2nd Annual Research Symposium

April 2, 2019

Health Professions Building Atrium

Free Communication Abstract Presentations
On behalf of the Research Committee, we would like to welcome you to The Herbert H. and Grace A. Dow College of Health Professions 2nd Annual Research Symposium. Through integrity, respect, compassion, inclusiveness, social responsibility, excellence, and innovation our vision is to be nationally recognized for the development of professionals who contribute to an inclusive, healthy society. We therefore hope you have an opportunity today to learn about the scholarly research activities our internationally known scientists, clinicians, academicians, and young researchers have been conducting.

Sincerely,

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Speech Intelligibility Gain in Reverberation in Bimodal Cochlear Implant Users

The purpose of this study was to determine the effects of reverberation on speech intelligibility gain for listeners of varying hearing status. Adults with bilateral cochlear implants (CI), bimodal implants (one CI and one hearing aid), and age-matched adults with normal hearing listened to monosyllabic words (0º azimuth) in noise (0º, ±90º azimuth) in five different levels of reverberation. Testing was a virtual SIG test (developed from Koehnke & Besing, 1996) listening to stimuli presented via circumaural earphones (Sennheiser HD280) and repeating the words heard. Threshold signal-to-noise-ratio for 50% speech intelligibility increased with increasing reverberation and decreased with speech and noise spatially separated for three groups, with poorer benefit observed for CI groups. A multivariate analysis method with a post hoc test was used for data analysis. Results revealed that bimodal and BCI users required significantly higher SNRs than listeners with NH for all noise locations and all reverberant conditions (p<.0001). In addition, the SNR decreased when speech and noise spatially separated for listeners with NH (AN & RT0.2-0.9s), BCI (AN & RT0.2-0.6s), and bimodal (AN & RT0.2s), which confirm the fact of release of masking and the ability of using binaural cues for bimodal and BCI users. Bimodal group had limited benefit and smaller intelligibility gain compared to other two listener groups. The findings of this preliminary study may extend our understanding of binaural processing ability of bimodal and BCI users in real-life situations, hence helping audiologists consult patients to develop better communication or rehabilitation strategies in adverse listening environments.
QuickSIN and COSI as Measurements of Hearing Aid Performance in Noise

Hearing loss typically leads to a suprathreshold distortion impairment (SDI), which causes difficulties with intensity and frequency discrimination and temporal processing. These listening challenges increase with age and affect speech understanding, especially in a noisy environment. The purpose of this study was to determine the immediate benefit of speech in noise to older adults with significant hearing loss by using three new premium technology level HAs from Widex (Evoke Fusion2-440), Oticon (OPN1 miniRITE-T), and Phonak (Audeo M90-R). Previous studies utilizing Quick Speech in Noise (QuickSIN) test stimuli in soundfield at 0° azimuth, found that on average adults of all ages experienced an improved SNR level while aided with older hearing aid (HA) technology compared to unaided (e.g., Mendel, 2007). With current HA technology, it would be beneficial to investigate whether they reduce the SDI to a significant degree.

Adults age 60 years or older with a significant bilateral sensorineural hearing loss and an SNR greater than 7 dB unaided with the QuickSIN participated in the study. Each participant completed a life-style questionnaire, a Self-Administered Geocognitive Examination (SAGE), and a Pre-Client Oriented Scale of Improvement (COSI). The Pre-COSI was completed by listening to four simulated noisy environments (kitchen, car, living room, and restaurant) to obtain information regarding unaided hearing difficulties. Three HAs were then fit in a random order using the manufacturer’s proprietary fitting formula and real-ear measures with speechmapping to achieve the best first fit. The participants then completed the Post-COSI using the four simulated environments for each HA. Next, an open-ended questionnaire was completed inquiring about a preferred hearing aid. Lastly, the aided QuickSIN in soundfield was completed with the participant’s preferred HAs and at five different presentation levels (50, 55, 60, 65, and 70 dB HL).

All participants indicated immediate improvements on the Post-COSI for each simulated noisy environment with each HA. However, for majority of test subjects the QuickSIN scores were similar between the unaided and aided conditions, which is inconsistent with previous findings. Note that the participants in the previous studies were younger adults and had HA experience before aided QuickSIN. In addition, the QuickSIN presents the signal and noise from the same speaker causing more difficulty for speech understanding. Moreover, the presentation level (70 dBHL) recommended for the QuickSIN was reportedly too loud in soundfield and caused a negative impact on performance. Loud but comfortable individual presentation levels led to more ideal speech in noise performance.

The clear subjective HA benefit in noise without immediate improvement of behavioral testing scores indicate the necessity of auditory rehab training for better performance in more adverse listening environments. In conclusion, this study will help audiologists appropriately evaluate and make recommendations for HA users.
The Effects of Conductive Components in the Audiogram on Hearing Aid Fitting

Hearing loss with any difference between air conduction and bone conduction results, an air-bone gap (ABG), will require more gain and output due to an impedance within the outer and middle ears where sound is transmitted. Missing bone thresholds may cause less gain and output from HA leading to inaccurate HA fittings and extra follow-up care to accommodate for the underfitting of prescriptive targets. No study has systematically investigated how ABG will affect HA fitting. The purpose of this study is to examine the effects of ABG on gain and output within HA manufacturers’ software for different fitting formulae and different degrees and configurations of hearing loss.

Simulated hearing losses with different degrees and configurations were created in the NOAH software using Resound, Oticon and Phonak software. Sensorineural hearing loss and mixed hearing losses were used in this study for the Resound Linx2 9, Phonak Audeo V-90, and Oticon Opn 1, receiver-in-the ear HAs. Gain and output for different ABGs and different input levels were recorded across multiple channels in the NAL-NL1, NAL-NL2, and DSL v5 fitting formulae, and then compared to those without ABG.

Results revealed that gain increased as the ABG increased for each configuration and degree of hearing loss simulated, with the most gain change occurred when using NAL-NL1 and the least gain change for DSL v5 fitting formula for different manufacturer software. The gain was up to 13 dB at 10 dB ABG for mild-sloping hearing loss and soft input sounds when using NAL-NL1 formula. The most gain was 19 dB which occurred at 30 dB ABG for mild-rising hearing loss for Resound software. There was not much gain change with air-bone increased for severe hearing losses and loud input sounds. Also, MPO increased as the ABG increased. The most MPO change occurred for mild-rising hearing loss, especially for DSL v5 fitting formula (23 dB). Compared to Resound software, Phonak software had more obvious changes in gain and MPO for NAL-NL1 formula as ABG increased.

The clear increase in gain and output with increasing ABGs indicates the importance of inputting the bone conduction thresholds for accurate fitting. The information obtained in this study should be useful for clinical audiologists when fitting listeners with conductive or mixed hearing loss to reach the best HA fitting outcome and hence help patients achieve better quality of life.

This study has been presented at the Middle Ear Mechanics Research and Otology Conference (MEMRO) in Shanghai, China for Summer 2018. Part two of this study which involves participant perceptions on loudness and clarity with and without bone conduction results for normal hearing, sensorineural and mixed hearing loss groups in currently underway.
Increased Engagement and Positive Displays of Emotion after Implementation of Montessori Programming

Context: Montessori for Aging and Dementia, extends the tenets of person-centered care by focusing on the abilities, needs, and interests of persons with dementia in a supportive environment. The steps of staff education, implementation and evaluation of a Montessori program that focused on engaging elders with dementia in previous life roles, while providing environmental supports according to the Montessori philosophy will be described.

Purpose: To evaluate the impact of Montessori programming in one care area and document the process for replication throughout the care community.

Methods: A pre-post quasi experimental descriptive study was conducted with 29 elders in the intervention community. The mean age of participants was 89.52 years (SD = 7.17); participants scored M = 9.86 (SD = 5.71, range = 2 – 25) on the Montreal Cognitive Assessment. The Montessori program was implemented over the course of one year via online and in-person didactic sessions, environmental modifications and weekly coaching calls. Outcome measures included number of responsive behaviors, falls, medications and hospitalizations; attitude and attention according to the Observational Measure of Engagement; the Observed Emotion Rating Scale; the Cohen-Mansfield Agitation Inventory; and the Dementia Quality of Life Scale.

A treatment fidelity measure was developed to record the frequency of the program standards in place before and after the program was implemented. Three standards areas were assessed: Leadership (seven features), Staff (nine features) and Prepared Environment (six features), for a total of 88 required components of a fully implemented program.

Results: At pre-test the community demonstrated 30% of the required features across the three standards areas. At the one year post-assessment, the community demonstrated a significant improvement in the required components of the program, 69%. At pretest, participants had no roles in caring for the community. As a result of Montessori implementation, more than half of the participants were engaging in one to two roles a day. Participants displayed significantly more positive emotions from pre-implementation (M = 3.35, SD = 1.04) to post-implementation (M = 3.97, SD = .76); t(28) = -2.83, p = .009. No other statistically significant relationships were noted.
Co-Constructing Personal Narratives in Traumatic Brain Injury: A View from the Storytellers’ Lens

**Purpose:** To explore the lived experience of persons with traumatic brain injury (TBI) following an intervention designed to co-construct a personal narrative about their life.

