

# 2021 UBC Okanagan/Vancouver Graduate Research Day

Day 1: Tuesday May 11, 2021

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## Session 1

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### Sex-differences in exercising hemodynamics: role of exercising muscle mass

**Joshua Bovard**, Daniele A. Cardinale, Filip J. Larsen, Emma Reiter, Mads Jensen-Urstad, Erik Rullman, David Morales-Alamo, Bjorn Ekblom, Jose A. L. Calbet, Robert Boushel

To determine their consequences on exercising hemodynamics with large (e.g., 2-leg cycling (BIKE)) vs. small (e.g., 1-leg knee extension (KE)) muscle mass. Healthy young subjects (4M, 3W) completed BIKE and KE exercise tests. The femoral artery and vein were catheterized to measure leg blood flow (Q),  $\text{CaO}_2$ , and mean arterial pressure (MAP). Vascular conductance (VC),  $\text{O}_2$  delivery, and leg  $\text{O}_2$  uptake ( $\text{VO}_2$ ) were calculated. Measures were normalized to right leg (BIKE) or quadriceps (KE) lean mass. Whole body  $\text{VO}_2$  was measured with a metabolic cart. Men and women were compared at similar and maximal work rates. Body mass was greater in men (M:  $80 \pm 6$  vs. W:  $59 \pm 12$  kg,  $p=0.03$ ). Although quadriceps mass ( $3.3 \pm 0.2$  vs.  $2.0 \pm 0.3$  kg,  $p<0.001$ ) and  $\text{CaO}_2$  were lower, women had a higher mass-specific Q, VC ( $p=0.054$ ),  $\text{O}_2$  delivery, and leg  $\text{VO}_2$  to maintain whole body  $\text{VO}_2$  during similar KE (Table 1). These differences were maintained during maximal KE, at which women tended to achieve a higher mass-specific work rate ( $21 \pm 2$  vs.  $25 \pm 3$   $\text{W} \cdot \text{kg}^{-1}$ ,  $p=0.10$ ). They were also apparent during similar BIKE despite a lower leg lean mass in women ( $8.7 \pm 0.3$  vs.  $5.3 \pm 0.7$  kg,  $p<0.001$ ). However, the differences were no longer present during maximal BIKE when mass-specific work rate was similar ( $21 \pm 2$  vs.  $20 \pm 2$   $\text{W} \cdot \text{kg}^{-1}$ ,  $p=0.70$ ) and whole body  $\text{VO}_2$  was lower in women. These findings highlight a greater hemodynamic capacity for women to overcome differences in  $\text{CaO}_2$  and maintain whole body  $\text{VO}_2$  at similar work rates during exercise. They also implicate the quantity of exercising muscle in facilitating the greater hemodynamic capacity and mass-specific work rate during maximal exercise with a small but not large muscle mass.

### Process through Partnership: The analysis, design, and development of an online training platform for Small Steps for Big Changes coaches with YMCA staff

**Kaela Cranston**, Tineke Dineen, Natalie Grieve, Mary Jung

*Introduction.* Small Steps for Big Changes (SSBC) is a diabetes prevention program that aims to empower individuals with prediabetes to make diet and exercise changes. Previously, SSBC coaches have been trained through a 3-day in-person workshop. In order to improve SSBC's reach, an online platform is necessary to train coaches in a less resource-intensive manner. The creation of the SSBC online training platform was guided by the 5-phase analysis, design,

development, implementation, and evaluation (ADDIE) model. The purpose of this project was to describe the analysis, design, and development phases of the SSBC online training platform. *Methods.* Focus groups with previously trained SSBC coaches were conducted to determine what skills, knowledge, and attitudes future coaches need to gain and how information should be delivered during the training. The research team worked with 3C Institute and SSBC coaches to determine learning objectives and the best way to deliver didactic and experiential components, develop scripts for the online modules, develop storyboard proofs, film the modules, develop a landing page, and finalize the online platform. *Results.* Recommendations from SSBC coaches were largely focussed on ensuring there were interactive components in the training and that SSBC content be better integrated with the motivational interviewing content. The final online training platform consisted of 7 modules and a resource centre. *Conclusion.* Using systematic methodology and engaging end-users and those with expertise in developing online learning platforms was necessary to develop a high-quality SSBC training platform for future scale-up.

### **The Effects of Exercise-Based Interventions on Urogenital Outcomes in Individuals with Spinal Cord Injury: A Systematic Review and Meta-Analysis**

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**Xueqing Zhou**, Alison M.M. Williams (MSc), Tania Lam (PhD)

This systematic review aimed to investigate the feasibility (dropout rates, adverse events) and effects of exercise training as a treatment to improve urogenital function and quality of life (QoL) in individuals with spinal cord injury (SCI). Database searches were conducted on MEDLINE, EMBASE, and CINAHL for studies that examined the effects of any exercise intervention on urogenital function and/or QoL in adults with SCI. Quality of the included studies was assessed using the Joanna Briggs Institute critical evaluation tools. When possible, Hedges'  $g$  was calculated for overall effect sizes. Descriptive subgroup analyses were conducted on sex and injury severity. Ten studies (228 participants) were included. Study interventions included pelvic floor muscle training ( $n=3$ ) and locomotor training (LT) ( $n=7$ ). The overall quality of evidence was low due to small sample sizes and non-randomized designs in most studies. Dropout rates ranged from 12% to 25%, and adverse events were reported only in some LT studies. For lower urinary tract (LUT) outcomes, urodynamic findings were mixed despite moderately positive changes in maximum bladder capacity ( $g=0.50$ ) and bladder compliance ( $g=0.37$ ). Fairly consistent but small improvements were observed in bladder awareness and incontinence. Fewer data were available for LUT QoL and sexual health outcomes, which presented mixed findings or minor improvements. Subgroup analyses based on sex and injury severity were inconclusive. There could be a potential benefit of exercise on urogenital outcomes in people with SCI, but the evidence is insufficient given the heterogeneity and relatively low quality of included studies.

## **Age-related muscle weakness and the vestibular control of quiet standing balance in females**

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**Phuong L. Ha**, Wendy B. Peters, Michael A. McGeehan, Brian H. Dalton

The purpose was to determine whether vestibular control of standing balance is altered in older compared to younger females and whether the vestibular-evoked balance response is related to muscle power. Sixteen young ( $n=8$ ;  $22.6\pm 1.8$  years) and older ( $n=8$ ;  $69.7\pm 6.7$  years) females stood quietly on a force plate, while subjected to random, continuous electrical vestibular stimulation (EVS; 0-20Hz, root mean square amplitude: 1.13mA). Medial gastrocnemius (MG) and tibialis anterior (TA) surface electromyography (EMG) and anterior-posterior forces ( $F_{AP}$ ) were sampled and quantified using frequency and time domain correlations with the EVS. Knee extensor strength and power were evaluated using a Biodex System 3 dynamometer. The weaker (-34%;  $p<0.05$ ) and less powerful (-39%;  $p<0.05$ ) older females exhibited a greater medium-latency peak amplitude for the TA (-99%;  $p<0.05$ ) and  $F_{AP}$  (-42%;  $p<0.05$ ), but no other differences were detected for short- and medium-latency peak amplitudes. The EVS-EMG coherence for the TA (<10Hz) and MG (<4Hz) and EVS- $F_{AP}$  coherence (<2Hz) was greater at lower frequencies in older females than young. A strong correlation was detected for  $F_{AP}$  medium-latency peak amplitude with centre of pressure displacement variability ( $r=0.75$ ;  $p<0.05$ ) and TA medium-latency peak amplitude ( $r=0.86$ ;  $p<0.05$ ). Knee extensor power was negatively and moderately correlated with  $F_{AP}$  medium-latency peak amplitude ( $r=-0.47$ ;  $p<0.05$ ). The enhanced vestibular-evoked whole-body balance response (i.e., EVS- $F_{AP}$ ) is related to muscle power capacity and greater sway variability. These findings indicate that an increased vestibular control of balance may compensate for an age-related reduction in power and accompanies greater postural instability in older females than young.

## **Evaluation of Passive and Partnered End-of-Grant Knowledge Translation of the Integrated Knowledge Translation Guiding Principles for Spinal Cord Injury Research: Preliminary Findings**

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**Alanna Shwed, M.Sc.**, Femke Hoekstra, Ph.D., Kathryn M. Sibley, Ph.D., Shane N. Sweet, Ph.D., Peter Athanosopoulos, John Chernesky, Christopher B. McBride, Ph.D., W. Ben Mortenson, Ph.D., SCI Guiding Principles Panel, Heather L. Gainforth, Ph.D.

Integrated Knowledge Translation (IKT) Guiding Principles were co-developed by a multidisciplinary panel of spinal cord injury (SCI) researchers, research users, and funders to help address the gap between SCI research and practice. However, they will only be helpful if people are aware and choose to adopt them, both of which are dependent on exposure and engagement with the Principles. Therefore, the aim of this project is to evaluate and compare exposure and engagement with the IKT Guiding Principles after a passive diffusion approach versus a coordinated partnership approach to end-of-grant knowledge translation (KT). Passive diffusion of the IKT Guiding Principles and website began November 9<sup>th</sup>, 2020 and included uncoordinated tweets and Facebook posts. The coordinated partnership approach to end-of-grant KT began February 8<sup>th</sup>, 2021 and included tweets, a UBC press release, information emails, organization website postings, videos, and news articles. Exposure and engagement with the Principles are

being tracked through Google Analytics of the IKT Guiding Principles website. For this study, exposure is defined as the number of new visitors to the website and engagement is defined as the number of new user downloads of the Principles. Passive diffusion from November 9<sup>th</sup>, 2020 to February 7<sup>th</sup>, 2021 resulted in 198 new visitors to the website and 4 downloads of the Principles. The first month of partnered end-of-grant KT from February 8<sup>th</sup>, 2021 to March 8<sup>th</sup>, 2021 resulted in 569 new visitors to the website and 61 downloads of the Principles. Our initial findings suggest that a partnered approach to end-of-grant KT strategies of the IKT Guiding Principles increased exposure and engagement at a faster rate than passive diffusion efforts. This study demonstrates the potential value of using a coordinated partnership approach for end-of-grant KT.

**Title: Knowledge, attitudes and practice regarding pelvic floor muscle training among people with spinal cord injury: A cross-sectional survey**

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**Maya Sato-Klemm**, Alison Williams, Ben Mortenson, Tania Lam

Pelvic floor muscle training (PFMT) is a mainstay of rehabilitation treatment for urinary incontinence in able-bodied populations. A typical PFMT program includes repeated and sustained contractions of the pelvic floor muscles, with the intent to increase strength, endurance and coordination. So far, there has been little attention to rehabilitation-based approaches to manage urinary incontinence and other urogenital symptoms in people with spinal cord injury (SCI). Further, it is unknown the extent to which the SCI community is aware of the possibility for such exercise-based approaches for addressing urogenital symptoms. Thus, the goal of this study was to assess knowledge, attitudes and practice related to pelvic floor muscle training in people living with SCI. A web-based survey was created to capture current knowledge, attitudes, and practice related to PFMT. Feedback from an advisory group including a pelvic floor physiotherapist, a sexual health clinician, and two members of the local spinal cord injury community was solicited and incorporated before deployment. The survey was distributed via mailing lists of domestic (e.g. Spinal Cord Injury BC) and international (e.g. New Zealand Spinal Trust) organizations that provide support to the SCI community. Responses from 50 individuals with SCI have been received to-date. Descriptive statistics will be used to summarize the respondents' level of knowledge, practice, and attitude towards PFMT. Survey responses will also be compared between males vs. females and people with complete vs. incomplete paralysis using Chi-square tests. Results from this work will help inform the development of PFMT interventions for people with SCI.

## **Sex and gender bias persists in exercise physiology literature**

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**Hira Niazi, William Sheel & Meaghan MacNutt**

Sex and gender are interrelated but not interchangeable important determinants of health and wellbeing; therefore, both should be considered in research. Findings without this consideration cannot be extrapolated to everyone. Over the past few decades, efforts have been made to rectify the historic problem of overrepresentation of male participants in exercise physiology literature. To examine if this bias remains, this study describes and quantifies the participant pool in terms of sex. Six of the most relevant journals were searched for exercise physiology articles published in 2018-2020. After filtering through 1485 articles, a total of 613 original research articles with adult human participants were included in the final analysis. Of the 39,627 participants across 613 studies, 22,994 (58%) were described as male and 16,633 (42%) were described as female. There were 272 (44%) mixed studies, 293 (48%) male-only studies, and 48 (8%) female-only studies. Only 13% of male-only studies indicated this in the title, compared to 83% of female-only studies. There were zero reports of intersex, transgender, gender non-conforming, or gender non-binary participants. Of all mixed studies, 37% conducted a gender or sex analysis, and 41% were male-dominant with less than 40% female participants. Substantial sex and gender bias persists in the recent exercise physiology literature. Females continue to be underrepresented, maleness is still centered as the default condition, and sex and gender are both described as binary.

