was weak evidence for associations between the AIMS total score and 5th centile cut-off and other MABC-2 and spatiotemporal outcomes.

Conclusion: The AIMS at 12 months' CA may be useful to identify VP infants who need targeted developmental surveillance and early intervention.

OC-075 | Effects of early crawling training on the motor development of very premature infants

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Introduction: A major, but under-investigated, question regarding extreme prematurity concerns the infants who do not appear to have major brain damage but who may nonetheless develop abnormal motor skills. Few early prevention programs exist for this population. Here we present an intervention based on very early crawling training. We hypothesize that stimulating crawling in this population will improve their motor development.
Population and Methods: Forty-five very premature infants (born 24–32 weeks GA) without major brain damage were randomly assigned to a Crawliskate training (CT) or Mattress training (MT) or non-training group (NT). Trained infants were positioned prone on the Crawliskate or on a Mattress for 5 min daily at home for 2 months as soon as they left the NICU. The infants' gross motor development of the 3 groups was assessed with the Bayley BSDI III at 2, 6, 9, 12 months corrected age (CA) and other domains with the ASQ3 questionnaire at 9, 12, 18 months CA.
Results: BSDI III Gross motor scaled scores at all ages grouped were significantly higher in the CT group compared to the Mat or NT groups ($p < 0.01$) with a significantly higher percentage of CT infants controlling their sitting, crawling and walking on the Bayley items. ASQ3 results at all ages grouped also revealed significantly better scores in all domains in the CT group compared to the Mat or NT groups ($p < 0.05$ to 0.001).
Conclusion: These preliminary results suggest that training crawling early in extremely premature infants without major brain damage could stimulate their gross motor and cognitive development.

OC-076 | Applications and identification of asymmetries in high-risk infants using the General Movement Assessment and Hammersmith Infant Neurological Evaluation to guide early intervention

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Introduction: The Prechtl General Movement Assessment (GMA) and Hammersmith Infant Neurological Evaluation (HINE) are tools supporting identification of neuromotor deficits. Evaluating asymmetries between tests should provide a comprehensive guide for targeting interventions.
Patients and Methods: Between 8/2019 and 10/2021, 184 infants were assessed with GMA/HINE within one week. Median gestational age 32 weeks; IQR 27–38, median GMA postmenstrual age: 53 weeks; IQR 51–55. Asymmetries between assessments were interpreted for correlative significance and clinical usefulness.
Results: GMA ratings included 167 normal fidgety, 15 absent/sporadic, 2 abnormal. Median Motor Optimality Score (MOS): 24; IQR 22–26. 120 (65.2%) infants had ≥1 asymmetry. Lack of head centering was most frequent (52.9%). Infants with asymmetries had lower MOS (MOS: 24; IQR 21–26) than infants without (MOS: 26; IQR 24–26, $p < 0.001$). Median HINE score (65, IQR 59.5–68). 108 infants (58.7%) had asymmetries on the HINE. Asymmetric lateral tilting was most frequent (36.6%). MOS and HINE asymmetries were not strongly correlated ($p = 0.08$). Infants with any GMA asymmetry had lower MOS scores ($p < 0.001$) and lower HINE scores ($p = 0.006$). Infants with any asymmetry on the HINE had lower HINE scores ($p = 0.017$) but not lower MOS scores ($p = 0.93$). Head posture asymmetry on the HINE was more frequent in infants with head not centered on GMA ($p = 0.004$; OR 3.17; 95% Cl:1.44–7.00).
Conclusions: These results support performing the HINE and GMA in tandem to evaluate both spontaneous patterns vs elicited function. Future analysis of outcomes with asymmetries will elucidate if motor patterns and function are predictive to establish more patient-specific interventions.

Unilateral CP

OC-077 | Children with cerebral palsy show higher static, but not dynamic, motor fatigability in grip and pinch tasks than typically developing children

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Aim: To investigate differences in static and dynamic motor fatigability during grip and pinch tasks between children with unilateral spastic cerebral palsy (USCP) and typically developing (TD) children, and between preferred/less-affected and unpreferred/more-affected hands.
Patients and Methods: 53 USCP and 53 age-matched TD children (mean 11y1m; SD 3y8m) participated in 30s maximal exertion sustained and repeated grip and pinch tasks. For sustained tasks, Static Fatigue Index (SFI) and ratio of mean force between first and last thirds of the curve (Ratio-F mean) were calculated. For repeated tasks, Ratio-F mean and the ratio of number of peaks between first and last thirds of the curve (Ratio-N peaks) were calculated.

Results: Higher SFIs for grip and pinch were found with USCP (p <0.006) in both hands, and between hands in both groups (p <0.007). Dynamic motor fatigability showed inconsistent results, with higher levels of fatigability in TD versus USCP for grip in Ratio-F mean in unpreferred hands (p = 0.001), and Ratio-N peaks in preferred hands (p = 0.002).
Conclusion: Higher motor fatigability in USCP compared to TD was found for static but not dynamic grip and pinch. Underlying mechanisms may play different roles in static and dynamic motor fatigability.

OC-078 | Somatosensation in the dominant hand of children with unilateral cerebral palsy compared to typically developing children: How is the information processing? Preliminary results

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Background: The commonly called "unaffected side" of unilateral cerebral palsy (UCP) children also presents some deficits and should therefore be considered in both assessment and intervention programmes. Somatosensation has the potential to facilitate functional performance in daily activities, but how UCP children process this information in the dominant hand (DH) is still uncertain and more research is needed. The study aimed to examine the somatosensory processing of UCP children in the DH compared to typically developing (TD) children.
Patients and method: Forty-seven children aged from 6 to 15 years (UCP = 24; TD = 23) were recruited. A somatosensory assessment battery targeting different domains was conducted: tactile registration (Semmes Weinstein Monofilaments), unilateral spatial perception (Two Point Discrimination) and haptic recognition (Manual Form Perception Test).
Results: UCP children showed lower performance in tactile registration test (p = 0.044). No significant differences were found in the unilateral spatial perception test (p = 0.136). Regarding the haptic form perception test, statistically significant differences were found in the number of correct shapes identified (p = 0.000), but not in the time taken to recognise them (p = 0.327).
Conclusions: UCP children show difficulties in somatosensory processing of DH compared to TD children, especially in tactile registration and haptic form recognition. Considering that UCP children tend to specifically engage DH in meaningful activities, and their success in performing these activities depends to a large extent on it, future research is needed to assess somatosensation with a comprehensive battery and to examine the possible relationship of these deficits to functional performance.

OC-079 | Best responders to HAND-ARM Bimanual Intensive Therapy Including Lower Extremities (HABIT-ILE) among children with unilateral cerebral palsy

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Introduction: HABIT-ILE has shown important effects in children with unilateral cerebral palsy (UCP). However, whether the response to HABIT-ILE depends on particular features of the children has yet to be studied.
Patients and Methods: This retrospective study included 51 children with UCP who received 90 hours of HABIT-ILE and were assessed pre and post-intervention using the Box and Block Test (BBT), Manual Form Perception Test (MFPT), Jebsen-Taylor Test of Hand Function (JTTHF), 6 minutes' walk test (6MWT), Assisting Hand Assessment and ABILOCO-kids. RM-ANOVA's were conducted to analyse changes magnitude in groups based on MACS level, GMFCS level, lesion type, lesion side and corticospinal tract (CST) reorganization. In addition, multiple logistic regressions were conducted to analyse whether these characteristics are associated with better responses to the therapy.
Results: The ANOVA's indicated an influence of the lesion side in the BBT-more affected hand (MAH) (p = 0.035, right lesions induce larger improvement), of the CST reorganization in the JTTHF-MAH (p <0.001, ipsilateral organization encounters larger improvement), as well as, of the lesion type in the 6MWT (p = 0.039) and MFPT-MAH (p = 0.033) where children with grey matter injury improved more. The regressions showed an influence of MACS on the BBT-MAH (p = 0.045), of the GMFCS on the ABILOCO-Kids (p = 0.040) and of both on the JTTHF-less affected hand (MACS, p = 0.014; GMFCS, p = 0.044).
Conclusion: We observed an influence of the CST reorganization and of the lesion side and type on the effectiveness of HABIT-ILE. Regarding the level of MACS and GMFCS children may present better responses to the therapy.