**Design:** This study was a qualitative phenomenological interpretative analysis that explored the lived experience of individuals who participated in an intervention designed to co-construct a personal narrative about life with TBI.

**Setting:** Inpatient and outpatient brain injury facility.

**Participants:** Eight participants ages 24-71 with clinician-confirmed TBI (two mild; two moderate; four severe).

**Interventions:** 7-month group intervention designed to co-construct and share a personal narrative about life with TBI.

**Main Outcome Measures:** Semi-structured qualitative interviews were conducted within two weeks of completion of the personal narrative co-construction intervention. Interviews were organized into four sections 1) developing your story; 2) sharing your story; 3) how stories meaningfully link the past, present, and future; and 4) thoughts on co-constructing stories with other persons with TBI. Interviews were videotaped and transcribed.

**Results:** A six-step interpretative phenomenological analysis process (IPA) was used to identify themes. IPA analysis revealed six themes; identity and thinking about the future; it was emotional; helpful supports; sense of pride; sense of community; and advocacy.

**Conclusions:** Co-construction of personal narratives about life with TBI can be a meaningful client-centered therapeutic activity. Participants reported enjoying the process, developing a sense of community within the group, and feeling empowered through the development and sharing of their personal narratives. Future research may explore methods for training clinicians in narrative co-construction methods to support clients in opportunities to make meaning out of the trauma of TBI.
Using Emotional Valence to Analyze Elicited Stories about an Important Event Told by Individuals with TBI in TBIBank

Background: Traumatic Brain Injury (TBI) is a leading cause of long-term disability in the United States. Approximately 1.5 million people in the U.S. sustain a TBI every year. The impact of living with TBI can be devastating as individuals often experience physical, cognitive, and emotional limitations that impact overall wellbeing and everyday life. These post-injury changes can also impact how a person conceptualizes their own identity. Emotional valence can be used to reveal the underlying attitudes and feelings of how people with TBI may view their impairments. The valence of one's story is a crucial part of understanding identity post-injury.

Study Aims: The purpose of this study was to determine if various independent variables such as age, sex, TBI severity, or years of education pre-injury impact the telling of important events told by persons with TBI. Research questions include: a) Using a discrete scale of negative, neutral, and positive, what is the emotional valence of a story about an important event told by a person with TBI? and b) Does severity of TBI, age, sex, or years of education pre-injury impact the emotional valence of a story about an important event told by a person with TBI?

Method: Secondary data about a prompted important event from the TBIBank database were collected, de-identified, and downloaded onto a HIPPA compliant lab computer in the university Carls Center. TBIBank is a national repository of speech samples from people who have a TBI. A total of 39 transcripts were analyzed by a group of four reviewers, who have been trained in determining valence. This study used a discrete scale of valence to categorize language samples of an important event from the TBIBank database. Using this discrete scale, a content analysis was conducted to determine the valence of each story. Once each transcript is coded with 100% agreement, codes for valence will be entered into SPSS for statistical analysis. Descriptive statistics, chi square, and linear regression analysis will be used. The CMU IRB for this project was approved recently; therefore, data analysis is currently underway.

Anticipated Results and Clinical Significance: Through the identification of valence in storytelling rehabilitation, clinicians may be able to indicate the emotions of varying clients with TBI. This understanding is essential as better outcomes for individuals with TBI are noted in people who demonstrate positive mood and may be able to help clinicians guide their clients through the process of recovery as well as gaining back their identity through storytelling.
Using Emotional Valence to Analyze Elicited Stories about an Important Event Told by Individuals with Aphasia in AphasiaBank

Background: Stroke is the leading cause of long-term disability and the leading preventable cause of long-term disability. Approximately 795,000 people in the U.S. have a stroke each year and a third of people with stroke have aphasia. Aphasia is an acquired neurogenic language impairment that results from an injury to the brain. Individuals with aphasia may have a range of losses that can include physical, emotional, social, cognitive, and communicative abilities. These post-stroke changes can impact how a person with aphasia conceptualizes themselves which in turn can impact their well-being. Stories are a way to make meaning out of traumatic events, such as having a stroke and aphasia. Stories contribute to our identity and provide a lens through which we view ourselves. Emotional valence can be used to reveal the underlying attitudes and feelings of how people with aphasia may view their impairments. The valence of one's story is a crucial part of understanding identity post-stroke.

Study Aims: This project examined the following research questions: a) Using a discrete scale of negative, neutral, and positive, what is the emotional valence of a story about an important event told by a person with aphasia? and b) Does type of aphasia, severity of aphasia, age, or sex impact the emotional valence of a story about an important event told by a person with aphasia?

Method: A secondary data set from AphasiaBank was used access prompted important event stories told by people with aphasia. AphasiaBank is a national repository of samples of people with aphasia. A total of 162 transcripts were analyzed by a group of 10 reviewers, who have been trained in determining valence in individuals with aphasia. This study used a discrete scale of valence to categorize important event stories from the AphasiaBank database. The discrete scale included positive, negative, and neutral ratings. Using this discrete scale, a content analysis was conducted to determine each story valence. Once each story was coded with 100% agreement, codes for valence will be entered into SPSS for a statistical analysis. Descriptive statistics, chi square, and linear regression analysis will be used. The CMU IRB for this project was approved recently and data analysis is currently underway.

Anticipated Results and Clinical Significance: The identification of valence in storytelling rehabilitation may assist clinicians to be better able to identify emotions of clients with aphasia. This understanding is important as improved rehabilitation outcomes are noted in individuals with aphasia who demonstrate positive mood states. Being able to identify the emotional valence of a story may be able to help clinicians guide their clients through the process of recovery and identity reconstruction through storytelling.
Speech-Language Pathology
Presenter – Taylor Neubauer
Faculty Mentor – Katie Strong, Ph.D., CCC-SLP

Thematic Analysis of Topics from Elicited Stories about an Important Event Told by Individuals with Aphasia from AphasiaBank

**Background:** The impact of living with stroke and aphasia can be devastating and chronic. Aphasia is an acquired neurogenic language impairment that results from a brain injury and can impact a person’s talking, reading, writing, and listening abilities. These post-stroke changes can impact how a person with aphasia conceptualizes their identity. Telling and re-telling stories can be one way to renegotiate identity. People with aphasia have impairments in language that impact their ability to tell and re-tell stories, which may in turn impact their post-stroke identity negatively. Storytelling in aphasia is important because it provides a way of making meaning for the person with aphasia and allows the listener to view an individual’s life in a holistic way. Currently literature is not available on what topics are of interest to people with aphasia who are telling an important event about their life.

**Study Aims:** The project examined the following research questions: a) What are the themes of topics found in prompted stories about an important event produced by persons with aphasia? And b) Does the topic of an important event told by a person with aphasia vary based on independent variables (i.e., age, sex, type of aphasia, and severity of aphasia)?

**Method:** Secondary data about a prompted important event from a national repository, AphasiaBank, was the source of data for this project. A total of 162 important event stories told by people with various types and severity of aphasia were analyzed by a group of 10 reviewers to identify the topic of the important event story. Analysis was conducted to identify the topic of each important event story. The topics of each story were then reviewed to identify themes evident in the important story events. NVivo software was used for thematic analysis. Themes identified were then examined to determine if independent variables impacted the themes told by individuals with aphasia. The CMU IRB for this project was approved recently and data analysis is currently underway.

**Anticipated Results and Clinical Significance:** Knowing the themes of important events told by persons with aphasia may allow rehabilitation clinicians working with people who have aphasia insight into relevant topics of interest to individuals with aphasia. This knowledge may be able to help clinicians guide clients through the process of recovery as well as gaining their identity through storytelling.
The Effects of TBI and Aphasia Simulations on the Knowledge, Attitudes, and Empathy of Future Speech-Language Pathologists

Purpose: To determine the impact of traumatic brain injury (TBI) and aphasia simulations on the knowledge, attitudes, and empathy of future speech-language pathologists (SLPs).

Methods: Students were recruited from CSD 431 (Audiologic Rehabilitation), a course in the first semester after acceptance to the Communication Sciences and Disorders major. Any students who decided to participate signed a consent form and filled out a demographic survey. This was followed by a pre-simulation survey, which determined information about each of the participant’s past experiences, attitudes, and knowledge about TBI and aphasia. The participants then completed five simulations, which were guided by the student researcher. After the simulations concluded, a post-simulation survey was provided for the participants to complete. The pre- and post-survey data (both quantitative and qualitative) were compared and analyzed to determine the change in the attitudes, knowledge, and empathy of the participants.

Results: The simulations increased the levels of knowledge and empathy in future speech-language pathologists about aphasia and TBI, as well as led to positive attitude changes toward populations who have experienced either a TBI or a stroke leading to aphasia.

