



Leading and Inspiring Movement, Health, & Performance

# Book of Abstracts 2019



UNIVERSITY OF SASKATCHEWAN

College of Kinesiology

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# College of Kinesiology Student Research Showcase 2019 Schedule

## April 1, 2019

- 2:30pm- Opening remarks from Dr. Chad London (**PAC 232**)
- 2:45-5:00pm- Honours presentations (**PAC 232**)

## April 2, 2019

- 11:30-12:50pm- Research presentations in **PAC 232**
  - Dr. Kent Kowalski- 11:30-11:50
  - Dr. Saija Kontulainen- 11:50-12:10
  - Drs. Marta Erlandson and Corey Tomczak- 12:10- 12:30
  - Drs. Amanda Froehlich Chow & Louise Humbert- 12:30-12:50
- 1:00-3:00pm- Student research poster presentations (**PAC 2nd floor foyer**)

## April 3, 2019

- 2:30-5:00pm- Honours presentations (**PAC 232**)
- 5:00pm- Closing

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# Honours Presentation Schedule

Abstracts arranged alphabetically by last name

## MONDAY April 1- 2:30-5:00 (PAC 232)

2:30	Introductions & Welcome	Dr. London
2:45	Anthony Kanz	Dr. London
3:00	Katie Latoski	Dr. Oates
3:15	Lindsay McInnes	Dr. Rodgers/Ms. Forrester
3:30	Annika Streilein	Dr. Farthing
<b>3:45</b>	<b>BREAK</b>	<b>BREAK</b>
4:00	Madison Williams	Dr. Foulds
4:15	Ashley Libke	Dr. Erlandson
4:30	Ethan Kish	Dr. Lanovaz
4:45	Matthew Chapelski	Dr. Erlandson

## WEDNESDAY April 3- 2:30-5:00 (PAC 232)

2:30	Kylee Kosokowsky	Dr. Tomczak
2:45	Chris Campbell	Mr. Hillis
3:00	Sami Leung	Dr. Humbert
3:15	Alexandra Brecht	Dr. Kontulainen
<b>3:30</b>	<b>BREAK</b>	<b>BREAK</b>
3:45	Hailey Brown	Dr. Humbert
4:00	Corey Blushke	Dr. Tomczak
4:15	Julia Koop	Dr. Spink
4:30	Katherine Rawlyk	Dr. Ferguson

## Cardiovascular Responses to the Exercise Pressor Reflex in Pediatric Heart Transplant Recipients

Student: Corey Blushke

Supervisor: Dr. Corey Tomczak

**Introduction:** Pediatric heart transplant recipients (HTR) have reduced exercise tolerance despite normal systolic ventricular function. A slower heart rate adaptation to exercise in HTR due to cardiac denervation is commonly observed in HTR patients, which explains, in part, the exercise intolerance. We tested the hypothesis that the cardiovascular response to exercise pressor reflex activation from handgrip exercise would be blunted in HTR.

**Methods:** Six pediatric HTR (3f/3m; mean±SD, 10±3 yrs) and five healthy-matched controls (CTL; 3f/2m; 10±2 yrs) were studied. After 3 min of resting baseline, subjects performed 2 min of isometric handgrip (HG) exercise at 40% maximal voluntary contraction, followed by 3 min post-exercise circulatory occlusion (PECO). Beat-by-beat mean arterial pressure, heart rate, and modelflow stroke volume and cardiac output were recorded. Data were analysed as the change ( $\Delta$ ) from rest using two-way repeated measures ANOVA ( $2 \times 3$ ; group  $\times$  condition) and Holm-Sidak multiple comparisons analysis. Significance was accepted at  $P < 0.05$ .

**Results:** Mean arterial pressure increased in HTR ( $\Delta 17 \pm 15$  mmHg) and CTL ( $\Delta 13 \pm 16$  mmHg) during HG ( $P < 0.001$ ) and remained elevated above baseline during PECO (HTR:  $\Delta 10 \pm 10$  mmHg; CTL:  $\Delta 11 \pm 9$  mmHg;  $P < 0.05$ ), with no between group differences. Heart rate did not significantly increase during HG in HTR ( $\Delta 4 \pm 5$  bpm,  $P = 0.235$ ) but did in CTL ( $\Delta 14 \pm 11$  bpm,  $P < 0.001$ ), and was 9 bpm lower in HTR vs CTL ( $P = 0.005$ ). Heart rate was not different during PECO from rest in HTR and CTL. Stroke volume increased in HTR ( $\Delta 3 \pm 1$  mL) and CTL ( $\Delta 3 \pm 3$  mL) during HG ( $P < 0.001$ ) and remained elevated above baseline during PECO (HTR:  $\Delta 3 \pm 2$  mL; CTL:  $\Delta 4 \pm 3$  mL;  $P < 0.001$ ), with no between group differences. Cardiac output did not significantly increase during HG in HTR ( $\Delta 0.34 \pm 0.21$  L/min,  $P = 0.074$ ) but did in CTL ( $\Delta 0.71 \pm 0.54$  L/min,  $P < 0.001$ ), and was 0.37 L/min lower in HTR vs CTL ( $P = 0.035$ ). Cardiac output was not different during PECO from rest in HTR and CTL.

**Conclusion:** Owing to the impaired heart rate response during handgrip exercise, cardiac output was lower in pediatric HTR compared to healthy-matched controls in response to exercise pressor reflex activation.

**Acknowledgments:** Natasha Boyes, Dana Lahti, Kylee Kosokowsky, Dr. Darcy Marciniuk, Dr. Scotty Butcher, Dr. Marta Erlandson, Dr. Kristi Wright, Dr. Scott Pharis, Dr. Charissa Pockett

## Hyperkyphosis and Physical Activity

Student: Alexandra Brecht

Supervisor: Dr. Saija Kontulainen

**Introduction:** Physical activity (PA) has important health benefits for older adults, particularly for those at risk for falls and fractures, such as individuals with hyperkyphosis (HK). However, it is unknown if HK is associated with objectively measured PA. My thesis objectives were to explore the associations between the degree of kyphosis and PA in individuals at risk of fracture and to test the following hypotheses: that the degree of kyphosis would be negatively associated with light PA (LPA), moderate PA (MPA), vigorous PA (VPA), and the number of daily impacts and the degree of kyphosis would be positively associated with sedentary time (ST).

**Methods:** For my cross sectional study, I utilized baseline data from 10 individuals, mean age 71.5 years, from the Nordic Walking intervention study. Participants were included if they had HK, osteoporosis, and/or vertebral fracture. I measured participant's degree of kyphosis using a kyphometer. Participants were asked to wear activity monitors (accelerometers) for 7 days and I calculated the number of daily minutes spent in ST, LPA, MPA, and VPA as well as the number of daily impacts obtained using the recommended methods. I tested my hypothesis using Pearson r correlation and I set significance as  $p \leq 0.05$ .

**Results:** There was no association between the degree of thoracic kyphosis and minutes of LPA, MPA, or the number of impacts  $>1.5g$  or  $>3.9g$  ( $p > 0.05$ ). The degree of kyphosis was negatively correlated with VPA ( $r = -0.632$ ,  $p = 0.05$ ). There was no correlation between the degree of kyphosis and ST ( $p > 0.05$ ).

