IC01: A MULTI-DISCIPLINARY APPROACH TO SURGERY FOR TREATING HIP DISPLACEMENT: A PERI-OPERATIVE JOURNEY FROM PLANNING TO OUTCOMES
Wade Shrader, M.D.; Benjamin Shore, MD, MPH, FRCSC; Abhay Khot, FRACS; Giuliana Antolovich, BSc(Hons), PhD, MBBS, FRACP; Kate Willoughby, B Physio, D Physio

Purpose: This course will present an overview of the journey from the decision to perform bony surgery for hip displacement through to the outcome. The indications for hip reconstruction in the context of cerebral palsy (CP) will be discussed, along with a review of evidence of the outcomes of surgery. The workshop will assist attendees to utilize multi-disciplinary team planning to prepare the child and family for surgery and minimize peri-operative risks. Attendees will learn the technical details involved in a varus derotational osteotomy (VDRO) through case examples and a hands-on laboratory session where they will perform a VDRO on a saw-bone model, guided by pediatric orthopedic surgeons.

Target Audience: Physicians, Physical and Occupational Therapists, Nurses

Course Summary: This course will provide an introductory level discussion of hip osteotomies for children and adolescents with CP and neuromuscular hip dysplasia. The pathophysiology, prevalence, and treatment indications for reconstructive hip surgery will be presented. Planning and preparation in the pre-operative period will be outlined with case examples. The step-by-step surgical details of a VDRO will be presented with photographic details and videos of actual surgical procedures. The technical modifications that allow clinicians to achieve surgical outcomes will be demonstrated. The laboratory portion of the course will allow participants to perform a VDRO on a saw-bone model with modern surgical instrumentation. Issues raised during the post-operative recovery period will be discussed to help clinicians navigate a potentially difficult time for the child and the family. The nuances of multidisciplinary post-operative care to realize both safe outcomes and the attainment of all pre-operative goals will be also be considered.

Learning Objectives:
1. Describe the causes and prevalence of hip displacement in children with CP
2. Recognise the scope and complexity of care required in the surgical planning process
3. Understand the indications for hip reconstruction in children with CP and describe the technical steps involved in the surgical technique of a VDRO
4. Navigate the post-operative recovery period after surgery and minimize peri-operative risks

IC02: APPLICATION OF MIYOGA, A NOVEL EMBODIED MINDFULNESS MOVEMENT PROGRAM, FOR CHILDREN WITH CEREBRAL PALSY
Catherine Mak, BS; Roslyn Boyd, PhD, MSc (PT), BAappsc (PT), BSc (Anatomy), Pgrad (Biomech)

Purpose: This workshop is based on the results of a randomised control trial of the MiYoga program. MiYoga is a lifestyle intervention based on mindfulness and yoga techniques for children with cerebral palsy. The presenters will review the theory and scientific evidence behind mindfulness and yoga and how it could benefit children with cerebral palsy. Attendees will learn techniques and strategies on how mindfulness and yoga can be applied in therapy, as well as how to help families utilise the strategies from this lifestyle intervention in their everyday lives. The practical component of this workshop will allow attendees to experience embodied mindful movements first hand as well as help them integrate it into their clinical practice.
**Target Audience:** This workshop is suitable for clinicians, therapy students, and parents caring for children with cerebral palsy.

**Course Summary:** This workshop aims to educate therapists and clinicians on the benefits of yoga and mindfulness for children with disabilities, especially cerebral palsy, based on current literature and results of a recent randomised controlled trial. In addition, it aims to provide participants an opportunity to experience the application of yoga and mindfulness in therapy. The workshop content includes a brief summary of current literature highlighting the benefits of yoga and mindfulness and how these are relevant for children with cerebral palsy. It will discuss the development of the MiYoga program and provide participants the opportunity to experience some of the mindfulness and yoga techniques in the program. There will be small group activities that will allow participants to apply some of the techniques and learn how to adapt and tailor simple mindful yoga sequences for children with cerebral palsy.