Conclusion: Since the simulations were concluded to positively impact the knowledge, empathy, and attitudes of future Speech-Language Pathologists, they may be a useful tool in Communication Sciences and Disorders (CSD) classes about TBI and aphasia. The simulations are likely able to improve the clinical competency of future SLPs. Additional research could be completed to examine the impact of simulations of other types of communication disorders on CSD students. Further research may also be conducted to determine the simulations’ efficacy in the workplace of SLPs.
Cognitive Load during Sentence Production Differentially Affects Younger and Older Adults’ Speech Motor Performance

Context: Age-related difference in speech motor and cognitive performance are well documented. For example, compared to younger adults, older adults demonstrate reduced articulatory movement pattern stability and executive functioning (Verhaeghen & Cerella, 2002; Wohlert & Smith, 1998). Both theory and empirical evidence support the presence of interactions between speech motor and cognitive functions (Smith, 2006). Even within the relatively optimally functioning systems of younger adults, increased cognitive load negatively affects speech motor performance (Dromey & Benson, 2003). Given the age-related changes that occur within speech motor and cognitive systems, and the effects of increased cognitive load on younger adults’ speech motor control, it is reasonable to posit that older adult’s speech motor performance may be particularly susceptible to destabilization by increased cognitive load.

Purpose: This study sought to determine the effects of increased cognitive load on the speech motor performance of older adults, as compared to younger adults.

Methods: Participants (16 younger adults, 22-23 years old, eight men) and 16 older adults (68-78 years old, eight men) completed multiple repetitions of a novel, sentence-level, modified Stroop task (e.g., “Pammy and Bobby picked blue, red, pink, and brown poppies with their mommy.”) in two conditions (congruent and incongruent). While motoric targets were consistent between conditions, cognitive load was greater in the incongruent condition. In this condition, the semantic meaning of the color word did not match the font color in which the word was written (e.g., blue); these matched in the congruent condition (e.g., red). In both conditions participants said the color in which the word was printed, rather than read the word, itself. Kinematic data from the lips and jaw were collected with a 3D Investigator Motion Capture System (Northern Digital, Inc.), and data were processed according to established methods (Smith & Zelaznik, 2004). Effects of age group and Stroop condition on a measure of articulatory coordination variability over repeated sentence productions, the lip aperture variability index (LAVAR), were examined with repeated measures ANOVAs.

Results: While increased cognitive load appeared to affect the speech motor performance of both age groups, results indicated that older adults experienced a disproportionate increase in the LAVAR with heightened cognitive load (p<.02). Age-related differences in the LAVAR were greatest in the incongruent condition (p<.001).

Conclusions: Results indicate the interaction of cognitive and motor functions supporting speech production. Additionally, the results provide evidence that the speech motor control of older adults, as compared to younger adults, is particularly susceptible to destabilization by increased cognitive load. This study of healthy speakers provides a foundation for future work in individuals with age-related neurological disorders that affect both cognitive and motor functions, whose motor performance may be more susceptible to increased cognitive load.
Service Learning with Residents with Dementia: We Have the Evidence, but What Does It Look Like?

The purpose of this project was to further illustrate the impact of Service Learning on undergraduate students who interact with people with dementia. The purpose of the study was also to highlight personal experiences and challenges of undergraduate students who participated in Service Learning. Detailed experiences of a select group of five undergraduate students provides a mechanism to illustrate the ups and downs of this evidence-based pedagogy. Emphasis on objective data in support of this type of programming will also be reported. Students completed reflective journals throughout their experience and provided details of connecting classroom content with skills in the service-learning environment. The experiences formulated by these students provide information that could alleviate anxieties of undergraduate students who are inexperienced interacting with people with dementia. Service Learning for undergraduate students with people with dementia is associated with positive shifts in attitudes and should be incorporated into curriculum.
Evaluating Physician Assistant Students Knowledge and Applications on ACSM’s Exercise is Medicine in Medical Practice

Objective: Educational programs focusing on the value of prescribing exercise to patients have shown that exercise is effective in the treatment and prevention of many chronic diseases. The American College of Sports Medicine’s “Exercise is Medicine” (EIM) initiative is seeking to increase knowledge in healthcare providers in order to increase the amount of exercise prescriptions written, while also engaging patients in exercise more frequently. The present research focuses on the effectiveness of an EIM presentation to an accredited Physician Assistant Program.

Methods: Following a 45-minute EIM presentation, an anonymous pre- and post-survey was completed by 22 students. The pre-survey included questions on knowledge of exercise’s effects on selected pathologies, attitudes about exercise, personal profiles of the students regarding prior education, a case study with questions to assess knowledge, and knowledge of the Exercise is Medicine initiative. The post-survey included questions on the likelihood of prescribing exercise, confidence in writing scripts for exercise, and the effectiveness of the seminar. The same case study as the pre-survey was revisited and redone to assess the effectiveness of the presentation.

Results: There was a +27.27% increase in the number of students that believed prescribing exercise will be a part of their practice as a clinician. As a result of the presentation, +31.82% of the students expressed an increase in their confidence to accurately prescribe exercise for their patients. In addition, students performed better in several areas on a practice exercise prescription case study and performed better in identifying diseases that benefit from exercise. For example, there was a +31.82% increase in identifying the correct exercise types for a patient. Improvements in scores on the case study were shown in almost all categories.

Conclusions: A short 45-minute EIM seminar can increase the knowledge and attitudes of physician assistants’ students, with respect to incorporating exercise prescription in their practices.
The Physical Activity Screening Tool: Utilizing Physical Activity as a Vital Sign in the Primary Care Setting

**Background:** Less than 23% of the U.S. population meets the ACSM recommendations for physical activity. One important step in abating this epidemic is the ability to quickly and accurately identify the physical activity level of patients in the primary care setting. The Physical Activity Screening Tool (PAST) was developed to provide physicians with a valid and reliable tool to rapidly assess aerobic and resistance training levels of primary care patients.

**Methods:** PAST data utilized in this study was collected from 118 (N=118) patients at a single primary care clinic. Height and weight measurements were recorded during the office visit by a member of the healthcare staff. Utilizing SPSS 25 software, self-reported responses to the PAST questions were analyzed for association with BMI via linear regressions.

**Results:** When adjusted for demographic factors, BMI decreased by 0.031 units for every minute of exercise per week (P<0.001). Patients who met or exceeded ACSM physical activity recommendations, on average, had a BMI of 7.009 units less, when compared with those who did not meet requirements (P<0.001).

**Discussion:** Responses to the PAST were significantly correlated with BMI, demonstrating that PAST is a clinically relevant tool. Our finding of an average decrease of 7.009 BMI units for patients who met or exceeded ACSM physical activity recommendations illustrates the importance of meeting physical activity guidelines. Future research should seek to verify the findings reported in this study via a larger clinical population. PAST may prove to be a key tool for physicians aiming to abate the physical inactivity epidemic.
Impact of Thermo-neutral and Hot Yoga Exercise Training on Vascular Function and Markers of Cardiometabolic Health

Introduction: While traditional aerobic exercise training is typically prescribed to treat/prevent many cardiometabolic diseases, yoga exercise training is not because it is performed at a low exercise intensity (~30% maximal ability). Interestingly, heat therapy (e.g., hot water immersion and repetitive sauna use) has been shown to have beneficial effects on health similar to aerobic exercise training. Therefore, it is possible that yoga exercise performed in a hot environment could result in meaningful changes in major markers of health.

Purpose: To examine the effects of thermo-neutral (TN) and hot (H) yoga training on major health outcome measures in overweight adults.

Methods: A total of eight inactive (no regularly planned physical activity ≥ 30 minutes/day, three days/week, for ≥ three months), overweight (BMI >25 kg/m2), adults participated in this study. Participants were randomized to an eight-week yoga training intervention performed in either a TN (n=5; 22.1 ± 0.2 °C) or H (n=3; 35.3 ± 0.8 °C) environment while maintaining their normal dietary habits. Cardiorespiratory fitness, vascular function, BP, and body composition (i.e., fat mas [FM], % body fat [%BF]) were measured before and after eight weeks of yoga training.

Results: Participants completed 84 ± 8% and 84 ± 5% of the yoga training sessions in the TN and H group, respectively (TN vs. H, p=0.92). No differences were detected in cardiorespiratory fitness, vascular function, or BP before or after eight weeks of yoga exercise training. However, we observed a significant reduction in %BF in the TN yoga group (45.4 ± 3.7 vs 42.9 ± 4.3, p=0.049) and a trend for a reduction in FM in the H yoga group (42.5 ± 5.3 vs 41.3 ± 5.6 kg, p=0.10), following eight weeks of yoga exercise training.

Conclusion: There do not appear to be additional beneficial effects of yoga exercise training performed in a hot environment when compared to yoga performed in a thermo-neutral environment. However, because only eight weeks of yoga exercise training impacted measures of body composition, it is possible that additional health benefits could be derived from longer duration yoga exercise training as a result of additional fat loss.
Examination of Underlying Mechanisms Contributing to the Enhanced Post-Exercise Blood Pressure Response

**Background:** Insulin resistance contributes to endothelial dysfunction establishing a causal link between type 2 diabetes and cardiovascular disease. An acute bout of exercise has been shown to enhance insulin sensitivity and endothelium function potentially contributing to reduced blood pressure post-exercise. However, the underlying molecular mechanism(s) for these improvements in smooth muscle remains unclear.

**Purpose:** To examine blood pressure response and key signaling proteins involved in insulin sensitivity and endothelial function following an acute session of exercise in aged rodents.