**Conclusion:** My results suggest that HK was not associated with minutes of ST, LPA, MPA, and number of impacts, whereas HK seemed to be negatively associated with VPA in individuals at risk of fracture. These preliminary findings need to be addressed in a larger sample of participants and in future prospective studies. However, findings indicate that HK may not limit individuals' ability to participate in LPA and MPA and this evidence can direct future interventions.

**Acknowledgements:** The Nordic Walking research team. Funding: SCPOR, SHRF, RUHF

## Exploring fundamental motor skills in a child with autism

Student: Hailey Brown

Supervisor: Louise Humbert

**Introduction.** Autism Spectrum Disorders affect approximately 1 in 66 Canadian children, more commonly males. Children with ASD experience deficits in social, communication, and behavior; however, an emerging body of literature supports that they also experience deficits in motor skills. The motor skill deficits children with autism experience are apparent in their performance of fundamental motor skills (FMS). Deficits in FMS proficiency are concerning as FMS are often considered as a prerequisite to participation in physical activity for children and youth.

**Purpose.** To explore the impact of an intervention designed to increase the development of FMS in a child with autism.

**Methods.** The student researcher designed and delivered a home-based program to develop FMS in a single participant (Kyle). Trained research assistants used Ulrich's (2000) Test of Gross Motor Development 2<sup>nd</sup> Edition (TGMD-2) to assess Kyle's FMS proficiency pre and post-program. Qualitative methods of data collection included semi-structured interviews and field notes.

**Results.** The quantitative results suggest minimal changes in FMS proficiency after the program's completion; however some changes were observed in the raw scores. Three themes emerged from the qualitative data. *"Recognizing and supporting individuality"* describes the importance for educators to learn each child's unique challenges, abilities, and motivators within a physical activity environment. *"Rethinking visual self-stimulation"* supports the use of integrating sensory stimulation into physical activity programs. *"FMS development: a road to inclusion"* emphasizes the importance of FMS development for children with autism to become integrated in social settings.

**Conclusion.** More research is needed to investigate the efficacy of developing FMS in children with autism using home-based programs. Designing individual programs that reinforce a child's specific areas of interests as well as including activities that integrate preferred sensory stimulations may increase engagement in both programming and physical activity in general. Developing FMS is important for all children, however, for children with autism it may be a critical strategy to promote social inclusion.

**Acknowledgments:** Dr. Louise Humbert, Dr. Jon Farthing, Kyle and his family.

## **The Effect of Concurrent Power and Strength Training on Power Output in University-aged Males**

Student: Chris Campbell

Supervisor: Doug Hillis

**Introduction:** Power, the product of force and velocity, is one of the most important physical determinants of athletic performance. Most modern power training models follow traditional periodization principles, which dictate that training should progress through discrete, sequential phases that focus on hypertrophy, strength, and power separately. This design posits that cumulative hypertrophy and strength adaptations directly translate into maximal power output, however this notion is not currently evidence-based, as little research exists that critically examines its physiological validity. Thus, a blended power-strength model may prove to be a superior design, due to more efficient neuromuscular development, as well as its potential versatility in being applied to a wide variety of training schedules. Though several non-periodized training frameworks have been proposed, there is currently no published research examining such a concurrent strength-power model.

**Purpose:** To compare the effects of a simultaneous power-strength training program to that of a traditional periodized program on maximal power output during a countermovement jump in healthy university-aged males (n=11).

**Methods:** Participants were randomly assigned to two intervention groups and tested for maximal power output before and after an 8-week lower-limb power training intervention, via countermovement jump (CMJ) trials on a force plate. The Traditional-training Group (TG) performed a standard periodized strength-power program, and the Study Group (SG) completed a concurrent strength-power program. Pre- and post-test results were compared in terms of percent change in maximal power output.

**Results and Conclusion:** At the time of writing, data has been collected and is undergoing analysis.

## **Effect of a 12-week Fundamental Skill Intervention on the Physical Literacy levels of Children with Congenital Heart Disease**

Student: Matthew Chapelski

Supervisor: Marta Erlandson

**Introduction:** Children with congenital heart disease can struggle to reach the recommended daily physical activity levels in part because they lack the confidence and competence to be physically active. Not reaching these guidelines can be detrimental to both their short- and long-term health. Physical literacy assesses how competent and confident an individual is in their physical function. Improving a child's physical literacy may give them the competence, confidence, and motivation to live an active lifestyle thus impacting their health and well-being.

**Purpose:** The purpose of this study was to assess if a 12-week intervention is effective in increasing the physical literacy of children with congenital heart disease.

**Methods:** Seven participants, 8-16 years of age, had their physical literacy assessed pre and post intervention. The battery of PLAY Tools were used to assess the participants' physical literacy. The PLAYself was used to assess the child's perception of their physical literacy. The PLAYparent was given to their parents to assess the parents' perception of their child's physical literacy levels. The PLAYfun was used to test 18 fundamental skills divided into five movement domains (running, locomotion, upper body object control, lower body object control and balance) which provides an overall physical literacy score. A higher physical literacy score relates to greater competence and confidence. The intervention involved six bi-weekly sessions that consisted of fundamental movement skill practice such as: object control, locomotion and balance activities. Percent change and paired t-tests were run to compare pre and post values.

**Results:** All PLAYfun domain scores increased. A significant increase ( $p < 0.05$ ) was seen in the PLAYfun locomotor, upper body object control, and their overall physical literacy score. There was also a significant increase in confidence and comprehension of the balance domain. All other domains' confidence and comprehension increased; however, none were significant. The PLAYself and PLAYparent results all increased; however, none were significant.

**Conclusion:** Our findings show that a 12-week intervention improved the physical literacy levels of the participants. These findings are similar to other physical literacy interventions in health individuals that have founds increases in physical literacy levels after an intervention. As children with congenital heart disease are at an increased risk of physical inactivity, physical literacy development provides an exciting opportunity to increase physical activity and potential health benefits in this at-risk population.

**Acknowledgements:** CHAMPS participants, Ashley Libke, Dana Lahti, Corey R Tomczak, Kristi Wright, Charissa Pocket, Tim Bradley, and Scott Pharis.

## Exploring Perceptions of Interpersonal Acceptance within the Trainer-Client Relationship

Student: Anthony Kanz

Supervisor: Dr. Chad London

**Introduction:** While it is widely known that trainers assist their clients in attaining sufficient physical activity (McClaran, 2001), considerably less is known about exactly how this occurs. Social support provided by a trainer likely enhances client exercise self-efficacy, a reliable predictor of success in long-term exercise behavior (Bandura, 1997). Servant leadership – a person-centered leadership philosophy with roots in positive psychology – is a compelling lens to examine the trainer-client relationship through.

**Purpose:** To begin to understand the subjective experience of servant leadership behaviors in the trainer-client relationship, including their possible effects on client exercise self-efficacy. This study focuses on interpersonal acceptance – a construct within servant leadership which relates to displays of empathy and forgiveness (van Dierendonck, 2011).

**Methods:** Participants (n=4) consisted of two trainer-client dyads over the age of 18 who had exercised together for at least six months. Data was collected during one-on-one, semi-structured interviews, each lasting approximately one hour. Thematic analysis was conducted according to Creswell's (2014) hand-coding process. A combination of predetermined and emergent codes were categorized into themes.

**Results:** Inductive analysis yielded two major themes pertaining to displays of interpersonal acceptance. The first theme, *"Perceptions of servant leadership"* explores trainer leadership characteristics and behaviors, as well as their client's experience of these behaviors and self-reported psychological effects. The second theme, *"Trainer-client fit"* describes the necessity of compatible personalities, and the evolution of the trainer-client relationship.