OC-080 | Action observation training to treat upper limb functions in infants with a unilateral brain lesion - a feasibility study

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Introduction: The aim of this study was to evaluate the adherence, feasibility, and acceptability of an action observation training (AOT) as a new therapy approach to improve bimanual hand function in infants with hemiparesis. In addition, accelerometers for movement measurement were evaluated.

Patients and Methods: This study included infants with a unilateral brain lesion. The AOT was planned for 4 weeks, 20 minutes a day (total 560 min). Therapy adherence was evaluated using a diary, feasibility and acceptability with self-designed questionnaires. Hand function was documented before and after the intervention using the Hand Assessment for Infants [HAI] and the Mini-Assisting Hand Assessment (Mini-AHA). Accelerometers were used to measure asymmetry of both upper extremities (2 days/week) and during the HAI/Mini-AHA. Their usability was assessed with the System Usability Scale (SUS) and a self-designed questionnaire.

Results: 8 infants participated in the study. Adherence was excellent with a mean exercise time of 607 minutes. Feasibility was rated with a score of 82%, acceptability with 73%. HAI and Mini-AHA scores significantly improved from pre- to post-test (HAI $p = 0.018$; Mini-AHA $p = 0.011$). Spearman correlation of the accelerometery with the HAI was $r_s = -0.69$, with the Mini-AHA $r_s = -0.76$ ($p \leq 0.05$). The SUS and questionnaire score were 91% and 88%, respectively.

Conclusion: AOT can be performed with infants and is well accepted among parents. Further research is needed to investigate its efficacy. Accelerometery measurements to assess upper limb movement asymmetry are feasible, and correlate with the clinical outcomes. Accelerometers could be used in future studies.

OC-081 | Neural correlates of mirror movements in children with arterial ischemic stroke

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Background: Mirror movements (MM) in pediatric stroke patients are related to abnormal ipsilateral Corticospinal Tract (CST). Whilst children with contralateral CST wiring may also present with MM, the role of interhemispheric interactions remains unknown. Here, we investigated the role of interhemispheric inhibition, facilitation and functional connectivity on MM in children with contralateral CST after arterial ischemic stroke.

Patients and Methods: 16 patients with pediatric stroke and contralateral CST wiring were included. Participants underwent multimodal examination including dual-pulse transcranial magnetic stimulation to measure interhemispheric inhibition (10 milliseconds interstimulus interval, measured on the flexor digitorum superficialis) and resting-state functional MRI to assess motor network functional connectivity between primary motor cortices. MM were measured with the Woods and Teuber scale in each hand (hand opening and closing, finger opposition and sequential finger movement). We conducted non-parametric correlation analysis and interpreted r-values as absent (<0.25), fair (0.25–0.50), moderate (0.50–0.75) or excellent (>0.75).

Results: Higher MM-scores in the affected hand were related to (1) lower interhemispheric functional connectivity between the primary motor cortices ($r = -0.48$, $p = 0.06$), (2) higher inhibition from the non-lesioned to the lesioned hemisphere ($r = 0.65$, $p = 0.01$) and (3) slightly higher facilitation from the lesioned to the non-lesioned hemisphere ($r = 0.36$, $p = 0.27$). MM-scores in the non-affected hand were higher with facilitation from the lesioned to the non-lesioned hemisphere ($r = 0.76$, $p = 0.006$).

Conclusion: In children with arterial ischemic stroke and contralateral CST wiring, the active motor cortex may facilitate the contralateral motor cortex and increase the occurrence of MM, highlighting the importance of interhemispheric interactions for this phenomenon.

Assessments

OC-082 | Agreement of the World Health Organization Disability Assessment Schedule (WHODAS 2.0) between parents and youth with physical illness

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Introduction: This study modelled the factor structure and tested for measurement invariance between youth and parent reports on the 12-item World Health Organization Disability Assessment Schedule (WHODAS) 2.0; estimated agreement between informants; and, examined moderators of youth-parent discrepancies.

Patients and Methods: Data come from the baseline wave of the Multimorbidity in Youth across the Life-course study (n = 117). Multiple-group confirmatory factor analysis was used to test for measurement invariance of the WHODAS 2.0 and Wilcoxon signed-rank tests compared youth and parent scores. Intraclass correlation coefficient (ICC) and Bland–Altman limits of agreement plots were used to examine youth-parent agreement. Multiple regression was used to identify moderators of informant discrepancy.

Results: The WHODAS 2.0 demonstrated measurement invariance between informants (χ^2 = 221.8[136], p <0.01; RMSEA = 0.073 [0.055, 0.091]; CFI = 0.962; and, SRMR = 0.078), though parameter constraints were released on the residuals for items Q8 (wash) and Q10 (people). Youth typically reported more disability compared to parent proxies, with the exception of item Q5 (emotional). Agreement was low (ICC = 0.08–0.53). Youth sex moderated informant agreement such that more consistent agreement was seen for female youth (β = 0.53, p <0.01) compared to male youth (β = 0.09, p = 0.38).

Conclusion: Youth and their parents interpret the construct of disability, as measured by the WHODAS 2.0, similarly. Thus, informant differences represent real differences that are not a consequence of error. Low agreement between youth and parents reinforces the need for collecting multiple perspectives in the pediatric setting, especially for male youth.

OC-083 | *Challenge-20* test for measuring advanced motor skills in children with cerebral palsy: Age related norms with typically developing children

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Aim: Develop age related norms for the *Challenge-20* with typically developing (TD) children and explore how scores of children with cerebral palsy (CP), in Gross Motor Function Classification System (GMFCS) level I and II compare to these age norms.

Method: 150 TD children 7–12 years (m = 69; f = 81) in 5 age groups were enrolled and tested using *Challenge-20* to determine age related norms, and compared with results of children with CP (n = 191), GMFCS level I (n = 135) and II (n = 56), 5–18 years.

Results: Reference curves by age and *Challenge-20* score, plotted across 5th to 95th percentiles. Younger TD children (7–8 years) scored lower (~50%) and older children (9–12 years) scored ≥85% and higher on *Challenge-20* showing similar developmental trajectories. Children with CP follow similar, albeit lower, *Challenge-20* score trajectory to that of TD children with continued progression beyond age 12. Highest scores came close or overlapped (15% of cases) with the lowest scores of TD children.

Interpretation: *The Challenge-20* is sensitive to progression in advanced gross motor skills in TD children. Children with CP in GMFCS I and II follow similar, albeit lower, *Challenge* score trajectory to that of TD children, and in some cases children in GMFCS level I came close to lower level abilities of TD children. The reference percentiles extend clinical utility of the *Challenge-20* for re-thinking advanced gross motor interventions in children with CP at GMFCS levels I and II given their potential to progress along the developmental trajectory.

OC-084 | Test–retest reliability and agreement between observers for the Both Hands Assessment (BOHA)

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Introduction: The Both Hands Assessment (BoHA) describes how effectively children with bilateral cerebral palsy (CP) use both hands together. Internal scale validity and reliability have been confirmed, while information regarding test–retest reliability and agreement between observers are unexplored. The aim is therefore to investigate test–retest and inter-rater reliability of the BoHA.

Patients and Methods: Children with bilateral CP, age range 18 months-18 years, with Manual Ability Classification System (MACS) levels I-III are eligible for participation and the aim is to include 60 participants. For test–retest reliability, participants are tested twice with the BoHA (time interval <7 days). The same observer scores test 1 and test 2. The BoHA unit is used in the statistical analyses. Standard measurement error (SEM) is calculated for test–retest data to investigate smallest detectable change (SDC). For inter-rater reliability, two observers score the same test more than two weeks apart and the Intraclass correlation coefficient (ICC) is calculated.