## **The effects of increased cognitive processing on reactive balance control following perturbations to the upper limb**

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**Megan Trotman, Michael Kennefick, Scott Coughlin, Brian Dalton**

Research is limited regarding how whole-body balance adjustments are integrated with continuous voluntary reaching movements when a hand perturbation is encountered. When two tasks are performed simultaneously through a dual-task paradigm, performance of one or both tasks is often disrupted owing to attentional resources being divided. The purpose here was to assess the effects of increased cognitive processing via a working memory task on whole-body balance responses to perturbations of the hand during a continuous voluntary reaching task. Sixteen participants (8 females,  $22.9 \pm 4.5$  years) stood and grasped the handle of a KINARM, a robotic-controlled manipulandum paired with an augmented visual display, and completed 10 trials of 100 continuous mediolateral arm movements at a consistent speed of one movement per second. Twenty anteroposterior hand perturbations were randomly interspersed throughout each trial (single-task). An auditory n-back task was performed during half of the trials (dual-task) and during quiet standing (cognitive-motor task). Peak centre of pressure (COP) displacement and velocity, time to COP displacement onset and peak, and hand displacement and velocity following the hand perturbation were evaluated. N-back performance for the dual-task was worse than the cognitive-motor task. Only peak COP displacement following posterior perturbations increased during dual- than single-task, with no other differences detected. Hand displacement decreased during dual- compared to single-task.

The main findings likely indicate that with increased cognitive processing, attentional resources were allocated from the cognitive task towards upper limb movements, while attentional resources for balance seemed unaltered.

### **Intermuscular coherence during balance in persons with Parkinson's disease and age-matched controls**

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**Rowan R Smart**, Anis Toumi, Owen Harris, Cydney M Richardson, Brian H Dalton, Daryl J Wile and Jennifer M Jakobi

Persons with Parkinson's disease (PD) have reduced balance compared to non-Parkinsonian individuals. In non-Parkinsonian persons, intermuscular coherence increases alongside balance task difficulty and has been associated with greater sway parameters. It is unknown if intermuscular coherence is a contributing factor to decreased balance control in persons with PD. We investigated intermuscular coherence during bipedal and single leg stance balance tasks for 9 persons with PD (70±5 yrs, 6 female, all on levodopa for symptom management, MDS-UPDRS motor score: 12±6) and 8 controls (71 ± 6 yrs, 5 female), and further challenged balance in no foam and foam conditions. Participants performed the balance tasks for as long as possible up to a maximum of 60 seconds, and EMG was recorded from the plantarflexors (agonists): medial and lateral gastrocnemii, soleus; and from the primary dorsiflexor (antagonist): tibialis anterior. Sway increased from bipedal to single-leg stances ( $p < 0.05$ ). During single-leg stance persons with PD had 20% and 12% greater SD of medio-lateral centre of pressure in no foam and foam conditions, respectively, compared to controls ( $p < 0.05$ ); and greater time-normalized sway area in no foam (101%) and foam (129%) conditions compared to controls ( $p < 0.05$ ). Agonist-agonist and agonist-antagonist coherence in the alpha (8-12Hz) and beta (15-35Hz) bands increased 38% from bipedal to single leg stance, but did not differ between groups. In a group of high-functioning PD individuals, SD of medio-lateral centre of pressure and time-normalized sway area are elevated in single-leg stance, but this is not due to group differences in intermuscular coherence.

## **Session 2**

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### **Impact of a very low-carbohydrate high-fat ketogenic diet program on cardiometabolic health markers in type 2 diabetes in primary care: A retrospective secondary analysis of medical records**

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**Helena Neudorf, MSc**, Michael Mindrum, MD, Christa Mindrum, MD, Cody Durrer, MSc, Jonathan Little, PhD

Family physicians are the primary access point for care for the majority of Canadians living with T2D, and growing evidence suggests that carbohydrate restriction is an effective strategy to improve outcomes for patients with T2D. However, examples of successful implementation options for physician-led programs in primary care are limited. This retrospective secondary

analysis of anonymized medical records assessed the impact of a very low-carbohydrate high-fat (VLCHF) ketogenic diet program on clinical outcomes in patients with T2D. This three-month diet program was delivered by a physician-led multi-disciplinary team in primary care, with follow-up visits at six- and 12-months. The primary outcomes assessed as markers of T2D management were HbA1c and glucose-lowering medication use. Secondary outcomes included blood pressure, blood lipids, and kidney and liver health. Compared to baseline, the VLCHF ketogenic diet program resulted in a clinically significant reduction in HbA1c at three-, six-, and 12-months of -0.8% (CI<sub>95</sub>[-1.1, -0.5];  $P < 0.0001$ ), -0.8% (CI<sub>95</sub>[-1.1, -0.4];  $P < 0.0001$ ), and -0.4% (CI<sub>95</sub>[-0.7, 0.0];  $P = 0.042$ ), respectively ( $N = 27$ ). This occurred in spite of simultaneously reduced glucose-lowering medication use as quantified by a significantly lower medication effect score at each timepoint (three-months: -1.7 (CI<sub>95</sub>[-3, -1]); six-months: -1.8 (CI<sub>95</sub>[-3.2, 1.1]); 12-months: -1.7 (CI<sub>95</sub>[-3.3, -1])). Other markers of cardiometabolic health, including blood pressure, triglycerides, HDL-C, and liver health assessed via the hepatic steatosis index were also improved. A physician-led VLCHF ketogenic diet program using a multi-disciplinary team appears effective at improving markers of T2D management, cardiovascular health, and liver health in a community setting.

### **The effects of higher- and lower-load resistance exercise training on leg and arm skeletal muscle mass in healthy young adult females**

Matthew Fliss, Jordan Stevenons, Sobhan Mardan-Dezfouli, Donna Li, Cameron Mitchell

Resistance exercise training (RET) is a potent stimulus for skeletal muscle hypertrophy. It was previously believed that moderate/heavier loads are superior to lighter loads when aiming to increase muscle size, but recent research has found that lighter load (LL) RET can lead to similar muscle hypertrophy as higher load (HL) RET when individuals train to volitional fatigue. While this result has been consistently shown in males, there are conflicting results when using female participants. The purpose of this study is to compare the muscle hypertrophic response to HL and LL RET in the upper and lower body of young adult females. The study used a repeated measures within-participant design wherein each participant had one arm and leg assigned to train with HL and the other arm and leg assigned to train with LL. HL training had participants reach volitional fatigue between 6-12 repetitions whereas LL RET had participants reach volitional fatigue between 20-30 repetitions. Participants performed thrice weekly training sessions over a 10-week training period where unilateral knee extension and unilateral dumbbell bicep preacher curls were performed for three sets each. Participants were also supplemented with 30-gram boluses of whey/vegan protein concentrate twice daily for the 10-week training period. Pre-RET testing occurred in the week immediately prior to the RET period and post-RET testing occurred in the week immediately following the RET period. The study is currently ongoing, and no results can be presented in this abstract but will be available on the presentation date.

## Social justice in the clinic: Caring for larger patients

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**Deana Kanagasingam**

From a social justice perspective, healthcare environments should be safe spaces that allow patients of all shapes and sizes to feel comfortable seeking support for a variety of health concerns, including weight (Puhl, 2010). However, a review of the existing literature reveals the presence of oppressive attitudes and behaviours directed at larger patients by a range of healthcare practitioners (Phelan et al., 2014). Despite the increased attention on such injustice, to-date there have been no empirical studies on 1) healthcare practitioners who practice social justice when treating larger patients for weight-related issues or 2) larger patients' experiences of receiving social justice-informed care. I refer to social justice in practice as addressing intersecting macro-level inequities such as racism, sexism, and sizeism through micro-level practitioner-patient interactions (Mishler, 2005). My study fills a research gap by presenting an alternative to the dominant paradigm of obesity treatment and examining how social justice is understood, enacted, and experienced in weight-related clinical interventions. Using an intersectional lens, I present findings from in-depth one-on-one interviews with 22 healthcare practitioners from different disciplines who identify as social justice advocates and 20 patients who are served by such practitioners. I address five main questions: 1) What does social justice mean to practitioners? 2) How do practitioners translate principles of social justice into concrete practices? 3) What are the challenges of practicing social justice that practitioners encounter? 4) What does social justice mean to larger patients? 5) How does social justice-informed care shape larger patients' experience in healthcare?

## Implementing a diabetes prevention program within a local community organization: A qualitative analysis

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**Tineke Dineen, Corliss Bean, & Mary Jung**

With type two diabetes on the rise, there is a need for more prevention programs to reach the large number of at-risk individuals. This research examined the implementation process, strategies, and multilevel contextual factors as an evidence-based diabetes prevention program was implemented into two local community organization sites. Guided by a pragmatic epistemology, semi-structured interviews were conducted with community organization staff who delivered the program ( $n = 8$ ), and a focus group was completed with implementation support staff ( $n = 5$ ) from both sites. Interviews were transcribed verbatim and thematically analyzed using a template approach guided by the consolidated framework for implementation research (CFIR). Within the template approach, themes were first inductively identified to ensure all salient ideas were captured, then identified themes were deductively linked to CFIR constructs. Implementation strategies used were appropriate, well-received by staff and promoted successful implementation. Several CFIR constructs were identified from all five domains: (a) process, (b) intervention characteristics, (c) outer setting, (d) inner setting, and (e) individual characteristics. Specifically, results revealed the partnered one-year planning process, program components and structure, level of support, and synergy between program and context

were important factors in the implementation. Successful implementation was supported by a fully engaged, partnered approach to planning, and subsequently executing, an implementation effort. The CFIR provided a thorough framework to identify and evaluate multilevel contextual factors impacting implementation. Results demonstrate a successful approach to working with a community partner to support implementation.

### **Are torque feedback mechanisms revealed in conditions of artificially restricted quiet standing?**

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Kyle J. Missen, Lorenz Aspländer, J. Timothy Inglis, Mark G. Carpenter

Upright human stance is mechanically unstable. The central nervous system counters destabilizing effects of gravitational and inertial forces acting on the body by generating corrective torque. Some of the corrective torque required to stabilize the body is generated through active, closed-loop feedback control mechanisms; however, many aspects of the organizational structure of these feedback mechanisms are still unclear. Simulations using neuromechanical models of balance control suggest experimental data is more accurately reproduced when a torque-related positive feedback mechanism is included in the model. However, the existence of a torque feedback mechanism for standing balance remains speculative and has yet to be experimentally verified. The purpose of this study is to test the assumption of a positive torque feedback mechanism contributing to human upright stance. Participants will be positioned in a unique apparatus that restricts body motion while standing (and without participant awareness). Participants will complete a series of standing trials which will start with participants standing without stabilization (120s), followed by a locked period (120s) where participants will be systematically locked in a forward leaning position at various angles. Torque responses from a force plate will be compared across all leaning conditions and experimental data will be fit with existing computational models of standing balance. Positive torque feedback predicts that body lean away from the neutral upright position corresponds with increasing torque across time as the system attempts to restore the neutral position. It is hypothesized that greater deviations from the neutral position will correspond with greater increases in torque.

### **“Do this to live longer”: A study of health and fitness magazine representations of older women**

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**Jessica Liang**

The purpose of this study was to investigate how older women were represented in health and fitness magazines, paying particular attention to the ways that the depictions of older women reinforced or challenged cultural assumptions about gender, health, and aging. Over a six-month period, we collected monthly issues for three widely read, health and fitness magazines distributed in North America, namely *Health*, *Prevention*, and *Yoga Journal*. We examined the texts and images associated with the magazines' advertisements and interest stories. Our thematic analysis revealed that older women were represented in three ways. To begin, 'Fitness

enthusiasts' entailed stories about older women who had used physical activity to remain healthy and happy. 'Active consumers', referred to advertisements that featured older women as consumers of supplements and cosmetic interventions to treat the physical signs of aging. Finally, 'Menopause warriors' included interest stories and advertisements of older women discussing and dealing with the changes linked to menopause. Within each category, we report on the use of imagery and language to construct a deeper understanding of how older women are pressured to engage in consumer culture to stave off the signs of aging. The findings demonstrated that older women were depicted in favourable light. This study contributes to aging scholarship and highlights the ways that the dominant discourses about aging, gender, and health are either reinforced or challenged by health and fitness magazine texts and images.

