



Presented by the McMaster
Women in Science and Engineering Initiative



May 2 - 13, 2022
McMaster University
Celebrating Equity in STEM Research

STUDENT RESEARCH PRESENTATIONS

May 6th, 2:00pm - 3:00pm

Presenter Name: Katharine Mackett

Time: 2:00 pm

Presentation Duration: 7 minutes

Title: Patient perspectives on the Ambulatory Glucose Profile (AGP) report for diabetes management: A national online survey

Introduction: The Ambulatory Glucose Profile (AGP) is a standardized report produced by continuous and flash glucose monitoring (CGM/FGM) devices. With the increased use of CGM/FGM for type 1 diabetes (T1D) management, making recommendations about the AGP would involve consideration of evidence for benefits and barriers towards the clinical utility of AGPs and of other factors such as acceptability to patients, resources and feasibility.

Methods: We developed an online survey based on current literature and the Digital Health Engagement Model framework for patient factors related to the use of digital interventions. The survey was pre- and pilot-tested. Statistical analyses were completed using SPSS.

Results: Those who understood their AGP (>65%) are more likely to feel motivated towards diabetes management (aOR:2.19, 95% CI:1.23-3.90). More than 70% consider the AGP important, yet less than 50% often discuss their AGP with health-care providers (HCPs). Those who often discuss their AGP with HCPs and those who feel supported are more likely to review their AGP on their own (aOR:8.10, 95% CI:3.54-18.53; aOR:2.43, 95% CI:1.26-4.69, respectively). Only 36% are satisfied with the AGP's clarity and 29% with the layout, however more than 60% agree the AGP is useful and accurate. Additionally, there is low satisfaction with insurance coverage for this technology (24%).

Limitations: This Canadian survey was not translated into French, and may have attracted respondents already comfortable with technology. Some questions may have been better answered in a qualitative study.

Conclusions: Visualizing data with the AGP is important, but there are areas for improvement. A barrier to this technology is insurance coverage, while facilitators are motivation, and support, especially from HCPs who engage in AGP discussions. Continued education and communication with HCPs are encouraged.

Presenter Name: Sarojini Vudumu

Time: 2:10 pm

Presentation Duration: 7 minutes

Title: Efficient Quantization for Multi-Target Tracking

In this paper, we study the effective quantization for multi-target tracking by dynamically allocating the available bandwidth among all the sensors. At each time step fusion center distributes the available bandwidth among the targets in such a way that posterior Cram er-Rao lower bound (PCRLB) on the mean squared error (MSE) is minimized. We formulate the problem as a multiobjective integer optimization problem. The proposed dynamic distribution method not only handles bit allocation to targets but also within the measurement vector if a measurement consists of more than one element. Since the optimal solution requires an enormous computational requirement and not realistic for real-time online implementation, we propose an approximate algorithm for bandwidth distribution. We compare the results with static bit allocation for all the targets and within the measurement vector. Simulation results show that even with fewer available bits, the proposed dynamic allocation approach leads to significantly improved tracking performance compared to a static bit allocation approach where each sensor and each target is allocated with an equal number of bits and a combination of Dynamic allocation of bits with non-uniform quantization gives good tracking performance.

Presenter Name: Steven Kottaras

Time: 2:20 pm

Presentation Duration: 7 minutes

Title: Bone Turnover Markers and Osteokines in Adolescent Female Athletes of High and Low-impact Sports Compared with Non-athletic Controls

