



LA PRÉVENTION AU CŒUR D'UNE MEILLEURE SANTÉ
BETTER HEALTH THROUGH PREVENTION

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PHYSICAL ACTIVITY AND AGING:
MULTIDISCIPLINARY APPLICATIONS

ABSTRACTS

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Weight misperception and health habits among young adults

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Introduction: A disconnect between actual and perceived weight status may affect dietary or physical activity (PA) behaviors. However the relationship between weight- status misperception and lifestyle behaviors has not been fully explored. The objective of this study was to determine if weight-status misperception (i.e., underestimating or overestimating one's weight status) relates to level of PA or motivation to be physically active. **Methods** A two-step cluster analysis of 676 young adults participating in an ongoing longitudinal study was conducted to identify homogeneous subgroups based on shared weight-related characteristics. We then compared clusters with respect their dietary habits, level of PA and their PA motivations using ANCOVA, controlling for age, sex and whether the participant was trying to lose weight. **Results** Three distinct clusters of weight misperceivers were identified ((i) normal weight accurate perceivers, (ii) normal weight over-estimators, (iii) overweight under-estimators, which were distinct in terms of level of PA (Cluster 3 reported less vigorous PA), PA motivation (Cluster 1 reported higher self-determined motivation towards PA) and some dietary habits (Cluster 1 reported often being very hungry in the morning , cluster 2 reported smoking to control their weight and cluster 3 reported higher use of diet pills). **Conclusion** Weight misperception may affect health behaviours such as PA and is an important issue to assess in young adults to ensure that their own decision-making with respect to healthy lifestyle habits takes “reality” into account. Clinicians may need to assess weight misperception with their young adult patients to inform their patient counseling, and public health interventions may also need to consider weight misperception in tailoring weight control interventions.

Dance/Movement Therapy leads to a lower cortisol awakening response in the elderly – a sign of stress reduction?

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Aging is associated with numerous chronic conditions that can be worsened by stress. There are already some interventions that are targeting stress but no research to date has looked at the effects of Dance/Movement Therapy (DMT) on chronic stress (measured by the cortisol awakening response – CAR). To further investigate this, 40 healthy older adults over the age of 60 were randomized into three groups: waiting list (WL; n=14), DMT (n=12), and Cardiovascular Training (CT; n=14). The CT consisted of high intensity activity on a recumbent bicycle, while the DMT was comprised of exercises including balance, coordination, body awareness, and socialization. The two training groups were supervised by appropriately certified instructors and met three times a week for three months. Before and after the training program all participants provided saliva samples on three non-consecutive days, and their fitness level was evaluated.

After controlling for BMI and sex, a Group X Time interaction was found ($F(2,35)=5.256$, $p=.01$, $\eta^2_{\text{partial}}=.231$), with the DMT group showing significantly lower salivary cortisol values post-training (as measured by CAR), while the other two groups showed no change. Physical assessments (VO₂max, 10 meter walk, and Maximal Aerobic Power) showed the greatest improvement in the CT group, moderate or no improvement in DMT, and no improvement in the WL. In other words, the change in cortisol for the DMT group is unrelated to fitness improvement. The results are further discussed in terms of psychological mechanisms that could explain the drop in the chronic stress biomarker in the DMT group.

Investigating exercise-dose response in cognitive, fitness and quality of life outcomes in older adults

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Purpose: Despite the well-documented health benefits of incorporating regular physical activity (PA), national prevalence rates of meeting recommended guidelines remain low. This is particularly noticeable among aging population who may encounter health-related barriers to PA such as frailty. Frailty is a state of increased vulnerability to stressors which can lead to disability, falls, and hospitalization. Frailty can compromise quality of life (QOL), which is an individuals' general-wellbeing when performing daily activities. Given the challenges of meeting PA guidelines in older adults, finding lower dose-response between PA and health outcomes could provide encouragement to seniors to initiate an active lifestyle. Hence, the purpose of this study was to test if lower-dose (LD) of PA (120 minutes/week) would provide same benefits in health outcomes (physical fitness, cognition and QOL) as higher-dose (HD) of PA (180 minutes/week) of PA.

Methods: Participants (n=71) consisted of random older adults residing in a large city (M=72, SD=7.24) who participated in two previous exercise interventions (LD and HD exercise groups). Participants were homogenous in demographic variables. All participants performed exercises under supervision in a laboratory setting for 12 weeks.

Results: Linear regressions found assigned exercise dose predicted significant increase in change of QOL: health ($\beta=.51$, $p<.001$), leisure time enjoyment LTE ($\beta=.53$, $p<.001$) and global score of QOL ($\beta=.57$, $p<.001$) in favour of the HD group. Group type also predicted change in physical performance test ($\beta=.25$, $p<.01$) but did not show difference in cognitive constructs (executive functioning and cognitive speed), $p>.05$. Physical frailty was homogenous between groups and did not predict each outcome ($p>.05$). However a group X frailty interaction was found to predict LTE, $F(1, 49)= 4.57$ ($p=.038$) which showed participants who were frail demonstrated greater increase in LTE scores in HD group compared to their LD counterparts.

Conclusions: When combined with previous findings, these results suggest that increasing PA time (120 minutes/week to 180 minutes/week) in older adults predicted change in various QOL domains and PA fitness. Further research would need to investigate if a higher dose of PA would demonstrate dose-response changes in cognitive constructs. Individuals who report frailty can improve their LTE with greater supervised exercise time.

The relationship between moderate physical activities and sleep quality and quantity among persons with dementia

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The prevalence of dementia is rapidly increasing worldwide due to an aging population (Ferri et al., 2005). Sleep disorders are a common characteristic of dementia, and pose a significant threat to the quality of life of persons with the condition and their families (Shub, Darvishi, & Kunik, 2009). This study compared the sleep quantity and quality between active and inactive persons with dementia, and sought to determine if physical activity was associated with more favourable sleep patterns.

This study utilized a cross-sectional design. Self-report telephone questionnaires were administered to 40 caregivers of community-dwelling persons with dementia. The caregivers answered the questions as proxies on behalf of their care recipient.

Persons with dementia who met the criteria to be considered active experienced significantly better sleep quantity (defined as achieving an average of 6-9 hours per night) than their inactive counterparts ($P=.000$). Furthermore, the active group obtained significantly better overall sleep quality scores ($P=.003$). Specifically, sleep onset latency ($P=.021$) as well as daytime napping ($P=.000$) and drowsiness ($P=.015$) were significantly correlated with activity level. These results were observed even after adjusting for age, length of time since diagnosis, medication usage, and use of home care supports.

The preliminary evidence from this study suggests that physical activity may be an important non-pharmacological method of improving sleep in this population. This study will aid in the promotion of safe and effective ways for managing aspects of dementia that impact quality of life and encourage future research in this area.

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Sensitivity and specificity of the Montreal Cognitive Assessment after the omission of hearing-dependent subtests

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A third of adults over 65 years of age suffer from hearing loss. The prevalence of mild cognitive impairment (MCI) can be up to 42%. The co-occurrence of hearing loss and MCI poses a challenge for cognitive assessment. The Montreal Cognitive Assessment (MoCA; Nasreddine et al., 2005) is a quick and efficient screening tool used globally to detect MCI in older adults; however, it assumes normal sensory function. The present research examines how omitting auditory subtests affects the MoCA's psychometric properties.

The original MoCA validation data were reanalyzed (MCI, n=94; Alzheimer's Disease, n=93; healthy controls, n=90), excluding four subtests that depend on proficient hearing (delayed recall, digit span, sentence repetition, sustained attention). We assessed the test's psychometric properties using absolute and proportional cut-off score adjustments and compared them to the original MoCA values (MCI sensitivity: 90%, specificity: 87%). Results showed that MCI sensitivity was substantially reduced (Absolute: 44%, proportional: 68%). Excluding only three subtests and maintaining delayed recall had no effect on sensitivity but reduced specificity (sensitivity: 94%, specificity: 71% using proportional cut-off). ROC curves were developed to determine ideal cut-offs. Overall, exclusion of memory-related subtests led to expected changes in sensitivity and specificity. Recommendations for screening in primary care settings will be discussed.

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Ergogenic effect of 5 days supplementation with Saffron on exhaustive exercise

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Saffron is a healthy spice with many health benefits. Saffron has been traditionally used in ancient medicine to cure various human diseases [1]. Coaches and athletes are interested to get benefit from such herbs to improve exercise performance. The author has reported ergogenic effects of 10-day supplementation with saffron [2]. The purpose of this study was to evaluate the effect of 5 days supplementation with saffron on gas exchange, ventilation and other physiological parameters during an exhaustive incremental treadmill exercise (Bruce test). One group Pre-test, Post-test with 20-day washout period design, was implemented and before (Control phase with 300 mg placebo/day) and after 5 days (experimental phase) 300 mg/day saffron supplementation a Pre-test and Post-test were repeated. A group of young soccer players (n=11; 21.5±1.5 y) was recruited in this study. Gas exchange, ventilation (VE), respiratory gas exchange ratio (*RER*), and heart rate (HR) were monitored during running tests and data were extensively analyzed by a custom software to determine RER-based estimates of Anaerobic Threshold (AT) in both tests. Cumulative oxygen uptake (VO₂) and carbon dioxide output were computed and compared during same exercise duration, as well as before and after AT between control and experimental phases. Any differences in oxygen uptake (VO₂), carbon dioxide output (VCO₂), and VE between the two phases analyzed by ANCOVA. Results showed a significant ($p < 0.05$) difference in oxygen consumption during same exercise duration, VE, CO₂/Kg BW, EQCO₂, and METs. Comparing these results before and after AT shows better results after AT. In conclusion, saffron shows improvement in the gas exchange and ventilatory cost of exercise.