### **Proposal for Testing a Tailored Smoking Cessation Intervention for Persons with Spinal Cord Injury: A Proof-of-Concept Study**

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**Kelsey R. Wuerstl, M.Sc** , Christopher B. McBride, Ph.D.<sup>3</sup>, & Heather L. Gainforth, Ph.D.<sup>1,2</sup>

Compared to the general population, people with spinal cord injury (SCI) report higher smoking rates, a disproportionate burden of tobacco-related health disparities, and unique circumstances to smoking cessation. Theory-informed and rigorously developed smoking cessation interventions may reduce smoking rates and health inequities among persons with SCI. To establish a proof-of-concept of a tailored smoking cessation intervention for persons with SCI. This proof-of-concept aims to 1) prepare and test the intervention manual for fidelity monitoring and 2) assess preliminary evidence of the intervention's efficacy to determine whether the intervention merits more rigorous testing using a randomized design. Aligned with an integrated knowledge translation approach, a provincial SCI organization is meaningfully engaged throughout the research process. Using a treatment-only, pretest-posttest design, a small, accessible sample of persons with SCI who smoke will receive a 12-week tailored smoking cessation intervention. Participants will receive bi-weekly 20min sessions with a trained smoking cessation counsellor. Session topics may include SCI-specific tobacco-related health information, managing post-cessation weight gain, and coping with secondary health conditions. Self-reported smoking and carbon-monoxide verified abstinence will be assessed post-intervention and at 3- and 6-month follow-ups. All intervention sessions will be assessed for fidelity using gold-standard video-recording and behaviour change technique coding. This study will provide the groundwork for a future randomized-control trial through preliminary evidence about the intervention's efficacy to facilitate smoking cessation among persons with SCI. Additionally, it will enable us to refine and optimize the intervention manual and fidelity protocol, which may enhance feasibility and efficacy.

### **Adaptive kayaking to improve seated balance and ability to complete activities of daily living in individuals with spinal cord injury: A mixed-methods case series**

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**Christine Zing-Ting Hsin\***, Jennifer Boughner\*, Alison Michelle McLean Williams, Andrea Bundon, and Tania Lam

\*Should be considered joint first authors

To understand how adaptive kayaking may improve sitting balance and the perceived ability to complete activities of daily living (ADLs) in individuals with spinal cord injury. Five subjects with spinal cord injury completed approximately 10 adaptive kayaking sessions over 12-weeks. Laboratory and clinical measures of seated balance, self-efficacy, and independence in completing ADLs were taken prior to and following the kayaking intervention. Semi-structured interviews were also completed following the intervention to explore self-perceived changes in self-efficacy and ability to complete ADLs, as well as the overall kayaking experience. On average, participants improved in functional balance measures, and seated balance measures when eyes were open. Qualitative interviews revealed that participants experienced an increase or maintenance of self-efficacy and perceived ability to complete ADLs. All participants reported that kayaking was a positive experience as a result of high confidence in safety of the activity, the outdoor environment, and the ability to choose the pacing of their exertion. Findings indicate that adaptive kayaking has potential as a recreational and rehabilitative tool to provide quality experiences in physical activity for individuals with spinal cord injury, while also improving their balance and independence in ADLs. In particular, accessible equipment, knowledgeable staff, and allowing for the self selection of exertion appear to be critical for success in adaptive kayaking programs.

### **Development of an in-vivo preparation to study the cardiac contractile response to manipulations of the baroreflex.**

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**Liam Stewart**, Liisa Wainman, Mehdi Ahmadian, Christopher R. West

Individuals with spinal cord injury (SCI) are predisposed to orthostatic intolerance stemming from disruptions to the sympathetic nervous system which impairs the arterial baroreflex. Whilst the vascular arm of the arterial baroreflex has been well studied, the cardiac-contractile arm has not. The first step in investigating the cardiac-contractile arm of the baroreflex is to develop an in-vivo model that permits the unloading of baroreceptors while simultaneously measuring left ventricle (LV) contractility. To develop an in-vivo neuro-cardiac testing platform in rodents that enables the measurement of LV contractility during baroreceptor unloading. Nine rats were instrumented with a LV pressure-volume catheter to measure LV contractility ( $P_{\max}$ -EDV and  $dp/dt_{\max}$ -EDV). Rats were also outfitted with an arterial pressure catheter, and placed in a lower body negative pressure (LBNP) chamber and exposed to vacuum pressures to reduce mean arterial pressure (MAP) by 10 (MAP-10) and 20 (MAP-20) mmHg to mechanically unload baroreceptors and stimulate the baroreflex. LBNP elicited mild increases in LV contractility at MAP-10 ( $P_{\max}$ -EDV:  $0.42 \pm 0.08$  vs.  $0.46 \pm 0.08$  mmHg  $\mu\text{l}^{-1}$ ,  $P=0.137$ ;  $dp/dt_{\max}$ -EDV:  $37.0 \pm 7.1$  vs.  $40.4 \pm 8.8$  mmHg  $\text{s}^{-1} \mu\text{l}^{-1}$ ,  $P=0.224$ ). At MAP-20,  $P_{\max}$ -EDV and  $dp/dt_{\max}$ -EDV were higher vs. baseline ( $0.50 \pm 0.08$  mmHg  $\mu\text{l}^{-1}$  and  $43.2 \pm 8.2$  mmHg  $\text{s}^{-1} \mu\text{l}^{-1}$ , both  $p<0.009$ ). We now have an in-vivo neuro-cardiac testing platform to interrogate the LV contractile response to unloading of the baroreflex. We will utilize this preparation to assess baroreflex function following SCI to better understand the mechanisms of orthostatic tolerance.

## Session 3

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### Developing novel methods to enable the longitudinal assessment of cardiac inotropic function in basic and preclinical research

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**Mehdi Ahmadian**, Liisa Wainman, Ryan L Hoiland, Erin Erskin, Glen E Foster, Christopher R West

End-systolic elastance ( $E_{es(IVC)}$ ) derived from inferior vena cava occlusion (IVCO) is the reference for quantification of cardiac contractility. However, such assessments require complex surgical procedures that make it practically impossible to use this method to assess longitudinal changes in cardiac inotropic function within the same animal. Consequently, there is an immediate need for developing methods that require less complex surgical procedures. Here, we tested the agreement of a novel  $E_{es(RES)}$  derived from respiratory-induced changes in cardiac preload during mechanical ventilation against  $E_{es(IVC)}$ . Thirty-eight Wistar rats (300-350g; aged 10 wks) were used. Once anesthetized and ventilated, animals were instrumented with 1) a LV pressure-volume (PV) catheter and 2) a femoral arterial catheter to record basal systemic hemodynamics.  $E_{es(IVC)}$  was measured as the slope of end-systolic PV relationship (ESPVR) obtained during an IVCO. Measurement of  $E_{es(RES)}$  was analogous to  $E_{es(IVC)}$  however, respiratory-induced oscillations in cardiac preload, rather than an IVCO, was used to calculate the slope of the ESPVR. Correlations and agreements between metrics of interest were examined using Pearson's and intraclass correlation coefficients (ICC). We found high positive correlation ( $r = 0.88$ ,  $P < 0.001$ ) and excellent agreement ( $ICC = 0.934$ ,  $P < 0.001$ ) between  $E_{es(RES)}$  and  $E_{es(IVC)}$ . Our findings suggest that respiratory-derived  $E_{es(RES)}$  appears to be a reliable surrogate for  $E_{es(IVC)}$ . With the advent of advanced preclinical tools to track changes in cardiac pressures and volumes (telemetry) over time, our findings provide a relatively straightforward method by which longitudinal changes in cardiac inotropic function can be tracked within an animal.

### Exercise Limitation Phenotype Alters the Power-Duration Relationship in COPD

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**Jinelle C.M.** Gelinas, Stephen P. Wright, Megan I. Harper, John P. Sasso, Gloria Agar, Bernie Melzer, Gregory R. duManoir, Jordan A. Guenette, J. Douglass Rolf, Neil D. Eves

Utilizing the power-duration relationship may help identify the optimal intensity for sustainable exercise in patients with COPD who have different exercise limitation phenotypes. We aimed to compare differences in critical power (CP) and  $W'$  between patients with different exercise limitations, and to assess the efficacy of this methodology to predict exercise tolerance in COPD. Individuals with COPD ( $n=30$ ,  $FEV_{1:31-111\%pred}$ ) were classified as having a ventilatory, cardiovascular or combined phenotype using an incremental cardiopulmonary cycling exercise test. Three constant-load cycling exercise tests were performed at 50-80% $W_{max}$  to construct individual power-duration relationships, determine CP and  $W'$ , and to calculate the highest power output that could be maintained for 30-minutes (CP30). A verification trial was performed

at CP30. CP was lower in the ventilatory phenotype compared to both other phenotypes ( $p < 0.01$ ), however  $W'$  was not different between phenotypes ( $p = 0.98$ ). CP30 was higher in the cardiovascular ( $61 \pm 7\%W_{max}$ ) and combined ( $57 \pm 6\%W_{max}$ ) phenotypes versus ventilatory ( $44 \pm 8\%W_{max}$ ) (both  $p < 0.01$ ). Throughout exercise at CP30, HR,  $VO_2$  and blood lactate were higher in the cardiovascular and combined phenotypes versus ventilatory (all comparisons  $p < 0.05$ ). No differences were found in the proportion of patients who achieved 30-minutes at CP30 between the ventilatory and cardiovascular ( $p = 0.07$ ) or combined ( $p = 0.51$ ) phenotypes. Patients with a cardiovascular or combined phenotype can exercise continuously for 30-minutes at a higher intensity and metabolic load compared to those with a ventilatory phenotype. This novel finding demonstrates the importance of identifying phenotypes of exercise limitation when prescribing exercise intensity for sustainable exercise in COPD.

### **“I’m glad I can walk, but sometimes it’s so challenging that it’s an inconvenience to myself and others”: Experiences in physical activity among individuals with SCI who ambulate**

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**Sarah V. C. Lawrason**, Jennifer R. Tomasone, Kenedy Olsen and Kathleen A. Martin Ginis

Ambulators with SCI participate in less leisure-time physical activity (LTPA) than wheelchair-users with SCI. Although some research has been undertaken to explore strategies for increasing the quantity of LTPA, no studies have been conducted to examine subjective experiences of LTPA (i.e., the quality of LTPA) among ambulators with SCI. Thus, the purpose of this study was to explore (a) conditions that influence perceptions of LTPA experiences and (b) elements involved in quality LTPA experiences. Semi-structured interviews were conducted with 23 ambulators with SCI. Using a philosophically pragmatic approach, the data were thematically analyzed using both inductive and deductive coding. The Quality Parasport Participation Framework was employed for deductively coding the elements and conditions associated with LTPA experiences. Three principal themes were identified which provide broad insights for LTPA among ambulators with SCI: (a) ableism, (b) sidelined from participation and (c) invisibility. These themes capture conditions that fostered a positive or negative quality PA experience, including: three intrapersonal, five social, four program, and one physical condition(s). Elements identified in the Quality Participation Framework (i.e., belongingness, meaning, mastery, engagement, challenge, autonomy) were also related to both positive and negative quality LTPA experiences. This study provides insight on how LTPA is uniquely experienced by ambulators with SCI, including conditions and elements that influence quality participation. Importantly, ableism, feeling sidelined, and invisibility can undermine LTPA experiences. Interventions should make use of program conditions (e.g., peer support) and elements (e.g., autonomy) that could help improve the quality of LTPA participation for ambulators with SCI.