**Methods:** Based on body mass, aged (~12 months) female Sprague-Dawley rats (n=47) were assigned to one of four groups: 1) sedentary control group without insulin injection (CON-ins), 2) control group with insulin injection (10mU/g; CON+ins), 3) exercise group without insulin injection (EX-ins), and 4) exercise group with insulin injection (EX+ins). Insulin or saline injections were administered five-min prior to sacrifice. Under isoflurane anesthesia, blood pressure was assessed and the descending aorta was harvested. Exercise cohorts were sacrificed three-hour after a 60-min swimming protocol. Western immunobloting was used to determine phosphorylated Akt (p-AktSer473), phosphorylated AMPK (p-AMPKThr172), phosphorylated PKA (p-PKAThr197) and phosphorylated eNOS (p-eNOSSer1177). An ELISA assay and a colorimetric assay kit was used to determine insulin and glucose concentrations for calculating insulin resistance (i.e., HOMA IR).

**Results:** Blood pressure was reduced following exercise in insulin stimulated conditions compared to sedentary conditions (p<0.001). P-eNOS was increased in insulin stimulated conditions compared to basal conditions (p=0.05). P-AktSer473 was higher (p<0.001) under insulin stimulated compared to non-insulin conditions, which was attenuated with exercise (p=0.007). No significant differences were observed in p-AMPK or p-PKA levels. HOMA-IR scores indicated presence of IR and there was no statistical difference between sedentary or exercise cohorts (18.4 vs 15, p=0.21)

**Conclusion:** Greater post-exercise improvement in blood pressure was only observed under insulin stimulated conditions. This outcome may be mediated by enhanced insulin sensitivity via Akt signaling or p-eNOS signaling in smooth aortic muscle.
Impact of Exercise on Markers of Health, Fitness, and Exercise Self-Efficacy in Type 2 and Pre-Diabetic Adults

Context: Type 2 diabetes (T2DM) is a metabolic disease where tissues become resistant to physiologic effects of insulin. This is usually preceded by pre-diabetes, characterized by non-significant insulin resistance. Exercise is recommended for the treatment of T2DM and for preventing the progression of pre-diabetes to T2DM. However, it remains unclear whether exercise training produces similar adaptations in health and fitness in T2DM and pre-diabetic patients given their varying states of insulin resistance.

Purpose: To compare markers of health and fitness in T2DM vs. pre-diabetic in response to the same 8-week exercise program.

Methods: Twelve male (n=6) and female (n=6), previously inactive (no regular planned physical activity ≥ 30 minutes/day, three days/week, for ≥ three months), adults with T2DM (n=8) or pre-diabetes (n=4) completed this study. Both groups completed an eight-week exercise training program including a combination of 30-40 minutes of aerobic, and 20-30 minutes of resistance training three days/week. Before (“baseline”) and after (“post-intervention”) the eight-week exercise intervention, major markers of health (i.e., body fat percentage [BF%] assessed via dual x-ray absorptiometry, systolic [SBP] and diastolic [DBP] blood pressure) and fitness determined by a six-minute walk test were measured. Participants’ self-efficacy related to exercise was also measured at baseline and post-intervention using the Self-Efficacy for Exercise (SEE) Scale.

Results: Exercise compliance was similar between our diabetic and pre-diabetic groups over the eight-week exercise intervention (85 ± 7% vs. 95 ± 2%, p=0.25). No significant differences were observed between groups (diabetic vs. pre-diabetic) at baseline or post-intervention. However, from baseline to post-intervention there was a significant reduction in SBP for the T2DM group (124 ± 4 vs. 117 ± 6, p=0.047). Additionally, we observed a significant improvement in 6MWT in both the diabetic (1570 ± 100 ft. vs. 1799 ± 100 ft., p=0.012) and pre-diabetic (1532 ± 142 ft. vs. 1830 ± 142 ft., p=0.019) participants. Interestingly, a significant improvement in SEE was observed from baseline to post-intervention in our diabetic group (34.3 ± 9.0 vs. 65.0 ± 9.0, p=0.029), but not our pre-diabetic group (38.8 ±12.8 vs. 60.0 ± 12.8, p=0.24).

Conclusion: The exercise training intervention employed in this study was sufficient to improve not only cardiorespiratory fitness, but also reduce blood pressure and improve exercise self-efficacy in diabetic adults. However, since this same exercise training intervention only resulted in improved cardiorespiratory fitness in pre-diabetic adults, this suggests that a more robust exercise training intervention may be needed to see additional health improvements in less insulin resistant adults.
The Effects of Dietary Medicum-Chain Triglycerides on Insulin-Stimulated Glucose Uptake in Skeletal Muscle

Background: Recently, there has been increased dietary consumption of medium-chain triglycerides (MCT; triglycerides containing fatty acids chains C8:0-C12:0) for purported ergogenic and weight loss effects. Diets high in fat are known to contribute to insulin resistance, but the impact of high MCT-based diets on glucose uptake and insulin signaling are not well-known.

Purpose: We investigated the effect of a high-MCT diet on insulin-stimulated glucose uptake in rat skeletal muscle.

Methods: Male Sprague-Dawley rats, ages 7-17 months, were assigned to one of three isocaloric dietary groups: 1) low-fat control group (LFM; 20% protein, 70% carbohydrate, 10% fat mostly from MCT), 2) high-fat group (HFL; 20% protein, 35% carbohydrate, 45% fat mostly from lard) and 3) high-fat MCT group (HFM; 20% protein, 35% carbohydrate, 45% fat mostly from MCTs). All rats had ad libitum access to their respective diets and water for eight weeks. Body masses and food consumptions were recorded weekly. During the terminal study, a soleus muscle from each rat was excised, split into equal thirds, and placed in vials containing physiological buffer including one of three insulin concentrations (0, 0.6, or 30nM). Muscles were then incubated in the presence of radioisotopes to determine glucose (two-deoxyglucose; two-DG) uptake. Homogenates were also used for Western blotting to assess phosphorylation and abundance of key insulin signaling proteins.

Results: There was not a significant difference in food consumption between groups and the MCT group gained the least weight at the end of eight weeks. We observed a main effect of insulin (p<0.05) regarding two-DG uptake, but no differences associated with diet. We did not find significant results regarding total or phospho-Akt2Ser474.

Discussion: We report that a high-fat diet consisting of MCTs will lead to less weight gain compared to a high-fat diet consisting of lard. However, the fat source did not affect insulin-stimulated glucose uptake in isolated muscle, suggesting that diets high in MCTs may not improve insulin sensitivity compared to high lard-based diets despite reduced weight gain. These results imply that a diet high in MCTs may translate greater meal satiety and better weight maintenance, compared to other high-fat and even lower-fat diets.
Exercise Science
Presenter – Joshua Muench
Faculty Mentor – Rachael Nelson, Ph.D.

Accumulating 10,000 Steps/Day Using a Wristband Activity Monitor May Not Meet Step Guidelines

Context: Physical activity (PA) guidelines aimed at accumulating 10,000 steps/day through exercise (EX) and activities of daily living (ADL) has become increasingly common with the advent of wristband PA monitors. Yet, accumulated “steps” with wristband PA monitors may not equal validated pedometers. Consequently, there is a need for evaluating and developing guidelines for step counts using wristband PA monitors for the general population.

Purpose: To compare pedometer and wristband PA monitor steps accumulated through EX and ADL designed to mimic real-world behavior using a diverse participant population.

Methods: Twenty-four males and 35 females, age: 18-65 yrs., BMI: 19-45 kg/m2, including exercisers and non-exercisers, were recruited for this two-day study. On Day one participants completed 30 minutes of EX on a treadmill at 64-74% of their age-predicted HRmax wearing a pedometer and wristband PA monitor. Pedometer and wristband PA monitor steps were recorded after EX and pedometer steps were subtracted from 10,000 to determine the remainder of steps participants needed to accumulate 10,000 steps through ADL on Day two (ADL pedometer steps = 10,000 steps – exercise pedometer steps). Next, participants were sent home with a pedometer and wristband PA monitor. On Day two, participants were instructed to accumulate the remainder of steps needed to reach 10,000 steps through ADL. Once participants accumulated their ADL pedometer steps, step counts on both devices (i.e., wristband PA monitor and pedometer) were recorded. Total step counts were calculated as: EX steps on Day one plus ADL steps on Day two for devices.

Results: Significantly fewer wristband PA monitor steps were accumulated than pedometer steps during treadmill EX (3864±68 vs. 3573±81 steps; P<0.01) on Day one by 7.5%. Conversely, on Day two, accumulated wristband PA monitor steps were significantly greater than pedometer steps during ADL (7973±275 vs. 6255±72 steps; P<0.01) by 27.5%. Consequently, total steps were significantly higher for wristband PA monitor steps than pedometer steps (11546±281 vs. 10119±57 steps; P<0.01).

Conclusion: In order to achieve to the equivalent of 10,000 pedometer steps using a wristband activity monitor through treadmill exercise and activities of daily living, wristband activity monitor users should strive for closer to ~11,500 “steps” per day.
Context: Despite a growing number of studies indicating that reduced sleep duration and quality have a negative influence on recovery and performance in many sports, data regarding the sleep habits of collegiate athletes is lacking. Highlighting factors that have a negative influence on sleep in collegiate athletes could lead to interventions that may increase sleep duration and quality, which could lead to increased performance and reduced injuries. College level athletes balance many physical and mental stressors, in order to be successful as student-athletes, and given the close relationship between mental states and sleep, these stressors may interfere with their sleep.