**Learning Objectives:**
1. To understand the benefits of mindfulness and yoga for children and how this may be relevant for children with cerebral palsy
2. To understand and practice, how mindfulness and yoga can be applied in therapy to facilitate embodied movements and to enhance children’s attention outcomes
3. To apply MiYoga strategies for children with cerebral palsy in an individual, group and in home settings where families can integrate strategies from this lifestyle intervention into their everyday lives
4. To practice and apply simple mindful movement routines for stretching, strengthening, body awareness and calming the neurological system

**IC03: DIFFERENTIATING BETWEEN PRIMARY, SECONDARY AND COMPENSATORY MECHANISMS IN GAIT IN PERSONS WITH CEREBRAL PALSY**

*Sylvia Ounpuu, MSc; Kristan Pierz, MD*

**Purpose:** The purpose of this course is to describe gait pathology in CP in terms of primary, secondary and compensatory deviations.

**Target Audience:** Physicians, orthotists, physical therapists and kinesiologists who are making treatment decisions to improve gait function in persons with neuromuscular disorders.

**Course Summary:** The course will begin with a brief overview of joint kinematics to allow a complete understanding of the angle definitions and kinematic plotting formats. Then the definition of primary, secondary and compensatory gait deviations will be provided and discussed. The importance of differentiating between these different categories of gait deviations will be reviewed. These concepts will then be illustrated in a series of case examples. These case examples will involve attendee participation through discussion of the initial visual assessment of each patient example. Each case will be discussed in terms of the joint kinematics and associated clinical examination parameters that allow determination of primary problems. All cases will be reviewed in an interactive format with the assistance of video records. Strategies for differentiating between primary and secondary deviations and compensations will also be discussed and illustrated.

**Learning Objectives:**
1. Define primary and secondary deviations and compensations seen in gait
2. Differentiate between primary deviations that need to be treated and other gait deviations that will resolve if the primary problem is addressed
3. Understand common multi-level gait patterns in CP
4. Describe how motion analysis can help us understand primary vs. secondary gait deviations
IC04: FUNCTIONAL NEAR-INFRARED SPECTROSCOPY (FNIRS): A NOVEL EMERGING MOBILE BRAIN IMAGING TECHNOLOGY FOR INVESTIGATION OF CORTICAL ACTIVATION DURING FUNCTIONAL MOTOR TASKS IN INDIVIDUALS WITH CEREBRAL PALSY
Ana Carolina de Campos, P.T, PhD; Theresa Moulton, Ph.D., DPT; Diane Damiano, PhD; Ryota Nishiyori, PhD

Purpose: This course will present the rationale for and utility of functional near-infrared spectroscopy (fNIRS) for investigating the neural coordinates of normal and abnormal motor control and for measuring cortical changes after motor training in cerebral palsy (CP). NIRS is an emerging mobile brain imaging technology that uses near-infrared light to examine Blood Oxygen Level Dependent (BOLD) changes in response to cortical activity, much like fMRI.

Target Audience: Researchers and clinicians interested in brain imaging technologies and cortical activation patterns in CP

Course Summary: fMRI has led to great advances in understanding brain reorganization in response to injury and as result of treatment in stroke and unilateral CP. However, the MRI scanner is restricted to small movements in supine and many with CP are unable to remain still in the scanner due to increased startle or involuntary movements. Because it can be used in clinical research settings and is more robust to movement artifacts, fNIRS presents great potential for investigating both typical and atypical control of functional movements such as reaching and walking. Our laboratory at NIH has collected data during motor tasks on more than 50 individuals with and without CP. This course will focus on the following topics:

• Review of the anatomy of the hemodynamic response, and the use of light to monitor blood flow;
• Literature review of the use of fNIRS to study movement in typically developing children and adults and in individuals with CP;
• Sharing experiences with fNIRS data acquisition and analysis in CP
• Comparison of fNIRS to other technologies, e.g. EEG, also being utilized to study cortical activation during motor tasks
• Present results obtained from fNIRS during motor tasks in the upper and lower extremities of individuals with unilateral and bilateral CP compared to those with typical development.