**Conclusion:** Our findings offer a preliminary understanding toward the ways in which displays of interpersonal acceptance may bolster exercise self-efficacy. Subsequent research could incorporate a larger sample, clients with an explicit history of prolonged or repeated exercise relapse unrelated to chronic pain, or trainers and clients working together for less than six months. Importantly, a substantial amount of conceptual overlap is apparent between the fields of leadership and exercise psychology. This overlap suggests an abundance of opportunities toward integrating research from both fields to advance the field of personal training in both theory and practice.

**Acknowledgements:** Dr. Chad London, Dr. Jon Farthing, the Human Performance Center.

## How does fatigue affect the kinematics and shot performance of guards and draws in young adult curlers?

Student: Ethan Kish

Supervisor: Dr. Joel Lanovaz

**Introduction:** In the sport of curling, players perform bouts of intense sweeping up to 60 times per game. Sweeping can cause increase heart rate and muscular fatigue due to inadequate recovery between sweeping bouts. Fatigue is known to alter motor patterns and increase error in precise movement outcomes. A limited number of studies have examined sweeping fatigue or delivery mechanics but none have combined these aspects. The purpose of this study was twofold; first to examine any relationships between kinematics during shot delivery and the outcomes of guards and draws; secondly to determine if sweeping fatigue alters kinematics or impacts shot accuracy or precision.

**Methods:** Eleven experienced curlers (6 male, Mean age:  $20.27 \pm 1.95$  years) performed eight baseline draw and eight guard shots in random order followed by five pairs of fatigued draw and guard shots. To induce fatigue, participants performed 20s sweeping bouts between the pairs of shots to achieve 75% of their age predicted maximum heart rate. Three inertial sensors measured kinematics of the wrist, trunk and lumbar region during the delivery. The draw target was the button while the guard target was midway between the house and hog-line. Correlations tested the relationships between kinematics and shot performance during baseline. A 2x2 (fatigue x shot type) Repeated Measures ANOVA was used to test effects of fatigue.

**Results:** During baseline, increased wrist movement (velocity & acceleration) was significantly associated with decreased line accuracy and precision. A significant main effect of fatigue was found indicating an increase in three-dimensional trunk movement during the slide. Fatigued participants started their slide with significantly more forward lean and maintained more lean during the slide. Lumbar acceleration at push-off significantly increased with fatigue for draw shots only.

**Discussion:** Increased wrist movement at release reduced line accuracy in both shot types. Shot performance had unexpectedly high variability and, coupled with the smaller sample size, likely limited the correlation results. Shot performance was not altered by fatigue but the fatigue induced trunk kinematic changes may cause compensation of other kinematic variables. Core strengthening may help control the trunk and mitigate the effects of fatigue on shot mechanics.

## **Descriptive, Dysfunctional, Dynamic – Norms and Physical Activity**

Student: Julia Koop

Supervisor: Dr. Kevin S. Spink

**Introduction:** Research using focus theory reveals a positive relationship between physical activity and descriptive norms (Crozier & Spink, 2017). While promising, problems arise when the desired behaviour is performed by the minority (non-normative). Dynamic norms (DyN) offer a solution as they capture the idea that a minority norm is increasing in popularity (Sparkman & Walton, 2017). The current study examined the impact of descriptive and dynamic norms on university students' interest in increasing their exercise during a final exam period. A DyN combined with a positive outcome expectation also was examined. Two possible DyN mediators were investigated – anticipation of others being active during future exams (preconformity) and anticipated success (changes in perceptions of limiting barriers).

**Methods:** Participants were full-time undergraduate students who were regularly active enough for health benefits but reported reducing their exercise levels during a previous exam period. One hundred and fifty-six participants were randomly assigned to one of four conditions: Attentional Control (AC), Descriptive Norm (DesN), Dynamic Norm (DyN), or Dynamic Norm and Outcome Expectation (DyNOE). Using an online platform, participants (1) completed questions on demographics and anticipated success in maintaining regular exercise routine over the next exam period, (2) were exposed to the condition, (3) answered questions about future final exam periods and their interest in increasing activity, anticipated success in maintaining their exercise routine, and perception of others' exercise levels during subsequent exam periods.

**Results:** Controlling for the pre-message perceived success, ANCOVA results revealed that interest in increasing activity during the forthcoming exams differed by condition,  $F(3, 151)=4.07$ ,  $p=.008$ , DyN > AC (.01) and DyNOE > AC (.03). A condition main effect emerged for anticipated success,  $F(3,151)=3.42$ ,  $p=.019$ , DyN > AC (.07) and DyNOE > AC (.06) as well as for preconformity,  $F(3, 151)=4.17$ ,  $p=.007$ , DyNOE > DesN (.007).

**Conclusion:** The results provided preliminary evidence that DyN can increase interest in exercising during exams even when exercising during exams is performed by a minority. Partial support was garnered for two mechanisms that might explain the DyN/behaviour relationship.

**Acknowledgements:** Dr. Kevin Spink

## Post-Exercise Oxygen Uptake and Muscle Oxygenation in Pediatric Heart Transplant Recipients and Healthy Matched Children

Student: Kylee Kosokowsky

Supervisor: Dr. Corey Tomczak

**Introduction:** Pediatric heart transplant recipients (HTR) have reduced exercise tolerance and peak oxygen uptake ( $\text{VO}_2$ ) values are 57-73% of age-predicted norms. Slow  $\text{VO}_2$  and muscle oxygenation recovery are related to exercise intolerance. However, despite clear exercise tolerance limitations,  $\text{VO}_2$  and muscle oxygenation during recovery responses are unknown in this population. We tested the hypothesis that both  $\text{VO}_2$  recovery and muscle oxygenation recovery would be slower after peak exercise in pediatric HTR compared to controls.

**Methods:** Five pediatric HTR (age =  $10.6 \pm 3.0$  years) and six healthy controls (age =  $11.4 \pm 2.6$  years) performed cycle ergometry to peak exercise followed by 5 minutes of 20-W cycle recovery.  $\text{VO}_2$  and muscle oxygenation (vastus lateralis tissue oxygenation index, TOI using near infrared spectroscopy) were sampled continuously during exercise and recovery. Data were linearly interpolated to 1-s intervals, and both  $\text{VO}_2$  and TOI data were averaged into 5-s time bins.  $\text{VO}_2$  recovery data were mono-exponentially curve-fitted to yield a recovery time constant ( $\tau$ ). TOI recovery was normalized from 0% (end exercise) to 100% (5 min post-exercise) and data analyzed at set time points to characterize TOI time course changes (0s, 15s, 30s, 60s, 90s, 120s, 180s, 240s, and 300s). Statistical analyses included independent t-tests for  $\text{VO}_2$  data and a between-within ( $2 \times 9$ , group  $\times$  time) factorial ANOVA for TOI time course changes. Significance was accepted at  $p < 0.05$ .