Results: So far, 50 children from Norway and Germany have been included (mean age 8y8m ± 5y2m). Preliminary results for 13 children indicate good inter-rater reliability with ICC = 0.89. The SEM of test–retest data was found to be 1.443 rendering a SDC 95% confidence interval of ±4 BoHA units.

Conclusion: The inter-rater ICC for the BoHA indicate that the results are reliable between certified observers. Furthermore, the preliminary results indicate that a minimum of 4 BoHA units is required to confirm a clinical change beyond measurement errors using the BoHA to assess bimanual performance in children with bilateral CP.

OC-085 | Physical activity energy expenditure predicts quality of life in school-age ambulatory children with spastic cerebral palsy

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Introduction: Participation in active physical leisure activities is positively associated with better quality of life in children with cerebral palsy (CP). The objective of this study was to examine the associations between habitual physical activity (HPA) and health-related quality of life (HRQOL) in school-age ambulatory children with spastic cerebral palsy.

Patients and Method: A secondary analysis of cross-sectional data of 46 ambulatory children with cerebral palsy who participated in a randomized controlled trial (ClinicalTrial.gov NCT03870893) was conducted (22 girls, 24 boys; mean age 7.48 years, SD 1.56 years. Gross Motor Function Classification System [GMFCS] level I, II, or III). Participants wore a triaxial accelerometer (model GT3X, ActiGraph, LLC, Pensacola, FL, USA) for 5 days to measure HPA; activity counts(counts/min), physical activity energy expenditure (PAEE, kcal/kg/day), and % moderate-to vigorous-intensity physical activity (%MVPA). Pediatric Quality of Life Inventory (PedsQL) 4.0 Generic Core Scales as well as Child Health Questionnaire Parent Form 50 Questions (CHQ-PF50) were used to measure HRQOL. After controlling for topography, gender, BMI, and GMFCS level, hierarchical regression analyses were performed.

Results: PAEE significantly predicted child-report PedsQL; total score ($\beta = 0.626$, $p = 0.017$), physical domain ($\beta = 0.579$, $p = 0.030$), emotional domain ($\beta = 0.570$, $p = 0.037$), and social domain ($\beta = 0.527$, $p = 0.043$). However, PAEE did not predict parent-report HRQOL (parent report PedsQL and CHQ-PF50).

Conclusions: PAEE could be used as a biomarker in studies on HRQOL and HPA in school-age children with cerebral palsy.

OC-086 | Responsiveness and performance discrimination of a modified Jebsen-Taylor Test of Hand Function scoring for children with unilateral cerebral palsy

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Introduction: The Jebsen-Taylor Test of Hand Function (JTTHF) is widely used to assess manual dexterity of children with unilateral cerebral palsy (UCP) in clinical and research contexts. The original version of this test only considers the time to complete the test (speed), disregarding the amount of objects handled (accuracy). We aimed to improve the measure, incorporating the accuracy, thus, generating a ratio (accuracy/speed) as the new score. To do so, we examined (1) the performance discrimination regarding the age for both scores in typically developing children (TDC), allowing also to provide normative data; (2) the responsiveness of the new score following an intensive intervention in children with UCP.

Patients and Methods: This study included 169 TDC (range 3-16y) assessed once to evaluate the discrimination using an ANOVA, and 40 children with UCP (range 5-17y) assessed before and after an intensive intervention to evaluate the responsiveness using paired t-test and the effect size.

Results: For TDC, the ANOVA showed a better discrimination regarding the age on the new score compared to the original. Also, significant differences were observed after the intervention in the less- and more-affected hand of children with UCP for both scores (all p <0.05). Moreover, small to moderate effect sizes were observed for both scores in both hands.

Conclusion: Our results highlight a more complete representation of changes in manual dexterity throughout age while using the new score of the JTTHF. After intervention, changes are also observed when considering speed and accuracy in the scoring of the JTTHF.

Miscellaneous

OC-087 | A retrospective natural history study of physical function in an Irish Duchenne muscular dystrophy paediatric population

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Introduction: The Neuromuscular clinic at the Central Remedial Clinic (CRC) in Dublin, Ireland has managed the majority of Irish children with Duchenne Muscular Dystrophy (approximately 75%) since 1985. Following confirmation of a DMD diagnosis, patients are typically referred for assessment and bi-annual review until 18 years of age.

Patients and Methods: A retrospective chart review for 68 patients with DMD who attended the CRC between 01/01/1999 to 01/02/2021 was completed. Data collection included age at first visit, profiling data, DMD genotype variant, pharmacological data, timing of visits with respect to the current standards of care (SOC) guidelines, physical function measures and age at loss of ambulation.

Results: The mean age of loss of ambulation (LOA) across all recorded cases was 116 months and was significantly influenced by mutation type. An interaction effect between glucocorticoid status and mutation type on age of LOA was noted. The introduction of SOC guidelines in 2010 had a significant effect for the age at performance of best physical function test. Age at first clinic visit and age at best 10-meter walk test were noted to significantly influence the age at LOA, with a higher age at first clinic visit associated with a lower age at LOA.

Conclusion: The study emphasises the significance of variables on age at loss of ambulation; such as DMD mutation type, standard of care guidelines and age at first clinic. The study also highlights utility of physical function assessments to monitor the DMD disease course.

OC-088 | A retrospective study of the effect of Nusinersen and physiotherapy on specific motor skills in spinal muscular atrophy

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Introduction: Spinal Muscular Atrophy (SMA) is the most common genetic cause of death in children. Nowadays, in Spain, Nusinersen is the only drug authorized to stop its evolution. Physiotherapy is essential in the multidisciplinary treatment approach. However, there is scarce evidence about which motor skills benefit more from the combination of Nusinersen with physiotherapy. The aim of this study was to assess the effect of this therapeutic approach on specific motor skills in SMA.

Patients and Methods: A retrospective study was conducted. Data from hospital records of 17 children diagnosed with SMA type II and III were extracted. Additionally, the scores of the following scales were registered: Hammersmith Functional Motor Scale Expanded, Revised Upper Limb Module and The Children's Hospital of Philadelphia Infant Test of Neuromuscular Disorders. The Friedman test was used to analyse the treatment's effect. In addition, the change score from baseline to each assessment (at 8, 16 and 24 months from drug treatment initiation) was studied.

Results: The ability to ascend and descend stairs was the unique of the studied skills that showed a statistically significant improvement ((3) =8.077, p <0.05). In addition, motor abilities in distal region of the upper limb and spontaneous and induced mobility of the lower limb showed clinically significant improvements.

Conclusion: Combination of Nusinersen with physiotherapy shows clinically significant improvements in the functionality of children with SMA type II and III. The ability to ascend and descend stairs appears to be the motor skill that benefits the most from this treatment approach.

OC-089 | Functional evolution according to the time of diagnosis and treatment of developmental dysplasia of the hip

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Introduction: Developmental dysplasia of the hip (DDH) is a common orthopedic condition in newborns and infants. Its early diagnosis and treatment are essential to minimize functional sequelae. The aim of this study is to evaluate the functional evolution of patients with DDH according to the age at diagnosis and treatment received.

Patients and Methods: This was a retrospective descriptive and comparative cohort study of patients hospitalized in Gregorio Marañon G.U.H from January-2012 to July-2021 diagnosed with DDH. The sample was divided into two groups: early (<6 months) or late diagnosis. Variables: age at diagnosis, sex, ethnicity, hip joint pathology, treatment, functional outcome.

Results: A total of 32 patients were included (81.3% female); 87.5% white. 7 patients (21.8%) were delayed referred to the hospital; 71.5% of them required surgical treatment compared to 24% of those with early diagnosis ($p = 0.02$). None of the patients with early diagnosis received surgical treatment initially; those who underwent surgery was after failed conservative treatment. From the late diagnosis group, 57% presented sequelae with limited range of motion compared to 16% of the early diagnosis group ($p = 0.026$) and gait claudication in 57% compared to 15% ($p = 0.029$). Patients who underwent surgery were referred to the rehabilitation department and included in a treatment program consisting of manual physiotherapy and gait re-education.