Learning Objectives:
1. Demonstrate a general understanding about the use of fNIRS to study brain activity
2. Critically discuss the challenges of using the technology with brains that have lesions, and advantages of this technology for CP
4. Appreciate relationship of brain activity to muscle activity and selectivity
**IC05: HYPERTONIA MANAGEMENT IN CEREBRAL PALSY: PAST IDEAS AND LESSONS, CURRENT PRACTICE AND OUTCOMES, FUTURE INNOVATIONS AND POSSIBILITIES**

Marcie Ward, MD; Mark Gormley, MD; Timothy Feyma, MD

**Purpose:** This course will review tone management in cerebral palsy -- the past and the lessons learned, the present and its shortcomings, and the future and its possibilities for improving care of patients. The course will review research which assesses tone management modalities, describe common clinical uses for tone management modalities and invite the audience to consider alternative uses of these modalities in clinical practice.

**Target Audience:** Developmental pediatricians, pediatric neurologists, neurosurgeons, pediatric orthopedic surgeons, pediatric physiatrists, physical therapists, occupational therapists and other providers who treat patients with cerebral palsy who want to learn more about spasticity and dystonia management options for their patients.

**Course Summary:** This course will begin by reflecting on the history of tone management for patients with cerebral palsy and the lessons learned from that practice. Next, the course will summarize current practice trends in tone management including neurosurgical options (rhizotomy and deep brain stimulation) in conjunction with a review of the available evidence evaluating those practices. Finally, the presenters will explore potential future directions in hypertonia management and consider novel uses for established techniques (such as "palliative rhizotomy"). Focus will be directed at examining the use of neurotoxins and nerve blocks, and neurosurgical interventions including rhizotomy, intrathecal baclofen and deep brain stimulation. Case examples will be presented and audience response software will be used to generate discussion and collaboration.

**Learning Objectives:**
1. Summarize the available tools for tone management, their potential limitations and benefits
2. Examine the current literature regarding the use of tone management modalities
3. Explore less common uses of surgical techniques for symptom relief in cerebral palsy
4. Review current efforts with deep brain stimulation therapy in cerebral palsy and learn early patient results

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**IC06: MAXIMIZE NEUROPLASTICITY AND MINIMIZE MALADAPTIVE HABITS IN CHILDREN AND TEENAGERS WITH CEREBRAL PALSY**

Karen Pape, MD, FRCPC; Pia Stampe, PT, DPT; Suzanne Davis Bombria, PT

**Purpose:** This course will provide an overview of human neuroplasticity, emphasizing the impressive recovery advantage of pediatric versus adult brain injury.

**Target Audience:** Physicians, surgeons and physical therapists who work with children with cerebral palsy.

**Course Summary:** A wide range of neuroplastic interventions has now been incorporated into the best practice delivery model for adult patients with stroke. Implementation of a similar intensive pediatric service model will be discussed. This course will help participants recognize neuroplastic potential and to institute evidence-based and best practice protocols that can replace early formed maladaptive movement patterns in cerebral palsy.
Learning Objectives:
1. To understand the peak periods of pediatric neuroplasticity and the interaction of brain changes with periods of peak body growth velocity
2. To develop skills in uncovering evidence of brain recovery marked by maladaptive habits
3. To discuss neuroplasticity based treatment plans incorporating evidence-based intensive protocols for skill and strength training
4. To understand ways to incorporate intensive practice into a pediatric service model

**IC07: PATIENT REPORTED OUTCOMES: STATE OF THE SCIENCE 2017**
Carole Tucker, PhD; Katherine Bevans, PhD

**Purpose:** This course will provide an overview of state-of-the-science patient-reported outcome (PRO) assessment methods for use in pediatric rehabilitation. The workshop will prepare attendees to make informed decisions about the administration and interpretation of PRO measures in pediatric rehabilitation.

**Target Audience:** Clinicians, researchers and individuals involved in quality improvement processes as well as those interested in patient reported outcomes

**Course Summary:** This course will highlight the strengths and weaknesses of several child- and parent-report outcome measurement systems used in pediatric rehabilitation (e.g., PROMIS®, CP-CAT). It will identify numerous technological innovations aimed at improving the feasibility and accuracy of PRO assessment. These include hybridization of generic and condition specific measures; use of computerized adaptive test algorithms; application of computerized adaptive test algorithms; and engaging data-capture platforms to enhance children’s self-report capacity, and integration of PRO data into electronic health records. Approaches to enhancing the interpretability and impact of PRO score reporting will also be reviewed. Lastly, workshop attendees will participate in a discussion with clinical leaders who systematically evaluate PROs in clinical care contexts.