**Results:** Recovery  $\text{VO}_2$   $\tau$  was significantly slower in pediatric HTR compared to healthy controls (mean  $\pm$  SD;  $68 \pm 17$  vs.  $47 \pm 11$  s, respectively;  $p=0.028$ ). There was a significant group  $\times$  time interaction for TOI recovery ( $p=0.009$ ) where TOI in HTR was significantly lower compared to controls at 15s ( $8 \pm 8$  vs.  $40 \pm 24\%$ ;  $p=0.014$ ), 30s ( $22 \pm 13$  vs.  $82 \pm 37\%$ ;  $p=0.006$ ), and 60s ( $47 \pm 23$  vs.  $109 \pm 38\%$ ;  $p=0.009$ ). TOI was not statistically different between groups by 90s onwards (all  $p > 0.05$ ).

**Conclusions:**  $\text{VO}_2$  and TOI recovery are blunted in pediatric HTR compared to healthy controls. These findings suggest that non-cardiac factors may contribute to the excessive recovery time following peak exercise in pediatric HTR.

## **Investigating the Relationship between Physical Activity and Balance in Individuals with Incomplete Spinal Cord Injury**

Student: Katie Latoski

Supervisor: Dr. Alison Oates

**Introduction:** Individuals who have sustained an incomplete spinal cord injury (iSCI) are one of the most inactive populations. Health improvements from physical activity (PA) in individuals with iSCI are similar to those seen in the able-bodied population; however, there is a lack of evidence outlining the effect PA has on balance in standing and walking in the iSCI population. The primary objective of this study was to examine the relationship between PA and balance in individuals with iSCI.

**Methods:** PA was assessed using the Physical Activity Recall Assessment for People with Spinal Cord Injury (PARA-SCI). Specifically, PA duration, intensity, and type were assessed. PA intensity was self-classified by participants as mild, moderate, heavy. PA type was classified as either an activity of daily living (ADL), activities done as part of an individual's daily routine, or leisure time physical activity (LTPA), activities an individual chooses to do during free time. Balance was assessed using the Mini-Balance Evaluation Systems Test (Mini-BESTest).

**Results:** Data was collected and analyzed from nine participants (n=9). A positive and very weak relationship ( $r=0.04$ ) was observed between total PA duration and balance. The relationship between balance and PA intensity was observed to be negative and very weak with mild PA ( $r=-0.11$ ) and positive and very weak with moderate PA ( $r=0.07$ ). A positive and very weak relationship was observed between balance and heavy PA ( $r=0.19$ ). In addition, the relationship between balance and PA type was observed to be positive and very weak with ADL ( $r=0.05$ ) and negative and very weak with LTPA ( $r=-0.03$ ).

**Conclusion:** There appears to be no significant relationship existing between PA and balance in individuals with iSCI. With a larger participant sample size, further conclusions may be drawn on the relationship between PA and balance in individuals with iSCI.

**Acknowledgements:** Ontario Neurotrauma Foundation & Rick Hansen Institute SCI

## **Understanding the Physical Activity Experiences of Girls who are Newcomers to Canada**

Student: Ms. Sami Leung

Supervisor: Dr. Louise Humbert

**Introduction:** In Canada, 60% of newcomers arrive from China and India, and many of these newcomers are families with children. Newcomers to Canada tend to have lower physical activity levels when compared to their non-newcomer counterparts. Participating in physical activity allows children who are newcomers the chance to develop friendships both within and outside of their cultural groups. While the benefits of physical activity are widely known, what is unknown are the physical activity experiences of children who are newcomers to Canada and in particular the experiences of girls who are newcomers.

**Purpose:** This study sought to investigate the barriers and facilitators that girls who are newcomers in Canada face when engaging or attempting to engage in physical activity.

**Methods:** A multiple case study approach was used in this study. Participants (n=3) were recruited from an after-school program run by the Saskatchewan Intercultural Association (SIA) organization in Saskatoon. Data was collected using one-on-one semi-structured interviews, coded by hand, analyzed for themes, and transcribed into infographics.

**Results:** Three themes emerged after data analysis. The first theme, "Parents", described how different family structures could facilitate and/or inhibit the physical activity experiences of the participants. The second theme, "Weather", discussed how various weather conditions could be both facilitators and/or inhibitors to a participant's physical activity experiences. The third theme, "Their School Environment: Curricular Activities and Non-Curricular Activities," described the role that the neighborhood schools played in both facilitating and/or inhibiting the physical activity experiences of children who are newcomers.

**Conclusion:** The findings indicated that girls who are newcomers between the ages of six to ten are influenced by three barriers and facilitators: parents, weather conditions, and their school environments which include non-curricular and curricular activities. The results from this study may help future organizations and researchers develop appropriate physical activity programs for these youth and children who are newcomers.

**Acknowledgements:** Dr. Humbert, Dr. Farthing, Saskatchewan Intercultural Association, Participants and their families

## **The Effect of a Physical Activity Intervention on the Body Composition of Children with CHD**

**Student:** Ashley Libke

**Supervisor:** Marta Erlandson

**Introduction:** Children with CHD are more likely to become overweight or obese than their typically developing peers, due to physical inactivity and weight gain interventions at birth. Obesity is particularly concerning in this population, as it can exacerbate already life-threatening health problems. Before medical advances to surgically correct life-threatening cases of CHD it was valid to restrict exercise participation; it is now recommended children with CHD follow the same guidelines as their healthy peers. Early experiences involving physical activity are important for maintaining a healthy lifestyle. Children aged 5-18 should participate in >60 minutes/day of moderate-to-vigorous physical activity (PA); however, many children are not meeting these guidelines. PA interventions are a means of inducing positive changes in body composition, notably the reduction of fat mass (FM).

**Purpose:** To determine the effect of a 12 week home based PA intervention on FM and LM in children with CHD. The findings of this study could also guide programs to manage overweight and obesity in this population.

**Methods:** Participants consisted of 8 children between the ages of 9-16 who were diagnosed with CHD by a pediatric cardiologist. They participated in a 12-week physical activity intervention which consisted of both aerobic and resistance training. Anthropometric variables (height, weight, sitting height, BMI), physical activity variables (MVPA, PAQ), fitness variables (6MWT, grip strength) and DXA variables (FM and lean mass (LM)) were measured pre and post intervention.

**Results:** DXA values were assessed using an ANCOVA and were adjusted for age, biological age, sex and MVPA. A significant decrease in total body FM, upper body FM and height were found between pre and post intervention measures ( $p < 0.05$ ). All other body segments measured reported an insignificant decrease in FM and increase in LM, with the exception of lower body LM which decreased slightly.

**Conclusion:** These findings suggest that physical activity in this population is beneficial for the reduction of FM and is an effective means of promoting a healthy body composition in this population.

## **A Comparison in Physiological Parameters of Female Volleyball Players and Baton-Twirlers**

Student: Lindsey McInnes

Supervisors: Carol Rodgers and Shannon Forrester

**Introduction:** Aesthetic sports such as gymnastics and figure-skating are being represented in high profile competitive environments, such as the Olympics. Despite this, and in contrast with traditional sports, little research has been done to profile the physiological attributes required to compete in most aesthetic sports.

**Purpose:** To examine the physiological similarities and differences of competitive female athletes in traditional (volleyball) and aesthetic (baton-twirling) sports.

**Methods:** Participants were competitive female baton-twirlers (n=3) and volleyball players (n=1), 16-20 years old ( $M_{age}$  17.75). Upon arrival at the laboratory participants completed the International Physical Activity Questionnaire (IPAQ) and two anthropometric measures (height and weight). Physiological attributes were assessed through eleven tests; following completion of the Leger test [predicted aerobic capacity] participants completed a circuit of five tests to assess lower body flexibility, strength, dynamic balance, coordination and agility/speed. Following a 10-minute nutrition break, participants completed four more tests to determine muscular power, upper body flexibility, static balance and muscular endurance. The test session ended following completion of the Wingate Anaerobic Test (peak power, mean power, fatigue index). Due to limited sample size statistical analysis was not possible. However, data were compared to the demands of the sport and the importance of each attribute in each sport.