Conclusions: In the present study we observe that the probability of requiring surgical treatment and the risk of suffering functional sequelae increases when the diagnosis of DDH is late. To optimize functional prognosis rehabilitation programs are essential in such cases.

OC-090 | Evaluation of the effects of family socioeconomic indicators, family burden level on child's quality of life in adolescents with cerebral palsy

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Introduction: Quality of life (QoL) is a significant aspect of health and socioeconomic status (SES) is a well-recognized predictor of neurodevelopmental outcome in children. The aim of this study was to identify the relation between adolescents with cerebral palsy (aCP) QoL and SES of parents and family-burden.

Patients and method: 100 aCP (spastic: 75%, dyskinetic: 16%, ataxic: 9%) age between 13–18 (mean:16.33 ± 1.51 years; 54% boys) were included. QoL was evaluated with Child-Health-Questionnaire, Parent-Form-50 (CHQ-PF-50), and consisted of physical, psychosocial health; SES: parental-education, employment, family-income, number of siblings; family burden was evaluated with the Impact-of-Family-Scale (IPFAM), which consisted of financial-support (FS), general-impact (GI), disruption-of-social-relations (SR), coping subscales. Motor levels of aCP were classified according to the Gross Motor Function Classification System (GMFCS) (Level I-II: 48%; III-IV: 52%), Manual Ability Classification System (MACS) (Level I-II: 54%; III-IV: 46%). The relationships between SES, QoL, and motor levels were examined with a structural equation model. Four goodness of fit statistics were used in the analysis: Root Mean Square Error of Approximation (RMSEA), goodness of fit index (GFI), Chi-square and degree of freedom, goodness of fit index (GFI). Ethical approval was gathered (no:GO-14/431–20).

Results: The proposed path model showed good fit indices ($p < 0.01$). According to the path model, SES (parental-education, employment, family-income, number of siblings) of the parents of aCP explained both QoL (CHQ-PF-50: physical-psychosocial health) and family-burden (IPFAM: FS, GI, SR, coping); GMFCS and MACS explained both family-burden and QoL in different percentages (RMSEA<0.08, GFI <0.90, chi-square <3, $p < 0.05$).

Conclusion: SES has an important effect on both QoL and family-burden. Social supports for rehabilitation programs for aCP should highlight that psychosocial health become more prominent in adolescence.

Brain Imagery/Neurophysiology

OC-091 | Exploring structural brain connectomes and its impact on sensorimotor function in children with unilateral cerebral palsy

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Introduction: We explored structural brain connectomes in children with unilateral cerebral palsy (uCP) and its relation to sensorimotor function using graph theory.
Patients and Methods: We assessed upper limb sensorimotor function in 44 children with spastic uCP (mean age 10y7m ± 2y9m; Manual Ability Classification System I = 14; II = 16; III = 14). We collected multi-shell diffusion-weighted, T1-weighted and T2-FLAIR MRI and performed transcranial magnetic stimulation. Structural connectomes were constructed using Desikan-Killiany parcellations based on Virtual Brain Grafting and MRTrix3 CSD-tractography. Graph metrics (characteristic path length, global/local efficiency and clustering coefficient) were calculated for ipsilesional/contralesional hemisphere and sensorimotor network (SMN), and were compared between lesion types (white matter [WM] = 27; grey matter [GM] = 17) and corticospinal tract (CST) wiring patterns (ipsilateral = 14; bilateral = 14; contralateral = 11; unknown = 5) using ANCOVA with age-correction. We used elastic-net regression to investigate how graph metrics, lesion volume/type and CST-wiring pattern predict sensorimotor function.
Results: In WM-lesions, the ipsilesional hemisphere and SMN have a lower cluster coefficient ($p < 0.01$), and the contralesional hemisphere and SMN respectively showed lower global and local efficiency ($p < 0.008$) compared to GM-lesions. No differences were found between CST-wiring patterns. Elastic-net regression predicted moderate to high values for sensorimotor function ($R^2 = 0.48–0.87$). For motor function, the CST-wiring pattern was identified as the strongest predictor. No strong predictors were revealed for somatosensory function for which all variables contributed to a limited extent.
Conclusion: Structural connectomes across both hemispheres differ between lesion types. For predicting motor function, the CST-wiring pattern still seems to outweigh structural connectomes, while for somatosensory function a strong predictor could not be identified.

OC-092 | Cerebral blood flow and cognitive outcome after pediatric stroke to the middle cerebral artery

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Introduction: Adaptive recovery of cerebral perfusion after pediatric arterial ischemic stroke (AIS) is sought to be crucial for sustainable rehabilitation of cognitive functions. We therefore examined cerebral blood flow (CBF) in the chronic stage after stroke and its association with cognitive outcome in patients after pediatric AIS.
Patients and Methods: This cross-sectional study investigated CBF and cognitive functions in 14 patients (age 13.5 ± 4.4 years) after pediatric AIS to the middle cerebral artery (time since AIS was at least 2 years prior to assessment) when compared with 36 healthy controls (aged 13.8 ± 4.3 years). Cognitive functions were assessed with neuropsychological tests, CBF was measured with arterial spin labeled imaging in the anterior, middle, and posterior cerebral artery (ACA, MCA, PCA).
Results: Patients had lower IQ scores and poorer cognitive functions compared to healthy controls ($p < 0.026$) but mean performance was within the normal range in all cognitive domains. CBF was lower in the ipsilesional MCA and PCA in patients compared to healthy controls ($p < 0.011$). Further, we found higher interhemispheric perfusion imbalance in the MCA in patients compared to controls ($p = 0.018$). Higher interhemispheric perfusion imbalance in the MCA was significantly associated with lower working memory performance.
Conclusion: Our findings revealed that even years after pediatric stroke in the MCA, reduced ipsilesional cerebral blood flow occurs in the MCA and PCA and interhemispheric imbalance is associated with cognitive functions. Our data suggest that cerebral hypoperfusion might underlie some of the variability observed in long-term outcome after pediatric stroke.

OC-093 | Structural brain damage and high level visual function in children with cerebral palsy due to periventricular leukomalacia

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Introduction: Visual function is crucial for development and can be impaired by several conditions, particularly

prematurity. Prematurity is, in fact, well known to give rise both to ophthalmological disorders and to cerebral visual impairment due to brain damage (mainly periventricular leukomalacia, PVL). This study aims to systematically explore the relationship between type and severity of brain lesion on MRI and "basic" and "high level" visual functions in a small cohort of children with periventricular leukomalacia.
Patients and Methods: 12 children with bilateral cerebral palsy and history of PVL were recruited at Stella Maris Scientific Institute in Pisa (Italy). We included data of participants with at least one MRI after the age of three years and an evaluation of basic visual functions (including fixation, following, saccades, nystagmus, acuity, visual field, stereopsis and color perception) and high level visual functions evaluated by form coherence and motion coherence task, unusual perspective and illumination task and the Developmental Test of Visual Perception. Brain lesions location and extent were assessed by a semi-quantitative MRI-scale for children with CP.
Results: Brain lesion severity strongly correlated with visual function total score (global MRI score p = −0.000; hemispheric score p = −0.001 and subcortical score p = 0.000). Moreover, form coherence z-score and motion coherence z-score strongly correlated with global MRI score (respectively p = 0.029 and 0.034) and hemispheric score (respectively p = 0.022 and 0.032).
Conclusion: Structural MRI is valuable for understanding the relationship between brain lesion severity and high level visual in children with CP.