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Let's dance: development and implementation of a dance intervention offered in the community

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Introduction: Dance is a meaningful evidence-based therapeutic modality that can be used in occupational therapy to address physical, cognitive and affective impairments and ensure treatment adherence [1,2]. This presentation will report on the process for the development and implementation of a dance intervention designed to integrate dance in a healthy lifestyle to increase physical activity, offer a socialization opportunity and promote dynamic movement, coordination, balance and mobility.

Methods: During a 7-week clinical course, a dance intervention was developed for individuals with mobility limitations or chronic disease from the community. With the support of the PERFORM center, the dance intervention was implemented and offered biweekly for 1-hour sessions. The dance intervention included a warm-up, routines, teaching of new dance steps and cool down/relaxation, all performed on Latin music. Two instructors with previous dance experience offered the dance intervention allowing an instructor to adapt the steps and the exercises to the need of each participant. Attendance to the dance group, occurrence of adverse and spontaneous feedback from participants were recorded.

Results: A total of 9 participants with a wide range of neurological or orthopedic conditions and impairments attended the sessions offered twice a week. No adverse events were experienced during or after the intervention. Positive comments were spontaneously expressed by participants, including that they were satisfied with the dance intervention and it was enjoyable.

Conclusion: This project led to the development of a toolkit comprise of videos and written document to ensure the sustainability of the dance intervention in the future.

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Default-mode network regions are larger and more connected in idiopathic hypersomnia

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Idiopathic hypersomnia (IH) is characterized by excessive daytime sleepiness but, in contrast to narcolepsy, does not involve cataplexy, rapid REM sleep onset (at the multiple sleep latency test, MSLT), or any consistent hypocretin-1 deficiency. The pathophysiological mechanisms of IH remain unclear, and no neuroimaging study has been published in IH.

We conducted magnetic resonance imaging in 12 participants with IH and 16 good sleepers. Daytime mean sleep latency from MSLT and Epworth sleepiness score were collected as assessments of objective and subjective sleepiness respectively. Anatomical images were used to compute cortical thickness, followed by structural covariance analyses of cortical thickness. Resting-state functional images were used to compute ROI-to-ROI functional connectivity analyses. Seed ROIs were based on the default-mode network (DMN) given its involvement in vigilance state transitions. Group differences and linear regression analyses were conducted.

Participants with IH had thicker cortex in the DMN (anterior cingulate cortex, precuneus, and lateral parietal cortex bilaterally) compared to good sleepers. Larger thickness positively correlated with more subjective daytime sleepiness. Regions within the DMN were more connected in IH compared to good sleepers, as shown by increased structural covariance and resting-state functional connectivity in IH between the posterior cingulate and left lateral parietal cortices.

The present findings show that IH displays structural as well as functional connectivity changes in the DMN. Changes compensatory to chronic daytime sleepiness might be reflected in larger and more connected DMN structures.

Validation of a new personal device to assess body composition in overweight and obese participants: comparison with DXA and BIA

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Introduction: Accurate identification of adiposity is key to establishing a person's health status. The study's objective was to evaluate the agreement between a new device that uses Electrical Impedance Myography (EIM) with Dual-energy X-ray Absorptiometry (DXA) and Bioelectrical Impedance Analysis (BIA) based on weight status.

Methods: In a sample of 82 healthy adults (48 women; 34 men), fat percentage was measured with DXA, two BIA (Impedimed SFB7 [IMP] and BodyStat Quadscan 4000 [QS]) and an EIM (Skulpt Chisel) device. Based on body mass index (BMI), weight status was classified as Normal, Overweight and Obese. Comparisons between devices were assessed through intraclass correlation coefficients (ICC), Bland-Altman plots and paired t-tests.

Results: Compared with DXA, the ICC was moderate-to-high (QS: ICC=0.87, IMP: ICC=0.90, EIM: ICC=0.77). However, as BMI increased, accuracy decreased in EIM compared with DXA: differences were +1.28% (p=0.07), -10.1% (p=0.004), and -13.4% (p=0.03) among normal-weight, overweight and obese men respectively, and -7.2% (p=0.03), -14.1% (p=0.1), and -11.4% (p=0.03) among normal-weight, overweight and obese women respectively. Bland Altman plots revealed that as fat percentage increased, IMP and QS had a negative bias and EIM had an increasing error.

Conclusions: These DXA alternatives should not be used interchangeably. Compared to DXA, the EIM device (1) consistently underestimated fat percentage and (2) increased in error as BMI increased. Thus before the EIM device should be recommended as a DXA alternative, these methodological issues should be further investigated. In particular, whether the EIM device is a valid proxy for measuring adiposity longitudinally is needed.

Predictive value of neuropsychological tests and correlation with morphometry measurements for conversion to dementia

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Introduction: A retrospective cohort study was conducted in subjects with mild cognitive impairment (MCI) and healthy controls (HC) from the study of dementia and Alzheimer's disease (AD) in Havana, Cuba. The follow-up study was performed 10 years after the initial diagnosis and included 48 participants, 27 MCI and 21 HC. The aim of the study was to determine the predictive value for conversion to dementia of neuropsychological tests (NTs) and its correlation with cortical thickness (CT).

Methods: The cognitive performance was evaluated through a neuropsychological battery that explored different domains (attention, memory, language, executive functions, perception, praxis and visuo-spatial skills). High resolution T1-weighted images were recorded using a 3T Siemens Trio scanner (Erlangen, Germany). The predictive value of the NTs was determined using the GLMNET logistic regression model included in Matlab (Matworks Inc.) To determine the CT, all images were segmented using FreeSurfer (<http://surfer.nmr.mgh.harvard.edu>), using a probabilistic atlas of 152 structures. The resulting values were submitted to a correlation analysis. Results: The NTs with a better predictive value of conversion to dementia also exhibited the highest correlations with CT measurements. Specifically, Learning Word Lists (LWL) and Rey Complex Figure (RCF) in the form of delayed recall (DR) and its correlations with the Right_Lateral_aspect_of_the_superior_temporal_gyrus and Left_Orbital_sulci (H-shaped_sulci), respectively.

Conclusions: The NTs evaluating episodic and visuo-spatial memory (RCF) and learning and immediate memory (LWL) enclose a high predictive value of conversion to dementia. Likewise, NTs' performance when evaluating these domains is a good predictor of structural changes in CT.

Cross-sectional association of nutritional intake with arthritis

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Background: An estimated 4.6 million Canadians are living with arthritis. While preliminary evidence suggests that modifiable lifestyle factors can influence arthritis symptoms, the association between arthritis and diet is poorly understood. This cross-sectional study compared the nutritional intake of adults living with arthritis to those without arthritis.

Methods: Data are from the 2013-2014 cycle of the National Health and Nutrition Examination Survey (NHANES), a representative sample of the general US population. Intake of micronutrients (e.g. vitamin A, zinc), macronutrients (e.g. protein, fat), and food categories (e.g. fruit, vegetables) were obtained from a single 24-hour food recall (n=4,171). Exclusion criteria included age (<20 y), energy intake (<800 or >5000 kcal), and self-reported digestive disorders. Intake differences were estimated using linear regression models adjusted for energy intake, age, gender, ethnicity, education, income, comorbidities, and BMI. Nutritional intakes were log-transformed to meet the normality assumption and parameter estimates were inversely-transformed for ease of interpretation. Sampling weights were used.

Results: One-quarter of the sample had arthritis (62.41% female, mean age: 60 years). In adjusted regressions, compared to those without arthritis, people with arthritis consumed less protein (-2.6%, p=0.01), cholesterol (-7.6%, p=0.01), vitamin A (-5.3%, p=0.02), dietary folate (-5.6%, p=0.04), vitamin C (-16.8%, p=0.03), sodium (-3.3%, p=0.03), and vegetables (-12.0%, p=0.03). Omega-3 fatty acids, calcium, and fruit consumption were not associated.

Conclusion: Arthritis is associated with lower dietary intake for several micro- and macronutrients. Further study on whether the intake fails to meet recommended levels (and thus prompts the need for nutritional interventions) is needed.

Gender-biases in stress-related screen-addiction

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Objective: New media technologies are integral to our daily lives. Some worry that screen addiction may be detrimental to mental or physical health. We aimed to investigate the relation between screens and stress in a broad demographic.

Methods: A multi-factorial electronic survey was distributed in the greater Montreal area. 495/648 individuals (69% women, with younger adults < 38 yrs comprising 65% of the sample) completed the survey questions about their daily screen habits, and self-assessed their physical and mental wellness. The survey included questionnaires from which to assess stress (Lazarus appraisal theory, 1993), and screen-addiction (Young, 1998).

Results: The GLM: *Screen Addiction = age + gender + mental + physical + stress* predicted significant variations in screen-addiction ($F_{1,5} = 29, p < .0001$), with all predictors being significant in the model. Screen-addiction in men was higher than women ($t = 4.06, p < .0001$). Irrespective of gender, screen-addiction was lower with age ($t = -6.04, p < .0001$) and higher with stress ($t = 4.7, p < .0001$). Men who rated both mental and physical state as bad were most addicted ($N = 29$, median = 27), followed by women in the same category ($N = 80$, median = 23). Screen-addiction was lowest in women who rated both mental and physical states as good ($N = 141$, median = 17).

Conclusion: Significant relationships between stress, age, gender and screen-related behavior necessitates further exploration of the psychosocial reasons why screens are more used by higher-stress individuals, in order to better understand whether the impacts of screen-dependence on a 'healthy lifestyle' are adaptive or detrimental.