**Results:** Baton-twirlers generally had higher BMIs than the volleyball player and scored better on flexibility [hamstring; shoulder], balance, and strength endurance [plank]. Comparatively, the volleyball player scored better on tests of aerobic capacity, anaerobic peak and mean power output, coordination and agility.

**Conclusion:** The athletes' pattern of scores generally reflected the difference in physiological demands between baton twirling and volleyball. Of notable exception was the lack of alignment of aerobic capacity and reported physical activity level [IPAQ] of the baton twirlers, as well as their lower coordination score, given the importance of this attribute for twirling. Future research is required to address gaps in the literature.

**Acknowledgements:** Thank you to all participants, coaches, testers as well as my supervisors that helped out in testing and recruitment to made this study possible.

## Self-Compassion and Well-Being Among Former University Athletes

Student: Katherine Rawlyk

Supervisor: Dr. Leah Ferguson

**Introduction:** Many athletes experience difficulties when they transition out of university sport (e.g., psychiatric symptoms, identity crises, feelings of isolation). Although various mechanisms have been suggested and implemented to ease the transition, there is room for improvement. Self-compassion (i.e., treating oneself with kindness and understanding when presented with difficult experiences) is an approach with great potential to manage the difficulties that athletes often face during their transition out of university sport. Despite its proven benefits within general and athlete samples, self-compassion has yet to be studied within a sample of former athletes.

**Purpose:** To evaluate the relationships between athlete identity, self-compassion, psychological well-being, satisfaction with life, and emotions among former university athletes. It was hypothesized that: (1) retirees with stronger athletic identities would exhibit lower levels of self-compassion; (2) retirees with higher levels of self-compassion will experience greater well-being and satisfaction; and, (3) retirees with higher levels of self-compassion will display more positive and less negative emotions.

**Methods:** Fifteen former university athletes ( $n = 9$  female;  $M_{age} = 22.8 \pm 2.88$  years) completed an online survey to assess self-attitudes, sport history, and well-being. After completing a demographic questionnaire, participants completed the Athlete Identity Measurement Scale, Self-Compassion Scale (SCS), Scales of Psychological Well-Being (SPWB), Satisfaction With Life Scale (SWLS), and Positive And Negative Affect Schedule (PANAS). Data analysis consisted of descriptive statistics and Pearson bivariate correlations.

**Results:** While hypothesis one was not supported, hypotheses two and three were supported. The SCS was correlated with the SPWB ( $r = .70, p = .004$ ) and the SWLS ( $r = .60, p = .02$ ). The SCS was also positively correlated with the PANAS – Positive Affect subscale ( $r = .63, p = 0.012$ ) and negatively correlated with the PANAS – Negative Affect subscale ( $r = -.53, p = 0.043$ ).

**Conclusion:** Former athletes with higher self-compassion displayed lower negative emotions, as well as greater psychological well-being, satisfaction with life, and positive emotions. This research has the potential to inform sport practitioners and future academics about the potential applicability of self-compassion during the transition out of university sport.

## The Effects of Fatigue on the Cross Education of Skill

Student: Annika Streilein

Supervisor: Professor Jonathan Farthing

**Introduction:** Cross education (CE) is a phenomenon whereby performance improvements occur in the untrained limb after unilateral skill or strength training. Unilateral fatiguing exercise has been shown to decrease inhibition in both sides of the brain, which may be relevant for CE paradigms. The purpose of this study was to examine if fatiguing exercise prior to unilateral skill training would enhance CE of skill to the untrained limb.

**Methods:** Eight participants were randomized into a non-fatigue (n=4) and fatigue group (n=4) before skill training of the right hand (force target matching task). The fatigue group performed a 1-minute fatiguing contraction on their left hand prior to training the right hand, whereas the non-fatigue group performed a light non-fatiguing contraction. After baseline testing, participants completed four consecutive days of training before post-testing (day 7) and retention testing (day 14). Measurements of task performance, maximal grip force and electromyography recordings of evoked volitional waves (an indirect measure of descending neural drive) were collected for both the right and left hand at each testing occasion (baseline, day 7, day 14).

**Results:** Both groups significantly improved task performance (reduced cumulative error) at day 7 for the trained right (19%) and untrained left limb (26%;  $p=0.047$ ,  $\eta_p^2=.400$ ), with no significant difference between groups. Maximal grip force did not change across the study for both groups. Preliminary analysis of volitional waves showed no significant change for either arm or either group at day 7 and day 14.

**Conclusion:** Cross education was evident in both the fatigue and non-fatigue groups; however, contrary to the hypothesis, fatigue did not alter the magnitude of skill transfer.

**Acknowledgements:** Special thank you to the participants, Doug Renshaw, Justin Andrushko, and Lauren Gleed.

## **Effects of exercise modality on mental health in middle aged women**

Student: Madison Williams

Supervisor: Heather Foulds

**Introduction:** Mental health is a growing concern worldwide, with women in the menopausal transition at greater risk. Increased anxiety and depression are associated with an increased risk of chronic disease, including cardiovascular disease. Exercise may be comparable to antidepressant and anxiolytic medications for managing depression and anxiety. Modalities of exercise are thought to impact mental health differently. Long-term aerobic training improves functional capacity that can facilitate endorphin catecholamine levels, whereas resistance exercise improves musculature that contributes to self-efficacy. Although chronic exercise modality has been linked to improved mental health, there is lacking information on the effects of acute exercise modality.

**Purpose:** This study aims to compare the effects of acute bouts of aerobic and resistance exercise on anxiety and depressive symptoms.

**Methods:** Nineteen women, aged 30-55 years, were randomly allocated to a single 20-minute, major muscle group resistance-training or moderate intensity interval aerobic biking exercise session. Measures of current feelings, using State-trait Anxiety Inventory (STAI-Y1) and the Depression Adjective Check List (DACL), were recorded prior to and following completion of the exercise session. An Analysis of Covariance compared post-exercise scores between exercise modalities, adjusted for pre-test scores.

**Results:** Participants completing resistance training reported a greater improvement in anxiety symptoms ( $24.3 \pm 6.7$  to  $22.1 \pm 2.7$  vs.  $25.5 \pm 4.3$  to  $27.6 \pm 6.1$ ,  $p=0.035$ ). Resistance training also led to greater improvements in depression symptoms ( $18.3 \pm 5.0$  to  $15.9 \pm 1.6$  vs.  $18.7 \pm 2.7$  to  $17.6 \pm 2.7$ ,  $p=0.048$ ).

**Conclusion:** A single resistance exercise session led to greater improvements in current feelings of anxiety and depression, compared to an aerobic exercise session. Future research should examine the factors that can contribute to how exercise modality can affect mood.