OC-094 | Functional and structural brain connectivity in children with bilateral cerebral palsy compared to age-related controls and in response to intensive rapid-reciprocal leg training

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Background: Less is known about brain reorganization and plasticity in bilateral versus unilateral CP especially in relation or response to motor training. Reports on brain imaging results alongside functional outcomes include a few studies in unilateral CP, and one on 3 children with bilateral CP. This is the first locomotor training trial in CP to our knowledge to report brain imaging with motor outcomes.
Patients and Methods: We compared MRI brain volumes, resting state connectivity and DTI in children with bilateral CP and preterm birth (<34 weeks), compared to controls, and from RCT of intensive 12 week rapid-reciprocal leg training using an elliptical or motor-assisted cycle. We hypothesized the CP would show decreased size and connectivity in sensorimotor-related brain regions and functional, but not structural, connectivity would improve post intervention. We further explored correlations between imaging and functional measures at baseline and post-intervention.
Results: 16 with CP and 18 controls had 3 T MRI/DTI scans. Decreased posterior white matter, corpus callosum and thalamic volumes, and posterior thalamic radiation Fractional Anisotropy were the most prominent differences. Only brainstem and midbrain volumes increased post-intervention. While motor cortex connectivity had high shared variance with motor function, specific evidence of corticospinal tract involvement was not found.
Conclusions: Results reinforce the involvement of sensory-related brain areas in bilateral CP. Given the wide individual variability in imaging findings and clinical responses to training, greater focus on neural and other (e.g. genetic) mechanisms related to better or worse treatment responses is recommended to enhance patient-specific rehabilitation outcomes.

OC-095 | Cerebral blood flow and its association with cognitive and motor performance in pediatric cancer survivors

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Pediatric cancer survivors (PCS) frequently experience long-term cognitive and motor difficulties as well as functional and structural brain alterations. However, little is known about cerebral blood flow (CBF) and its possible relationship with cognition and motor abilities in PCS. We therefore examined (1) CBF, cognitive functions, and motor abilities in PCS and (2) investigated the possible associations between these three domains. Forty children post-non-central nervous system cancer (aged 7–16 years; ≥1 year following termination of cancer treatment) and 40 healthy children and adolescents were included in this cross-sectional analysis. All participants underwent MRI including arterial spin labeling. We investigated global CBF and the cerebral flow territories of the anterior, middle, and posterior cerebral artery (ACA, MCA, and PCA). Cognitive functions (i.e. fluid intelligence, executive functions, and processing speed) were assessed with neuropsychological tests and motor abilities (i.e. coordination and strength) using the German Motor Test. CBF (global, ACA, MCA, and PCA) did not differ between PCS and controls. Working memory (p = 0.043) and motor performance (p = 0.002) were significantly worse in PCS than controls. CBF was negatively correlated with age (r = −0.659) and body mass index (r = −0.602) in controls, but not in PCS. In PCS, but not in controls, CBF was negatively correlated with working memory (r = −0.404) and motor performance (r = −0.436). Our results might indicate a changed relationship between maturation and CBF in PCS. Furthermore, the association between CBF and functional outcome in PCS points towards different brain-behavior mechanisms after cancer and its treatment.

OC-096 | Corpus callosum white matter microstructures links to cognitive performance and functioning laterality in preterm and term born children

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Introduction: Knowledge is lacking concerning long-term influences of preterm birth on action-cognition integrations related to corpus callosum (CC) maturation/myelination. Here, we investigate long-term-effects of preterm birth on CC microstructures/organization in relation to cognition and functional-laterality.

Patients and Methods: The sample included 82 children, 41 term-born (M-age = 8.1y), and 41 preterm-born (M-age = 8.2y); subdivided into V-PT, (GA = 25–32w, N = 23), and M-PT, (GA = 33–35w, N = 18), without major brain-deficits. DTI performed in 3 T-MRI-scanners, generated maps of CC Genu, Truncus, Splenium (FA, MD, AD, RD-values). Results from WISC-IV (verbal-comprehension-VCI, perceptual-reasoning-PRI, working-memory-WM, processing-speed-PS, FSIQ), and Laterality-index (hand-, foot-, eye-preference) were analyzed related to DTI-outcomes.

Results: Significant group difference was found regarding CC-FA-values (F[2,79] = 5,3527, p = 0.006), post-hoc-test showed that VPT differed from term (p = 0.015) and MPT-born (p = 0.016), by lower FA-Genu, Truncus, Splenium. This pattern was also found for MD, RD, and AD-values. Positive-correlations (p <0.01) were found between GA and all CC-FA-values, and negatively for all MD, RD and AD-Splenium. VPT-born showed lower (p = 0.005) FSIQ (M = 93) than term (M = 103). Correlations (p <0.05) were found between WM and CC-FA-values in Genu for VPT-born, and between CC-FA-values in Genu, Truncus and PRI-index (p <0.01) for term-born. VPT-born showed lower hand- and overall-laterality-index than term and MPT, and no significant correlations between laterality-index and CC-values. Term and MPT-children showed positive correlations (p <0.01) between decreasing overall-laterality-index and FA-values, and negative for MD-Splenium, RD-Splenium and RD-Truncus.

Conclusion: DTI revealed evidence for long-term impact of very-premature birth on CC related to atypical hemispheric maturation and behavioral integrations compared to term-born controls. The findings highlight the importance of including functional-laterality to models investigating brain white-matter-microstructures.

OC-097 | Asymmetry in sleep spindles predicts motor outcome in infants with unilateral brain injury

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Introduction: Our study aimed to determine whether interhemispheric difference in sleep spindles in infants with perinatal unilateral brain injury, could link to a pathological network reorganization that underpins the development of unilateral cerebral palsy (UCP).

Patients and Methods: This was a multicentre retrospective study of 40 infants with unilateral brain injury. Sleep-spindles were detected and quantified with an automated algorithm from electroencephalograph records performed at 2–5 months of age. The clinical outcomes after 18 months were compared to spindle power asymmetry (SPA) between hemispheres in different brain regions.

Results: We found a significantly increased SPA in infants who later developed UCP (N = 13; 33%), with the most robust interhemispheric difference seen in the central spindles. The best individual-level prediction of UCP was seen in the centro-occipital spindles with an overall accuracy of 93%. An empiric cut-off level for SPA at 0.65 gave a positive predictive value of 100% and a negative predictive value of 93% for later development of UCP.

Conclusion: Our data suggest that automated analysis of interhemispheric SPA provides a potential biomarker of UCP at a very early age. This functional biomarker holds promise for guiding and targeting early therapeutic interventions in infants with a perinatally identified brain injury.

European Society for Movement Analysis in Adults and Children (ESMAC)

OC-098 | The impact of BMI progression on gait kinematics in children with cerebral palsy

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Introduction: Obesity is a global concern with high prevalence rates reported in children. Children with cerebral palsy (CP) may have a greater risk of becoming overweight or obese due to biomechanical, behavioural, or medical issues that restrict participation. The impact of body mass index (BMI) on the gait of children with CP has previously been reported to be small. However, it is not clear how gait kinematics change in those children with CP who progress from normal BMI to overweight/obesity. Therefore, the purpose of this study was to examine how the progression of BMI status from normal to overweight/obese BMI impacts gait kinematics in children with CP.

Patients and Methods: A retrospective analysis was conducted of the Gait Laboratory database. Children with CP with at least two assessments, a normal BMI on initial assessment and increased BMI on follow-up assessment, and no reported orthopaedic interventions between assessments, were included. Differences in lower limb kinematics in all 3 planes were analysed using Statistical non-Parametric Mapping.

Results: Thirty children progressed from a normal BMI status to either overweight or obese at follow up. Small changes in the rotational profiles of the hip ($p = 0.001$) and tibia ($p = 0.001$) were present during stance. Minimal changes were also evident in the sagittal plane.

Conclusion: This study demonstrated subtle changes in lower limb kinematics as children with CP progressed from normal to a higher BMI. It is important that these changes are fully understood in the context of intervention and surgical planning in these children.

OC-099 | Gait of preschool-age children born very preterm at risk for developmental coordination disorder

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Introduction: Walking in children with cerebral palsy (CP) has been well-investigated, but less so in children with non-CP motor impairment, including developmental coordination disorder (DCD). We aimed to explore the spatiotemporal gait characteristics during different walking conditions in children born <30 weeks' gestation either at risk or not at risk of DCD.