Purpose: To explore associations between stress, mood, sleep quality, and sleep duration in a college female soccer team across an entire season.

Methods: Twenty-one Division I female soccer players (18.9±1.28 years; 167.5±4.91 cm; 63.8±6.9kg) participated in this study. Each participant was asked to record their levels of stress, mood, and sleep quality using a seven-point scale into a smartphone application, every day for an entire competitive season. Stress was rated from -3: Very anxious to 3: Very Calm; mood was rated from -3: Very Unpleasant to 3: Very Pleasant; and Sleep Quality was rated from -3: Very Restless to 3: Very Restful. Subjects were also asked to record the duration of their sleep. Pearson’s correlations were conducted to test associations between stress, mood, sleep quality, and sleep quantity.

Results: There was a positive relationship between mood and sleep quality ($r=0.230$, $p<0.01$), and stress and sleep quality ($r=0.305$, $p<0.01$). There was also a correlation between mood and sleep duration ($r=0.052$, $p<0.05$), and stress and sleep duration ($r=0.076$, $p<0.01$).

Conclusion: Both sleep quality and sleep duration are negatively affected by increased stress and also by a perceived low mood. Interventions that could help players better manage their stress and elevate their moods could result in increased sleep quality and duration in college soccer players.
Heart Rate and Energy Expenditure in Division I Collegiate Soccer Players during a Competitive Season

**Context:** The use of monitoring systems (e.g. Global Positioning Systems (GPS), heart rate monitors) to determine metabolic and physiological requirements within different sports is increasing in popularity. However, little to no information exists on the metabolic and physiological needs during Division I women's soccer.

**Purpose:** To measure heart rate data and energy expenditure in college soccer players during the regular competitive season.

**Methods:** Twelve college female soccer players (19.3 ± 1.6 yrs, 167 ± 3.0 cm, 62.4 ± 4.9 kg) were included based on playing time (>60%). Measures recorded for all players included average heart rate (AvHR), average heart rate percentage (AvHR%), peak exercise heart rate (HRpeak), percentage of time spent in heart rate zones (%TM1, %TM2, %TM3) and energy expenditure per kilogram (EE). Differences between positions, center backs (CB), full backs (FB), midfielders (MF) and forwards (FW), were assessed.

**Results:** Significant differences (p≤0.05) were observed across positions for parameters measured. AvHR for CB and MF was significantly lower than FW (168.9±5.8 vs. 179.6±6.9 bpm, 172.7±7.8 vs 179.6±6.9 bpm). CB AvHRs were also significantly lower than FB (168.9±5.8 vs. 177.3±5.9 bpm). MF HRpeak was significantly lower than all groups. CB HRpeak was also significantly lower than FW (195.5±3.6 vs. 200.2±5.0 bpm). AvHR% was significantly lower and %TM1 was significantly higher for CB compared to all groups. For %TM2, MF were significantly higher than CB (81.7±12.7 vs. 68.7±20.0%) and FW (81.7±12.7 vs. 68.3±16%). FW were significantly higher than MF for %TM3 (27.7±17.4 vs. 11.1±14.3%) EE was significantly higher for MF compared to all groups.

**Conclusion:** Results identified positional differences for metabolic and physiological needs during competitive D1 college soccer. This information could contribute to the understanding of the game and implementing specific training regimens.
Effects of Heavy Squat Training on a Vibration Platform on Maximal Strength and Jump Performance in Resistance-Trained Men

**Context:** Whole body vibration (WBV) has become a popular mode of training for athletes and fitness enthusiasts as either an alternative or a complementary procedure to their routine strength and/or power training.

**Purpose:** To determine maximal strength and jump performance outcomes of heavy squat training on a low-amplitude (<1.0 mm peak-to-peak) vibration platform (VP).

**Subjects:** Nineteen recreationally resistance-trained college-aged men (22.3 ± 1.66 years) completed the six-week study.

**Methods:** Participants were randomly assigned to one of two training groups: SQT (n = 10) performed conventional back squats on the floor and SQTV (n = 9) performed back squats on the VP. Supervised training took place over 12 sessions (2 d/wk), which used an aggressive strength development protocol (85–95% 1 repetition maximum [1RM]), which was identically followed by both groups.

**Results:** After the intervention, both groups showed (via t-test) a marked increase (p < 0.001) in 1RM squat strength (SQT = 34.5 kg vs. SQTV = 36.2 kg), but there was no significant difference (via mixed analysis of variance) between groups (p = 0.875). Standing broad jump performance increased by an average of 5–6 cm but was not significantly changed in either group (SQT; p = 0.199, SQTV; p = 0.087).

**Conclusions:** Squats performed with whole body vibration (WBV) were not superior to conventional squats with respect to maximal strength and jump performance outcomes. There was no additive effect of superimposed WBV training on strength beyond that caused by strength training alone. This study can help strength conditioning professionals and athletes make an informed decision on whether to invest in a VP and use WBV as an alternative or a complementary mode of training.
Associations Between Bullying and Intent to use Electronic and Combustible Cigarettes Among Children and Young Adolescents from Low-Income Families

**Background:** In youth, bullying has been shown to predict intentions to use combustible cigarettes. The introduction of electronic(e) cigarettes has led to recent increases in tobacco product use among U.S. middle and high school students. Little is known, however, about the association between bullying and intent to use e-cigarettes among children and young adolescents who have never tried combustible or e-cigarettes.

**Methods:** Data were collected from a cross-sectional sample of youth aged six – 14 years from low-income families enrolled in a summer program in the Midwestern United States (n = 318). Associations between bullying and intent to use e-cigarettes in adulthood were analyzed using logistic regression, controlling for demographics and e-cigarette exposure. A similar model was used to examine intent to use combustible cigarettes.

**Results:** From this ethnically diverse sample (69.4% non-white), 68.2% self-reported bullying, victimhood, or both (bully-victim). Analysis showed 15.9% had intent to use e-cigarettes and 13.8% to use combustible cigarettes in adulthood. Multivariate analysis showed associations between bullying and intent to use e-cigarettes (adjusted odds ratio [AOR]=23.42, 95% CI=2.09–262.27) and combustible cigarettes (AOR=19.61 and 95% CI=3.39–113.51). Bully-victims had marginally significant higher odds of intent to use e-cigarettes (AOR=8.39, 95% CI=0.94 – 74.7 p=.056) and significantly higher odds of intent to use combustible cigarettes as adults (AOR=7.80, 95% CI=1.65–36.85). There were no associations with victimhood.

**Conclusions:** Among this sample, those who reported bullying had greater odds of intent to use e-cigarettes and combustible cigarettes in adulthood. These findings suggest a need for targeted interventions before tobacco experimentation begins.
The Two-to-Four Year Transition in Public Health Education: Guidelines for Collaboration

Mid-Michigan College (Mid) and Central Michigan University (CMU) began collaborating in 2014 to increase the number of Health Education courses that transferred between the two institutions. Using the 2014 report, “Community Colleges and Public Health Project: Final Report” created by the collaboration between the League for Innovation in the Community College and the Association of Schools & Programs of Public Health as a model, Mid and CMU expanded transferrable program offerings from four courses to the development of an associate degree in Public Health in 2017. During program development review at Mid, Community/Public Health scored third on potential new programs according to occupational outlook (state and national), salary, potential return on investment, and regional competition. The Associate in Applied Science (AAS) is the result of the collaboration with CMU and the program development process. Additionally, Mid collaborated with Everyday Life Consulting, LLC, to offer a non-credit bearing credential for Community Health Workers that would ladder into the AAS in Public Health. The resulting long-term career pathway between Mid and CMU provides career and workforce development opportunities that may begin as a short-term training program and AAS at Mid transitioning to a bachelor’s degree (Health Educator) and master’s degree in Public Health at CMU. All degrees can also stand alone.

With an increased need for a community and public health workforce, this project was designed to encourage a continuum of education in public health, beginning at the community college level with a special focus on entry-level employees in need of basic educational skills and an introduction to principles of public health. The collaboration between Mid and CMU is leading the wave of the future in Michigan with this innovative preparation of public health workers. Of the 62 credits required for the associate degree, 53 directly transfer to CMU to pursue a bachelor’s degree. The remaining nine credits transfer as electives and are specifically designed to enter the workforce after completion of the associate degree.
Placental Pathology Findings and BWD

**Purpose:** Our study aimed to investigate the pathological characteristics of the cord and placenta associated with fetal sex.

**Methods:** A retrospective cohort of twins born in British Columbia Children and Women’s (C&W) Hospital for a period of a decade (2000-2010) was studied. Data were abstracted from pathology reports and linked with information from mothers and babies’ suites. The pathology data were then linked to delivery outcome data such as gestational age and birth weight by Perinatal Services British Columbia. Incidences of placenta and cord characteristics were compared between male and female. Bivariate analysis was used to determine significant variables that were to be included in the generalized estimating equation regression analysis.