This study examined differences in resting concentrations of markers of bone formation and resorption and osteokines between female adolescent (12-16 years) swimmers, soccer players and non-athletic controls. Resting, morning blood samples were obtained after an overnight fast from 20 swimmers, 20 soccer players and 20 non-athletic controls, matched for age. Carboxyl-terminal crosslinking telopeptide of type I collagen (CTX), amino-terminal propeptide of type I collagen (P1NP), total osteocalcin (OC), sclerostin, osteoprotegerin (OPG), and receptor activator of nuclear factor kappa B ligand (RANKL) were analysed in serum. After controlling for percent body fat, there were no significant differences between swimmers and non-athletic controls in any of the measured markers. In contrast, soccer players had significantly higher P1NP (89.5 ± 25.6 ng·ml⁻¹), OC (57.6 ± 22.9 ng·ml⁻¹) and OPG (1052.5 ± 612.6 pg·ml⁻¹) compared to both, swimmers (P1NP: 66.5 ± 20.9 ng·ml⁻¹; OC: 24.9 ± 12.5 ng·ml⁻¹; OPG: 275.2 ± 83.8 pg·ml⁻¹) and controls (P1NP: 58.5 ± 16.2 ng·ml⁻¹; OC: 23.2 ± 11.9 ng·ml⁻¹; OPG: 265.4 ± 97.6 pg·ml⁻¹), with no differences in CTX, sclerostin and RANKL. These results demonstrate that bone formation is higher in adolescent females engaged in high-impact sports like soccer compared to swimmers and controls.

Presenter Name: Artash Nath

Time: 2:30 pm

Presentation Duration: 7 minutes

Title: Silence of Global Oceans: Acoustic Impact of the COVID-19 Lockdown

Low-frequency noise from marine shipping is an underwater acoustic pollutant in oceans. The noise spectrum overlaps with frequencies marine mammals use to communicate and navigate, leading to stress and increasing collision with ships. The research established a model to measure the contribution of anthropogenic activities to underwater noise levels.

The COVID-19 lockdown led to a decline in marine traffic globally. The model quantified the reductions in noise levels before and during the lockdown in the Arctic, Atlantic, Pacific Oceans, and the Mediterranean Sea. Underwater ocean sound peaks between 10 – 100Hz and is dominated by noise from shipping traffic. Hydrophones (underwater microphones) data from seven ocean observatories were analyzed at 1Hz spectral and 1 min temporal resolution. Power spectral densities were calculated, aggregated into monthly long-term spectral averages, and noise levels in the 63Hz third-octave band compared to previous years.

The study found that global oceans quietened by an average of 4.5dB, or the peak sound intensity decreased 2.8 times during the lockdown period. The maximum decrease was at locations close to major shipping channels and cruise tourism destinations. The findings were validated by comparing shipping traffic using the satellite-based Automated Identification System. The study proved that strategic “anthropauses” can reduce underwater noise levels and give marine mammals a chance to reverse the decline in their population.

A web application MonitorMyOcean.com was created to provide updated anthropogenic noise levels in global oceans. Policymakers can determine if measures such as shifting shipping channels or moratorium on new shipping routes are leading to “Quieter Oceans.”

Presenter Name: Heather Wild

Time: 2:40 pm

Presentation Duration: 7 minutes

Title: Improving Language Learning Apps: The role of emotional language

Learning a new language is hard. Our research looks for ways to improve language learning apps to make this process a little easier. Previous studies found that emotionality plays a role in how we learn words. For example, positive words like vacation are easier to learn than negative words like flu. Words are also recalled better when they were learned in positive sentences (e.g. I had a lovely time on vacation) than in negative sentences (e.g. I was attacked by sharks on vacation). However, these findings were based on highly controlled experiments and had not been tested in real-world learning scenarios.

We analysed data from a popular language learning app, Lingvist (<https://lingvist.com/>), to determine how word learning is influenced by (i) the positivity of the words themselves (e.g. vacation vs. flu), and (ii) the positivity of the context in which words are presented (e.g. I had a lovely time on vacation vs. I was fighting a terrible flu).

Initial results show that positivity of the word and positivity of the context are both significant predictors of successful learning. The more positive the conditions, the more likely learners are to succeed. I discuss how we turn these results into recommendations for language learning apps and how to strike a balance between basic and applied research goals.