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Biomedical versus biopsychosocial treatment approach of Athletic Therapists and Athletic Trainers regarding low back pain

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Introduction: Previous research has focused on the patient's biopsychosocial barriers to low back pain rehabilitation. Recent evidence suggests physiotherapist's biopsychosocial orientation can influence treatment strategies.¹ However, Athletic Therapists in Canada and Athletic Trainers in the United States treat low back pain patients and currently, no data exists on these clinicians.

Methods: AT's from Canada and the USA completed an online survey consisting of demographic questions and the Pain Attitudes and Beliefs Scale for Athletic Therapists/Trainers.

Results: For 399 Athletic Therapists in Canada, the mean biomedical score (32.1 ± 6.5) was significantly higher than the mean biopsychosocial score (31.3 ± 4.2 , $p=0.03$). AT's who treat more than 100 low back pain patients a year had a significantly lower biomedical score than Athletic Therapists who treat 0-5 patients a year ($p=.005$). In addition Athletic Therapists treating the general public had significantly higher ($p=.04$) biopsychosocial scores than those therapists treating amateur elite athletes. For 273 Athletic Trainers the mean biomedical score was significantly higher than the mean biopsychosocial score ($p>.001$), and ATC's who treated less than 15 back pain patients per year had a significantly higher biomedical score than those who treated more than 15 patients ($p=.039$). Athletic Trainers had a significantly higher biomedical score compared to Athletic Therapists ($p=.03$).

Discussion: While a biopsychosocial approach to low back pain treatment is recommended,² these findings suggest Athletic Therapists/Trainers retain biomedical practices. Since previous studies indicated a higher biomedical orientation in physiotherapists led to poorer treatment outcomes in low back pain patients,³ this may be a concern for AT's.

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NIRS 3D reconstruction based on maximum entropy on the mean (MEM)

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Introduction: Near-infrared spectroscopy (NIRS) tomography reconstructs the measured data on the scalp to the cortical regions, it provides the feasibility of NIRS to be an imaging modality to investigate functional brain activities [1]. Briefly, NIRS reconstruction assumed that there are many possible locations of hemodynamic changes distributed over a “source space” defined on a cortical region. Solving the reconstruction problem is to solve an “inverse problem”, estimating a unique solution, which has infinite number of solutions. The accuracy of the reconstruction method influences the spatial and temporal features of the estimated hemodynamic responses within specific cortical regions. Thus, more accurate method provides better functional image quality which ensures more reasonable and reliable investigations of the ongoing brain activities.

Method: In the present study, we adapted a nonlinear EEG/MEG reconstruction method - Maximum Entropy on the Mean (MEM) [2,3] to solve the inverse problem in NIRS reconstruction, considering its accurate and stable performance when recovering the locations of the generators together with their spatial extent along the cortical surface. MEM offers an efficient probabilistic framework to incorporate prior knowledge in the solution of the inverse problem [4]. It estimates a unique solution of the inverse problem by maximizing the relative entropy to a pre-defined reference model.

Results: Our results suggested that MEM framework could provide quite promising NIRS reconstruction results in recovering mainly superficial cortical hemodynamic responses. Comparing to standard MNE-based reconstruction [5], MEM allowed reconstructing more spatially accurate and robust hemodynamic responses.

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The relationship between sleep misperception and spindle architecture in primary insomnia

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Sleep misperception, the discrepancy between self-reported and objectively-recorded sleep duration, is often observed in insomnia, and may result from dysfunction in underlying neural mechanisms indexed by electroencephalogram. Recently, evidence has suggested that sleep protection mechanisms, indexed by sleep spindle architecture may be associated with sleep misperception. However, the relationship between spindle architecture and sleep misperception index (MI) is unknown. In the current study, 22 individuals (17 females, 5 males, mean age = 42.0, SD = 15.3) diagnosed with primary insomnia completed an overnight polysomnographic (PSG) recording in the sleep laboratory, and spindle density, duration, frequency, and amplitude were calculated using automatic detection during stage N2 sleep. MI was calculated as the degree of discrepancy between total sleep time as measured by PSG compared to self-reported sleep time from 1-week sleep diaries. A significant positive correlation (.364, $p = .048$) was observed between MI and spindle density per 30 second epoch, as well as MI and spindle amplitude (.378, $p = .042$), where greater sleep misperception was associated with higher spindle density and larger spindle amplitude. Interestingly, the strongest correlation was observed between MI and REM duration (.477, $p = .012$). No significant correlation was observed between MI and N1, N2, or N3 duration, spindle duration, spindle frequency, or spindle power (a trend, .352, $p = .054$ was observed for spindle power). These results support a subgrouping approach to insomnia, whereas individuals with objective psychophysiological insomnia exhibit spindle dysfunction, and differ from individuals with a high MI where spindles remain intact.

Regional adiposity and markers of inflammation in pre-school age children

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In adults, android adiposity increases the risk of metabolic disease more than gynoid adiposity, by increasing systemic inflammation. The objective of this study was to determine if this relationship exists in preschool-age children. A subset of children (n=71, 35 males), aged 3.69 ±1.04 years, were analyzed from a random sample (n=515) from daycares in Montréal, QC. Adiposity was determined through dual-energy x-ray absorptiometry (DXA; Hologic 4500A Discovery Series). Concentrations of C-reactive protein (CRP) and tumour necrosis factor alpha (TNF α) were determined in capillary blood samples, via enzyme-linked immunosorbent assay (R&D Systems Quantikine) and multiplex assay (catalog No. HMHMAG- 34K, Millipore), respectively. Data was normalized using logarithmic transformations and reported as median and interquartile range. Circulating concentrations of CRP were 2.47 ng/ml (IQR: 1.00) and TNF α 6.95 pg/ml (IQR: 3.82). Pearson correlations revealed positive relationships between circulating concentrations of CRP and android (r=0.31; P \leq 0.01) and gynoid adiposity (r=0.29; P \leq 0.05). Circulating concentrations of TNF α positively correlated with gynoid adiposity (r=0.27; P \leq 0.05). Children were split by BMI percentiles and categorized as healthy (3-85% percentile, n=49) or overweight (>85% percentile, n=21), according to WHO charts for ages 2-19. Overweight children had significantly higher android to gynoid ratio, indicating excess fat was predominantly stored in the abdominal depot (P \leq 0.05). CRP was significantly higher in overweight children 2.79±0.60 ng/ml compared to healthy weight 2.29±1.12 ng/ml (P \leq 0.05) however, TNF α was not. In preschool-age children, android and gynoid adiposity is associated with higher inflammation. Future longitudinal studies should examine the risk of premature metabolic disease young overweight populations.

Decreases in bone mineral density are related to cancer stages

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Introduction: Decreases in bone mineral density (BMD) are associated with breast cancer in post-menopausal women¹⁻³. However, little is known if cancer stage influences BMD. We assessed femoral neck and total hip BMD measurements in cancer patients according to their cancer stages.

Methods: Using dual energy x-ray absorptiometry (DXA), mean t-scores from right and left total hip (TH) and femoral neck (FN) scans were obtained from 118 cancer patients (49 females; 69 males; age 65.3±12.5 yrs; weight 70.2±16.4 kg) who were divided into three categories of cancer stages, (Restorative-cancer free patients, Supportive-advanced-cancer patients receiving oncological treatments and Cachexia-patients with anorexia and/ or weight loss secondary to advanced disease.). T-score values that categorized patients according to the World Health Organization categories of BMD [normal (≥ 1.0), osteopenic (< -1.0 to > -2.5), osteoporotic (≤ -2.5)] were generated using the DXA software. Appendicular skeletal muscle mass was calculated from arm and leg lean mass measurements.

Results: Of the 118 patients measured, 78 (66%) had BMD values classified as either osteopenic (n=61, 52%) or osteoporotic (n=17, 14%). When compared to the supportive care group, patients in the cachexia group had significantly lower BMD (mTH, -1.25 ± 1.11 vs -0.54 ± 1.27 , $p=0.009$; mFN, -1.70 ± 0.99 vs. -1.18 ± 0.97 , $p=0.02$) t-scores and had a greater incidence of sarcopenia ($p=0.002$). Appendicular skeletal muscle index correlated with mFN ($r=0.22$; $p=0.016$) and mTH ($r=0.26$; $p=0.005$).

Conclusions: BMD losses are prevalent in this cancer cohort and are related to cancer stages. Health care professionals should address nutritional and functional strategies to improve BMD in all cancer patients.

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Predicting childhood impulsivity - Comparison between a polygenic score for ADHD and a biologically informed score based on insulin receptor expression in striatum and PFC

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Background: There is high prevalence of co-morbidity between obesity and ADHD. Brain insulin acts on striatal and prefrontal (PFC) regions and modulates reward sensitivity and inhibitory control.

Aims and Methods: To investigate if a genetic score based on genes co-expressed with the insulin receptor (IR) in striatum and PFC predicts impulsivity in 260 4-year old children from the MAVAN Project using a computer-based task (Information Sampling Task, Cambridge Neuropsychological Test Automated Battery, IST- CANTAB), in comparison to the polygenic risk score for ADHD (Psychiatric Giant Consortium GWAS). Co-expression data were derived from an existing database for mice and homologous expression in comparable areas for humans were obtained from online databases. Betas for these genes were taken from the ADHD GWAS and multiplied by the number of risk alleles and then summed to create the insulin co-expression genetic score. A median split divided the scores into low and high risk.

Results: Children with high genetic risk score, (IR co-expression score, 1450 snps), had increased impulsivity on the IST in comparison to low risk children, (One-Way ANOVA adjusted by birth weight, $p=0.018$). No differences were seen between high and low risk children in this task when using the conventional ADHD PRS at stringent, (p -value threshold $p=0.001$, 423 snps included, Test p -value= 0.123), or nominal thresholds, (p -value threshold $p=0.05$, 14835 snps included, Test p -value= 0.982).