**Results:** Twenty-six percent of twins were monochorionic and 74% were dizygotic. More than 50% of twins were male and 66.6% were sex concordant. Of sex-concordant twins, 34.7% were male-male and 31.2% were female-female. Adjusted for chorionicity, birth weight discordance (BWD) ≥30% and gestational age, the odds of chorionitis, anastomosis, unequal sharing of placenta, placental inflammation and lesions were higher in male twins compared with females. Twins of either sex from sex-discordant pairs were less likely to have placental anastomosis compared to the reference category. Males from male-male pairs had higher odds of unequal placental sharing (74% higher) and composite inflammation (52% higher) compared with the reference twins.

**Conclusion:** Our findings suggest a relationship between sex and placental pathological results.
Age of Menarche, Heritability and Birth Weight

**Purpose:** This study attempts to first estimate the effects of birthweight and sex discordance on age at menarche. Secondly, we used genetic analysis to assess the contribution of genes versus environment using a maximum likelihood analysis.

**Method:** We had two main objectives: (1) to estimate the effects of birthweight and sex discordance on age at menarche and (2) to estimate the genetic component of age at menarche. We studied twins registered at State Washington Twin Registry. A group of female-female monozygotic (n=994, 497 pairs), female-female dizygotic (n=296, 148 pairs) and females from opposite sex twin sets (n=168) replied to a reproductive health questionnaire. The primary goal of this study was to use a modern maximum likelihood quantitative genetic method to estimate the heritability (h²) of age at menarche. The second goal was to study the role of sex discordance and birth weight on onset of menarche.

**Result:** Birth weight was positively associated with age of menarche (r=0.07, p<0.01) but not sex discordant. After adjusting for birthweight, the monozygotic correlation for age of menarche (0.59) was about 4.21 times the dizygotic correlation (0.14). The optimal fitted model for heritability of age of menarche was AE model identifying the additive genetic effect (0.58) and non-shared environment effect (0.41) as the main determining factor.

**Conclusion:** Age of menarche is genetically determined. From the potential intra-uterine environmental factors, birth weight seems to be related to age of menarche but not sex discordance.
Is There a Relationship Between Fetal Sex and Placenta and Cord Characteristics in Twin Gestations?

**Purpose:** To assess the fetal, perinatal and maternal outcomes in twin pregnancy according to chorionicity.

**Methods:** This was a retrospective cohort study of 1,571 twin pregnancies with placental pathological examination collected from 2000-2010. Fetal, neonatal and maternal outcomes of twins were compared via multivariate analysis.

**Results:** Placenta anastomosis, unequal placenta sharing, cord size and cord insertion type were found to be the key elements that impacted growth discordance in twin gestations. Higher rates of severe growth discordance were negatively associated with higher frequencies of anastomosis. Placentas in monochorionic twins were more likely to have shared arteries/veins.

**Discussion:** Monochorionic placentas compensate for lack of nutritional flow by penetrating to other placenta surfaces. Compensation for lack of vascular sufficiency would mean a fused placenta or sharing more portions of the placenta. Higher rates of unequal placenta sharing among growth discordant twins is reported irrespective of chorionicity.

**Conclusion:** Attention to placenta pathology is important in growth discordant twins.
Factors Associated with Condom Use Among African American and Hispanic/Latino Youth

**Introduction:** There are various factors that affect condom use among individuals. It is important to examine factors that affect a person’s intent to use condoms or not to prevent the transmission of sexual health infections and diseases such as HIV/AIDS. Research has shown that African American and Hispanic/Latino youth are at an increased risk of contracting HIV/AIDS and other sexually transmitted infections and diseases.

**Purpose:** To examine various factors that affect condom use among African American and Hispanic/Latino youth.

**Methods:** Data from the 2015 Youth Risk Behavior Surveillance System (YRBSS) was analyzed. The survey used a three-stage cluster sample design to produce a representative sample encompassing data from all public, catholic and other private schools from 9th through 12th grade throughout the United States.

**Results:** Among African American youth, condom use was more likely among males (2.09; 95% CI: 1.45-3.02) compared to females and less likely among gays/lesbians compared to heterosexuals (0.33; 95% CI: 0.12-0.90), adjusted for confounders. Among Hispanic/Latino youth, condom use was more likely among males (1.70; 95% CI: 1.25-2.31) compared to females and less likely among gays/lesbians (0.16; 95% CI: 0.57-0.44) and those who used alcohol/drugs during last sex (0.54; 95% CI: 0.37-0.78), adjusted for confounders.

**Conclusion:** For both racial groups, females and those identifying as gay or lesbian were more at risk of not using condoms. For Hispanic/Latino youth who used alcohol/drugs during last sex, they were more at risk of not using a condom. This study can be used to identify culturally appropriate interventions that must be implemented to encourage greater condom use amongst African American and Hispanic/Latino youth.
**Sex Discordance and Breast Cancer-A Twin Study**

**Purpose:** To perform an analysis of the relationship between sex discordance and risk of breast cancer in female twins in the United States.

**Methods:** A cross-sectional study of 14,462 female twins was conducted using data from Washington State Twin Registry (WSTR) in the USA. The variables collected included, BMI, age, race and zygosity. This study used Generalized Estimating Equation (GEE) modeling to determine the relationships between twin pairs and variables of interest such as breast cancer and sex concordance. Zygosity, BMI, age and race were used for adjustment. Proband wise concordance was done to ascertain the heritability of breast cancer in twins.

**Results:** Being a female-female twin pair increased the odds of breast cancer by 34% (95%CI: 1.18-1.53). After adjusting for zygosity, age, BMI, race, and childbirth, the odds of breast decreased by 31% in female-female twin pairs [AOR (95%CI):0.69 (0.53-0.90)]. The proband wise concordance was higher in monozygotic twins as compared to dizygotic twins. The values for dizygotic and monozygotic twins were four and 17 respectively.

**Conclusion:** The findings of the study show that there is a positive association between sex discordance and breast cancer in female twins though other factors such as zygosity, BMI and age can influence breast cancer diagnosis. From our study, the proband wise concordance for monozygotic twins was higher than that of dizygotic twins. Breast cancer is therefore considered heritable.
Are Socio-Demographic Factors, Awareness and Access Responsible for the Uptake of Human Papilloma Virus Screening

**Background:** Uptake of Human Papilloma Virus screening (including Pap test and Human Papilloma Virus DNA test) can be affected by socio-demographic factors. Low level of screening is one of the factors responsible for the high incidence of cervical cancer in United States.

**Purpose:** To study predictors of the uptake of Human Papilloma Virus screening including awareness, access to screening & sociodemographic factors.

**Methods:** A cross-sectional study of 33,672 women was conducted using the 2015 National Health Interview Survey. Data was obtained through multistage sampling. Inclusion criteria are women aged 18 years old and above. Outcome: Uptake of Human Papilloma Virus screening. Predictors: Awareness and access to Human Papilloma Virus screening including socio-demographic factors.

**Results:** Compared to the women in the Southern region of the United States, women in the Northeast and Midwest regions have 14% (95% CI 0.742-0.990) and 15% (95% CI 0.756-0.965) lower odds of uptake of Human Papilloma Virus screening. In comparison to women who live with a partner, women who are married have 88% higher odds of screening (95% CI 0.157,0.213). Women who are aware of Human Papilloma Virus have 18% lower odds of having screening (95% CI 1.564-2.261) compared to those who are not aware. Women who paid none of the cost of screening have 26% lower odds of having screening (95% CI 0.604-0.917), compared to women who paid all the cost.

**Conclusion:** Awareness and access to Human Papilloma Virus screening as well as socio-demographic factors can influence the uptake of Human Papilloma Virus screening. Recommendations for screening and educational campaigns may not be effectively reaching under-screened women.
Validity of Common Body Core Temperature Measurement Sites in Hyperthermic Humans Wearing American Football Uniforms

Context: Valid body core temperature measurements are essential for diagnosing and monitoring patients with exertional heat illness (EHI). American football uniforms put athletes at risk of EHI because they increase metabolic activity and decrease heat dissipation. No research has established the validity of common body temperature sites when American football uniforms are worn during clinically-applicable situations. Therefore, we determined the criterion-related validity of four body temperature measurement sites when participants wore an American football uniform during rest, exercise, cold water immersion (CWI), and post-immersion recovery. We hypothesized all body temperature sites would be considered invalid (i.e., all body sites would differ from rectal temperature [Trec] by more than 0.27°C).

Methods: Thirteen men (age=22±2 y, mass=77.5±8.8 kg, height=181.3±5.7 cm, body fat=6.9±2.9%, body surface area=1.98±.13 m2) completed this cross-sectional laboratory study. Participants donned a full American football uniform (shoes; socks; undergarments; athletic shorts; three-quarter length pants with hip, knee, tailbone, and thigh padding; t-shirt; shoulder pads; mesh jersey; helmet) and entered an environmental chamber (~39°C, 39% humidity). Trec was compared to temperatures recorded from a liquid-crystal sticker placed over the forehead (FHD) and thermometers inserted in the axilla (AXL), mouth (ORL), and ear canal (EAR). Temperatures were recorded from each site during a 10-minute rest period; exercise until Trec reached 39.75°C; CWI (9.95±0.12°C) until all thermometers read ≤38°C; and a 15-minute post-immersion recovery period. Overall, we compared 34 measurements (11 during rest, 10 during exercise, 10 during CWI, and three during recovery). We calculated temperature differences (i.e., bias) between sites and our criterion-gold standard, Trec, for each experimental period. Repeated measures analyses of variance and Tukey-Kramer post-hoc tests assessed differences in bias between sites; similar statistics were used to compare raw temperatures between sites over time (NCSS v.2007, α=0.05).