**Acknowledgements:** Lab technicians, Vanessa MacCormick and Shane Schwanbeck

# Graduate Student List of Presenters

Abstracts arranged alphabetically by last name

<b>Student</b>	<b>Program</b>	<b>Supervisor</b>
Danelle Banman	MSc	Dr. Cathy Arnold
Jocelyn Blouin	PhD	Dr. Nancy Gyurcsik
Mackenzie Bone	MSc	Dr. Alison Oates
Natasha Boyes	PhD	Dr. Corey Tomczak
Danielle Cormier	PhD	Drs. Kent Kowalski & John Dunn
Natalie Houser	PhD	Drs. Louise Humbert & Marta Erlandson
Ramlah Iqbal	MSc	Dr. Corey Tomczak
Avery Ironside	MSc	Dr. Heather Foulds
Dana Lahti	MSc	Dr. Corey Tomczak
Mackenzie Marchant	PhD	Dr. Nancy Gyurcsik
Justin Pifko	MSc	Dr. Joel Lanovaz
Eric Pitman	PhD	Dr. Joel Lanovaz
Nathan Reis	PhD	Dr. Kent Kowalski
Doug Renshaw	PhD	Dr. Jon Farthing
Mahdi Rostami Haji Abadi	PhD	Dr. Saija Kontulainen
Yuwen Zheng	MSc	Dr. Saija Kontulainen

## Differences in Fall Risk Factors Between Men and Women Aged 60 years and Older

Student: Danelle Banman

Supervisor: Dr. Cathy Arnold

Full Author List: Danelle Banman, Cathy Arnold, & Joel Lanovaz

**Introduction:** A decrease in muscle strength, impaired balance, problems with gait and slow walking speed are risk factors for falls in ageing adults. Demographic factors such as age and body mass index (BMI) may increase the likelihood of a fall. There is sparse evidence comparing gender differences in sociodemographic fall risk factors and no cross-sectional studies comparing physical fall risk factors between men and women. The study purpose was to compare differences in demographic and physical fall risk factors between men and women over 60 years.

**Methods:** Data was collected from  $n=73$  participants (45% males) that participated in an ongoing study on fall risk prevention. Age, height and weight were recorded at each session. Medical demographic questionnaires were used to identify medications used and number of falls within the past 12 months. Physical fall risk factors assessed were total strength, functional mobility, walking speed, balance, and response time. Total strength was assessed via combined mean of three trials of the right- and left-hand grip and push off test scores. Timed up and go test was used to assess functional mobility. Walking speed was calculated using a 10-meter walk test. Balance assessment included: 30 second tandem stance, one legged stance test, and the modified clinical test of sensory interaction and balance (MCTSIB). Response time was recorded in response to a random tone that was manually activated with pre-determined pause lengths. An independent samples t-test was used to compare fall risk factors, where as a chi square analysis was used to compare the history of reported falls.

**Results:** Males ( $M= 125.10, \pm SD=36.73$ ) scored significantly higher than females ( $M=74.33, \pm SD=19.33$ ) in total strength, as well were significantly faster in the auditory response time task ( $p<.05$ ) when compared to females. Females MCTSIB scores on the foam pad ( $M= 19.73, \pm SD=11.41$ ) was significantly higher than the male participants ( $M= 14.30, \pm SD=9.63$ ).

**Conclusion:** Possible explanation for a significant difference between participants strength, response time and balance may be due to age. Further testing should consider a larger sample size and similar age when testing for differences in fall risk factors between gender in older adults.

**Acknowledgements:** Saskatchewan Centre for Patient Orientated Research; Saskatchewan Health Authority; SHRF-Saskatchewan Health and Research Foundation; Biomechanics of Balance and movement lab

## **Pilot Testing the Effectiveness of a Community-Based Yoga Program on Health Outcomes Among Adults Living with Chronic Pain**

Student(s): Jocelyn E. Blouin & Tessia M. Philipenko

Supervisor: Dr. Nancy Gyurcsik

Full Author List: Jocelyn E. Blouin, Tessia M. Philipenko, & Nancy C. Gyurcsik

**Introduction:** Chronic pain affects nearly 20% of Canadian adults and can severely impact health and well-being. Using prescription opioids is the most common pain management strategy, despite their long-term ineffectiveness and high dependency, tolerance, and addiction risks. Alternatively, exercise is a recommended non-pharmacological evidence-based strategy. Gentle movement exercises, including yoga, are efficacious in improving pain-related health outcomes (pain intensity; depressive symptoms; physical function) in randomized controlled trials. However, testing the effectiveness in real-world settings has not been done.

**Methods:** This study examined the effectiveness of an 8-week community-based yoga program on improving pain intensity, symptoms of depression, and physical function among adults living with chronic pain. Participants ( $n = 7$ ;  $M_{\text{age}} = 54.14 \pm 7.54$  years) completed pre- and post-program paper surveys assessing all health outcomes.

**Results:** Wilcoxon signed rank tests revealed that symptoms of depression decreased significantly from pre- to post-program ( $p = .04$ ), whereas changes in pain intensity and physical function were non-significant ( $p$ 's  $> .05$ ). Given the small sample size, effect sizes were also calculated. All health outcomes demonstrated large effects ( $r$ 's = 0.42 to 0.54).

**Conclusion:** This study was the first to show that a community-based yoga program had a large, favorable impact on pain intensity, symptoms of depression, and physical function. Future replication research with larger samples is needed to determine if community-based yoga that targets adults living with chronic pain is an effective management strategy. If so, then this type of exercise should be made available to people living with pain in communities across Canada.

**Acknowledgements:** The research was unfunded and the authors do not have conflicts of interest to disclose. The researchers extend a sincere 'thank you' to all of the participants who volunteered their time to make this research possible.

## Investigating Proactive Balance Control in Individuals with Incomplete Spinal Cord Injury

Student: Mackenzie D. Bone

Supervisor: Dr. Alison Oates

Full Author List: Mackenzie D. Bone, Joel L. Lanovaz, Kristin E. Musselman, Gary A. Linassi, & Alison R. Oates

**Introduction:** Of the 86,000 Canadians who have a spinal cord injury, approximately 80% of individuals with incomplete spinal cord injury (iSCI) will experience at least one fall per year and 65% will experience a fall that causes injury. Most falls occur while walking on uneven or slippery surfaces and lead to a fear of falling. The purpose of this study was to compare the proactive balance of individuals with iSCI to age- and gender-matched able-bodied (AB) individuals when walking over a known slippery surface.

**Methods:** This study quantified participant's balance control strategies, while walking on a 10 m runway, using a motion capture system. Mean stride velocity, step width, step length, AP margin of stability (MOS), and ML MOS were calculated as indicators of proactive balance strategies. We hypothesized that individuals with iSCI ( $n = 15$ ) would use proactive balance strategies such as reduced stride velocity, decreased step length, and an anterior shift in MOS position, to a greater degree than AB individuals ( $n = 10$ ) when approaching a known slippery surface.

**Results:** The 2 (group: SCI vs AB) by 2 (condition: non-slippery vs. slippery) factorial ANOVAs showed a significant main effect of group,  $p < .004$ , on all measures of proactive balance. There was no significant main effect of walking condition or significant interaction effect,  $p > .05$ .

**Conclusion:** Individuals with iSCI use proactive balance strategies to a greater extent than AB individuals during both non-slippery and slippery conditions. Both groups did not significantly change their balance strategies when approaching the known slippery surface compared to the non-slippery condition. Based on these results, fall prevention programs should recommend the use of route previewing and proactive balance strategies when approaching a destabilizing condition. Future studies could investigate whether individuals with iSCI are able to adapt to a known slippery surface.

**Acknowledgments:** I would like to thank my supervisors and committee members for their expertise and contributions to this study. This work was funded by an Establishment Grant awarded to A. Oates by the Saskatchewan Health Research Foundation.