### **Examining the Effect of Salbutamol Use in Asthma and/or EIB Whilst Exercising in Ozone Air Pollution**

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**Ben Stothers**, Michael Koehle, Andy Hung, Patric Oliveira Goçvalves

As the world's population continues to increase and become more industrialised more people are being exposed to ambient air pollution. Concurrently, an emphasis is being put on the importance of physical activity in a healthy lifestyle. This raises concerns for people with asthma and/or exercise induced bronchoconstriction (EIB) who's airways are more sensitive to respiratory irritants. One irritant in air pollution that effects this population is ozone (O<sub>3</sub>) generated in photochemical smog. Salbutamol (SAL) is a bronchodilator commonly prescribed to people with EIB and/or asthma. SAL use in O<sub>3</sub> pollution may be contradicted because it increases the O<sub>3</sub> exposure in the airways of individuals that are prone to inflammation. This has been shown previously in rodent studies. Salbutamol use will increase the amount of airway inflammation experienced in people with asthma and/or EIB exercising in ozone air pollution. In a double-blinded crossover design people with EIB and/or asthma will complete four 30-minute bouts of exercise at 60% of their VO<sub>2MAX</sub> on four separate days: [100]ppb O<sub>3</sub> + SAL, [100]ppb O<sub>3</sub> + placebo SAL, filtered air + SAL, filtered air + placebo SAL. A eucapnic voluntary hyperpnoea test will be done to confirm the presence of EIB in addition to a VO<sub>2MAX</sub> test. Lung inflammation will be measured before and after exercise using FeNO in addition to pulmonary function measured by spirometry. Post-exercise FeNO and spirometry measurements will be analyzed using linear regression. Baseline adjustments will be made taking pre-exercise values as covariates in the regression models.

## **Does Transcutaneous Tibial Nerve Stimulation Enhance Corticomotor Excitability of the Pelvic Floor Muscles?**

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**Gevorg Eginyan**, Alison MM Williams, Mason Chow, Tania Lam

Urinary incontinence negatively impacts quality of life for over 420 million people worldwide. The pelvic floor muscles (PFM) are crucial for maintaining urinary continence in humans. Transcutaneous tibial nerve stimulation (TcTNS) is used to manage urinary incontinence. However, the mechanisms of this treatment remain unclear. There is compelling evidence from upper and lower limb studies that peripheral nerve stimulation alone can trigger neuroplastic changes in primary motor cortex in the absence of motor training. Since the tibial nerve (L4-S3) shares segmental innervation with the pudendal nerve (S2-S4), which supplies the PFM, we hypothesize that TcTNS may lead to neuromodulation of the corticospinal projections to the PFM as well as Adductor Hallucis (AH) (innervated by tibial nerve). Thus, the purpose of this study is to evaluate whether TcTNS may alter corticospinal excitability of the PFM and AH when delivered at two different patterns on stimulation in neurologically intact individuals. We will show the preliminary results from two individuals who completed the study protocol. TcTNS was delivered either intermittently (trains of square wave pulses at 30Hz, 50% on/off duty cycle), or continuously at 30Hz. Stimulation conditions were randomized and tested on separate days. Surface electromyography will be used to record motor evoked potentials (MEPs) from PFM and AH before and after the 2-hr stimulation period. MEPs in the PFM and AH were elicited by transcranial magnetic stimulation (TMS) over the motor cortical areas controlling these muscles before and after TcTNS to compare the corticomotor excitability of these muscles.

## **A Community Based Exploration of Physical Activity in Masters Athletes**

**Garry M<sup>c</sup>Cracken, Jennifer Jakobi**

Canadians are living longer and spending more years in retirement. This demographic shift has prompted significant growth in sport participation by older adults. The purpose of this research was to explore the principles of Physical Literacy (physical activity, motivation and engagement) within the Masters Athlete community in the Okanagan, and to determine how this group of older active adults put principles into practice in their lives. Of the 35 Masters Athletes who consented and completed an online survey of sport participation in a pre-COVID19 scenario, more than half declared themselves to be lifelong athletes, while almost a quarter could be considered “late bloomers” coming to competitive sport later in life. The survey also showed that while most Masters Athletes were unaware of Physical Literacy, they embodied its principles in their practice of physical activity and sport to maintain a healthy lifestyle for life. Following the survey, 8 participants were selected to participate in semi-structured interviews. The interviews showed that when presented with the Physical Literacy definition, Masters Athletes felt that it had little relevance for them and failed to see how it could be adapted to address the needs of older adults. The importance of social connection in sport was prominent in the interviews. Several commented about how sport had replaced the socialization previously found in the workplace. These data suggest that although Masters Athletes are unaware of the construct of Physical Literacy they are engaged in its principles and sought to share their active lifestyle with other older adults.

## **Assessing endothelial dysfunction in those with carotid atheroma to predict stroke risk**

**Jay Carr, Emmanuel Katsogridakis, Matt Bown, Ronney B. Panerai, Emma M.L. Chung, Phil N. Ainslie, Jatinder S. Minhas**

Cerebrovascular diseases are preceded by - and associated with - endothelial dysfunction in the cerebral vasculature. However, clinical assessments of cerebrovascular function currently lack specificity for extra-cranial artery endothelium-dependent function. In particular, typical measures of cerebrovascular function assess a number of overlapping and redundant vasodilator pathways, and do not hold strong predictive value in populations other than those with overt steno-occlusive disease. The extent of cerebral endothelium-dependent shear mediated vasodilation within patients with various categories of carotid stenoses and atherosclerotic burden are largely unknown. In 50 carotid stenosis patients we will evaluate large cerebral extra-cranial artery vasoreactivity using three common and integrative assessments (cerebral flow-mediated dilatation, cFMD; CVR; and common carotid artery cold pressor reactivity, CAR). cFMD will be assessed during transiently elevated shear stress caused by increased inspired carbon dioxide using the Douglas bag following protocols based on similar previous studies. CVR will be assessed during steady-state elevation of CO<sub>2</sub>. Assess large extra-cranial artery endothelium-dependent shear-mediated vasodilation across severities of carotid stenosis, using a comprehensive evaluation of arterial vasomotor function. Extra-cranial artery endothelium-

dependent shear-mediated vasodilation will be associated with volume of carotid stenosis. Shear-mediated vasodilation and sympathetic vasodilation responses will be associated with risk of negative outcome. Differentiation of cerebral endothelial function across a range of impairments, and in the presence of atherosclerotic burden/risk but absence of manifest carotid stenoses, will inform future clinical diagnoses of carotid and systemic atherosclerotic risk to the cerebral vascular tree.

## **Session 4**

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### **Exploring interaction modality and frequency of interaction employed by peer mentorship interventions for people with disabilities**

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**Robert B Shaw**, Sarah VC Lawrason, Kendra R Todd, Katheen A Martin Ginis

Peer mentorship is beneficial for people with disabilities and yet little is known about characteristics of the mentor-mentee relationship that contribute to the observed positive outcomes. To date, no review has examined characteristics of peer mentorship (i.e. interaction modality, interaction frequency) that could impact the quality and effectiveness of this service. The purpose of this project was to synthesize the peer mentorship literature for people with disabilities and report on the interaction modality and frequency employed in each study. Six databases were searched for articles that employed one-to-one peer mentorship interventions for people with spinal cord injury, cerebral palsy, multiple sclerosis, amyotrophic later sclerosis, stroke, spina bifida, spinal stenosis, amputee, muscular dystrophy, or fibromyalgia. A total of 2105 articles were screened, with 13 meeting the review inclusion criteria. Five different forms of interaction modalities were reported across the 13 included studies (i.e., face-to-face, telephone, text, email, video chat). Most studies (n=12) included telephone interactions and ten studies incorporated several interaction modalities. Intervention length varied greatly (range=6-104 weeks) as did the average number of weekly interactions between mentors and mentees (range=0.17-2.16). Only five studies allowed participants to self-select their interaction frequency. Peer mentorship research interventions have been delivered through various interaction modalities and at varying frequencies. Further research is needed to investigate the impact that interaction modality and frequency have on the quality of peer mentorship interactions for people with disabilities and the effect this could have on outcomes for both mentors and mentees.

### **Resistance Training as a Stimuli for RBE – Contribution of the Extracellular Matrix**

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**Donna Li** and Cam Mitchell

Skeletal muscles responds to unaccustomed exercise by orchestrating an adaptive response to attenuate damage by future bouts of same or similar exercise. This intrinsic protective phenomenon is known as the repeated bout effect (RBE). Currently, the mechanisms underlying

RBE has yet to be elucidated. There is evidence to suggest that the protective effect can be elicited by submaximal, nondamaging exercises. However, to our knowledge, no study has identified whether conventional resistance training (RT) can confer a similar magnitude of protective effect. Moreover, the role of extracellular matrix (ECM) remodeling has been identified as one potential mechanism in the adaptation of the musculature and its microenvironment to mechanical stimuli. Considering the lack of knowledge underpinning the mechanisms behind RBE and recent discoveries emphasizing the importance of ECM dynamics in dictating this niche muscle environment, we hypothesize that conventional RT preceding a damaging bout of exercise will mitigate indirect damage markers (e.g., Soreness and strength) and induce a RBE. Importantly, markers of ECM adaptations will be evident with an increase in growth factors (e.g., TGF $\beta$ ), collagen synthesis and degradation (e.g., MMPs), as well as glycoprotein levels (e.g., TN, FN). Using a unilateral design, 24 young healthy subjects (12 men and 12 women) will complete: 3 weeks of conventional RT on the training leg (CRT) [3 sets of 12 rep leg extensions twice a week, totalling 6 sessions], followed by two eccentric bouts separated by 21 days on both the trained and untrained (CON) leg. The trained and control leg will be randomized. Following exercise, immunohistochemistry (e.g., FN, TN), magnetic bead multiplex (e.g., TGF $\beta$ ) and qPCR (e.g., Collagen, MMP-2 and -9) will be used to characterize differences in ECM expression. These findings will provide insights into how the ECM interacts to manifest RBE following exercise.

### **Characterizing blood biomarkers of inflammation and brain injury in women who have experienced intimate partner violence**

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**Naomi Maldonado-Rodriguez**, Jon Smirl, Colin Wallace, Cheryl Wellington & Paul van Donkelaar

One in three women will experience intimate partner violence (IPV) in their lifetime and up to 92% may report symptoms that are consistent with brain injury (BI). Although neuropsychological and neurophysiological deficits related to IPV-related BI have been described, little is known about the physiological sequelae of IPV-related BI. In the case of IPV-related BI where injury is often chronic and repetitive, blood biomarkers may provide insight into potential pathophysiological mechanisms underlying chronic symptoms. The purpose of this exploratory study was to examine the relationship between IPV-related BI and blood-based biomarkers of neurological injury and inflammation. Women who have experienced IPV were recruited from various community women-serving organizations. BI load, PTSD, anxiety, depression, substance use, and history of abuse were assessed. Biomarkers of inflammation and neurological injury were quantified using an ultrasensitive immunoassay. Stepwise multiple regression was undertaken to explore the relationship between BI load and biomarker concentration while accounting for comorbid psychopathologies. In 24 participants assessed between 2 months and 12 years after BI, no biomarker concentration was predicted by BI load. Interleukin-10 and tumor necrosis factor- $\alpha$  concentrations were associated with PTSD severity. Interleukin-6 concentration was negatively associated with history of abuse. Our findings suggest IPV survivors may experience chronic low-grade systemic inflammation. This may be related to PTSD severity,

reflecting ongoing stress in participants' lives. Small sample size and large range in time since last BI may partly account for the lack of association of BI load with biomarkers of neurological injury.

### The effect of age and sex on the respiratory muscle metaboreflex.

**Michael G. Leahy**, Shalaya Kipp, Dr. Nisha Charkoudian, Dr. Glen E. Foster, Dr. Michael S. Koehle & Dr. A. William Sheel

The metaboreflex is a metabolically stimulated reflex originating in skeletal muscle that causes a sympathetically driven pressor response, increasing; heart rate, peripheral vascular resistance, and mean arterial pressure. The respiratory muscles can evoke the same reflex through high-intensity inspiratory work. Women have an attenuated blood pressure and heart rate response to intense respiratory muscle contractions compared to men. There are a number of possible reasons for sex-based differences, but some are thought to be due to the protective qualities of circulating sex hormones (i.e. estrogen and progesterone) on cardiovascular regulation. Additionally, the effect of aging on the respiratory metaboreflex response remains largely unclear. The purpose of this ongoing study is to observe the effect of age and sex on the respiratory muscle metaboreflex. The comparison of in pre- and post-menopausal women to age-matched men can help us understand possible effects of circulating estrogen on muscle based pressor reflexes.

### The relationship between physical activity, cardiorespiratory fitness and indices of physiological and psychological stress in individuals with spinal cord injury.