Conclusions: A polygenic risk score based on genes co-expressed with insulin receptor in striatum and PFC is a more robust predictor of impulsivity in children at 48 months in the IST task, than a non-biologically informed ADHD PRS.

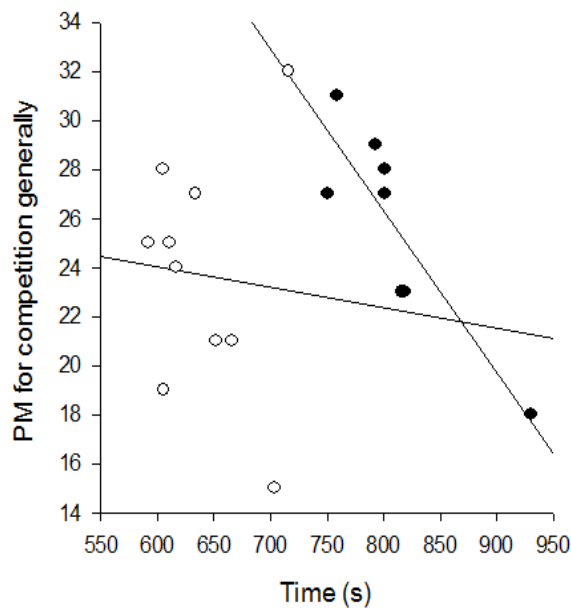
Performance index and psychological momentum during a 3000m competition amongst university Cross-Country Runners: A psychophysiological perspective

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Performance during a competition amongst endurance athletes may be distressed by psychophysiological parameters. The understanding and connection between them may lead to adapting training and follow up in elite athletes. Thus, the purpose of this study was to identify psychophysiological links with performance in a 3000m race. Distance runners were invited to participate at a recruitment race trial to be part of the varsity cross country team. Twenty runners participated: 10 women (25.9±7.0 years old; 22.2±1.8 BMI) and 10 men (23.2±2.4 years old; 22.6±1.6 BMI). Competition was filmed in order to hold semi structured individual interviews using a self-confrontation approach. During the interviews, athletes were invited to find key moments (positive and negative) of their race. Athletes also completed a maximal aerobic speed test (191 ± 10 bpm; 17.2 ± 1.1km/h) that was used to create performance indexes (PERF₁) relative to select moments. A significant PERF₁ difference (p <0.001) was observed between positive (97.04 ± 5.88%) and negative (108.46 ± 7.76%) moments. Psychological momentum for women before the competition (24.86±4.67) and for competition generally (25.75±4.17) was significantly correlated (r²=0.88 p<0.01; r²=0.76 p<0.01 respectively) with the performance in the 3000m that was not for men (22.78±7.38 r²=0.0007 p=0.946; 23.70±4.88 r²=0.005 p=0.838 respectively). Momentum before the competition was correlated for women (r²=0.89 p<0.001) with confidence and was not for men (r²=0.38 p=0.142). In conclusion, it seems that a significant difference between sexes is present in the manner of living a competition in elite athletes and that mental preparation should be sex specific.



Bayesian-based multimodal medical image fusion technique in non-subsampled shearlet domain using the Cauchy Prior

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In modern medicine, due to the rapid development of noninvasive imaging technologies, fusion of images from heterogenous sensors plays a significant role in the diagnosis and treatment of disease. However, the existing automated fusion algorithms face multiple challenges such as loss of significant attributes, blocking artifacts, noisy patches, contrast reduction and intolerable to handle misregistrations and noisy environment. Hence, we propose a novel multimodal medical image fusion algorithm based on the statistical properties of non-subsampled shearlet transform (NSST) coefficients. After investigating the best representation of data in NSST domain, we show that the NSST detail coefficients of the detail subbands is highly non-Gaussian [1], i.e., the probability density function (PDF) of the NSST coefficients are sharply peaked around zero with heavy tails. Therefore, we use a heavy tailed PDF, Cauchy distribution, to describe the marginal statistics of the detail subband coefficients. Then, we propose to use Cauchy pdf as a prior for developing bayesian-based multimodal medical image fusion. Experimental results show that the proposed fusion algorithm has significant improvement in subjective and objective fusion results compared to some of the state-of-the-art methods. This is because the NSST transform has the potential to capture the salient information in different scales and directions and the prior Cauchy PDF is more suitable for describing the NSST coefficients than that of the traditional generalised Gaussian distribution [2]. As a result, it has the capability to clearly understand the different aspects of disease process and also be a key for any automatic disease diagnosing tasks.

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Reciprocal modulation of helper Th1 and Th17 cells by the β 2-Adrenergic Receptor agonist

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Introduction: T helper (Th) cells protect the body against infections. One subtype of Th cells is called "Th17 cell" which is responsible to protect the body against extracellular bacterial and fungal infections. These cells are also major players in autoimmune diseases. The beta2-adrenergic receptor (β 2AR) pathway regulates metabolic reactions in response to catecholamine hormones such as epinephrine and norepinephrine. The aim of this study is to determine the effect that the signaling pathway has on Th17 cell proliferation, cytokine secretion and the balance of Th cells.

Methods: Blood samples were collected from healthy human subjects. The immune cells were isolated and treated with different pharmacological ligands in an *in vitro* setting. Proliferation was measured by flow cytometry and cytokines were measured by enzyme assay.

Results: The β 2AR-specific agonist terbutaline increased Th17 cell cytokine levels while decreasing the Th1 cell cytokine levels ($p < 0.01$). The effects of terbutaline were blocked once the Th cells were treated with a β 2AR-specific antagonist. Cell signaling pathways were targeted by adding an enzyme inhibitor for protein kinase A (H89) and a cAMP analog (dbcAMP). Th17 cytokines were inhibited in all subjects' samples when H89 was added, whereas dbcAMP effect was variable depending on the dose added. Proliferation was not altered by terbutaline.

Conclusion: Cell signaling through β 2AR alters the Th17 cytokines. Results show that catecholamines modulate the balance of Th1 and Th17 cells during an adaptive immune response and can help understand the predisposition for autoimmunity.

Direct and mediating effects of short term exercise on sleep and recognition memory in young, sedentary adults: A pilot study

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Introduction: Research has provided evidence for the beneficial role of exercise in enhancing cognition and improving sleep. Brain oscillations during sleep has been linked to memory processing. We aim to test the idea that a nap and exercise session may have synergistic effects on memory. **Methods:** Participants were screened based on a history of having a low-to-moderate level of physical activity. Participants underwent medical, psychological and sleep evaluations. The study involved three groups (N=5/group): 1) exercise+nap (ExNap), nap only (NoExNap), exercise only (ExNoNap). Participants were provided with a lunch after undergoing 40min of moderate-intensity cycling, followed by a study session (13h30), and a 60min nap (14h00). At the test session (17h00), the participants completed a memory task whereby 45 of the studied photos were intermixed with 45 "foils". Polysomnography was used to monitor sleep. A visual analog scale was administered prior to testing to monitor vigilance. The outcome variables were accuracy (%correct) and sleep metrics (N3, N2, total sleep time). **Results:** We have preliminary data in 15 young adults ($M_{age}23\pm3.11$ SD yrs). Our results based on effect size calculations showed that the ExNap group was more accurate than the NoExNap group ($M\pm SD$ 93.8% \pm 2.9 vs. 91.3% \pm 8.7, respectively), ES $d=0.38$. We also found that the NoExNap and the ExNap group were more accurate than the ExNoNap group (89.6% \pm 6.6), $d=0.23$ and $d=0.83$, respectively. Pearson correlations revealed associations between performance on the memory task and sleep variables.

Conclusion: These preliminary data suggest that a single aerobic exercise session and nap may improve performance more than a nap or exercise alone in young adults with a sedentary lifestyle.

Investigation of the differences in sympathetic responses using the cold pressor test

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Background: The cold pressor test (CPT) induces a robust sympathetic outflow that increases blood pressure. It is used to study thermogenic responses, and as a model for pain research. We sought to establish and validate CPT at PERFORM Centre, and explore human variations in response patterns and interactions with pain perceptions.

Methods: Healthy human volunteers submerged one hand into ice cold water for three to five minutes while continuous recording of blood pressure, heart rate and detailed cardiovascular parameters were obtained with an automated blood pressure monitor, impedance cardiograph with full band electrode configuration, and waveform beat-to-beat monitoring system. Serial saliva samples were measured by α -amylase kinetic reaction kit as an independent measure of sympathetic tone. Questionnaires related to state and trait anxiety and pain catastrophizing were administered before the CPT.

Results: Baseline salivary α -amylase correlated inversely with the change in systolic blood pressure during CPT (Pearson coefficient -0.460), as did the baseline heart rate (-0.390). We stratified subjects, post hoc, into two categories, hyper-responders (>22 mmHg), and hypo-responders (<22 mmHg) based on their systolic blood pressure response. Hyper-responders had significantly lower baseline salivary α -amylase, heart rate, and cardiac output, as compared to hypo-responders. Analysis revealed that pain catastrophizing positively correlated to heart rate changes during CPT.

Conclusion: We demonstrated that baseline sympathetic tone correlates inversely to blood pressure change during CPT. Our data supports the use of cold pressor test to further understand the physical link with pain perceptions.