May 13th, 2:00pm - 3:00pm

Presenter Name: Kian Yousefi Kousha

Time: 2:00 pm

Presentation Duration: 7 minutes

Title: Perceived Agency of Audiovisual Stimuli Does Not Affect Sensitivity to Synchronization During a Synchrony Judgment Paradigm

Multimodal integration of auditory and visual cues necessarily involves synchronizing across modalities. Synchrony perception of audiovisual stimuli is experience- and stimulus-dependent. The action observation network (AON), which is also involved in auditory beat perception, has a greater response to actions that are ‘like me’, performed by humans or agents that behave like or resemble a human. Therefore, we investigated the influence of perceived stimulus agency (i.e., how much it resembles a human) on sensitivity to audiovisual synchrony. Using motion capture data, we generated point-light figures (PLFs) of a human actor performing jumping jacks or side twist motions. We applied four levels of scrambling to the PLFs to gradually decrease the stimuli’s perceived agency. Auditory rhythms then accompanied the PLFs, and we made different temporal shifts between the videos and the audio. Eventually, participants judged synchrony between the auditory rhythms and the PLFs of varying degrees of agency. We found stimuli agency to significantly affect participants’ point of subjective simultaneity but not their sensitivity to synchronization. In other words, the ecological relevance of audiovisual stimuli influenced the choice of spatiotemporal cues picked to judge synchrony. Nevertheless, this did not induce distinct tolerance to audiovisual asynchrony. We also analyzed covariates of sensitivity to synchronization. Social personality traits did not result in differential treatment of agency when judging synchrony. As well, whereas participants with prior music experience were more sensitive to synchrony, experience with video gaming did not affect sensitivity to synchronization. The present study contributed to the vast body of literature on the topic of audiovisual synchronization. A greater understanding of sensitivity to synchronization can eventually optimize the interventional strategies used for patients with autism spectrum disorder or Parkinson’s disease.

Presenter Name: Mugdha Dave

Time: 2:10 pm

Presentation Duration: 7 minutes

Title: Standardization of bacterial pathogen genomic sequencing reporting

Antimicrobial resistance (AMR) occurs when microbes develop mechanisms to evade or degrade antimicrobials, rendering them ineffective. AMR is a major public health concern as the use of antibiotics is jeopardized. Genomic sequencing can identify the pathogens causing infection and any genes or mutations contributing to AMR. Sequencing is an important tool for diagnosis, treatment, and surveillance. While genomic sequencing has increased usage, there is a lack of standardized clinical reporting systems for information to be sent to clinicians with all the necessary infection information, including antibiotic resistance and susceptibility. This has created an imminent need for evidence-based guidelines on sequencing reports for bacterial infections. The general hypothesis of my project is that the automation of bacterial pathogen genomic sequence reports made in conjunction with input from clinicians, bioinformaticians, and public health officials can reduce the burden of AMR and improve patient outcomes. The goal of this project is to create a software tool that can automate genomic sequencing reports to provide valuable information regarding antibiotic resistance and susceptibility based on the specific pathogen(s) sequenced. A survey of public health scientists, clinicians, and diagnostic labs will be conducted to establish the current challenges and practices with genomic sequencing. These findings will then be used to design standardized genomic sequencing report templates. The software tool will use the Comprehensive Antibiotic Resistance Database (CARD)'s Resistomes & Variants datasets as a reference, which include information about important pathogens and their AMR genes. This tool will be integrated with the evidence based antibiotic prescribing guidelines, outbreak analysis, and detection of pathogens that are emerging threats. Validation will occur through a pilot study at Sunnybrook Health Sciences to assess its effectiveness. These reports will better equip clinicians by providing contextual information about their patient's bacterial infection, resulting in better antimicrobial stewardship and improved surveillance efforts.

Presenter Name: Tanjot Grewal

Time: 2:20 pm

Presentation Duration: 7 minutes

Title: Identification and Prioritization of Persistent, Mobile, and Toxic Plastic Additives Used in Canada