**Gabriel Dix**, Garrett Jackson, Kendra Todd, Jonathan Little, Kathleen Martin Ginis

No research has explored the relationships between cardiorespiratory (CR) fitness, cortisol, perceived stress, and leisure time physical activity (LTPA) in adults with a spinal cord injury (SCI). This study examined the relationships between LTPA, CR fitness and psychological (i.e., perceived) and physiological (i.e.,cortisol) stress in adults with chronic SCI. It was hypothesized that LTPA and CR fitness would negatively correlate with 1) perceived stress, and 2) circulating cortisol. Nine men with chronic (>1-year post injury) traumatic SCI (M=18.4 years post-injury) participated in this cross-sectional study. Fasted blood samples were taken, and participants completed the Perceived Stress Scale and a self-report LTPA measure prior to performing a  $\dot{V}O^2_{peak}$  test. Cortisol concentration was assessed using a cortisol ELISA. Hypothesis 1 received partial support as CR fitness was trivially negatively correlated with perceived stress ( $r=-.076$ ), whereas a small negative correlation was observed between total LTPA and perceived stress ( $r=-.187$ ). Hypothesis 2 was supported as both  $\dot{V}O^2_{peak}$  ( $r=-.306$ ) and total LTPA ( $r=-.475$ ) demonstrated a medium-large negative correlation with levels of cortisol. Forced regression analysis indicated  $\dot{V}O^2_{peak}$  and LTPA together explained 23.2% of the variance in cortisol ( $R^2_{adj}=.232, F[2,5]=0.755, p=.517$ ) and 3.5% of the variance in perceived stress ( $R^2_{adj}=.035, F[2,5]=0.091, p=.914$ ). Results suggest that as physical activity and fitness increase, cortisol levels decrease. Regression results suggest that a combination of physiological adaptation and behaviour may play a role in cortisol secretion. Interestingly, our regressions

suggest that additional factors not examined in the present study likely contribute to variations in perceived stress.

### **Gaze behaviour with height-induced postural threat**

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**Emma Reiter**, Rocio Hollman, Minh John Luu, Sarah de Faye, Mark Hollands, Mark Carpenter  
School of Kinesiology, University of British Columbia, Vancouver, BC

Vision has an important role in postural control in concert with other sensory systems. Aspects of sensorimotor control of posture have been investigated with height-related threat, however, eye-movement has not been extensively explored. Less exploratory gaze behaviour has been demonstrated in individuals with visual height intolerance (vHI) compared to controls [1] however visual exploration was not compared to ground level. Therefore, this study aimed to investigate changes in eye-movement between low and high heights. We hypothesized less exploratory eye-movements under conditions of postural threat. Twenty healthy young adults (8 female; mean age=26) stood on a forceplate at low (0.8m) and high (3.2 m) heights facing a blank canvas. Eye-movements were measured with a Dikablis eye-tracking system and normalized to participant eye level (horizon) and center of view. Repeated measures ANOVAs revealed significant changes in postural and emotional-cognitive outcomes, indicating a successful threat manipulation. No significant changes in average eye location or vertical exploration were found, but there was a significant reduction in horizontal exploration at height ( $p=0.051$ ,  $d=0.80$ ). Five participants (25%) reported having vHI, aligning with current estimates of vHI prevalence [2]. Descriptively, at height these participants fixed their gaze further above their respective horizons compared to the overall group and showed more vertical exploration, in contrast to findings of horizon fixation previously reported in this population [1]. Further analysis in this project will investigate location and duration of gaze fixations to gather a more detailed understanding of gaze patterns under these conditions.

### **Investigating the impact of a low carbohydrate versus a low fat breakfast on cognitive function in type 2 diabetes**

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**Kara Crampton**, Dr. Barbara Oliveira & Dr. Jonathan Little

Type 2 Diabetes is a chronic condition characterized by increased blood glucose, or hyperglycemia. One of the complications associated with this condition is a decrease in cognitive function. Consumption of carotenoids, specifically lutein and zeaxanthin, found in fruits and vegetables as well as eggs has been found to increase visual and spatial memory and learning. Lutein and zeaxanthin are the only two carotenoids that have been found to specifically accumulate within the macula of the eye and play a protective role for both eye and brain health. The purpose of my research will be to compare the effect of regularly consuming an egg-based breakfast on cognitive function in participants with T2D. This 3-month trial will have approximately 50 participants randomized into either a high-carbohydrate/low fat (control) or low-carbohydrate/high fat egg-based (experimental) breakfast condition. Participants will consume their assigned breakfasts everyday over the course of the trial and will complete

cognitive assessments at three time points (baseline, middle, end) during the study. Dried blood spots will also be collected at baseline and conclusion of the study to be analyzed for blood carotenoid levels. At this time, 8 participants completed the study. Preliminary results will be presented. *My research will test whether a relatively straightforward dietary strategy of consuming more eggs will help increase blood carotenoid levels and ultimately offset cognitive dysfunction in people with T2D.*

## Day 2: Wednesday May 12, 2021

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### Session 1

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#### Acute effects of outdoor vs indoor exercise: a systematic review and meta-analysis

**Luke Peddie**, Ben Hives, Nicole Mazara, Matt Noseworthy, Jean Buckler, Spencer Pratt, Faith Park, Scotia Barry.

Physical activity and exposure to nature have each been recognized for their positive effects on health and wellbeing. When taken in tandem, outdoor exercise is proposed to have additive benefits compared to exercising indoors or being inactive outdoors. The present review sought to summarize the body of literature that compares physiological and perceptual differences of a single bout of exercise in outdoor spaces versus indoor spaces. The findings of 24 articles (Total N = 757) published before November 2019 were examined. Summarized outcomes include objective exercise intensity, perceived exertion, performance, neuroendocrine responses, cardiovascular responses, thermoregulation, enjoyment, intention for future exercise and perceptions of the environment. Meta-analysis was conducted for measures of mean heart rate, perceived exertion, mean speed, time to completion, enjoyment, and future intention for exercise. Significant effects of the environment were detected for meta-analyses of perceived exertion ( $g = -0.84$ , 95% CI = [-1.60, -0.09],  $p = 0.03$ ) and enjoyment ( $g = 1.24$ , 95% CI = [0.59, 1.89],  $p < 0.001$ ). Methodological diversity made it impossible to statistically summarize the remaining outcomes, results split between no effect and statistically significant changes, resulting in inconclusive findings. Although no additive physiological benefits were identified by the present review as result of exercising outdoors, exercise still presents well-documented potential for improved health. When performed at an equivalent objective intensity, outdoor exercise appears to be easier and more enjoyable than indoor exercise. Outdoor exercise may be more likely to be repeated and more sustainable, allowing physiological benefits to accrue over repeated bouts.

#### Development of a rodent spinal cord injury model permissive to study the cardiovascular effects of rehabilitation approaches designed to induce neuroplasticity

**Liisa Wainman, Mehdi Ahmadian, Erin Erskine, Christopher West**

Spinal cord injury (SCI) induced dysregulation of the cardiovascular (CV) system occurs primarily due to altered descending control over the sympathetic preganglionic neurons. In order to study the effects of neuroplasticity on functional outcomes within the sympathetic nervous system we aimed to develop a contusion injury model demonstrating a balance between sufficient sparing of descending pathways and substantial cardiovascular impairment. A total of 36 Wistar rats were assigned to either SCI (n=13) or naive (n=23) groups. For spinal cord contusion, animals were injured at the T3 spinal segment with 300 kdyn of force. Fourteen days post-SCI left ventricular (LV) and arterial catheterization was performed to assess in vivo cardiac and hemodynamic function. Spinal cord lesion characteristics were determined via immunohistochemistry. Between-group differences in outcomes were analyzed using an independent samples t-test. Statistical significance was set at  $p < 0.05$ . SCI produced a decrease in LV maximum pressure (LVmax) (naive= $120 \pm 9$  mmHg vs SCI= $99 \pm 12$  mmHg,  $p < 0.001$ ) and maximal rate of LV pressure rise (dP/dtmax) ( $9984 \pm 1049$  vs.  $6101 \pm 787$  mmHg/s  $p < 0.001$ ), arterial systolic blood pressure ( $127 \pm 14$  vs.  $97 \pm 10$  mmHg,  $p < 0.001$ ), diastolic blood pressure ( $76 \pm 11$  vs.  $57 \pm 8$  mmHg,  $p < 0.001$ ) and mean arterial pressure ( $93 \pm 12$  vs.  $69 \pm 8$  mmHg,  $p < 0.001$ ). Immunohistological staining and visualization of the epicenter of the cord revealed  $17 \pm 4\%$  tissue sparing. Our novel SCI model produced significant decreases in cardiac and hemodynamic function while preserving sufficient tissue at the epicentre. These findings suggest that our novel injury is a useful pre-clinical model of SCI to study rehabilitation approaches designed to induce neuroplasticity.

### Does localized cooling of the foot dorsum influence the vestibular control of standing balance

**Mathew I.B. Debenham, Hogun J. Kang, Stephen S. Cheung, and Brian H. Dalton**

Somatosensory cues from the feet provide important information for standing balance control. Previous reports demonstrate that cooling the foot sole increases vestibular-evoked balance responses, yet it is unclear if the foot dorsum exhibits similar effects. The purpose of this study was to determine whether decreasing cutaneous receptor sensitivity via foot dorsum cooling can modulate the vestibular control of balance. It was hypothesized that whole-body vestibular-evoked balance responses would increase with cooling. Eighteen participants (9 females) stood quietly on a force plate with feet together, eyes closed, and head rotated leftward for 4 trials (2 baseline; 2 cooled) of binaural, bipolar electrical vestibular stimulation (EVS; 0-25Hz; peak-to-peak amplitude =  $\pm 5$ mA; 90s each). The cooling protocol involved placing icepacks on the dorsum of both feet for 15min. During the EVS cooled trials, the icepacks remained on the feet. Vestibular-evoked balance responses were characterized using a correlation-like analysis to determine the relationship between the EVS input and the whole-body balance response (anterior posterior forces; APF). T-type thermocouples monitored foot dorsum skin temperature, which decreased following cooling ( $28.0 \pm 1.9^\circ\text{C}$  to  $8.1 \pm 3.4^\circ\text{C}$ ;  $p < 0.05$ ). Cooling reduced EVS-APF peak-peak amplitude compared to baseline ( $0.19 \pm 0.04$  vs  $0.21 \pm 0.05$ , respectively;  $p < 0.05$ ). The vestibular control of standing balance decreased following reduced foot dorsum temperature. The current findings likely represent an alteration in cutaneous mechanoreceptor sensitivity of

the foot dorsum and their subsequent role in the transformation of the vestibular-evoked whole-body balance response.

### **Partitioning the work of breathing during running and cycling using optoelectronic plethysmography**

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**Shalaya Kipp**, Michael G. Leahy, Jacob A. Hanna, A. William Sheel

Work of breathing ( $\dot{W}B$ ) derived from a single lung volume and pleural-pressure does not fully characterize the mechanical work done by the respiratory musculature. Abdominal activation also increases with increasing exercise intensity, yet the mechanical work done by these muscles is not reflected in  $\dot{W}B$ . Optoelectronic plethysmography (OEP) is a 3-dimensional motion analysis tool that measures the positions and displacements of reflective markers on the thorax and abdomen to calculate volume. Importantly, OEP permits an assessment of the ribcage and abdominal contribution to volume changes during breathing. First, show the volumes measured using OEP (VCW) were comparable to volumes from flow integration ( $V_t$ ) during cycling and running. Second, to demonstrate that partitioned ribcage and abdominal volume from OEP could be utilized to quantify the mechanical work done by the ribcage ( $\dot{W}BRC$ ) and abdomen ( $\dot{W}BAB$ ) during exercise. We fit 11 subjects with 89 reflective markers, and esophageal and gastric balloon catheters. Subjects completed a cycling test to exhaustion and a series of submaximal treadmill-running trials. We found good agreement between VCW vs.  $V_t$  during cycling and running ( $p > 0.05$ ). From rest to maximal-exercise,  $\dot{W}BAB$  increased by 84% ( $\dot{W}BAB$ :  $1 \pm 1$  J/min to  $61 \pm 52$  J/min). The relative contribution of the abdomen increased from  $17 \pm 9\%$  at rest to  $26 \pm 16\%$  during maximal-exercise. Incorporating the work done by the abdomen allows for a greater understanding of the mechanical tasks required by the respiratory muscles during exercise. Our approach could provide insight into how the respiratory system functions under pathophysiological conditions and injury.