The importance of pain-related fear for the injured athlete and the clinicians who treat them

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Introduction: Elevated pain-related fear can affect athletes' rehabilitation from ACL reconstructions,¹ however, little research exists on other musculoskeletal injuries. While most research focuses on the patient, recent evidence suggests the biomedical versus biopsychosocial orientation of the clinician can also affect treatment outcomes.² Objectives: (1) To determine the relationship between athletes' pain attitudes and return-to-play after injury. (2) To measure the biomedical versus biopsychosocial treatment orientations of AT's.

Methods: Study 1: Forty-one athletes who suffered an acute musculoskeletal injury completed questionnaires including: Pain Catastrophizing Scale (PCS), Tampa Scale of Kinesiophobia (TSK), and the Fear-Avoidance Beliefs Questionnaire (FABQ). Function was measured by self-report questionnaires, range of motion, and strength. Study 2: NATA members (n=273) completed a survey including demographic information, and the Pain Attitudes and Beliefs Questionnaire for Athletic Trainers. Results: Study 1: Athletes demonstrated significant improvement in function and pain from being injured to return-to-play ($p < .001$). High PCS scores were correlated to low function after injury ($p = .048$). High TSK and FABQ scorers experienced greater change in function ($p < .001$). Study 2: NATA members had higher biomedical scores than biopsychosocial scores ($p < .001$). AT's with less than 15 back pain patients/year had higher biomedical scores ($p = .007$).

Conclusion: Athletes with high catastrophizing, kinesiophobia, and strong fear-avoidance report greater disability at injury onset. AT's tend toward a more biomedical approach in their treatment.

Discussion: Pain-related fear is an important variable to consider in athletes' rehabilitation. Clinicians' beliefs concerning pain-related fear may also be important to successful rehabilitation, but more research is needed in this area.

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The influence of semantic context and proficiency on speech perception in noise in bilingual sentence processing

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Speech perception often occurs in suboptimal listening conditions (e.g., with background noise or talkers). Nevertheless, most individuals perceive speech successfully, suggesting they use information, such as sentence context, to compensate for the hearing deficit. This information can facilitate speech perception in one's native language (L1). However, the degree to which contextual cues can be used in one's second language (L2) remains unclear. To examine this, we recruited three groups of bilinguals: 14 English-French sequential bilinguals (M age of acquisition of L2 (AoA) = 5.92), 12 French-English sequential bilinguals (M AoA of L2 = 5.89), and 11 simultaneous English-French bilinguals. Participants were asked to identify the terminal word of spoken sentences, which were adapted from the Revised Speech Perception in Noise Test (SPIN). Stimuli were blocked based on language (L1 vs. L2) and listening condition (quiet vs. competing 16-talker babble mask). Sentence context was intermixed within blocks, such that sentences led to either high-predictability (HP; e.g. "He stirred his coffee with a *spoon*") or low-predictability (LP; e.g. "He considered the *spoon*") terminal words. We recorded electrophysiological activity using an electroencephalogram (EEG). English-French sequential bilinguals reported a lower speaking proficiency in L2 and were less accurate compared to the other two groups under challenging conditions (i.e., LP, babble mask). Latency of N400 ERP was differentially affected by noise among sequential bilinguals, but not among simultaneous bilinguals. Furthermore, HP sentences showed a shorter latency in L2 compared to L1 in quiet. This last finding demonstrates that bilinguals use context in quiet listening conditions.

Age-related differences in monitoring for self-produced speech errors

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During action tasks, performance is monitored by a domain-general, conflict-based monitoring system. This system is hypothesized to also monitor speech production¹. Research suggests that young adults (YA's) and old adults (OA's) differentially use this monitoring system during tasks that require a motor response². However, whether these differences translate to differences in monitoring for speech errors remains unclear. The aims of this study are to investigate the involvement of a conflict-based system in monitoring for self-produced speech errors and to determine whether YA's and OA's differ in the use of such monitoring processes during speech. To do this, 15 OA's ($M_{age} = 70.33$, $SD = 5.0$) and 19 YA's ($M_{age} = 25.12$, $SD = 3.7$) were recruited. Participants performed a phoneme substitution task that required a verbal response (e.g. substituting /d/ and /t/; stimulus: "drain", response: "train"). During this task, OA's made more speech errors than YA's ($p = .007$). Pre-articulatory and post-articulatory speech monitoring were investigated using stimulus-locked and response-locked event-related potential (ERP) analyses, respectively. Stimulus-locked analyses revealed a longer latency for the P200 ($p = .022$) and N200 ($p < .001$) ERP components in OA's compared to YA's. This suggests that processes involved in lexical access (P200) and detection of response conflict (N200) are slower in OA's compared to YA's. Response-locked analyses revealed an ERN effect for YA's only ($p = .037$), suggesting that YA's and OA's differentially use error monitoring processes. As such, young and old adults appear to differentially use a conflict-based monitoring system during speech production.

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Associations between measures of adiposity and cardiac autonomic function in children with a family history of obesity (QUALITY Cohort)

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Objectives: Adiposity is associated with decreased heart rate variability (HRV) in adults and adolescents, but studies are limited in pre-pubertal children. We examined the association between adiposity indices and HRV in a large sample of children.

Methods: Data are from the QUALITY cohort (630 children aged 8-10 years with parental history of obesity). Adiposity indices include: waist-to-height ratio, obesity (BMI percentile >97.7thile) and %fat mass (Dual energy X-ray absorptiometry). HRV indices were derived from Holter ECG recordings: SDNN (standard deviation normal to normal), RMSSD (root mean square of the successive differences), pNN50 (percentage of successive normal sinus RR intervals/50ms), low frequency (LF), high frequency (HF), and LF/HF ratio. Multivariable linear regression models were adjusted for these covariates: age, sex, Tanner stage (assessed by nurse), moderate-to-vigorous physical activity (minutes; accelerometry), self-reported screen time (minutes), and fitness (peak oxygen consumption).

Results: Obesity was associated with lower ln-HF (back-transformed B[95% CI]=0.79 [0.63,0.99]), lower RMSSD (B=-4.56 [-8.86,-0.27]); lower pNN50 (B=-5.32 [-9.08,-1.55]) and greater LF/HF ratio (B=0.49 [0.29,0.68]). Similarly, waist-to-height ratio was associated with lower ln-HF (back-transformed B=0.35 [0.13,0.95]); lower RMSSD (B=-23.32 [-42.42,-4.22]); lower pNN50 (B=-26.03 [-42.76,-9.29]) and greater LF/HF ratio (B=1.83 [0.97,2.70]). Likewise, %fat mass was associated with lower ln-HF (back-transformed B=0.44 [0.22,0.90]); lower RMSSD (B=-19.52 [-32.97,-6.06]); lower pNN50 (B=-21.16 [-32.94,-9.38]) and greater LF/HF ratio (B=1.50 [0.89,2.11]). Other HRV indices were not associated with adiposity.

Conclusions: Adiposity is independently associated with decreased parasympathetic activity (HF, RMSSD, pNN50) and autonomic imbalance (LF/HF ratio) in children. Longitudinal studies exploring these pathways are needed.

Comparison of two modalities of exercise for fat mass and metabolic profile in older women with abdominal obesity

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The impact of high-intensity interval training (HIIT) compared to the current exercise recommendations (moderate intensity continuous aerobic exercise; CONT) has to be verified in obese older women before being used by health professionals. Objective: The purpose of this study is to compare the effect of HIIT to CONT on body composition, metabolic profile and affective responses in obese elderly. Methods: A total of 20 older and sedentary women (60-75 years) with abdominal obesity (waist circumference ≥ 88 cm) are currently recruited and randomized to one of the following group: 1) HIIT (n=10); 2) CONT (n=10). All variables are measured before and after 8 weeks of intervention: Anthropometry (weight, height, body mass index), body composition (fat mass [FM], lean body mass [LBM], visceral adipose tissue [VAT]; DXA), metabolic profile (fasting lipid profile, glucose and insulin) and physical capacity (senior fitness test). Affective responses are measured before and after each training session. Preliminary Results: VAT tend to decrease in HIIT group only (p=0.07) while total FM remained unchanged. Moreover, HDL-C tend to increase in HIIT only (p=0.09) while LDL-C decreased (p=0.01) in both groups. Finally, while HbA1c tend to increase, total cholesterol tend to decrease in HIIT and CONT (both, p=0.08). Finally, affective response before and after each training were similar between HIIT and CONT (both p>0.48) and remained unchanged. Conclusion: Our preliminary results suggest that HIIT could provide better improvements (VAT and HDL-C) compared to the current exercise recommendations in physically inactive older women.

Thalamocortical reactivation during sleep spindles following declarative learning

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Introduction: Spindles are EEG oscillations typical of sleep stages N2-N3, and are categorized as slow (10-13Hz) and fast (13-16Hz). Increasing evidence suggests a role for spindles in the consolidation of memory traces.

Our objective was to further investigate the neural mechanisms of spindle-related memory consolidation using EEG-fMRI during sleep after declarative learning.

Methods: 14 young-healthy participants (6 females) were scanned in 2 sessions at 1-week interval, during the first half of the night using simultaneous EEG/fMRI. In each session, subjects were scanned during a hippocampal-dependent declarative task (face sequences) with immediate recall, during sleep, and then during a post-sleep delayed recall. The second session served as control since the task was completely learnt by then.

Results: During sleep, higher pre-sleep learning was associated with larger response in the thalamus during fast (vs slow) spindles in the learning (vs control) condition whereas, lower pre-sleep learning was associated with larger response in the parahippocampal gyrus. Higher post-sleep memory retention was associated with larger responses in the parahippocampal gyrus.

Conclusions: Parahippocampal reactivation during fast spindles was observed in individuals who had low pre-sleep learning performance, while those who acquired information efficiently showed a reinforcement of thalamic responses with fast spindles. Parahippocampal reactivation with fast spindles was also associated with better post-sleep memory retention. Our findings suggest a reactivation during fast spindles of brain areas involved in prior declarative learning, a process modulated by the amount of information effectively learnt and promoting the consolidation of memory traces.