Results: Total bias differed between sites (F1,13=75.7, P<0.001). AXL bias (mean±SD, 4.66±1.88°C) was higher than ORL (1.04±0.24°C), FHD (-0.29±0.39°C), and EAR (0.47±0.21°C; P<0.05). ORL also differed from FHD (P<0.05). No statistical differences occurred between EAR and FHD or ORL and EAR (P>0.05). For raw temperatures, AXL statistically differed from Trec and exceeded our 0.27°C bias threshold at all times (34/34). FHD statistically differed from Trec eight times during rest; eight times during exercise; 0 times during CWI; and twice during recovery (18/34, 53%). FHD exceeded our bias threshold 28 times during the study (82%). EAR statistically differed from Trec five times during rest; 0 times during exercise; five times during CWI; and once during recovery (11/34, 32% overall). EAR exceeded our bias threshold 15 times during testing (44%).

Conclusions: AXL, FHD, EAR, and ORL thermometers should not be used to diagnose or monitor body core temperature in American football players suffering from EHI. Trec remains the clinical gold-standard body core temperature site.
Sweat Characteristics in Individuals with Varying Susceptibilities of Exercise Associated Muscle Cramps

**Context:** Many medical professionals believe dehydration and/or electrolyte losses cause exercise associated muscle cramps (EAMCs). Data from field studies demonstrated athletes with a history of EAMC (i.e., crampers) had higher sweat sodium concentrations ([Na+]sw) and sweat losses than athletes without EAMC history (i.e., noncrampers). However, these studies did not account for factors that can influence sweat characteristics or varying EAMC susceptibilities.

**Objective:** To compare [Na+]sw, sweat potassium concentration ([K+]sw), sweat chloride concentration ([Cl−]sw), and sweat rate (SWR) in individuals with varying EAMC susceptibilities while accounting for initial hydration status, diet and fluid intake, exercise duration and intensity, and environmental temperature and humidity.

**Interventions:** Sixteen females and 14 males (age=21±2y, mass=69.1±11.6kg, height=171.4±9.9cm) self-reported EAMC history and were divided into three groups: no EAMC history (n=8; never experienced EAMC); low risk (n=10; EAMC occurred in one muscle, never recurred during exercise, or EAMC did not affect performance); or high risk (n=12; EAMC recurred during exercise, EAMC occurred in multiple muscles, or medical help was sought for EAMC). We measured maximum oxygen consumption (VO2max) and taught subjects how to keep a diet log. At least three days later, euhydrated subjects ran at 70% of their VO2max for 30 minutes in the heat (40.0±0.5°C, 36.1±1.8% humidity). Sweat was collected from the posterior forearms and analyzed using ion-selective electrodes. SWR was estimated from pre- and post-exercise nude body weights and normalized using body surface area (BSA). Average daily fluid intake, dietary Na+, and dietary K+ ingestion was estimated from the diet logs for the three days immediately preceding sweat testing.


Measures of central tendency were calculated. Nonparametric and parametric inferential statistics were utilized as appropriate. Alpha level was set a priori at 0.05 (NCSS v.2007). Results: We observed no differences between the three groups for [Na+]sw (F2,27=0.61, P=0.55), [K+]sw (F2,27=3.5, P=0.05), [Cl−]sw (F2,27=0.5, P=0.61), SWR/BSA (F2,27=0.8, P=0.47), dietary Na+ (F2,29=1.97, P=0.16), dietary K+ (F2,29=0.89, P=0.42), and fluid intake (F2,29=0.32, P=0.73). We combined the cramp groups and re-analyzed them against the non-cramping group. Again, there were no differences for [Na+]sw (crampers=56±15 mmol/L, noncrampers=58±14 mmol/L, t28=0.5, P=0.68), [K+]sw (crampers=4.1±0.3 mmol/L, noncrampers=4.5±0.8 mmol/L, Z28=1.1, P=0.86), [Cl−]sw (crampers=67±22 mmol/L, noncrampers=72±22 mmol/L, t28=0.5, P=0.69), SWR/BSA (crampers=0.66±0.15 L/h/m2, noncrampers=0.59±0.11 L/h/m2, t28=1.2, P=0.11), dietary Na+ (crampers=3074.7±1290.4 mg, noncrampers=3863.0±1182.5 mg, t28=1.5, P=0.93), dietary K+ (crampers=1833.0±1056.7 mg, noncrampers=1634.7±1093.5 mg, t28=0.4, P=0.32), and fluid intake (crampers=47.3±47.2 oz/d, noncrampers=70.1±32.8 oz/d, Z28=1.1, P=0.86).

**Conclusions:** Crampers had similar sweat electrolyte concentrations and SWR as non-crampers when multiple factors known to influence sweat characteristics were controlled. EAMCs may not be directly attributable to fluid and/or electrolyte losses.
Cryotherapy and Thermotherapy Application Prior to Proprioceptive Neuromuscular Facilitation (PNF) Contract Relax (CR) Stretching

**Context:** Modalities are commonly applied before stretching. It is suggested moist heat packs (MHP) prior to static stretching facilitate hamstring flexibility. Where cryotherapy prior to static stretching is suggested to produce greater gains in flexibility than MHP. What is unknown is whether these modalities influence flexibility when applied prior to proprioceptive neuromuscular facilitation (PNF) stretching.

**Objective:** Determine if cryotherapy or thermotherapy influences passive hip flexion ROM, when applied prior to PNF-contract relax (CR) stretching.

**Design:** Randomized controlled study.

**Setting:** Laboratory.

**Patient or other Participants:** Thirty subjects (n=25 female and n=5 males; age=21.07±1.86yrs, ht=171.53±9.98cm, mass=64.54±9.61kg) with adipose tissue (<20 mm) and less than 90° of hip flexion ROM participated.

**Intervention:** A 2x3x6 repeated measures factorial guided data collection. Independent variables were stretch type (PNF-CR or nothing), treatment (ice bag, MHP, and nothing), and day (one, two, three, four, five, six). Subjects reported on six days separated by 24 hours. On the first day, we obtained demographic information and randomly assigning subjects to a treatment and stretch type. For testing, we positioned subject’s supine, wearing shorts. To ensure consistency for ROM, a mark was placed on the anterior tibia. To minimize accessory movement of the hip and contralateral leg, straps were placed across the hip and uninvolved leg just superior to patella. We then passively moved the dominant leg (kicking leg) into passive flexion until their reported end ROM. This point was recorded in triplicate using a bubble inclinometer. Subjects then received one of the three randomly assigned treatments. While prone, two ice bags or two MHP’s were applied to hamstrings for 20 minutes. Those randomly assigned to receive nothing, remained stationary on the table during the 20-minute time. After each treatment, subjects were again positioned supine and stretched using a PNF-CR method; three sets of six second contractions performed three times. Immediately following stretching, passive hip flexion ROM was recorded in triplicate.

**Main Outcomes Measures:** Average pre-treatment passive hip flexion ROM on day one and post-treatment ROM on day six.

**Results:** A significant main effect interaction for treatment and day occurred (F5,23=4.72, P=.004). Ice bag and MHP prior to PNF-CR stretching did not influence hip flexion ROM (ice bag, day one pre: 77.88±6.98°; day six post: 85.91±3.88°; MHP, day one pre: 75.11±3.54°; day six post: 85.38±9.50°; P>.05) when compared to PNF-CR alone (day one pre: 74.81±5.59°; day six post: 88.64±8.60°). Ice bag and MHP application prior to PNF-CR stretching was greater than those receiving nothing (P<.05). Passive hip flexion ROM did not change across time for those receiving nothing (P>.05).

**Conclusion:** A 20-minute ice bag nor MHP influenced passive hip flexion ROM when applied before PNF-CR stretching. These modalities may not be necessary when used in conjunction with PNF-CR stretching.
Athletic Training
Presenter – Blaine Long, Ph.D., AT, ATC

Clinical Perceptions on the Physiological, Psychological, and Clinical Influence of Kinesio Tex Tape (KTT) in Health Care Practice

Context: Kinesiology (Kinesio or (KTT)) has become popular in clinical practice. Evidence on its effectiveness, however, is conflicting. Some investigators support while others refute its physiological effects. To date, there is limited information on the psychological effects (e.g., placebo effect) of KTT or whether its application has been influenced by professional athletes.

Objective: Assess Athletic Trainers’ and other health care providers’ perception on the physiological, psychological, and clinical influence of KTT.

Design: Survey-based questionnaire assessing descriptive data.

Setting: Online survey.