## **Peak Exercise and Post-Exercise Recovery Oxygen Uptake and Muscle Oxygenation in Patients with Heart Failure and Preserved Ejection Fraction and Healthy Matched Adults**

Student: Natasha G. Boyes

Supervisor: Dr. Corey Tomczak

Full Author List: Natasha G. Boyes, Janine Eckstein, Stephen Pylypchuk, Dana S. Lahti, Scotty J. Butcher, Darcy D. Marciniuk, Dalisizwe M. K. Dewa, Calvin R. Wells, Mark J. Haykowsky, & Corey R. Tomczak

**Introduction:** Low peak oxygen uptake ( $VO_2$ ) and muscle dysfunction characterize heart failure with preserved ejection fraction (HFpEF). Low peak  $VO_2$  and slow post-exercise  $VO_2$  recovery are predictors of mortality. The relationship between peak  $VO_2$ , recovery  $VO_2$  and muscle oxygenation is unknown in HFpEF. We hypothesized that post-exercise  $VO_2$  recovery would be slower in patients with HFpEF compared to controls, and that slower post-exercise  $VO_2$  recovery would be related to slower muscle oxygenation recovery in patients with HFpEF.

**Methods:** Eight patients with HFpEF and 8 healthy matched controls completed a cycling peak exercise test followed by 5-min of recovery. Pulmonary  $VO_2$  (metabolic cart) and muscle oxygenation (tissue muscle oxygenation index, TOI) and deoxygenated hemoglobin (HHb) via near infrared spectroscopy (NIRS) were sampled continuously.  $VO_2$  data were linearly interpolated and averaged to 5-s intervals.  $VO_2$  recovery data were mono-exponentially curve-fitted (OriginPro, 2017) to yield a recovery tau and amplitude change. TOI and HHb at end-exercise, end-recovery, and the amplitude change were calculated as 10-s averages. Statistical analyses included independent *t*-tests and stepwise multiple regression. Significance was accepted at  $P < 0.05$ .

**Results:** Peak  $VO_2$  ( $15.8 \pm 5.9$  vs.  $24.6 \pm 6.6$  mL/kg/min,  $P = 0.011$ ) and  $VO_2$  recovery amplitude ( $-10.0 \pm 4.9$  vs.  $-15.1 \pm 4.2$  mL/kg/min,  $P = 0.041$ ) were significantly lower in patients with HFpEF compared to matched controls. However, there were no differences between groups in  $VO_2$  recovery tau ( $98 \pm 43$  vs.  $71 \pm 16$  s,  $P = 0.122$ ) nor in any TOI or HHb parameter (all  $P > 0.05$ ). Stepwise regression by group to predict peak  $VO_2$  yielded a positive regression using both peak-exercise HHb and  $VO_2$  recovery amplitude in HFpEF ( $R^2 = 0.957$ ,  $P < 0.001$ ) but only  $VO_2$  recovery amplitude in controls ( $R^2 = 0.947$ ,  $P < 0.001$ ). The same parameters predicted  $VO_2$  recovery tau in HFpEF ( $R^2 = 0.940$ ,  $P = 0.001$ ) with no significant finding in controls ( $P > 0.05$ ).

**Conclusions:** Slower post-exercise  $VO_2$  recovery in patients with HFpEF compared to their healthy counterparts was not confirmed with these data. Regression analyses suggest that the level of muscle deoxygenation during peak exercise may be a more important contributor to peak  $VO_2$  in patients with HFpEF compared to their healthy counterparts. The latter may suggest a muscle-based limitation in HFpEF.

**Acknowledgements:** The Russ Kisby Physical Activity and Health Promotion Laboratory; Integrative Cardiovascular Physiology Research Program; Saskatoon Heart Function Clinic; Saskatoon LiveWell Chronic Disease Management Program.

## **Incremental Validity Evidence Supporting the Domain-Specific Conceptualization and Measurement of Grit in Intercollegiate Student-Athletes**

Student: Danielle Cormier

Supervisor(s): Dr. Kent Kowalski & Dr. John Dunn (Previous at University of Alberta)

Full Author List: Danielle Cormier, John G.H. Dunn, & Janice Causgrove Dunn

**Introduction:** The personality trait of grit (Duckworth, Peterson, Matthews, & Kelly, 2007) has traditionally been conceptualized and measured as a global or domain-general construct. The purpose of this study was to determine if grit is best conceptualized and measured as a domain-general construct or as a domain-specific construct (see Griffin, McDermott, McHugh, Fitzmaurice, & Weiss, 2016). To address this question, we sought incremental validity evidence to determine if domain-specific measures of grit could explain variance in domain-matched achievement-related criterion variables beyond the variance explained by a global measure of grit.

**Methods:** A sample of 251 (102 female) intercollegiate student-athletes ( $M$  age = 20.34 years,  $SD = 2.0$ ) completed three versions of Duckworth et al.'s *Grit Scale*: the original global (domain-general) version, a sport version, and a school version. Participants provided their Grade Point Average (GPA) and completed a self-report measure of perfectionistic strivings and perfectionistic concerns in sport (see Stoeber & Madigan, 2016).

**Results:** Results of a hierarchical regression analysis indicated that the school measure of grit explained an additional 20% of the variance in university GPA beyond the variance explained by the global measure of grit ( $p < .001$ ). Results of a second hierarchical regression analysis indicated that the sport measure of grit explained an additional 3% of the variance in student-athletes' perfectionistic strivings in sport beyond the variance explained by the global measure of grit ( $p < .05$ ).

**Conclusion:** The results provide incremental validity evidence supporting the domain-specific conceptualization and measurement of grit in academic and sport settings.

**Acknowledgements:** I am thankful for the support of Dr. John Dunn and Dr. Janice Causgrove Dunn throughout the completion of my Masters thesis, as well as the invaluable encouragement from the University of Saskatchewan's SHElab and Dr. Kent Kowalski.

## **Saskatchewan parent perspectives on physical literacy**

Student: Natalie E. Houser

Supervisors: Dr. Louise Humbert & Dr. Marta Erlandson

Full Author List: Natalie Houser, Louise Humbert, Lauren Sulz

**Introduction:** Physical activity participation is a critical component in the healthy growth and development of children, with a wide range of physical, psychosocial, and cognitive health benefits associated. Physical literacy influences the likelihood of physical activity participation throughout the lifecycle. Physical literacy is described as the motivation and confidence, knowledge and understanding, and physical competence to value and participate in a range of physical activities and environments throughout the life course. With this concept, children are encouraged to experience a range of different movement opportunities in a variety of different environments (ground, ice, water, etc.). For children and youth, parental involvement can play an influential role in how physically active and physically literate children are, yet there is little research exploring parent perspectives on physical literacy.

**Methods:** Phone surveys were conducted through random digit dialing on a representative sample of Saskatchewan parents with children aged 0-16. A total of 384 parents (65.9% female) over the age of 18 years, with a child/children between the ages of 0 and 16 years participated in the study. The survey asked about understanding and beliefs surround PL, their child's physical activity participation, and their own activity levels. A descriptive exploration of the survey results will be conducted for the purpose of this study.