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Effect of total hip arthroplasty surgical approach on gluteus medius and gluteus maximus muscle activation during gait

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The lateral approach for total hip arthroplasty (THA) disrupts gluteus medius. Research is required to determine if this dysfunction impacts functional activities. The purpose was to compare gluteus medius and maximus muscle activation during gait between patients that underwent lateral or posterior approaches for THA one year after surgery and healthy controls. Patients that had a THA for hip osteoarthritis using a lateral approach (n=4), posterior approach (n=6), and healthy adults (n=5) were recruited. Surface electromyography (EMG) captured gluteus medius and maximus activation as participants ambulated at self-selected speeds for five trials. Gait EMG waveforms were amplitude normalized to maximum voluntary isometric contractions. The dependent variable was mean EMG over the gait cycle. Effect sizes and Kruskal-Wallis tests examined differences between groups. For gluteus medius, moderate and large effects were present with lateral THA (d=0.90) and posterior THA (d=0.66) groups having higher mean EMG than healthy controls; however differences were not significant (p=0.40). Visual inspect reveals prolonged activation in THA groups. Only a small effect was seen for the difference between THA groups (d=0.30). Small, nonsignificant effect sizes (d=0.10 to 0.40; p=0.57) were present when comparing gluteus maximus mean EMG between THA groups and healthy controls. This preliminary analysis indicates potential differences between THA groups and healthy controls for gluteus medius activation, but the small sample size precludes any firm conclusions. Muscle activation differences between THA approaches were not apparent with the current sample. Thus, muscle function remains impaired irrespective of the THA approach.

Clinical utility of the sport concussion assessment tool – 3 (SCAT3) in university athletes

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Introduction: Sport-related concussion is a type of traumatic brain injury that remains challenging to identify and diagnose. The Sport Concussion Assessment Tool-3 (SCAT3) provides a strong framework for evaluating concussion by amalgamating well-established assessment tools (McCrory et al., 2013). The current study evaluated the clinical utility of the SCAT3 in identifying concussion across time by calculating the sensitivity and specificity of the SCAT3 subtests (Standardized Assessment of Concussion, modified Balance Error Scoring System, Post-Concussion Symptom Scale) in the absence and presence of baseline data.

Methods: The SCAT3 was administered to athletes prior to the start of the athletic season in order to attain a baseline measure. 23 (10 male) athletes sustained a concussion during the study period, and 22 (9 male) uninjured athletes were recruited for serial assessment. The SCAT3 was administered within the first 3 to 5 days post-injury (acute phase) and then again at three weeks post-injury (post-acute phase).

Results: The SCAT3 was revealed to be sensitive in detecting concussion within 3 to 5 days post-injury, with the utility being comparable when post-concussion scores were contrasted to baseline data or sex-based norms. The Post-Concussion Symptom Scale contributed the most to the overall sensitivity of the SCAT3, with the balance and cognitive measures adding little clinical value.

Conclusion: This study provides evidence to support the use of the SCAT3 as a screening tool for identifying concussion within the first 3 to 5 days post-injury, however, SCAT3 utility might be limited beyond this timeframe.

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Bayesian fNIRS smooth adaptive deconvolution

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Classical functional Near-Infrared Spectroscopy~(fNIRS) data analysis mainly consists in window-averaging [1] which might be biased by improper baseline definition or GLM-based analysis which cannot properly provide evoked hemodynamics estimates on the whole temporal support. The current work addresses these issues with a new method to deconvolve the hemodynamic response function~(HRF) in fNIRS, inspired by an approach developed for fMRI [2]. The novelty of the approach relies on a temporal regularization scheme in the Bayesian framework, through the use of B-spline bases to constrain the covariance of the sought evoked response. The proposed model allows not only to recover various HRF profiles but also provides statistical uncertainty (ie confidence intervals) on its temporal features: time-to-peak or time-to-undershoot.

The approach is validated on artificial data built from realistic resting-state NIRS signal, with varying signal-to-noise ratios~(SNR). Compared to the classical window-average processing, the proposed deconvolution provides more sensible profiles and shows good robustness to noise. On the same experiments, we also showed that fast event-related paradigms are more suitable than block designs to properly estimate the response dynamics. Validation on real data experiments involving passive checkerboard stimulations also showed more stability for the fast event-related paradigm relatively to the block one.

Lastly, deconvolution was applied to resting-state data to assess for the method specificity. The deconvolution model caught significant on-going physiology which coincided with an artificial evoked paradigm. However, resorting to the peak uncertainty, false negative activity could be discarded.

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Assessing the reliability of electrical source imaging from high density EEG measured simultaneously with fMRI

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Electrical Source Imaging (ESI) from Electroencephalography (EEG), and functional Magnetic Resonance Imaging (fMRI) are two neuroimaging techniques to detect neuronal activity or its neurovascular counterpart. Here, we evaluated the feasibility of ESI using high-density EEG (hdEEG) recorded simultaneously with fMRI and assessed the ESI accuracy as a function of signal-to-noise ratio (SNR). Seven subjects underwent two hdEEG acquisitions with an identical visual task (256-electrodes, EGI): (1) outside the MR scanner, (2) simultaneously with fMRI (GE-MR750 3.0T in PERFORM Centre). Following artefact correction [1], coherent Maximum Entropy on the Mean (cMEM) ESI was performed on averaged signals from N randomly drawn trials (N from 10 to 60 in steps of 10). Draws were repeated 20 times for each N. ESIs were compared to the most significant fMRI cluster [2] and ESI accuracy was quantified by: (1) dipole localization error (DLE: the minimum distance between the ESI maximum and the fMRI cluster), (2) ratio of spurious activity (RSA: percentage of remote-spurious-energy to total-energy). DLE inside and outside the scanner were similar (<8mm) for all SNRs (range:0.002-96, median:5). However, RSA inside the scanner was higher compared to outside (e.g. 30% vs 13% using 40 trials), suggesting decreased stability. Stable DLE and RSA across averages of different number of trials indicate cMEM-ESI could provide accurate reconstructions despite high noise inside the MR scanner. These results open a new perspective to study not only the general relationship of neuronal and neurovascular activity, obtained by averaging trials, but also the variability of this relation between trials.

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Reproducibility of Human Connectome Project pipelines across operating systems

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Introduction: The lack of computational reproducibility threatens data science in several domains [1]. We aim at (1) quantifying the effect of operating system version updates on biological results and (2) identifying the software tools in a pipeline that are responsible for this effect. We focus on the pre-processing of data from the Human Connectome Project (HCP) [2].

Methods: We used raw data from 10 subjects in the HCP S500 Release Subjects. The HCP pre-processing pipelines (v3.19.0) were executed in Docker containers created from CentOS versions 5.11, 6.8 and 7.2. We deployed the containers on servers using CBRAIN [3]. File checksums were recorded before and after execution to check for file corruption. For each subject, pre-processing was repeated three times with each of the three CentOS versions to check for inter-OS and intra-OS differences. We also recorded file accesses by executable(s) using the Reprozip [4] system-level monitoring tool.

Results: Among the 92 NIFTI imaging files common to all 10 subjects, 33 differed between CentOS5 and CentOS6, 76 differed between CentOS6 and CentOS7 and 76 differed between CentOS5 and CentOS7. In addition, one file showed intra-OS differences coming from the HCP workbench tool (wb_command).

Conclusion: Our CBRAIN plugins, Dockerfiles and analysis scripts are available at [5]. We are currently working on extending the results to (1) the 500 HCP subjects, (2) other pre-processing pipelines (fMRI, diffusion imaging, etc.), (3) distance metrics other than just checksums.

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Analysis of oxygen metabolism in hubs of resting-state brain functional connectivity

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Hubs are the highly functionally connected regions of the brain lying at the core of the brain's connections. Hubs perform a crucial role in maintaining networks robustness and global communication between the functionally specialized networks. Hubs have notably been suggested to be susceptible to the early onsets of several brain disorders [1]. Our overall objective is to further characterize baseline metabolism of functional hubs identified at the single subject level. While the change in glucose metabolism and cerebral blood flow (CBF) of hubs due to variation in neuronal activity of brain has been studied [2], their local oxygen metabolism, characterized by the cerebral metabolic rate of O₂ (CMRO₂) and the oxygen extraction fraction (OEF) have never been investigated. In this study, functional hubs will be derived from individual resting state functional MRI data; using a recently developed Sparsity-based Analysis of Reliable K-hubness (SPARK) method, which can identify and count the number (K-hubness) of functional networks associated to each voxel [3]. The resting CMRO₂ and OEF will then be measured using an Arterial spin labeling (ASL) method combined with generalized Quantitative O₂ imaging (QUO₂) MRI technique [4]. This MRI-based method using hyperoxic and hypercapnic gas manipulations estimate resting arterial O₂ content and also resting OEF map, which derived from functional relationships between the resting BOLD signal M, and relative change of OEF. Multiplying the resting OEF Map, resting arterial O₂ content, and the resting CBF map from ASL provides a map of the resting CMRO₂. We are presenting preliminary data obtained on two 25-30 years old healthy subjects, for whom SPARK method was applied to extract hubs and baseline CMRO₂ and OEF were estimated. These data allow us to investigate the relationship between K-hubness and their corresponding oxygen metabolism, and thus providing for the first time a characterization of resting state oxygen consumption efficiency of hubs compared to non-hubs regions.