Patients and Methods: A prospective cohort of 149 children born <30 weeks' gestation were recruited at birth. Risk for DCD was identified at 4–5 years' corrected age as scoring ≤16th percentile on the Movement Assessment Battery for Children-2, scoring ≥80 IQ on the Wechsler Preschool and Primary Scale of Intelligence, and without CP. A GAITRite® system was used to capture spatiotemporal variables and variability during preferred speed, cognitive dual-task, motor dual-task and tandem walk conditions.

Results: Of 111 children with motor and gait assessments, 26 were classified as being at risk of DCD, which was associated with higher gait variability than those not at risk in all conditions. Greater spatiotemporal differences between those at risk and not at risk of DCD were seen when gait was challenged in dual-task and tandem conditions, more than during preferred speed. Key differences included wider base of support (BOS) in motor dual-task (mean differences [MD] = 0.86 cm, 95%CI 0.10, 1.61) and tandem (MD = 0.63 cm, 95%CI 0.07, 1.20) walk, and higher BOS variability in preferred speed, cognitive dual-task, and tandem walk.

Conclusion: Children born very preterm at risk of DCD show the greatest gait differences than children not at risk when walking demand increases.

OC-100 | Long term goal attainment results of robot-assisted gait therapy in children with cerebral palsy - a large cohort prospective study

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Introduction: There is a wide interest in robot-assisted therapy (RAT) in children with cerebral palsy (CP) observed in the literature. The aims of this study were to: (1) assess the effectiveness of RAT in gait related goals achievement and its persistence in a 6 month follow up period and (2) analyze the demographic, function and previous surgery influence on results.

Patients and Methods: 374 CP patients 5–21 years with GMFCS I-IV were included in the study. All underwent one rehabilitation 10 days session with exoskeletons and distal-effectors gait training. The Goal Attainment Scale (GAS) rating was collected just after intervention (short-FU) and at 6 month follow-up (long-FU). Age, gender, GMFCS, previous orthopedic surgery and initial GMFM were obtained and analyzed.

Results: A total of 263 patients (70.32%) obtained the initially established goals of RAT at short-FU and 245 patients (65.51%) at long-FU. There was no difference in GAS rank between operated (N = 135) and no-operated patients (N = 128) ($p <0.05$) after RAT both in short and long-FU. The similar results were observed for GMFCS and input GMFM score. For no-operated children, younger children (up to 15 years) were better therapy responders, achieved their goals faster, and the stability of that achievements were stronger ($p <0.01$). The score of short-FU for boys was higher than for girls ($p <0.01$), but the results sustainability was lower ($p <0.05$).

Conclusion: This large cohort prospective study provides evidence that RAT in gait related purposes is effective for children with CP, with higher success rate for patients younger than 15 years.

OC-101 | Reliability of the GAIT.SCRIPT interpretation tool to systematically assess gait impairments in children with spastic cerebral palsy

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Introduction: To standardize the clinical interpretation process of gait analysis in children with cerebral palsy (CP) we created a comprehensive core set of gait features in relation to their potential underlying impairments following a Delphi procedure. Our supportive Excel-based GAIT.SCRIPT interpretation tool can further implement objective interpretation of gait analysis in daily practice. The aim of this study is to ascertain the reliability of the GAIT.SCRIPT interpretation tool.

Patients and Methods: Reliability of the tool was tested by performing gait analysis of 20 retrospective CP cases (age 8.9 ± 3.2 [5–14], GMFCS level I-III) by an expert and two novices. They individually scored gait features for all cases and, based on the expert's list of deviating gait features, identified possible underlying impairments. Interrater repeatability of the tool was calculated as percentage agreement between novices, and between mean of the novices and the expert.

Results: Agreement in identified gait features between novices amounted to 77.7 ± 14.6% (30–100%) and between novices and expert to 67.4 ± 12.9% (37.5–90%). Agreement in identified underlying impairments between novices was 72.1 ± 16.0% (35–95%) and agreement between mean of the novices and expert was 72.6 ± 12.2% (45–92.5%).

Conclusion: The moderately high levels of agreement between novices and expert, especially in identifying underlying impairments, could indicate that the tool may compensate for the novices' lack of experience in interpretation. This tool can therefore support unexperienced clinicians in achieving a more objective and reliable assessment of gait impairments in children with CP. Future steps include further validation of the tool in clinical practice.

OC-102 | The effect of prolonged walking on gait in children with cerebral palsy

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Introduction: Walking-induced fatigue limits functional capacity of children with cerebral palsy (CP), especially when walking longer distances. Here we study the effect of prolonged walking on the gait pattern, and on underlying mechanisms including muscle fatigue and dynamic motor control.

Patients and Methods: Twelve children with spastic paresis and fifteen typically developing (TD) children walked on an instrumented treadmill, while 3D motion capture and muscle activity (EMG) were recorded. Participants walked for six-minutes (6 MW) at a fixed comfortable speed, followed by a 2-min period of moderate-intensity walking (>70% of predicted maximum heart rate). If this level was yet reached during 6 MW, speed and slope were increased. Finally, participants walked at a comfortable speed again for 4 minutes. Muscle fatigue was investigated through EMG median frequency (EMG-MF) and motor control using total variance accounted for by one synergy (tVAF1).

Results: The gait pattern significantly worsened with longer walking (Gait Profile Score from 11.7 ± 3.4 to 12.7 ± 3.7degrees in CP), with a systematic increase in knee flexion in early stance and several individual changes. EMG-MF decreased in children with CP indicating increased muscle fatigue, but not in TD. In both groups tVAF1 slightly decreased indicating more complex motor control, but differences were negligible.

Conclusion: Gait deviations in CP are progressive during prolonged walking, which may be related to increases in muscle fatigue, rather than changes in motor control. These findings give insight in the causes of walking-induced fatigue in daily life situations. Assessment of prolonged walking may be useful for better diagnostics of fatigue-related walking problems.

OC-103 | The medium-term effects of selective dorsal rhizotomy on gait compared to a matched cerebral palsy control group: a follow-up study

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Introduction: Selective dorsal rhizotomy (SDR) has been shown to improve gait in the short-term in children with cerebral palsy. Longer-term matched-control outcomes from high quality data are needed.
Patients and Methods: This is a retrospective matched cohort study. Participants underwent SDR at mean age 6.3 years and completed baseline, 1-year and 5-year follow-up gait analyses. Control participants were matched at baseline. Differences were assessed within and between groups. Kinematic variables were analysed using Statistical Parametric Mapping. Lower extremity orthopaedic surgical history was recorded.
Results: The initial SDR group consisted of 29 participants, reducing to 19 at 5-year follow-up. Of these, 13 had orthopaedic surgeries either concurrent with or in the intervening period since the SDR, mean 2.1 procedures per participant. The initial control group had 18 participants, reducing to 17 at 5-year follow-up. Of these, 13 had orthopaedic surgeries, mean 4.5 procedures. At 1-year follow-up the SDR group had significantly improved knee extension, ankle dorsiflexion, foot progression, Gait Deviation Index, and normalised step length, $p < 0.05$, and outcomes were maintained at 5-years. At 5-year follow-up the control group had significantly improved knee extension, ankle dorsiflexion and foot progression, which were not present at 1-year analysis. At 5-years, there were no significant kinematic differences between the groups.
Conclusion: At medium term-follow up the SDR and control groups show similar gait improvements, however, most participants in both groups had undergone orthopaedic surgery. Previously reported outcomes 1-year post-SDR are maintained at 5-years, but the high drop out rate in this group should be considered.