**Learning Objectives:**
1. Understand the relative merits of multiple PRO assessment systems for use in pediatric rehabilitation
2. Understand technological innovations that may enhance PRO measurement in pediatric rehabilitation
3. Discuss ways of improving the interpretability and impact of PRO scores in clinical care contexts
4. Identify facilitators and barriers to using PRO measures in real-world pediatric rehabilitation settings

**IC08: PRINCIPLES AND BASICS OF CLINICAL RESEARCH FOR CLINICIANS**
Hiroko Matsumoto, MA, PhDc; Brian Snyder, MD, PhD; Chan-Hee Jo, PhD

**Purpose:** The purpose of this instructional course is to provide clinicians with a basic understanding of study design, hypothesis development and testing, and data interpretation.

**Target Audience:** Clinicians and researchers who conduct clinical research with patients with cerebral palsy.
**Course Summary:** Conducting high quality research with patients with Cerebral Palsy has been challenging in many ways. Most investigators in the field are busy clinicians without much help from epidemiologists or biostatisticians. Therefore, developing a research hypothesis, designing a study, analyzing the data and interpreting the results can be extremely challenging. This instructional course will review 1) how to develop a testable research hypothesis, 2) basic study design that tests the hypothesis, 3) what to measure and 4) how to interpret results appropriately. There will be a working session for audience to participate. The session will involve direct audience participation in developing a research question, testable hypothesis, appropriate study design, meaningful statistic analyses, and interpretation of results. Participants are highly encouraged to bring their research ideas and questions to the course. At the end of the session, participants will have a basic understanding of how to conduct a clinical research.

**Learning Objectives:**
1. Develop a testable research hypothesis
2. Understand basic study design that tests a research hypothesis
3. Define variables to measure in their proposed studies
4. Interpret results appropriately

**IC09: STEPPING INTO PHYSICAL THERAPY MANAGEMENT FOR INDIVIDUALS WITH CEREBRAL PALSY FOLLOWING SINGLE EVENT MULTI-LEVEL SURGERY**
*Kelly Greve, DPT; Michelle Menner, DPT*

**Purpose:** Evidence-based recommendations will be provided to coordinate and improve care for physical therapists evaluating and treating individuals with cerebral palsy between 5-25 years old who have had a Single Event Multi-Level surgery (SEMLs). Clinicians will be informed of finalized clinical recommendations for this patient population. Case studies will be presented for ambulatory and non-ambulatory individuals receiving physical therapy following SEMLs.

**Target Audience:** Physical Therapists, Orthopedic Surgeons, PMR Physicians, Pediatricians, Occupational Therapists, Orthotists, Nurses, Social Workers, Child Life Specialists

**Course Summary:** Orthopedic surgeons prefer Single Event Multi-Level surgery (SEMLs) to improve bony and muscle alignment to maximize function and mobility for individuals with cerebral palsy. This surgical intervention is most successful when supported by physical therapy. To reduce the wide variation of care between pre and post-operative physical therapy, evidence-based physical therapy recommendations were developed for physical therapists evaluating and treating individuals with cerebral palsy undergoing SEMLs. A physical therapy algorithm will be presented along with case studies of ambulatory and non-ambulatory individuals who received physical therapy following SEMLs.

**Learning Objectives:**
1. Outline evidence-based recommendations for physical therapists evaluating and treating individuals with cerebral palsy undergoing SEMLs
2. Explain an evidence-based physical therapy algorithm for individuals with cerebral palsy undergoing SEMLs
3. Examine case studies across Gross Motor Function Classification System levels for physical therapy management in individuals with cerebral palsy undergoing SEMLs using evidence-based recommendations and an algorithm
4. Discuss gaps in the literature and future research for physical therapy management of individuals with cerebral palsy undergoing SEMLs
Purpose: Through a partnership with the American Academy of Cerebral Palsy and Developmental Medicine (AACPDM), the National Institute of Neurological Disorders and Stroke (NINDS), initiated the development of cerebral palsy (CP) specific Common Data Elements (CDE) as part of the NINDS project to develop data standards for all funded clinical research in neuroscience. The first iteration (Version 1.0) of the NINDS CP CDEs was made available on the NINDS CDE website in December 2016. Use of the CP CDEs and associated case report forms is highly recommended for investigators submitting research grant applications involving children with CP to NIH. Thus, this course is intended to facilitate a greater understanding about the CP CDEs and the NINDS CDE Website. This course includes information on CP CDEs definitions, how they were developed, and how to use them.