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Capturing step counts at slow walking speeds in older adults and people with stroke: Comparison of ankle and waist placement of a commercial accelerometer

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Background: It is important to be physically active to maintain good health into old age or even in the presence of chronic disease. Commercially available accelerometers which monitor and provide feedback of walking activity can improve motivation to engage in exercise [1]. However, most devices are not accurate at slow walking speeds.

Objective: This study examined the accuracy of the Fitbit One to measure step counts in community-dwelling older adults and people with stroke at slow walking speeds, comparing the accuracy when placed at the waist and the ankle (non-paretic limb for those with stroke).

Methods: The Fitbit One was placed at the ankle and waist of older adults (n=42) and people with stroke (n=43) as they performed walking trials at seven different speeds (0.3-0.9 m/s). Accuracy was determined by comparing step counts obtained from video recordings (gold standard) and from device readings.

Results: The device had 10% or less error when positioned at the ankle for all speeds between 0.4 and 0.9 m/s for both older adults and people with stroke. When positioned at the waist, the device achieved 10% or less error only at the two highest speeds (0.8 and 0.9 m/s).

Conclusion: Although not recommended by the manufacturer, the Fitbit One can be placed at the ankle to accurately capture step counts at slow walking speeds in both older adults and people with stroke. A readily available device which can accurately provide feedback of physical activity may be beneficial for motivating those who experience mobility limitations.

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Vitamin and mineral supplement use by older adults with complex medication needs

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Vitamin and mineral supplements can assist in meeting recommended nutrient intakes, but excessive use can pose risks. Research has shown that individuals who take many medications, and who are at risk of undernutrition, may benefit from using vitamin and/or mineral supplements, but recognized that too much supplementation may cause adverse drug-nutrient interactions [1]. The purpose of this research is to assess personalized vitamin and mineral supplement use in older adults with complex medication use and identify potential overuse of these supplements. A retrospective chart review was completed on 229 medically-complex patients 50 years of age and older who had medication assessments completed between January 2014 and January 2017. Data indicate that 76.4% (n=175/229) of patients aged 50+ years (mean: 68.9 years) reported using ≥ 1 vitamin and/or mineral supplement daily. Total product count (oral prescriptions, over-the-counter products, dietary supplements) ranged from 1-48 per day, with a mean of 9.93 (median 9). Of reported supplement users, 32.6% (n=57/175) exceeded the tolerable upper intake level (UL) for at least one nutrient, from supplements alone. Supplemental vitamin D (≥ 400 IU) use was only reported by 64.6% (n=148/229) of patients. In conclusion, high use of vitamin and mineral supplements, with many doses exceeding the UL, was observed in this population. Data from this study will be used to identify nutrition concerns in order to design and implement feasible nutritional interventions (including supplements) at the community and acute care levels, which will aid in improving the health status of people living with chronic disease(s).

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Attributions for physical activity in older adults: Effects on everyday physical activity and mortality

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Although physical activity is recognized as health promoting behaviour for older adults, there are notable barriers that may reduce activity (Chao et al., 2000; Sarkisian et al. 2005, 2007). While poor health is one barrier to activity for older adults, little research has explored attributions as potential psychological (vs. health) barriers. We examined EPA and mortality over a 10-year period (2006-2016) in a sample of older adults ($M_{\text{age}} = 86$) participating in the U Manitoba Successful Aging Study (SAS; $N = 261$). Our objective was to assess the role of adaptive and maladaptive attributions for physical activity when older adults feel unwell (see Weiner, 1985, 2012). Hierarchical and Cox proportional hazard regression analyses revealed that adults endorsing more internal, stable, and uncontrollable attributions (e.g., physically incapable) for physical activity had lower subsequent EPA levels ($\beta = -.22, p = .004$), and higher 10-year mortality risk ($HR = 1.51, p < .001$). Other attributions with different dimensional properties (e.g., internal, unstable, and controllable) did not predict EPA or mortality. Findings suggest that beliefs older adults have about their past health promoting behaviour (e.g., physical activity) can strongly influence their future behaviour and longevity. Psychological treatments designed to encourage adaptive attributional thinking for older populations who face barriers to physical activity may be an important avenue for future research.

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Physical activity and risk of cognitive decline in individuals with hypertension and diabetes

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While some cognitive decline is part of the normal aging process, certain changes have been linked to physical health or lifestyle-related diseases. Hypertension and type 2 diabetes have been associated with a heightened risk of cognitive decline, whereas physical activity can protect against or delay the onset of cognitive decline and dementia. This study examined the extent to which physical activity moderates the impacts of hypertension and diabetes on cognitive decline. Data are from the Memory and Aging Project (MAP), a longitudinal study of older adults. Multilevel models evaluated baseline differences and linear and quadratic change on four cognitive measures: mental status, perceptual speed, and immediate and delayed episodic memory. Greater levels of physical activity were associated with better perceptual speed at baseline, and significantly less linear decline across all measures. Individuals with diabetes had worse immediate episodic memory performance initially, but diabetes was largely unrelated to rate of change and initial performance on the other measures. Hypertension was associated with better initial mental status and delayed episodic memory. Contrary to expectations, most interactions between physical activity and the two health conditions were non-significant. However, physical activity moderated the relationship between comorbid diabetes and hypertension on immediate episodic memory, such that individuals with both conditions who were more physically active experienced a reduced rate of linear and curvilinear decline compared to inactive individuals. These findings suggest that physical activity may reduce the impact of comorbid conditions on certain cognitive functions, and that immediate episodic memory may be particularly susceptible.

Bringing change to the study of gait speed and survival in older adults

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Background: Recently, an emerging body of literature has indicated a strong association between poor gait speed and mortality. However, these studies have several methodological limitations. Gait speed is measured at a single arbitrary time point, to assess the association between gait speed and survival over several years. This approach fails to account for changes in gait speed that occur commonly in late life. These studies also neglect the possible confounding effects of time-varying health and lifestyle characteristics.

Objective: To estimate the association between time-varying gait speed and survival, while controlling for time-varying effects of health and lifestyle covariates. **Methods:** This study is based on data from the Cardiovascular Health Study (CHS). The CHS consists of a cohort of 5,201 older persons with annual measurements of gait speed and several covariates. Using these annual measurements, we estimate the association between time-varying measure of gait speed and survival, while controlling for several time-varying health and lifestyle characteristics. For comparison, we provide estimates of models where variables are treated as time-fixed. **Results:** Overall, we found that the time-varying measure of gait speed is more strongly associated with survival compared to the time-fixed measure. Controlling for time-varying confounding by health and lifestyle factors attenuates the association in women, but not in men.

Conclusion: Using time-varying measures of gait speed and controlling for health and lifestyle confounders provides a more meaningful estimate of the association between gait speed and mortality.

Agreement between accelerometer non-wear time validation methods used with older adults' data

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We used Bland Altman plots to compare agreement between a self-report diary and five different non-wear time algorithms [an algorithm that uses ≥ 60 minutes of consecutive zeroes (Troiano et al 2008) and four variations of an algorithm that uses ≥ 90 minutes of consecutive zeroes to define a non-wear period] for estimating community-dwelling older adults' ($n = 106$) sedentary behaviour and wear time (minutes/day) as measured by accelerometry. We found that the algorithm developed by Troiano et al (2008) may overestimate sedentary behaviour and wear time by ≥ 30 minutes/day. Algorithms that use ≥ 90 minutes of continuous zeroes more closely approximate participants' sedentary behaviour and wear time. Across the self-report diary vs. ≥ 90 minute algorithm comparisons, mean differences ranged between -4.4 to 8.1 minutes/day for estimates of sedentary behaviour and between -10.8 to 1.0 minutes/day for estimates of wear time; all 95% confidence intervals for mean differences crossed zero. We also found that 95% limits of agreement were wide for all comparisons, highlighting the large variation in estimates of sedentary behaviour and wear time. Given the importance of reducing sedentary behaviour and encouraging physical activity for older adult health, we conclude that it is critical to establish accurate approaches for measurement.

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Impacts of a New Greenway on older adult mobility: A mixed-methods analysis in Vancouver, BC

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Our population is aging, and life expectancies are increasing globally [1]. One strategy to promote healthy aging is by creating environments that support physical activity. Supportive built environments can promote walking, active forms of transportation, and increased physical activity, yet little work leverages construction of new infrastructure to study this relationship. We address the gap in longitudinal data by using a natural experiment study to assess change in physical activity among community-dwelling older adults after the 2013 development of the Comox-Helmcken Greenway, a 2 km multi-modal corridor in the West End neighbourhood of Vancouver, BC [2]. We captured location-specific travel and physical activity using accelerometers and GPS monitors one year before and one year after the Greenway was developed. We acquired data from older adult residents (≥ 60 years) in the Active Streets, Active People study ($n=121$, mean age 69.9 ± 6.6 years at baseline). We used fixed-effects linear regression models to measure within-person changes in transportation-related physical activity from 2012 to 2014. We also measured specific activity along the Greenway and along a comparison corridor. To complement the quantitative results, we interviewed a subset of these older adults ($n=13$) to capture their perceptions of this built environment change. We found no significant change in weekly physical activity levels, but a decrease in the number of trips older adults took along the Greenway. Our interview data suggests this may result from confusion of messaging, the steep slope, and a lack of destinations along the Greenway.

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Exercise decreases markers of immune activation in post-menopausal women with knee osteoarthritis

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Osteoarthritis (OA) is a chronic, degenerative joint disease that most commonly affects women over the age of 65. OA is exacerbated by obesity, aging, smoking and injury, all of which increase inflammation [1]. We hypothesize increased systemic inflammation in individuals with knee OA, increases cellular inflammation, which contributes to disease severity (pain and mobility). Furthermore, we believe exercise will improve patient outcomes by decreasing systemic inflammation.