Patients or other Participants: A random sample of NATA members (n=1,000) received the survey; 21% (n=209) partially completed the survey and 16% (n=164) completed all portions. A majority of respondents were credentialed as Athletic Trainers (99%) who worked in the college/university (43%), secondary school (32%), secondary school/clinical outreach (26%), and sports medicine clinic or hospital (15%).

Intervention: Our survey included 38 questions: 17 Likert questions assessing likeliness and level of support, 10 related to use and knowledge of KTT, and 10 demographic questions.

Main Outcome Measures: We examined descriptive data (%) for the 16% of respondents who completed all portions of the survey.

Results: Most (84%) reported never completing a KTT class, yet 90% had used KTT and learned it from colleagues or online video’s. Many (76%) felt patients benefited from KTT, but 93% used KTT in less than 20% of their time. Over half (65%) felt it provided a physiological and psychological benefit. A small percentage, felt there was sufficient research on the physiological (20%) and psychological (18%) effects of KTT. Those (77%) who thought KTT provided a physiological benefit, indicated they would use it. However, over half (62%) indicated they would not use KTT if they did not feel the tape provided their patients with a physiological benefit. In addition, if it was reported in the literature that KTT provided a physiological benefit, 88% would use the tape. If it is reported the tape did not provide a physiological benefit, 90% would not use apply it. Many (71%) also indicated if KTT benefited their patients psychologically, they would use it in clinical practice. Respondents also indicated if published research provided evidence supporting a psychological benefit, 68% would utilize KTT. If, however, published literature suggested KTT did not provided a psychological benefit, 63% were less likely to incorporate it. Nearly all respondents (99%) have observed professional athletes wear KTT. In addition, 71% indicated they were recommended to apply KTT after watching professional athletes. Of the respondents, 59% reported KTT worn by professional athletes has influenced their practice. In addition, if the tape did not provide their patient with any physiological effect, 78% would not apply it for aesthetic reasons. In assessing written feedback, a trend regarding cost was as a major drawback on it use. Many respondents provided written feedback indicating they would apply the tape only if it was purchased by the patient regardless if it impacted the perceived physiological or psychological aspects of their clinical practice.

Conclusion: Clinicians often use KTT for its suggested physiological benefits. It appears however that many may apply the tape for its psychological benefit. Most clinicians have observed KTT application where over half indicated it has influenced their clinical practice. Most concede that sufficient research has yet to be published to support or negate its physiological or psychological benefits.
Comparison of Muscle Activity in a Person with Servere Stroke During a Sit to Stand Activity With and Without Mechanical Patient Handline Equipment. A Case Study

Context: Safe patient handling and mobility (SPHM) equipment helps caregivers and therapists mobilize difficult to move patients in order to reduce risk of injury, but also to promote recovery and active engagement during the rehabilitation process. There is limited research looking at muscle activity during rehabilitation when safe patient handling equipment is utilized as compared to manual assist from a therapist during rehabilitation.

Purpose: To compare muscle activity in the lower extremities (LE) in a person with severe stroke during a repeated sit to stand activity under three assisted conditions: manual assist by a PT (MA), mechanical assist by a floor-based sit to stand lift (FL), and mechanical assist by an overhead lift (OL).

Methods: Surface EMG markers analyzed LE muscle activity in a person with severe hemiplegia from stroke during sets of repeated sit-to-stand activities with three types of assistance (MA, FL, OL). The patient was instructed to provide maximal effort when performing each set of the sit to stand movements. Results: Preliminary data analysis suggests that of the three conditions, greatest muscle activation of both the affected side and non-affected LE was recorded during the sit-to-stand activity using the OL. FL and MA conditions yielded less activation of the affected lower extremity as compared to OL.

Discussion: Use of the OL promoted the greatest muscular engagement as compared to MA and FL. This suggests that using the OL may offer the greater opportunity for neuromuscular re-education of LE as compared to MA or FL.

Conclusion: Therapists should consider SPHM equipment to improve muscular engagement, while at the same time reducing risk of injury for themselves during rehabilitation of neurologic conditions.
Acute Changes in Gait Characteristics in People with Parkinson’s Utilizing Walking Sticks

**Background:** Parkinson’s disease (PD) can result in decreased stride length and walking speed. Walking programs are effective in people with PD (PwPD) to minimize effects on walking. Nordic Walking (NW) utilizes the use of poles to increase arm movement, stride length, and stability during long-term use.

**Purpose:** To assess if NW can induce acute changes in gait characteristics in PwPD compared to normal walking. A secondary purpose was to gain insight into participants’ perception about using NW poles.

**Methods:** Nine individuals with PD performed Two-Minute Walk Tests (2MWT) in three separate trials; without the use of NW poles (Trial one), with the use of NW poles (Trial two), and a repeated trial without the use of NW poles (Trial three). Gait characteristics were assessed using the APDM Opal system. Pre-post test measures and gait speed were analyzed using a two-way repeated measures ANOVA and paired two-tailed t-test. Perceptions about using the NW poles were collected via interviews.

**Results:** There were no statically significant changes noted in stride length, gait speed, or lateral step variability from Trial one to Trial three. Statistically significant reduction in gait speed was noted from Trial one to Trial two. Most participants reported using the walking poles improved sense of stability.

**Conclusion:** Results suggest long-term training with NW poles is needed to see changes in gait characteristics. PwPD have difficulty with tasks that have a cognitive and physical component such as using walking poles, which may explain reduction in gait speed.
The Impact of Community-Based Programs Among Rural Participants with Neurologic Conditions

Introduction: Throughout the United States, individuals living in rural areas have increased health disparities and limited access to healthcare when compared to their urban counterparts. Research has been conducted focusing on rural health disparities on individuals with neurologic conditions, such as Multiple Sclerosis (MS), Cerebral Vascular Accident (CVA), Parkinson’s Disease (PD), and Huntington’s Disease (HD), and on the importance of community-based programs, but at this time, limited studies exist combining the three topics. There is a continued need to determine the importance and effectiveness of community-based programs, such as Physical Therapy-Chippewa Outreach in Neurorehabilitation and Education with Community Teams (PT-CONECT) and MOVE! for Health, in rural populations to address health disparities.

Purpose: To explore the impact of community-based programs with 2nd year Doctor of Physical Therapy students on community members with neurologic conditions in the rural communities of Mount Pleasant and Houghton, Michigan.

Methods: This study utilized a mixed methods approach that included a survey and semi-structured interview. 19 participants from the Mount Pleasant region and eight participants from the Houghton satellite campus completed surveys and interviews. Constant comparative method was used to analyze interview data and identify themes.

Results: The preliminary results from 27 participants indicate transportation distance to CMU’s community-based programs averaged 15 miles, distance to see their neurologist averaged 110 miles, and distance to see their movement disorder specialist averaged 100 miles. The three major themes discovered from community members that were interviewed included the need to increase the prevalence of community-based programs in rural regions, the collaboration with 2nd year Doctor of Physical Therapy students, and the value of education on the management of their neurologic condition.

Conclusion: Community members with health disparities and neurologic conditions from rural communities in Michigan were positively impacted by community-based programs. Community outreach programs offered by CMU 2nd-year DPT students addressed health disparities in rural communities.
The Relationship Between the PA School Admissions Exam (PA-CAT) Versus Prerequisite GPA

Objective: PA programs often set minimum GPA and graduate record examination (GRE) requirements for admission, citing that candidates with higher admission GPA and GRE scores will perform better in the PA program. However, to date, there are limited published studies that have investigated the validity of using these preadmission characteristics to predict performance in PA programs or on the PANCE exam. In regard to the studies that are available, there were inconsistent results. The development of a physician assistant admission college entrance exam that has predictive validity to determine PANCE success would give PA admissions committees an addition resource to make admission decisions. This study is being conducted to determine the strength of relationship between PA-CAT and prerequisite GPA. The development of an admissions exam could provide a valid instrument for PA faculty to make admissions decisions in the future.

Methods: The PA-CAT is comprised of 180 questions covering 12 subject areas based upon research identifying the relative importance of that subject to success in the PA curriculum. IRB approval was obtained from University of Tampa. Version 1.1, 1.2 and 1.3 was administered through secured computer-based testing delivery to 479 PA students newly admitted to PA programs distributed throughout the United States. Regression analysis was conducted with 479 cases with scale scores from Rasch analysis as the predicted variable and two predictor variables (undergraduate GPA and undergraduate science GPA).

Results: The Pearson correlation coefficient between undergraduate GPA and scale scores is 0.16 and the correlation between undergraduate science GPA and scale scores is 0.22. Although these correlation coefficients are statistically significant (p<0.001), the strength of the correlation is not strong. The regression coefficient of undergraduate science GPA is statistically significant (p<0.01). An examinee with an undergraduate science GPA of one point higher is expected to score 17.39 scale score points higher on the PA-CAT exam. This translates to about nine-tenth of the standard deviation of the sample scale scores. The regression coefficient for the undergraduate GPA is not statistically significant.

Conclusion: Early results from this research study demonstrates there is statistical significance between the PA-CAT and prerequisite science GPA in newly admitted PA students. Limitations of the study include the fact that students voluntarily took this exam without consequence. Further study is needed to determine if the exam can be generalized to the entire PA applicant pool thereby providing a valid instrument for admissions decisions.
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