Target Audience: Any individual interested in or currently involved in cerebral palsy clinical research. This is particularly important for individuals submitting clinic research involving children with cerebral palsy to NIH as they will be required to use the CP CDE in their proposal or justify why they did not use this tool.

Course Summary: The CP CDEs are an important step towards faster CP study start-up and data sharing. For creation of the CP CDEs, the AACPDM created working groups (WG) consisting of worldwide experts in seven domains: (1) Participant Characteristics and Disease/Injury Related Events; (2) Health, Growth, Genetics, Comorbidities, and Labs; (3) Neuroimaging; (4) Neuromotor Skills and Functional Assessments; (5) Neurocognitive, Social, and Emotional Assessments; (6) Engagement and Quality of Life Assessments; and (7) Integrated Across Working Groups. In this course, we will discuss how the WGs developed the CP CDEs including the standardized process used. We will describe how to locate and use the recommended CP CDEs. This course will include demonstrations of navigating the NINDS CDE website and selecting CP CDEs; examples of how CP CDEs may be used for a research study; how users can submit feedback; and an interactive session with CP CDE WG members where participants (bring own laptops) use the CP CDE website to identify CDE and instruments for their research projects.

This project was funded by: HHSN271201200034C.

Learning Objectives:
1. Define CP CDEs
2. Describe the process for development of the CP CDEs
3. Demonstrate how to navigate the NINDS CDE website
4. Demonstrate how to use CP CDEs and case report forms in a research study
IC11: THE SINGLE EVENT MULTI-LEVEL SURGERY (SEMLS) WENT WELL, NOW WHAT? AN EVIDENCED-BASED GUIDE TO MANAGEMENT IN THE FIRST YEAR AFTER SURGERY TO IMPROVE GAIT

Vedant Kulkarni, MD; Jon Davids, MD; Karen Howes, RN, FNP; Suzanne Bratkovich, PT

Purpose: Single-Event Multi-Level Surgery (SEMLS) has emerged as the standard of care for improving gait in children with cerebral palsy at high-volume centers using instrumented gait analysis. A successful outcome requires not only appropriately indicated and executed surgeries, but also effective post-operative pain management, orthotics, and rehabilitation. This course will provide the attendee with a variety of evidence-based methods for optimizing the experience and outcome in the first year after SEMLS.

Target Audience: Physical Therapists, Physical Medicine and Rehabilitation Physicians, Orthopaedic Surgeons, and Orthotists

Course Summary: The course divides the recovery after SEMLS surgery into four phases, each with unique challenges and priorities: the inpatient phase, early post-operative phase, early rehabilitation phase, and late rehabilitation phase. Participants will learn about multi-modal pain protocols, urinary retention prevention guidelines, and mobility techniques for the inpatient phase. For the early post-operative phase, the course will present methods for cast management of knee flexion contractures, pain management in the ambulatory setting, maintaining muscle strength and mobility, and prescribing orthotic prescriptions. The course will give techniques and goals for optimizing a child’s outcomes using a week-long outpatient intensive physical therapy program for the early rehabilitation phase. Finally, the course will cover methods for continuing progress in a community-based physical therapy in the late rehabilitation phase. In each phase, focus will be on guidelines and protocols that can be immediately applied into practice.

Learning Objectives:
1. Upon completion, participants will be able to define the priorities of the four phases of recovery after SEMLS surgery – inpatient, early post-operative, early rehabilitation, and late rehabilitation phases
2. Upon completion, participants will be able to apply multi-modal protocols for post-operative management of pain following SEMLS
3. Upon completion, participants will be able to tailor a child’s post-operative cast and orthotics based on the gait optimization goals
4. Upon completion, participants will be able to apply principles of rehabilitation appropriate for each phase of recovery

IC12: THE YEAR’S TOP TEN ARTICLES ON DEVELOPMENTAL DISABILITIES

Nancy Murphy, MD; Richard Adams, MD

Purpose: To present summaries of the ten most intriguing articles on developmental disabilities published in the past year (2016 to 2017), and to encourage discussion about them among participants.