We analyzed markers of cellular and soluble inflammation in peripheral blood of post-menopausal women (n=22) with knee OA before and after 3 different interventions: yoga, strength training or meditation. The interventions were practiced for 12 weeks with 3 x 1 hour sessions per week. Baseline measurements were compared to healthy age- and sex-matched controls (n=15). Cellular inflammation was quantitated by flow cytometry to enumerate leukocyte populations and measure expression of surface markers associated with activation and migration. Soluble inflammation was quantified by high-sensitivity multiplex ELISA.

Women with knee OA had significantly increased serum c-reactive protein (CRP) and increased expression of innate immune activation markers compared to controls. Soluble and cellular markers of inflammation strongly correlated with increased pain and decreased mobility; suggesting monocytes contribute to the functional decline in knee OA. The strength training group showed a significant decrease in cellular inflammation, although no significant differences in BMI or soluble inflammation were seen. Cellular changes in inflammation could precede declines in adiposity or soluble inflammation, which would be expected with longer exercise interventions. Future work will focus on the mechanisms driving decreased cellular inflammation in the strength training group.

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Examining frailty and cardiovascular disease risk profile in middle aged and older women

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Frailty, assessed with the Fried criteria, is characterized as having a lack of reserve for tolerating health stressors, and has been shown to be a predictor of cardiovascular morbidity and mortality in the elderly (Fried et al., 2001). Even frailty's intermediary stage, pre-frailty, increases risk for cardiovascular disease (CVD) (Veronese et al., 2017). Despite this knowledge, few studies have examined CVD risk profile, independent of previous CVD, comparing non-frail and pre-frail participants. (Veronese et al., 2017)

This examination of CVD risk assessment data collected on 615 women 55 years of age or older will examine the difference in CVD risk profile between non-frail and pre-frail women with no previous history of CVD. Twenty-seven percent (n=162) of the cohort was classified as pre-frail. Cardiovascular risk factors were compared between non-frail and pre-frail participants using a Mann-Whitney U test for continuous variables and Chi-Square or Fisher's Exact Test for categorical variables. This comparison identified that pre-frailty was associated with a host of lifestyle behavior and physiological factors that increase risk for CVD.

The identification of a range of risk factors for CVD in pre-frail women further supports the need for frailty assessment in the clinical setting and the need for increased health management for those in the early stages of frailty. This research furthers the understanding of CVD risk associated with pre-frailty, independent of prior CVD, highlighting that this association is caused by more than just age.

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Exploring participant's thoughts on reducing sitting time and experiences following a pilot 12-week exercise referral scheme enhanced by self-management strategies

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Introduction: Sedentary behaviour has been identified as an independent risk factor for numerous health conditions. Older adults (≥ 65 years old) have been identified as being at risk of high levels of sedentary behaviour. In order to inform the development of future RCTs in older adults, there is a need to understand how older adults perceive such interventions.

Method: This study reports a qualitative investigation of the determinants of sedentary behaviour in older adults. Focus groups were conducted pre (n=7) and post intervention (n=4) in order to explore participant's experiences of an exercise referral scheme enhanced by self-management strategies (SMS) and motivators to reduce sitting time.

Results: The pre-intervention focus groups demonstrated that participants were most sedentary when watching television, on the computer or completing sitting-based hobbies. The participants reported some awareness of methods to reduce sedentary behavior; however, none were reaching the recommended physical activity guidelines. Following the intervention, the participants reported that they found the SMS component useful and that the sessions increased their awareness of how inactive they were. Participants said that they enjoyed the group-based sessions and agreed that the SMS component provided practical advice which could be implemented into their everyday lives.

Conclusion: The results demonstrated that participants were unaware of methods to reduce their sitting time prior to the intervention. Participants reported that they were willing to use the behaviour change techniques and SMS to change their sedentary behaviour, with the post-intervention results depicting a positive message regarding the SMS component of the study.

Title self-management strategies for chemotherapy-related adverse effects and their relevance to older adults: A scoping review

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Background: Self-management (SM) is an important component in dealing with chemotherapy-related adverse effects in patients with cancer. Optimal SM for these adverse effects can prevent chemotherapy treatment interruptions and reduce hospitalization. Yet, little is known about SM for chemotherapy-related adverse effects in older adults (OA). The aims of this review were to synthesize and evaluate the existing knowledge on SM for chemotherapy-related adverse effects, as well to assess SM current evidence relevance to OA.

Methods: We conducted a scoping review using the updated guidelines of Arksey and O'Malley. A comprehensive literature searches were performed using Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE (including MEDLINE in-process), Cumulative Index to Nursing and Allied Health (CINAHL), and PsychINFO from January 1995 to May 2016. The quality of included studies were assessed with the Mixed Methods Appraisal Tool.

Results: Forty-three studies were included with different designs. Several SM support interventions were used to empower patients with cancer to perform SM strategies to reduce chemotherapy-related adverse effects severity. The reported effectiveness of SM interventions was inconsistent, and the underlying mechanisms of SM interventions were not described adequately. The evidence about SM in OA within the context of chemotherapy treatment was limited.

Conclusions: There is growing enthusiasm about enabling and empowering patients to perform SM strategies to gain control over their conditions, improve their symptoms, and improve their quality of life. Significant gaps exist in the knowledge regarding SM utility and usefulness in managing adverse effects from chemotherapy in the context of advanced age and age-related changes.

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Objective sedentary behaviour and self-rated health in English adults and older adults

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Introduction: Reducing sedentary behaviour may represent a feasible approach to improving health. Self-rated health is generally accepted as a valid measure of health status in population studies, with lower ratings associated with increased morbidity and mortality. No research has explored the associations between objectively measured sedentary behaviour and self-rated health.

Methods: A sub-sample of adults (<65 years) and older adults (≥ 65 years) from the 2008 Health Survey for England wore an ActiGraph GT3X accelerometer for 7 days. Self-rated health was measured using the General Health Questionnaire. Analysis of Covariance was used to compare the average daily sedentary behaviour time between three groups of self-rated health (very good/good; fair; bad/very bad), using Tukey post-hoc tests. Covariates used included sex, BMI, total household income and average daily moderate-to-vigorous physical activity (MVPA) time.

Results: Older adults spent more time in sedentary behaviour than adults (614 ± 83.46 mins/day versus 521 ± 112.22 mins/day) and a greater proportion rated their health as either fair or bad/very bad. After adjustment, significant associations between sedentary behaviour and self-rated health were found in adults ($p=0.02$; adjusted $r^2=0.43$) and older adults ($p=0.002$; adjusted $r^2=0.13$). Older adults rating their health as very good/good spent significantly less time in sedentary behaviour than those with fair health ($p=0.0004$).

Conclusion: This study suggests sedentary behaviour could be a novel and important variable to consider alongside more established correlates of self-rated health such as mortality, morbidity and social status. Future longitudinal research could help determine how changes in sedentary behaviour influence self-rated health as individuals' age.

Vascular risk factors and cognitive function in a coronary artery disease population

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Background: Diabetes, smoking history and a high body mass index (BMI) are known risk factors for vascular disorders and are commonly present in those with coronary artery disease (CAD). CAD is associated with an increased likelihood of cognitive impairment, including impairments in memory and executive function. This study aimed to assess the impact of vascular risk factors on cognitive function in a CAD population.

Methods: Participants were recruited from the University Health Network Toronto Rehabilitation Institute. Cognition was assessed using a battery of neuropsychological tests including the Brief Visuospatial Memory Test (BVMT) and Animal Naming Test. Presence of diabetes and smoking history were obtained through patient interviews. Height and weight were obtained through patient records.

Results: 52 CAD patients (75% male, mean±SD: age=62.5±11.4, BMI=27.8±4.7), were included in the analyses. In a linear regression model (controlling for age and total years of education) BMI, diabetes and smoking history accounted for 33% of the variance in BVMT total recall scores ($F(5,46)=4.45$, $p=0.002$) and diabetes was independently associated with lower BVMT scores ($\beta=-0.384$, $p=0.009$). In the same model, the three vascular risk factors accounted for 21% of the variance in animal naming scores ($p=0.048$).

Conclusion: The presence of vascular risk factors are associated with poorer scores on tests of executive function and visuospatial memory in a CAD population. The mean BMI of this population indicates that they are overweight. Lifestyle interventions such as physical activity may be particularly important in this population and may have the potential to improve cognition.

Towards easy and efficient processing of large brain imagery data

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Introduction: There currently does not exist an easy and efficient way to process large brain images, which can range from a few 100GBs to 1TB, as most existing software is incapable of handling images of such a size. An example of a large brain image is the BigBrain, which is approximately 1TB in size at its highest resolution [1]. We plan to build a system that will benefit open-science by facilitating the processing of BigBrain and other large images.

Methods: Our system will parallelize processing pipelines using MapReduce [2] and Spark transformations and store the data in the Hadoop Distributed File System (HDFS). To facilitate code deployment, Docker containers equipped with MapReduce scripts or Spark transformations and associated libraries will be used. Since we intend to reuse existing processing pipelines, we will partition the large image into NIfTI-1 blocks or slices. This will be achieved using the Python library Nibabel [3]. To transmit the results, we will have to reduce the data or provide online visualization.

Results: To date, we have implemented a simple histogram computation in MapReduce as a proof-of-concept for using such parallelization templates for brain image analysis. Currently, we are experimenting with different partitioning strategies for splitting and merging and have encountered some difficulties with the Nibabel library.

Conclusion: We will need to test out more complex MapReduce and Spark programs with our system as further proof-of-concept. More efficient strategies for splitting and merging will be investigated. We also intend to create Nibabel extensions.

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