Many plastic additives have been examined for their risk to the environment and human health. However, little emphasis has been put on plastic additives that are persistent, mobile, and toxic (PMT) rather than persistent, bioaccumulative, and toxic. Due to their high mobility and stability, it is unlikely that wastewater treatment plants (WWTPs) effectively remove PMT plastic additives. Herein, an in-silico analysis was performed to assess the retention of PMT plastic additives registered for use in Canada in WWTPs using SimpleTreat 4.0. This study aimed to identify and prioritize PMT plastic additives with low retention based on their in-silico retention in WWTPs, physical-chemical property space plot, and elemental composition. A partitioning space plot was created to identify the Log Kow and Log Kaw ranges that were indicative of low retention PMT plastic additives. 124 Canadian PMT plastic additives were identified, of which 60% had less than 10% removal from WWTPs based on predictions using the SimpleTreat model. Furthermore, it was found that non-halogenated PMT plastic additives that contained nitrogen were most likely to be poorly retained in WWTPs. Overall, this study provided a ranked suspect list for PMT plastic additives registered for use in Canada, which can be used by the scientific community, regulators, and industry alike to screen for chemicals with potential PMT characteristics.

Presenter Name: Shirley Quach

Time: 2:30 pm

Presentation Duration: 7 minutes

Title: Qualities and Features of COPD self-management apps in the Public Android marketplace

The development and use of mobile health (mHealth) apps for self-managing chronic obstructive pulmonary disease (COPD) has increased over the past decade. Over the last few years, the COVID-19 pandemic has heightened the interest of its use in clinical practice. However, regulation on their development is extremely limited, and may inadvertently misinform users. We have summarized the features and quality of COPD-specific self-management apps using the mHealth-Index Navigation Framework (MIND) framework.

The Google Play Store was searched in December 2021, using search terms: Chronic obstructive pulmonary disease; COPD and bronchitis. Apps were screened by two researchers and included for evaluation if they were: In English, COPD-specific, patient-facing, and free to use. The MIND framework was tailored to fit the needs of this study to evaluate the apps.

A total of 437 apps were screened and 12 met the inclusion criteria. Most (8/12) provided COPD-related education. The availability of other features was inconsistent. These included: disease screening (4/12), medication reminders (4/12), symptom tracking (2/12), goal planning (3/12), and peer networking (2/12). Four apps were designed for patients to use in partnership with a clinician. None of the features were customizable and none reported effectiveness, feasibility, or usability information to support their use.

Using an established framework for evaluation, we have described the features of the apps in the Android market. We note that they lack evidence to support their effectiveness. Healthcare professionals should be aware of the differences in the quality and features of currently available apps to ensure their safety, credibility, and validity before incorporating them into medical plans.

Presenter Name: Sehely Rahman

Time: 2:40 pm

Presentation Duration: 7 minutes

Title: The effect of acute isometric handgrip exercise on working memory and reaction time in young, healthy adults

Introduction: We use working memory and reaction time daily. Since these measures of cognition fluctuate throughout the day, boosting them can be beneficial. Acute whole-body exercise has been shown to improve them; however, it is not always accessible. A novel strategy to acutely boost cognition might be handgrip exercise (HGX), which is typically used to manage blood pressure. A recent study has shown that HGX may also improve reaction time in the Go/No-Go task; however, it is unknown whether these effects apply to other cognitive domains. Therefore, we investigated the hypothesis that handgrip exercise will improve reaction time and working memory in young healthy adults.

Methods: In a randomized-controlled crossover study design, eight young, healthy adults (age=22.3±2.3years; BMI=22.1±2.2kg/m²) completed a HGX and time-matched control condition. The HGX consisted of four sets of 2-min unilateral HGX at 25% maximum voluntary contraction (MVC) with 3-min rests, whereas the control condition, consisted of watching a nature documentary. Reaction time and working memory were assessed at baseline and after both conditions via the Forward Corsi Block Tapping Test, the 4-Choice Reaction Time Test, and the N-Back Test. Blood pressure (BP) and heart rate (HR) were taken before, during, and after each condition. A linear mixed effects model was used for analysis.

Results: Post hoc comparison showed that BP and HR significantly increased during HGX ($P < 0.001$) but returned to baseline levels during recovery compared to the control condition. Contrary to our hypothesis, HGX did not significantly improve reaction time and performance accuracy ($P > 0.001$).

Conclusions: HGX significantly changed hemodynamics but not reaction time or working memory in young, healthy adults. Future studies should investigate HGX and its impact on cognition in a controlled environment. This research will help implement HGX as a strategy to boost cognition when full-body exercise is not possible.