Target Audience: Physicians, nurses, and other provider who care for children with developmental disabilities and want to keep abreast of the latest evidence-based, scientific findings that have the greatest translational impact on care. Cross disciplinary participation is welcome and encouraged. The articles selected are generally grounded in a medical context; however, the articles are relevant to those whose practices are focused on children and youth with disabilities.
**Course Summary:** The top ten clinically relevant articles published in English between Fall 2016 and Summer 2017 will be presented to the audience. Articles will be chosen from the presenters’ personal experiences as well as from searches in Medicine and CINAHL (Current Information in Nursing and Allied Health Literature). Categories from which the articles are typically chosen include the following: attention deficit hyperactivity disorder, autism spectrum disorders, cerebral palsy, congenital syndromes and genetic conditions, intellectual disabilities, spina bifida, and spinal cord and acquired brain injuries. They will be selected using the following criteria: (1) impact on clinical care, (2) scientific merit of the study [strength / validity], and (3) translation to clinical practice. The presenters will summarize the ten articles in reverse order (saving number one for last). Their impact on clinical practice, place in the context of current care, and their implications for future research will be discussed. The audience is encouraged to respond to each article as it is presented. A copy of the references and abstracts will be provided to the attendees.

**Learning Objectives:**
1. Summarize the major conclusions of each of the ten articles presented. a) Be inspired by the presentations to seek articles on their own
2. Identify areas in which additional research is needed
3. Evaluate the utility of each of the articles for their own clinical practice
4. Be inspired by the presentations to seek articles on their own

**IC13: USING COGNITIVE TRAINING (CO-OP APPROACH) AS A REHABILITATIVE TOOL FOR CHILDREN WITH NEURODEVELOPMENTAL DISORDERS INCLUDING CEREBRAL PALSY**

Hortensia Gimeno, MSc, OT; Iona Novak, B App Sc (Occupational Therapy), MSc (Hons), PhD; Helene Polatajko, BOT, MEd, PhD; Ann-Marie Ohrvall, PhD; Marie Peny-Dahlstrand, PhD

**Purpose:** With the shift in paediatric neuro-rehabilitation to focus on interventions that address activity and participation, new therapeutic approaches are being developed and tested in children and young people with neuro-disabilities, including Cognitive Orientation to daily Occupational Performance Approach (CO-OP Approach). CO-OP’s focus is on increasing activity and/or participation rather than redressing impairments, but the key difference between CO-OP and other motor learning approaches is CO-OP’s unique focus on child-led problem solving, making it a cognitive and motor intervention. The success of top-down interventions, such as task-oriented, goal-directed approaches and CO-OP in children with neurodevelopmental disabilities, has implications for understanding the modifiable attributes of activity performance. We propose to explore lessons learned from research and clinical practice about the CO-OP Approach. Initially developed for children with developmental coordination disorder (DCD), the approach has now been empirically tested with children and young persons with more severe motor deficits, such as cerebral palsy (CP).

**Target Audience:** This workshop will be suitable for clinicians and researchers in any area of neurodisability, both adult and paediatric populations. Specifically OTs, PTs, psychologists, neurologists, paediatricians, movement scientists.

**Course Summary:** We will draw on the expertise of researchers working with populations including Stroke, DCD, spastic CP, spina bifida, dystonia and hyperkinetic movement disorders to begin to elucidate the principles that drive motor skill acquisition and performance in these populations. The ingredients of this cognitive treatment approach and the similarities and differences between different diagnostic groups will be also explored. We will discuss implications of these research findings in terms of principles for practice. Videos will be shown to exemplify some of the salient ingredients of CO-OP intervention and activity performance changes.
Learning Objectives:
1. Recognise the key principles and ingredients for CO-OP
2. Outline emerging research evidence-base for CO-OP in children and young people/adults with cerebral palsy and other developmental disorders
3. Present new data on the effectiveness of the CO-OP Approach in populations other than developmental coordination disorder
4. Explore knowledge translation implications for the implementation of CO-OP