### **Real-Time Subject-Driven Sensory Augmentation for Virtual Reality and Motor Adaptation**

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**Anthony Chen** & Jean-Sébastien Blouin

Probing sensorimotor mechanisms in humans typically include externally imposed perturbations which involves a set stimulus independent of subject action. Alternatively, real-time sensorimotor modulations through changing the relationships between actions (motor commands) and their consequences (sensory cues) may be critical to reveal how the brain integrates these signals in a task-relevant manner. Here, we highlight how a portable microcontroller with a sensor-driven electric current stimulator may be used to achieve real-time modulation of sensory feedback associated with motion. This device delivers current based on subject-driven action(s) through recording wearable sensory data (i.e. inertial measurement unit) which may be placed in a variety of anatomical locations offering a plethora of novel sensorimotor experiments both within a laboratory setting and outside of it. We propose two research topics utilizing this technique. First, physiologically equivalent electrical vestibular

stimulation can attenuate or augment vestibular sensory feedback through real-time tracking of head kinematics. We intend to exploit this technique to supplement vestibular sensory input during virtual reality usage to modulate presence and cyber-sickness. Second, low-frequency sinusoidal current based-on/scale-to a calibrated motion provides a novel task-relevant experimental pain model. Here, we will induce phase-dependent pain within the gait cycle to explore adaptations in locomotor behaviour. In summary, our novel methods will probe directly the neural mechanisms controlling self-motion and adaptation during altered, yet controlled, sensorimotor environments. The portability and increased accessibility enabled by our approach may also allow us to explore motor adaptations over a protracted timespan unconstrained to the laboratory setting.

### Let's get digital: Examining the effectiveness of an online training program for diabetes prevention coaches

**NJ Grieve**, KD Cranston, ME Jung

*Small Steps for Big Changes* (SSBC) is a diabetes prevention program in the Okanagan. SSBC includes guided exercise and counselling sessions for individuals with prediabetes. The program utilizes a motivational interviewing (MI) counselling style, which is a collaborative and client centered approach that aims to strengthen a client's motivation to change. A standardized "train-the-trainer" workshop has been delivered face-to-face to train SSBC coaches, however this process logistically limits training opportunities and expansion of SSBC to other communities. As such, the development of an online program to deliver training to SSBC coaches is currently underway in partnership with an industry partner that specializes in developing digital learning platforms. The purpose of this project is to test the effectiveness of this new online training program for SSBC. Primary outcomes will include knowledge of diabetes, MI, SSBC content, and self-efficacy to deliver the program. User satisfaction and user engagement metrics will also be assessed. Outcomes will be assessed by psychometrically-sound questionnaires delivered pre- and post-study, as well as user engagement data. Once effectiveness of the online training program has been demonstrated, SSBC will be able to expand to more communities in a cost-effective and sustainable manner, while maintaining high program fidelity. Ultimately, this will allow the research team to extend their reach and help more Canadian adults living with prediabetes.

### Force steadiness and motor unit properties in strength-matched males and females

**Parisa Alaei**, Changki Kim, Rowan R Smart, Kaylee A Larocque, Jennifer M Jakobi

Lower strength in females compared to males may lead to reduced force control; measured in the laboratory as force steadiness (FS). To eliminate strength-related effects on FS, we matched maximum voluntary contraction (MVC) force between males and females and examined motor unit (MU) properties and FS. Six males (24±3yr, MVC =199.7±26.1N) and 6 strength-matched females (22±2yr, MVC =188.6 ± 15.6N) performed submaximal isometric elbow flexion tracking tasks at 2.5, 5, 10, 15, and 25% of MVC force. MU action potential trains were recorded from the

biceps brachii using fine-wire intramuscular electromyography (EMG) and discharge rate (DR) and MUDR variability calculated. FS was measured as the SD of force (absolute variability) and coefficient of variation (CV) of force during the 7.5 seconds steady contractions. CV of force was not different between males and females ( $p=.99$ ), and decreased as force level increased (2.5% MVC =  $2.9 \pm 0.13\%$ ; 25% MVC =  $0.6 \pm 0.12\%$ ,  $p < .001$ ). SD of force increased with force levels ( $p < .001$ ), and females showed 26.4% higher SD of force at 25% MVC ( $p=.03$ ) than males. The MUDR of the 224 recorded units increased with force (2.5% MVC =  $13.4 \pm 0.4$  pps; 25% MVC =  $18.6 \pm 0.3$  pps,  $p < .001$ ). Overall, females showed 7.9% higher MUDR than males ( $\Delta = 1.14$  pps,  $p < .001$ ). MUDR variability was not different between sexes. When MVC is matched in females and males, CV of force does not differ, but SD of force is greater in females at higher force levels potentially as a result of higher MUDR.

### **The impact of the COVID-19 pandemic on the physical activity parenting practices of Canadian parents of school-aged children**

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**Derek Paterson**, Guy Faulkner

Since the instatement of lockdown measures, there has been widespread evidence of significant declines in the physical activity (PA) behaviours of school-aged children. The largely descriptive nature of this evidence body suggests the need for theoretical perspectives to account for these observed behaviour changes. A recent line of inquiry has found that the strategies used by parents to influence their child's PA, referred to as physical-activity parenting practices, have been associated with child PA (Hutchens & Lee, 2018). Given these prior associations and the ongoing pervasive stay-at-home conditions, there is a sound theoretical basis to explore PA parenting practices as an avenue for understanding pandemic-induced changes to child PA. Therefore, the purpose of this study is, through qualitative interviews, to examine the contextual experiences of parents and understand how their parenting practices have been impacted by the COVID-19 pandemic. One-on-one semi-structured interviews with Vancouver parents of school-aged children (aged 5-11) will be conducted through the development of an interview guide informed by a recent psychometrically validated item bank for measuring physical activity parenting practices (Mâsse et al, 2020). A reflexive thematic analysis will be undertaken for the flexibility to interpret transcribed interviews both deductively through a theoretical lens and inductively for the purposes of generating novel themes in an emerging research area. The findings of this study will contribute to the development and revision of theoretical models, and may produce practical knowledge surrounding parenting practices for dissemination as a means of supporting families both through and beyond the COVID-19 pandemic.

### **Is the burn worth it? Pain perception following prolonged exposure to low-concentration topical capsaicin.**

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**Goodings HET**, Linde L, Kramer JLK

Chronic pain is a growing concern in Canada and around the world. The development of chronic pain is typically predicated by neuroplastic changes within the spinal cord in response to

persistent noxious stimuli, termed central sensitization. TRPV1 receptors, found throughout the spinal cord and periphery, are known to contribute to the development of sensitization. TRPV1 receptors are known to activate with temperatures  $<42^{\circ}$ , acidity and capsaicin. Capsaicin, the active ingredient in chilli peppers, is a common ingredient in pain relieving ointments. The mechanism of pain relief, resulting from prolonged use of low concentration 0.1% capsaicin, is currently missing from the literature. Determine the effect of adjacent sensitization, on a region of skin desensitized via the prolonged application of capsaicin. Individuals will apply 0.1% capsaicin cream thrice daily on the forearm for a 20-day application period. Following the application period, Contact Heat Evoked Potentials (CHEPS), Cold Evoked Potentials (CEPS), and hot and cold pain thresholds will be collected in the area of application and an adjacent control region. Mechanical Pain Sensitivity (MPS) will be assessed within the capsaicin and control regions prior to, and following, a repeated suprathreshold heat stimulus applied between the two regions. The 20-day application period of low dosage capsaicin will be sufficient to desensitize TRPV1 receptors. The desensitized region will not be susceptible to mechanical sensitization following an adjacent suprathreshold heat stimulus. Findings from this thesis will further inform our mechanistic understanding of central sensitization, an underlying mechanism in chronic pain development.

### **Diet and Exercise Interventions for Ethnically Diverse Populations at Risk for Type 2 Diabetes: A Scoping Review**

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**Cara Johnston**, Megan MacPherson, Kaela Cranston, Sean Locke, Matthew Vis-Dunbar, Mary Jung

Previous reviews have highlighted the efficacy of lifestyle diabetes prevention programs (DPPs) in decreasing the risk of type two diabetes (T2D). Ethnically diverse populations in high-income countries such as the United States and Canada are disproportionately affected by T2D; therefore, there is a need for research to focus on sustainable implementation and translation of DPPs to diverse ethnic populations identified as most at risk for developing T2D. This work aims to improve future DPP implementation by synthesizing intervention characteristics within published DPPs targeting ethnically diverse populations. An ongoing scoping review is being conducted to synthesize all published DPPs. Medline, CINAHL, PsycINFO, Embase, and SPORTDiscus were searched for terms relating to T2D risk and lifestyle programs. This project represents a sub-analysis of DPPs created for at risk adults who are part of an ethnically diverse population. Data regarding study characteristics will be systematically extracted using the Template for Intervention Description and Replication (TIDieR) checklist. 18,795 titles/abstracts were screened for inclusion. 789 progressed to full text review resulting in 200 DPPs. 39 DPPs were identified as targeting ethnically diverse populations and were included in this sub-analysis. Data extraction is currently underway and will ultimately inform future researchers on the scope of DPPs targeting ethnically diverse populations. Understanding how interventions targeting ethnically diverse populations are currently being implemented and summarizing them in a single location can assist future DPP developers in creating more targeted interventions, allow for more effective translation of DPPs, and reduce T2D in those most at risk.

## Session 2

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### **The Impact of Abdominal Body Contouring Surgery on Physical Function After a Massive Weight Loss: A Pilot Non-Randomized Controlled Trial**

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**Sobhan Mardan-Dezfouli**, Matthew David, Owen Reid, David Harris, Michael Lyon, Cameron Mitchell

It is estimated that 70% of individuals who undergo a massive weight loss (MWL) develop excess skin (ES). The ES around the abdominal area has been shown through patient reported outcome measures to negatively impact physical function. Yet no studies have examined the impact of abdominal body contouring surgeries on direct measures of physical function. Patients who have undergone MWL were recruited through 3 medical clinics and were allocated to either a body contouring intervention group or post massive weight loss matched control. They participated in a series of physical function batteries of tests including 9-item modified physical performance test, 30s-chair to stand, star excursion balance test, timed up and go, modified agility t-test, 6-minute walk test, and body composition measures of fat mass and bone free fat free mass. There was a total of two visits which were 8-12 weeks apart to accommodate for recovery time for abdominal contouring procedures. The primary outcome of the study was to assess the variability of outcome measures to determine floor, ceiling and learning effect and to collect and synthesize data from which sample size of a definitive cluster could be estimated. The secondary outcomes of the study were recruitment/retention rates and acceptability of the protocol. This study can help develop appropriate tests for measuring physical function in patients who have undergone a MWL and have ES in order to develop future clinical trials in this population.

### **The COvid-19 Pandemic and Exercise (COPE) Trial: A multi-group randomized controlled trial comparing effects of at-home workouts to waitlist control on depression symptoms**

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**Benjamin Hives**, Nicole Mazara, Nikol Grishin, Joshua Webster, Stacey Hutton, Michael Koehle, Yan Liu, Mark Beauchamp, Eli Puterman

The number of adults across the globe with significant depression symptoms has grown substantially during the COVID-19 pandemic. The extant literature supports exercise as a potent behavior that can significantly reduce depression symptoms in clinical and non-clinical populations. Using a suite of mobile applications, at-home exercise, including high intensity interval training (HIIT) and/or yoga, was completed to reduce depression symptoms in the general population in the early months of the pandemic. A 6-week, parallel, multi-arm, randomized controlled trial was completed with 4 groups: [1] HIIT, [2] Yoga, [3] HIIT+Yoga, and [4] waitlist control (WLC). Low active, English-speaking, non-retired Canadians aged 18-64 years were included. Depression symptoms were measured at baseline and weekly following randomization. A total of 334 participants were randomized to one of four groups. No differences in depression symptoms were evident at baseline. The results of latent growth modeling showed significant treatment effects for each

active group compared to the WLC, with small effect sizes in the community-based sample of participants. Treatment groups were not significantly different from each other. Effect sizes were very large when restricting analyses only to participants with high depression symptoms at baseline. At-home exercise is a potent behavior to improve mental health in adults during the pandemic, especially in those with increased levels of depression symptoms. Promotion of at home exercise may be a global public health target with important personal, social, and economic implications as the world emerges scathed by the pandemic.