OC-104 | Development of the Walking Ability Level Classification System (WALCS) in cerebral palsy patients: inter-observer agreement, bio-psycho-social factors and implementation guidelines

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Introduction: The Gross Motor Function Classification System (GMFCS) allows the classification of children with cerebral palsy according to their walking ability. The lack of sensitivity in detection of changes and the absence of a global evaluation of the patient justify the search for new assessment tools. The three Objectives: of this study are: (1) To present the Walking Ability Level Classification System (WALCS); (2) To show the inter-observer concordance study performed; (3) To expose the implementation guidelines for its practical use.
Patients and Methods: This system consists of two distinguished components: the first subclassifies functional gait abilities into different levels according to walking or transfer skills and the degree of assistance required, and the second analyzes the bio-psycho-social factors that condition multilevel orthopedic surgery. Focusing on preoperative surgical assessment, an evaluation framework was built by an interdisciplinary team. An inter-observer concordance study was held to obtain the first insight.
Results: 14 participants studied the medical reports and video gait laboratory images of 10 cases. The concordance kappa index was 0.76 for gait ability level, and for bio-psycho-social assessment, 0.79 for biological, 0.69 for the psychological, and 0,64 social factors. In order to facilitate its use, new practical application guidelines are shown.
Conclusions: WALCS provides a new assessment framework that gathers patients' walking abilities and limiting factors for surgical orthopedic treatment. The initial inter-observer agreement rate endorsed further intra- and inter-observer studies, as well as multicenter studies that, aided by new practical application guidelines, have the potential for robust cross-validation.

Participation

OC-105 | Daily functioning in children with developmental coordination disorder: how do learning, performance and participation correlate?

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Introduction: Children with developmental coordination disorder (DCD) struggle with functioning of motor-based activities of daily living (ADL). However, little is known about the specific inter-relationships between ADL learning, performance and participation or about how these aspects contribute to predict each other.
Patients and Methods: We explored a sample of 62 children with probable DCD (p-DCD) as identified by the Spanish country-adjusted cutoffs of the Developmental Coordination Disorder Questionnaire (p-DCD n = 26 [5–10 years old; girls = 30.8%]; severe p-DCD n = 36 [5–10 years old; girls = 50%]). Learning, performance and participation of 23 motor-based ADL were assessed with the DCDDaily-Q.

According to recent evidence, we hypothesized that both learning and participation would predict performance, and that learning and performance would predict participation. Multiple backward stepwise regression analyses were performed to explore the predictive values of these relationships.
Results: In the p-DCD group, delayed learning significantly predicted poor performance of motor-based ADL (adjusted $R^2 = 0.358$), but both delayed learning and reduced participation predicted poor performance in the severe p-DCD group (adjusted $R^2 = 0.671$). Poor performance contributed to predict participation in both groups (p-DCD adjusted $R^2 = 0.103$; severe p-DCD adjusted $R^2 = 0.541$).
Conclusions: Learning, performance and participation of everyday activities in children with DCD show a complex and intertwined relationship, with different displays according to the child's motor coordination difficulties. These findings further support the activity deficit hypothesis and the mediating role of motor performance regarding participation in children with motor coordination difficulties as proposed by recent research. This study highlights the need for early and tailored intervention to promote participation.

OC-107 | Capturing participation patterns among transition-aged youth with visual impairments

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Introduction: Research on participation patterns of transition-aged youth with visual impairment is scarce. This study examines the usefulness and applicability of the newly developed Y-PEM (Youth and Young-adult Participation and Environment Measure) in capturing participation patterns among this population.
Patients and Methods: A sequential explanatory mixed-Methods: design was employed among youth with visual impairment involving two consecutive remote sessions one week apart. In session 1, the Y-PEM and the QQ-10 questionnaire were administered (QUAN). In session 2, youth reflected on their Y-PEM results via an individual semi-structured Stimulated Recall Interview (QUAL). Thematic analysis of qualitative data and descriptive analysis of quantitative data were integrated through a narrative summary.
Results: Eleven youth (3 females, 8 males) aged 17–24 ($\bar{x}$=21, SD = 2.6) from French and English communities participated. A mean value-score of 77% (SD = 10.4) and burden-score of 19% (SD = 5.6) on the QQ-10 reflected the Y-PEM's perceived value. This was confirmed through youth's report that the Y-PEM is well-structured, organized, comprehensive, and could be used to capture participation patterns, set participation-based goals, and show progress over time. Three themes emerged from the qualitative analysis. Insights on participation revealed increased awareness of participation patterns and environmental factors impacting participation. This led to a reflective evaluation of their situation involving the recognition of intrinsic processes and management of obstacles. Finally, approaches to participation elucidated the strategies used in their decision-making process about whether to pursue participation.
Conclusion: Findings suggest the Y-PEM is useful and applicable in capturing participation patterns and identifying environmental supports/barriers for this population.

OC-108 | Characterization of participation at home of infants with and without biological risk in the first year of life

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Introduction: Participation has been the main outcome of biopsychosocial health practice, but is still little explored in infants in the first year of life. We aimed to compare the participation at home of infants with and without biological risk (BR) in the first year of life.
Patients and Methods: This was an observational and cross-sectional study (ethical approval: 31256620.5.0000.5504). 28 typically developing infants (mean age 6.4 months) and 54 infants with BR (mean age 5.6 months) participated in the study. Criteria for BR infants: Gestational age (GA) <36 weeks; low weight at birth; Apgar<7 in the 1st/5th minute; neonatal asphyxia; use of oxygen therapy; resuscitation or prolonged hospitalization. Criteria for typically developing infants: GA >37 weeks; birth weight > 2500 g; uncomplicated birth. Caregivers answered by voice call the Young Children's Participation and Environment Measure, which assesses the frequency and involvement in participation at home in the domains of basic care routine (A), housework (B), organized interactive play (C) and socialization (D). We compared both groups using Mann–Whitney test, using SPSS-V24.0, with a significance level as 5%.
Results: The BR group had a significant lower frequency of participation in domains A ($U = 899.00$; $p = 0.042$) and B ($U = 1089.50$; $p = 0.001$); and less involvement in domains B ($U = 1065.50$; $p = 0.002$) and D ($U = 966.50$; $p = 0.019$).
Conclusions: Infants with BR participated less in routine activities such as feeding, clothing, bathing, and in household chores and taking care of family members, indicating their experience was limited when compared to typically developing infants. In addition, they are less involved in chores, activities, and in socialization, which may represent less opportunity to engage, probably due to family's attitudes.

OC-109 | Supporting participation of children with and without neurodevelopmental conditions: the role of social and physical environment

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Introduction: About 9% of school-aged children present with a neurodevelopmental disorder, which significantly compromises participation. Research suggest that social and physical environment may enhance or reduce participation, but it is not yet known how this influence inter-relates with neurodevelopmental status.

Patients and Methods: Twenty children with a clinical diagnosis of a neurodevelopmental disorder (ASD = 50%; motor coordination/psychomotor disorders = 25%; ADHD = 15%; pervasive developmental disorder = 10%) and twenty typically developing sex- and aged-matched children were included. Daily participation across home, community, school and instrumental activities was measured using the Child and Adolescent Scale of Participation. Environmental barriers were assessed using the Child and Adolescent Scale of Environment. Sociodemographic data (i.e., age, sex, family education level, living area, etc.) were collected using an ad-hoc questionnaire. A linear backward stepwise regression model was used as the main statistical strategy to identify predictors of participation.

Results: Children with neurodevelopmental conditions reported more social and physical barriers than typically developing peers (Glass's delta = 3.81, p <0.001). Environmental barriers were strongly and significantly associated with participation across home, community, school, and instrumental living activities (r = 0.594–0.819, p <0.001). The final model included environmental barriers, neurodevelopmental status and mother education level, which altogether explained more than 75% of the variance in daily participation (adjusted $R^2 = 0.762$). Environmental barriers accounted for most of the variance in participation, even more than presence of neurodevelopmental disorders.

Conclusions: While children with neurodevelopmental disorders display more restrictions in participation, these findings suggest that social and physical environment factors play a decisive role on daily participation in both children with and without neurodevelopmental conditions.

OC-110 | Driving a wheelchair: you need to train to master the task

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Introduction: To enhance the functioning and participation, children using wheelchairs need to be efficient in driving skills, including engagement in traffic. No available tests are focused enough on those skills, so we decided to develop a new one.

Patients and Methods: The test includes four subscales, 32 items for active wheelchair (AW) users - managing wheelchair, basic and advanced driving skills, skillful driving and traffic and additional one for electric-powered wheelchair (EPW) users - these were evaluated on a 4-point scale. In the pilot testing protocol, we invited children, who were referred to children's department in the period from July 2019 to September 2021.

Results: 40 children (32 boys), with an average age of 8.3 years were included; 20 used AW, 20 EPW. Children using EPW scored significantly lower than those using AW in all four subscales (p <0.001). On average, children scored lower in management of AW and advanced driving skills, achieving up to 43.5% and 46.2% of the maximal score (15.2% and 45.7% of EPW maximal score). 20 children were referred to a 10-day specific training program to improve their skills. Mean total improvement in the AW group was 2.5 points (N = 8) and 3.2 points in the EPW group (N = 12).

Conclusion: The test is very helpful in identifying skills that need further training. It well discriminate among driving skills of AW and EPW users. It looks sensitive enough to detect a small change in skills after the focused training program. Psychometric features of test are to be tested in the future.

OC-111 | Tailor-made tricycles in rehabilitation

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Introduction: People with physical disabilities are far less active than recommended. Some need adapted equipment to participate in physical activity and many are motivated for cycling on a tailor-made tricycle. In Norway, people with long-lasting disabilities can apply for such equipment. The research question in this study was: Does the acquisition of an adapted tricycle lead to better cycling outcomes, and are there differences associated with the application procedure?

Patients and Methods: An observational study was conducted. Cohorts of participants applying for an adapted leg-driven tricycle via (1) rehabilitation centres or (2) local therapists. Questionnaires were answered electronically before applying and after having had the opportunity to use the new tricycle for at least 3 weeks. Fifty participants (54% women) aged 5–79 years (M = 31.5) with diverse disabilities responded. Non-parametric analyses were conducted in SPSS.

Results: Forty-seven participants (94%) used their tricycle. Results showed a significant positive change in cycling frequency, cycling performance and satisfaction with cycling (*p* <0.01). The group of participants who applied at a Healthsports Centre reported higher performance and satisfaction with cycling both after testing (pre-test) and after having used their new tricycles for some weeks (post-test).

Conclusion: Acquisition of an adapted tricycle led to a higher amount of cycling, better cycling performance and higher satisfaction with cycling. The highest scores were seen among those who apply via a Healthsports Centre.

Programmes

OC-112 | PERRIN Next Step: better together from knowledge to active practice

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Introduction: Knowledge from scientific studies often remains confined to scientific papers instead of aiding patients and healthcare professionals in daily practice. In the research program PERRIN, children with cerebral palsy (CP) have been followed longitudinally (0–35 years of age), focusing on the development of activities and participation. Knowledge on developmental trajectories and determinants of activities and participation was provided. The goal of PERRIN Next Step is to translate this knowledge into high quality tools enabling people with CP, parents and professionals to actively use the knowledge in daily life and clinical practice and facilitate Shared Decision Making (SDM).
Patients and Methods: In PERRIN Next Step, adolescents and young adults with CP, parents, professionals and researchers work together in an iterative co-creation process to translate knowledge into information and tools.
Results: The result of the PERRIN Next Step project is an interactive website that shares knowledge about the development of children, youth and young adults with CP. This website will facilitate personalized information including developmental curves for various domains, Background: information, infographics and experience stories. The process of co-creation contributes to a perfect fit between the website, tools and needs of end users. Co-creation also leads to active participation in the implementation process of all involved.
Conclusion: The iterative co-creation process is a solid method for translating and implementing longitudinal knowledge on the development of CP. The co-creation process leads knowledge translation better tailored to the needs in daily practice.

OC-113 | Introducing PRISM to clinical practice in residential neurorehabilitation setting for severe acquired brain injury

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Introduction: Neurorehabilitation is a complex and multifacetted intervention. Evaluating outcomes is challenging with little known of the components of the programme delivered. PRISM is a new tool to capture rehabilitation input. The aim of this study was to explore the introduction of PRISM for a cohort of severe paediatric acquired brain injury (ABI).
Patients and Methods: The multidisciplinary team in one centre completed PRISM monthly using consensus to identify priority rehabilitation ingredients that week (child/family active practice; child/family explicit learning of strategies; child/family mental wellbeing; advocating for child in community; other management; equipment/adaptations).
Results: Six months data (n = 20). Average age at injury 9 years, average time since injury 23 weeks. A variety of PRISM profiles were captured, some with a bias towards active practice, others towards emotional health. Case example illustrates activities early in the placement - child active practice (0.17); child's learning of explicit knowledge (0.35); community professionals' learning explicit knowledge (0.07); other management of child activity and function (0.41). PRISM captures a change in priority later in the programme with greater time spent on child active practice (0.59); more time on community professionals' explicit learning (0.16); and a new priority of advocating for child/family in community (0.25). Further examples demonstrate a decrease in active practice in favour of other supports for the child. The team found the PRISM calculator tool easy to use.
Conclusion: PRISM captures individualised/dynamic rehabilitation input offered to children with differing needs following severe ABI. This tool facilitates team and family discussion about rehabilitation priorities. Research is required to explore the relationship between PRISM inputs and child/family outcomes.

OC-114 | Cerebral palsy as an underlying cause of death

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Introduction: The objective of this study was to examine temporal trends in cerebral palsy (CP) as the underlying cause of death overall in the US.
Patients and Methods: National cohort from the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research database from 1999 to 2019. The underlying cause of death was determined using the International Statistical Classification of Diseases and

Related Health Problems, Tenth Revision (ICD-10 code G80, Infantile CP) based on death certificate adjudication. Crude mortality rates, age-adjusted mortality rates (AAMRs), and 95% confidence intervals were calculated for adults with CP from 1999–2019.

Results: Between 1999 and 2019, there were 25,138 deaths where CP was listed as the underlying cause of death. There was a steady increase in deaths attributable to CP in both crude mortality rates and AAMRs from 1999–2019, with the highest rates occurring in 2019. Most deaths attributed to CP occurred in large metropolitan areas (n = 866 [45.8%]) followed by medium and small metropolitan areas (n = 653 [34.5%]), and rural areas (n = 374 [19.7%]); however, the crude mortality rates were significantly higher among rural areas. The highest co-occurring causes of death were other diseases of the nervous system (36.4%), diseases of the respiratory system (17.2%), symptoms, signs, and abnormal clinical and laboratory findings (15.3%), and diseases of the circulatory system (8.2%).

Conclusions: Labeling a cause of death as CP must be accompanied with other mechanisms leading to death in this population, to bolster our understanding of the natural history of this condition.

OC-115 | ARRoW-CP: Gait rehabilitation with an active video game for children with cerebral palsy. Preliminary results

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Introduction: The international clinical practice guideline recommends overground gait training (OGT) to improve walking capacity in children with cerebral palsy (CP). Interventions in enjoyable and fun ways have also shown positive effects. To improve gait rehabilitation after Single-Event Multi-Level Surgery, we have developed an Active Video Game (AVG), ARRoW-CP, which incorporated motor learning theories and audio-visual feedback to perform a 4-week intensive OGT.

Patients and Methods: The ARRoW-CP study is a randomized clinical controlled trial. A total of 14 children and adolescents aged 12–18 years with CP will be included. The minimum time between surgery and inclusion is 7 weeks and participants have a Functional Mobility Scale 50 meters rating superior or equal to 2. The intervention group participates in OGT with ARRoW-CP. The control group has treadmill gait training. Outcomes are 6-Minutes Walk Test and Muscle Power Sprint Test. Enjoyment is assessed with the Physical Activity Enjoyment Scale.

Results: First qualitative results (N = 7) showed a significant improvement for 6MWT and MPST in both groups. Children had a linear progression in WS between each session and weeks. Enjoyment and motivation were higher in the ARRoW-CP group. All participants completed the overall protocol, except one in the control group.

Conclusion: Both groups have an evidence-based physical therapy training. In addition, ARRoW-CP combines multiple ingredients of motor learning theories: context focused therapy, goal-directed training, task-specific, variable practice, high intensity, feedback during therapy sessions and motivation of the patient. The study is in progress and preliminary results are very encouraging.