### **Title: Seeing Without Sight: An Exploration of the Athlete-Guide Partnership in High Performance Para-Sport**

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**Staci Mannella**, Andrea Bundon

Individuals who are blind or visually impaired compete in sports such as skiing, cycling, athletics, and triathlon because of the help of their sighted guides. The guide participates with the athlete, and the pair communicate back and forth seeking to achieve optimal performance together. The partnership transforms many sports typically understood to be individual sports into team sports dependent on communication, trust, and rapport. While some literature has explored athlete-athlete relationships in sport, nothing has been published on these dyadic partnerships in disability sport. Poczwardowski et al. (2019) proposed the 5C's model of interdependence for high performance athlete – athlete dyads which includes compatibility, commitment, complementarity, coorientation, and closeness. This presentation presents the findings from a study which aimed to document and explore how the athlete – guide partnership is experienced in elite para-sport. More specifically, the study sought to identify how the athlete-guide partnership challenges and/or reproduces normative assumptions of bodies, abilities, and sport and how interdependence is experienced and understood within these partnerships. The study was informed by a critical interpretivist paradigm and included semi-structured interviews with elite athletes and guides who have competed internationally. The data was thematically analyzed and included both inductive and deductive coding. The findings are discussed in relation to the 5C model of interdependence and also narratives of ableism and disablism. The study provides novel insights into how these partnerships are and the ways in which interdependent relationships shape experiences and understandings of disability in the context of elite sport. Recommendations for sport psychologists and other practitioners who support these partnerships are provided.

### **The effect of 24hrs of sleep deprivation on the vestibular control of standing balance.**

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**Paige V. Copeland**, Megan Trotman, Hogun Kang, Chris J McNeil, Brian H. Dalton  
School of Health and Exercise Sciences, UBC Okanagan, Kelowna, BC Canada

Adequate postural control is required for performing functional tasks of daily living. The importance of balance often goes unnoticed until a stressor causes postural and functional impairments. To maintain standing balance, the central nervous system integrates and process multiple sensory cues; the vestibular system provides sensory information pertaining to the

position of the head and body in space and is, therefore, a crucial sensory system to investigate. Stochastic electrical vestibular stimulation (SVS) is a valuable method in investigating the role of the vestibular system in the control standing balance. Using SVS, we are able to characterize vestibular-evoked balance responses (VEBR) in the lower limb musculature. These reflexes, present over a bandwidth of 0-20Hz, have been shown to change due some common physiological stressors. For instance, in healthy adult aging, VEBR have been shown to compress toward lower frequencies, and show a higher relative gain at those frequencies. These findings may provide some explanation towards the impaired balance we see in aging populations. Sleep deprivation is another common condition known to affect various aspects of psychomotor performance, but there is currently a lack of consensus as to how sleep deprivation may alter one's vestibular control of standing balance. Due to the role of the vestibular system in standing balance, and the importance of standing balance in performing activities of daily living, the purpose of the current study is to investigate the effect of 24hrs of sleep deprivation on the frequency domain characteristics of vestibular-evoked reflexes in the lower limb.

### **Exercise research issues among individuals with a spinal cord injury: Are we moving in the right direction?**

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**Kendra R. Todd**, Kathleen A. Martin Ginis, John L.K. Kramer

The Spinal Cord Injury Physical Activity Guidelines (SCI PAG) were published in 2011, with the primary goal of improving health outcomes among persons with SCI. A secondary goal of these guidelines was to establish a benchmark to gauge the effects of varying volumes of activity. A benchmark was required given the heterogeneity of exercise studies that supported guideline development. Effective guidelines rely on research and community-based implementation; therefore, this study evaluated the impact of the SCI PAG on SCI-exercise research published since 2011, and identified trial characteristics related to study publication. ClinicalTrials.gov was searched for trials that investigated the effects of exercise among persons with SCI. 391 registered trials were screened to determine trial eligibility. Sixty registered trials met the eligibility criteria, and were included in this analysis. To achieve cardiorespiratory and cardiometabolic health benefits, 48% of trials included protocols meeting activity frequency recommendations. 47% of trials met SCI PAG activity length recommendations. Only 32% of trials met recommendations regarding activity intensity. Trials that included wait-list control groups [ $\chi^2(1,48)=7.27, p=0.009$ ], participant-selected exercise types [ $\chi^2(1,48)=9.60, p=0.013$ ] and received investigator-initiated funding [ $\chi^2(1,48)=18.91, p<0.001$ ], were significantly more likely to be published than trials lacking these characteristics. These results demonstrate the gap in translating the SCI PAG into current research practice. Exercise trial characteristics that increase the likelihood of publication were identified, which may improve health outcomes through greater research transparency. Ultimately, wait-list control groups and participant-selected exercise types might facilitate participant adherence and retention, which in turn could increase the likelihood of studies achieving publication.

### **Developing a Library of Theory-Based Text Messages to Promote Behaviour Change Adherence Following the Small Steps for Big Changes Diabetes Prevention Program**

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**Megan MacPherson, Kaela Cranston, Sean Locke, Mary Jung**

Diet and physical activity (PA) improvement can reduce type 2 diabetes (T2D) risk; however, long-term adherence to diet and PA is poor. Text messaging (SMS) is a cost-effective way to improve long-term diet and PA changes; however, SMS interventions often fail to report theoretical underpinnings. This study describes the development of a SMS library targeting diet and PA adherence following a diabetes prevention program using the Behaviour Change Wheel (BCW). The BCW is a synthesis of 19 behaviour change frameworks which provides structure to intervention design and has been used extensively in health behaviour change interventions. The following BCW stages were followed: identify (I) target behaviours and barriers/facilitators to engaging in them; (II) intervention options and policy categories; and (III) relevant behaviour change techniques (BCTs) associated with selected intervention options. A SMS library was then written to map onto identified BCTs and was coded for BCT fidelity. Target behaviours included adherence to diet and PA recommendations. Sixteen barriers/facilitators and 28 BCTs were identified through previous qualitative work. A total of 124 messages were written. Following the fidelity check, 43 unique BCTs were included in the final message library. Previous studies using the BCW have not checked BCT fidelity following intervention development. This step proved imperative in developing a comprehensive picture of active components. By reporting on the theoretical underpinnings, future research can understand not only *if* these messages are effective, but also *why* certain messages are more/less effective, and what combination of messages optimally influences behaviour.

### **Exercise-Induced Arterial Hypoxaemia in Female Master Athletes**

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**Shiffman V., Kipp S., Leahy M., Khoele M., Mckenzie D., McKinney J., Hughes B., Rose P., Sheel A.W.**

Healthy humans are able to maintain the amount of oxygen (O<sub>2</sub>) in their arterial blood at near-resting levels even in the face of maximal exercise. However, about 50% of highly-trained male endurance athletes demonstrate a significant reduction in arterial oxygenation – a phenomenon termed exercise-induced arterial hypoxemia (EIAH). EIAH reflects the inability of the healthy pulmonary system to meet the metabolic and circulatory demands of heavy exercise. Few studies have sought to characterize the prevalence of EIAH in women. However, there is limited evidence to suggest that EIAH is more prevalent in young female athletes. Importantly, little-to-no attention has been paid to the older female athlete with respect to pulmonary gas exchange. The majority of female master's athletes will develop EIAH during all intensities of treadmill exercise. 10 female masters athletes will be recruited to participate in the study. On the first day of testing pulmonary function will be assessed followed by an incremental treadmill exercise test to determine their maximal oxygen consumption (VO<sub>2</sub>max). On the second day participants will be instrumented with a radial artery catheter, an oesophageal balloon-tipped catheter and temperature probe. Participants will exercise at 50%, 75% and 90-95% VO<sub>2</sub>max for 3-4 minutes while blood samples are drawn. Main variables analyzed with an arterial blood gas analyzer are pH, PaO<sub>2</sub>, PaCO<sub>2</sub>, SaO<sub>2</sub>, ctHb. The proposed work will advance our understanding of the

complex inter-relationships between aging and training-induced changes to the components of O2 delivery in an under studied group.

### **Contraction duration impacts analysis of frequency but not amplitude-based components of submaximal force steadiness tasks**

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**Owen Harris, Rowan Smart, Jennifer Jakobi**

Accurate representation of output measures of force steadiness (FS) is essential for understanding physiological contributions to force control. Duration of analysis has been suggested to influence frequency and amplitude-based output measures of FS, but the direct comparison of short and long-duration contractions has not been systematically undertaken. This study investigated the effect of contraction duration on frequency and amplitude-based measurement components during FS tasks. Eleven subjects ( $23 \pm 5$  yrs) performed submaximal isometric elbow-flexion tracking tasks with plateaus of 5-seconds and 10-seconds at force levels of 5, 10, 25, 50 and 75% of maximal force. Amplitude-based variables of coefficient of variation of force (CV), standard deviation of force (SD), and normalized root mean square electromyography (EMG), and frequency-based variables of power spectrum density (PSD: 0-0.5Hz, 0.5-1Hz, 1-1.5Hz, 1.5-2Hz) and intermuscular coherence (IMC) were analyzed for the plateau phase of the 5-second, 10-second and last 5-second of the 10-second contractions. No difference was observed for CV ( $1.7 \pm 0.6\%$ ), SD ( $1.3 \pm 1.2$ ), or EMG ( $28.5 \pm 37.9\%$ ) between contraction durations ( $p > 0.05$ ). Contraction duration influenced PSD differently across all four frequency bins ( $p < 0.05$ ). IMC was significantly lower in the 10-second compared to 5-second and 5-seconds of 10-second analysis across alpha (~44% lower), beta (~43% lower), and gamma (~35% lower) frequency bands for agonist-agonist and agonist-antagonist muscle pairings. The lack of differences in CV, SD, and EMG suggest that shorter contraction durations are suitable for analyzing amplitude-based variables, while the differences in PSD and IMC indicate shorter contraction duration overestimates IMC, and produces variable effects on PSD.

## **Session 3**

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### **Women Coach Recruitment and Retention in Canadian Ice Hockey**

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**Donna Cumming**

The underrepresentation of women in coaching is an issue that persists despite significant strides towards equality in female athlete participation. Extensive research shows that as the number of women participating in sport has steadily increased over the last few decades, the opposite has occurred in women coaching, with a slow but steady decline particularly among women head coaches. This research project focuses on recruitment and retention of women coaches in the context of Canadian ice hockey, where women represent less than 5% of all coaches in the country (Hockey Canada, 2020). A review of academic and industry literature was conducted with an objective to better understand the barriers commonly experienced by women in coaching, as

well as existing strategies to support women coach recruitment and retention. While there have been many initiatives targeting the retention of women coaches, these strategies often target elite coaches at an individual level thus overlooking most current and potential coaches at a variety of development stages. Despite the benefits these programs may have for the individual coaches involved, the lack of strategic approaches at a structural level has led to a fragmented approach to women coach retention. Based on identified gaps in the literature and in current women coach recruitment and retention strategies, recommendations are made to focus on coordinated action at a systemic level.

### **The Relationship Between Breathe Acetone Biofeedback and Weight Loss in Men and Women with Overweight and Obesity**

**Nicholas J. Reitsma**, Kaja Falkenhain, BSc; Sean R. Locke, PhD; Dylan A. Lowe, PhD;; Terry Lee, PhD; Joel Singer, PhD; Ethan J Weiss, MD; Jonathan P Little, PhD

Obesity is associated with a number of serious chronic health conditions including cardiovascular disease and type 2 diabetes. A ketogenic diet is an intervention that has been growing in popularity; still, the overall efficacy of the diet in a real-world setting remains to be thoroughly explored. Breath acetone, which is produced when the body is in a state of ketosis, has been suggested as a non-invasive proxy for rate of fat loss; however, this has not been evaluated in a clinical trial. Therefore, we aimed to evaluate the correlation between average breath acetone values and weight loss over a 12-week ketogenic diet intervention. As part of a larger randomized trial, 77 participants (71% female; 42±11 years; BMI = 33.5±4.7 kg/m<sup>2</sup>) were randomized to follow an app-based ketogenic diet program where they collected breath acetone measurements three times daily for 12 weeks. Baseline and follow-up weights were measured on an at-home wireless scale and mean breath acetone values were calculated. Participants lost an average of 5.6 kg (95% CI: 4.5 kg to 6.7 kg) over 12 weeks. There was a significant correlation between average breath acetone value and weight loss ( $R^2=0.42$ ,  $p<0.001$ ), suggesting greater weight loss with higher breath acetone levels across the 12-week intervention. Among men and women with overweight/obesity, a ketogenic diet app with breath acetone biofeedback was effective at promoting weight loss in a real-world setting. Rate of weight loss was associated with higher breath acetone values.

### **A Mediterranean-Based Ketogenic Diet Mobile Health Application Compared to a Calorie-Restricted Low-Fat Diet Application for Weight Loss and Cardiovascular Risk in Women and Men with Overweight or Obesity: A Randomized Trial**

**Kaja Falkenhain**, Sean Locke, Dylan Lowe, Nicholas Reitsma, Ethan Weiss, Jonathan Little

Very low-carbohydrate ketogenic diets have gained popularity due to efficacy in promoting weight loss and improving metabolic health. However, there is inconclusive evidence on the real-world effectiveness of such diets and concerns remain about negative effects on blood lipids and cardiovascular risk associated with higher fat intake. Participants (N = 155) with overweight/obesity (41±11 y, BMI = 34±5 kg/m<sup>2</sup>, 71% female) were randomized to an mHealth

application promoting a Mediterranean-based ketogenic diet paired with a breath acetone biofeedback device (Keyto) or a calorie-restricted low-fat diet (WW). Interventions were delivered entirely via the mobile app. Participants were instructed to take daily weight measurements on an at-home wireless scale and a fasted blood sample was obtained by a third-party laboratory at baseline and 12 weeks. The Keyto group observed a greater decrease in body mass (-5.6 kg; 95% CI, -6.7 kg to -4.5 kg) compared to the WW group (-2.5 kg; 95% CI, -3.6 kg to -1.4 kg) (between group difference: -3.1 kg; 95% CI, -4.6 kg to -1.5 kg;  $p < 0.001$ ). Similarly, participants randomized to the Keyto app experienced greater decreases in HbA1C, alanine aminotransferase, alkaline phosphatase and albumin/globulin ratio when compared to WW (all  $p < 0.01$ ). No other differences were observed in markers of cardiovascular or metabolic risk. This trial provides evidence that an app promoting a Mediterranean-based ketogenic diet paired with breath acetone biofeedback monitoring is a viable option to provide metabolic and weight loss benefits without negative effects on blood lipids in a real-world setting.

## Session 4

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### When East Meets West: Older Chinese Immigrants in Canada and Their Perceptions and Experiences of Mental Health and Mental Illness

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#### Danni Zhang

In this study, I propose to explore older Chinese immigrants' perceptions and experiences of mental health and mental illness. Studies have found that the mental health of new immigrants' is often negatively impacted by acculturative stress arising from language difficulties, social isolation, changes in work and family roles, the absence of supportive networks, and new social norms. Older Chinese immigrants are at higher risk of mental health issues and mental illness compared to the general Canadian population. Although the barriers to obtaining help for mental health issues and mental illness have been well documented, little is known about the lived mental health and illness experiences of older Chinese immigrants. Using symbolic interactionism as my theoretical framework, I will conduct semi-structured interviews with 10 – 15 Chinese immigrants aged 65+. I will seek to understand the meanings that participants give to mental health as well as to mental illness and how those meanings underscore their everyday health and illness practices and experiences. I will ask them about how their attitudes towards mental health and mental illness have been shaped by their earlier life socialization as well as their experiences of immigration, what they think promotes mental health or leads to mental illness, and what they do to maintain their mental health. The study will build on the existing research and provide important insights into Chinese immigrants' lived experiences of mental health, mental illness, and help-seeking behaviour.

### Neural effects of sleep deprivation on inhibitory control

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Justine Magnuson, Hogun Kang, Brian Dalton, and Chris McNeil

Sleep deprivation (SD) is commonplace and has been shown to impair working memory, inhibition, cognitive flexibility and attention. However, little is known about the impact of SD on the human brain in the context of inhibitory control and emotion processing. To address this knowledge gap, 12 participants performed computerized go/nogo tasks (one with shapes and one with faces) after both a night of normal sleep and after 24 hours of no sleep. Electroencephalographic recordings were taken during a 3-minute eyes-open resting period prior to go/nogo task performance as well as during task performance. We found significantly higher theta power ( $p < 0.05$ ) for the SD condition compared to the control condition during eyes-open rest. Participants also made more errors on the go/nogo tasks ( $p < 0.01$ ) and had slower response times ( $p < 0.05$ ) after 24 hours of no sleep. Smaller differences in amplitude between the go and nogo trials for the N2 ( $p < 0.01$ ) and both the N2 ( $p < 0.05$ ) and P3 ( $p < 0.01$ ) event-related potential components were found for the face and shape go/nogo tasks, respectively. These results suggest that participants devoted fewer resources to processing new, relevant, information (nogo trials) compared to common go trials. This might indicate a more bottom-up, stimulus-driven processing approach responsible for inhibiting the motor response for both object and emotion-related inhibition. Furthermore, it is possible that the increase in theta power indicates a slowing of neural processing and an impaired ability to exert top-down attentional processes during task performance.

## Receptiveness to Workplace Exercise

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**Blessing Adeagbo**, Matthew J. Stork<sup>a</sup>, Mary E. Jung

Physical activity in the general population is decreasing, while sedentary behaviours are concurrently increasing – and these trends have only been magnified in light of the COVID-19 pandemic. These patterns of behaviour have deleterious effects on health and therefore are an important target in improving population health outcomes. Adults spend a large proportion of their sedentary time in the workplace, where they are often required to spend long hours sitting and limited time moving. Further, COVID-19 has led to an increased proportion of people working from home. As such, the work environment is a viable target for physical activity interventions. “Exercise snacks” – short bouts (e.g., 20-60 seconds) of high-intensity exercise with 1-4 hours of rest in-between each bout – are one possible intervention. However, many workplace interventions are not informed by a comprehensive appraisal of all relevant behaviour change techniques, leading to ineffective programs and short-lived behaviour change. Therefore, the purpose of this study is to 1) investigate the determinants of participation in workplace exercise, 2) assess potential differences between individuals who work from home versus on-site, and 3) explore the considerations around the incorporation of exercise snacks into the workplace. Full time employees who report 6+ hours per workday of sitting and/or standing still will be recruited to participate in this study. Determinants and receptiveness will be assessed using a self-report survey, which includes the Determinants of Physical Activity Questionnaire. The findings from this research will help inform the development of future workplace exercise interventions for effective behaviour change.

## **Passive Heat Therapy to Reduce Cardiovascular Disease Risk in Individuals with COPD: A Project Proposal**

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**Kyla Coates & Dr. Neil Eves**

Chronic obstructive pulmonary disease (COPD) is characterized by abnormal lung mechanics and intolerable dyspnea with exertion, which lead to exercise avoidance and contribute to the heightened risk of cardiovascular disease (CVD) in this population<sup>1-3</sup>. A novel way to enhance cardiovascular health without performing exercise is with passive heat therapy (PHT). PHT increases blood flow thereby improving vascular endothelial function and arterial compliance through elevated vascular shear stress<sup>4,5</sup>. In turn, the development and progression of arteriosclerosis, atherosclerosis and hypertension may be reduced<sup>6,7</sup>. However, no study to date has investigated whether PHT can reduce CVD risk in people with COPD. Objectives are to (1) To characterize the acute hemodynamic and vascular responses to a single bout of PHT (2) to determine the efficacy of an 8-week PHT intervention on CVD risk in people with COPD. Both studies will involve a 30-min lower-leg hot-water immersion (42° C) as the intervention, compared to a thermoneutral (36° C) sham condition. Study 1 will follow a randomized cross-over design and will examine the acute hemodynamic changes to cardiac output, femoral blood flow induced vascular shear stress and endothelial function from a single bout of PHT vs. sham. Study 2 will follow a parallel two-arm, randomized control trial design, comparing the effects of chronic PHT vs. sham (8 weeks of 3x/week) on changes in femoral artery endothelial function, central arterial stiffness and 24-hr ambulatory blood pressure. This research could provide a novel and accessible means of reducing CVD risk in people with COPD.

## **A systematized review of the effects of cannabinoids on spinal motor neuron output**

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**Elijah Haynes & Jennifer Jakobi**

In Canada and elsewhere, expanded access to cannabis and de-stigmatization surrounding its use have contributed to an overall increased prevalence of its use. Cannabis products are supposedly useful for the management of chronic conditions (e.g. pain, inflammation) thus recommendations for its use is increasing in older adults. Aging, however, also causes declines in neuromuscular function and movement control, and it is not well understood how cannabinoids interact with motor control processes affected by aging. In the literature, the term 'cannabinoid' refers to both naturally occurring substances in cannabis, as well as substances which have been found to interact with receptors of the endogenous cannabinoid system (CB1, CB2). The majority of research on cannabinoids has focussed on psychological and behavioural effects, as well as effects on supraspinal motor systems, such as the basal ganglia. While this research is both necessary and relevant to age-related pathologies (e.g. Parkinson's disease), knowledge about how cannabinoids might influence physiological processes in the spinal cord that contribute to functional movement in humans have only just begun to be explored. My project will consist of a systematized literature review of cannabinoid research concerning spinal motor neuron output. Included studies will undergo a critical analysis of their methods, results and findings. Emerging research themes, limitations and considerations for future research will be discussed. Findings

from my project will facilitate the design of future studies seeking to better understand the effects of cannabinoids on functional movement, which is particularly relevant to those experiencing neuromuscular decline due to aging.

### **Quantifying standing balance with wearable sensors**

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**Liam Foulger**, Emma Reiter, Calvin Kuo, Mark Carpenter, & Jean-Sébastien Blouin

Our ability to balance upright provides a stable platform to perform many activities of our day-to-day life. The assessment of standing balance is frequently performed in controlled research and clinical settings to determine one's postural stability and potentially diagnose balance disorders. Most commonly, standing balance has been quantified in laboratory environments by measuring the centre of pressure (CoP), which represents the average location of the forces we apply to the ground. However, these measurements require bulky equipment, making them less than ideal for testing outside of a structured laboratory setting. The influence of the environmental context on how we stand further emphasizes the need to assess standing balance in multiple environments representative of our daily activities. The growing availability of low-cost wearable sensors may provide an ideal solution for these issues. Here, we developed methods to estimate the CoP oscillations while balancing upright with wearable sensors. First, we compared the orientation of the body segments estimated using wearable sensors placed on the lumbar and sternum regions to the orientation of the same segments estimated using motion capture. Second, we compared the postural oscillations estimated with our sensors to CoP measures extracted from force plates. Preliminary findings showed a correlation ( $0.74 \pm 0.17$ ) between estimated and measured CoP displacements. Successful estimation of balance measures with wearable sensors will have important clinical and research implications, such as increasing accessibility for at-home balance evaluations.

### **Assessing cortical voluntary activation using two different methods of determining transcranial magnetic stimulator output**

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**Christina (Nique) D. Bruce**, Justine Magnuson, & Chris McNeil

Transcranial magnetic stimulation (TMS) of the motor cortex during an elbow flexor maximal voluntary contraction (MVC) can be used to quantify neural drive to these muscles (i.e., cortical voluntary activation; cVA). cVA is calculated by expressing the additional torque evoked during an MVC (i.e., the superimposed twitch; SIT) relative to the estimated resting twitch (ERT) torque expected if the same stimulus were delivered at rest. Traditionally, stimulator output (SO) is set so that electromyographic (EMG) responses (motor evoked potentials; MEPs) from biceps brachii and triceps brachii simultaneously reflect a large ( $\geq 50\%$ ) and small ( $\leq 20\%$ ) proportion of the total electrical potential ( $M_{\max}$ ) for each muscle, respectively. However, criteria based on EMG instead of joint torque may cause investigators to set SO to a level that evokes a submaximal torque response (SIT) from the elbow flexors, possibly leading to an underestimation of cVA. Therefore, we propose an alternative method that sets SO based on the largest elbow flexor SIT, regardless of triceps brachii MEP size. During one experimental session, 16 young, healthy participants will

perform a series of isometric elbow flexor contractions of their dominant arm, with SO set according to the two methods. We hypothesize that the new proposed method will yield higher cVA scores when compared to the traditional method of determining SO.

### **Lessons learned from working with a youth organization to evaluate a community-based physical activity intervention for adolescents experiencing depression and anxiety in British Columbia**

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**Kandola, M.,** Lau, E., Crocker, P., & Faulkner, G.

Evaluation of community-based interventions can provide valuable information to understand the effectiveness in improving intended program outcomes and services. Previous research has provided limited insight into the challenges of working with community organizations in conducting the evaluation of interventions. The purpose of this research presentation is to share the lessons learned from the 2-year evaluation of a community-based physical activity intervention for teens experiencing mild-to-moderate symptoms of depression and anxiety delivered by the YMCA in British Columbia. Lessons learned include challenges with leadership engagement and motivation, staff turnover, and establishing expectations. Insights from this presentation can help researchers to understand and avoid similar challenges in future evaluations with community organizations.