**Results:** Despite the rise in awareness of the concept of physical literacy both nationally and internationally, this study found that approximately 80% of the sample of Saskatchewan parents had not heard of the concept of physical literacy. Although there appears to be a lack of knowledge on the concept of physical literacy, when the term was defined to participants, 91.5% of parents agreed or strongly agreed that their child was physically literate. Further, 87.8% of the sample believed that they have the primary responsibility for helping children develop physical literacy, reporting developing movement skills and playing sports are the most important factors in this development.

**Conclusion:** This study explored parental involvement by looking at the perceptions of parents with respect to development of physical literacy, as well as the current knowledge on the concept of physical literacy. Recognizing the role that physical activity plays in a child's health, this leads us to ask how physical literacy should be approached in non-research settings, in order to see the best outcomes in understanding and practice of the concept, with the ultimate goal of improving the health of children.

## Lower Baroreflex Sensitivity During Muscle Metaboreflex Activation in Children and Adolescents with the Fontan Circulation and Single Ventricle Physiology

Student: Ramlah M. Iqbal

Supervisor: Dr. Corey Tomczak

Full Author List: Ramlah M. Iqbal, Natasha G. Boyes, Stephanie Fusnik, Dana S. Lahti, Marta C. Erlandson, Kristi D. Wright, Ashok Kakadekar, Timothy J. Bradley, Scott Pharis, Charissa Pockett, T. Dylan Olver, & Corey R. Tomczak

**Introduction:** Individuals with the Fontan circulation and single ventricle physiology have elevated sympathetic nerve activity at rest and during muscle metaboreflex activation that is consistent with autonomic dysfunction. Adults with the Fontan circulation also show reduced baroreflex sensitivity (BRS); however, there is limited understanding of BRS in children or adolescents with the Fontan circulation. In healthy adults, BRS decreases with increased sympathetic nerve activity during isometric handgrip exercise, but not during isolated muscle metaboreflex activation. The effect of handgrip exercise and muscle metaboreflex activation on BRS in children and adolescents with the Fontan circulation is currently unknown. The purpose of this study was to test the hypothesis that BRS is lower at rest and less responsive during handgrip exercise and post-exercise circulatory occlusion (PECO) in children/adolescents with the Fontan circulation compared to healthy controls.

**Methods:** Eight children/adolescents with the Fontan circulation ( $12\pm 2$  yrs; 3 males) and 8 healthy controls ( $13\pm 4$  yrs; 5 males) were studied. Continuous heart rate (ECG) and non-invasive blood pressure (Finometer® MIDI) were recorded during 3-min of resting baseline, 2-min of isometric handgrip exercise at 30% of maximal voluntary contraction, and 3-min of PECO. Continuous heart rate, systolic blood pressure, and diastolic blood pressure signals were analyzed using the *BRS Analysis* software (Nevrokard, Slovenia, 2018) to yield average BRS values during rest, handgrip, and PECO for each group. Differences between groups and across conditions were assessed using two-way repeated measures ( $2\times 3$ , group  $\times$  condition) ANOVA.  $P<0.05$  was considered significant.

**Results:** There was a significant group  $\times$  condition interaction for BRS ( $P<0.001$ ). BRS was lower in children/adolescents with the Fontan circulation vs. healthy controls at rest ( $13\pm 8$  vs.  $38\pm 10$  ms/mmHg;  $P<0.001$ ) and during PECO ( $18\pm 17$  vs.  $37\pm 18$  ms/mmHg;  $P=0.044$ ), but not during handgrip ( $13\pm 10$  vs.  $14\pm 6$  ms/mmHg;  $P=0.843$ ). BRS in children/adolescents with the Fontan circulation did not change across conditions ( $P=0.188$ ).

**Conclusion:** Our findings suggest that BRS is lower at rest and has a blunted response during sympatho-excitation in children/adolescents with the Fontan circulation compared to healthy controls. Collectively, our findings indicate potential autonomic dysfunction in children/adolescents with the Fontan circulation.

## **Social Support and Cultural Factors as Determinants of Physical Activity in Indigenous and General Populations**

Student: Avery Ironside

Supervisor: Dr. Heather Foulds

Full Author List: Avery Ironside, BSc, Caitlyn Kirkpatrick, & Heather J. A. Foulds, PhD

**Introduction:** Physical activity (PA) decreases risks of developing chronic disease and is linked to improved mental well-being. Social support (SS) and cultural factors may play key roles in physical activity, particularly for Indigenous populations. The objective of this systematic review and meta-analysis is to evaluate the linkages between SS and cultural factors with PA, and further evaluate these relationships specific to Indigenous populations.

**Methods:** Of 5 databases searched, 7383 unique citations were evaluated through title, abstract and full text screening, cross referencing and authors' knowledge.

**Results:** Literature searching yielded 53 articles for inclusion. Meta-analysis identified those reporting higher physical activity had greater odds ratios of reporting strong overall SS = 1.21 (1.16-1.26, N = 8775), friend-SS = 1.22 (1.16-1.28, N = 6 256), and family-SS = 1.20 (1.14-1.25, N = 6 256). Positive correlations between SS and PA were also meta-analyzed, overall SS:  $r = 0.41$ , friend-SS:  $r = 0.27$ , and family-SS:  $r = 0.04$ . Meta-analysis also highlighted the importance of cultural factors, with a greater likelihood of meeting PA guidelines with high acculturation (odds ratio = 1.60, N = 6460) and with moderate acculturation (odds ratio = 1.22, N = 6460). Qualitative systematic review findings identified, frequently active individuals reported greater general SS (mean = 4.7, SE = 0.02, N = 6170) than infrequently active individuals (mean 4.6, SE = 0.02, N = 5 999,  $p < 0.001$ ). Those reporting high leisure time PA ( $\geq 120$  min/week) reported significantly greater friend-SS ( $p < 0.01$ ). Significant correlations of friend-SS with PA volume ( $r_s = 0.15$ ,  $p < 0.05$ ) and classifications ( $r_s = 0.20$ ,  $p < 0.01$ ) were identified. Specific to Indigenous populations, SS was positively correlated with PA levels ( $r = 0.33$ ,  $p < 0.01$ ). Indigenous peoples who are living a more traditional lifestyle (enculturated) are significantly more physically active than those who do not ( $p = 0.02$ ). Greater tribal self-identification, speaking a Native language at home, and participating in traditional events were also associated with greater PA ( $p < 0.05$ ).

**Conclusion:** SS and cultural factors are significantly associated with PA, particularly among Indigenous populations.

**Acknowledgements:** This research was supported by the University of Saskatchewan. Megan Kennedy for her guidance and support in developing the citation search strategy.

## Effect of Home-Based Exercise Training on Post-Exercise Peripheral Muscle Oxygenation in Children with Congenital Heart Disease

Student: Dana Lahti

Supervisor: Dr. Corey Tomczak

Full Author List: Dana S. Lahti, Corey R. Blushke, Charissa Pockett, Timothy J. Bradley, Scott Pharis, Scotty J. Butcher, Kylee Kosokowsky, Natasha G. Boyes, Kristi D. Wright, Marta C. Erlandson, & Corey R. Tomczak

**Introduction:** A hallmark feature of children with congenital heart disease (CHD) is exercise intolerance, along with slow post-exercise muscle oxygenation recovery. Exercise rehabilitation programs have been shown to improve peak  $\dot{V}O_2$  in children with CHD; however, exercise tolerance is still limited compared to healthy matched controls. Whether exercise training improves post-exercise recovery of muscle oxygenation (as measured by tissue oxygenation index, TOI) in children with CHD compared to healthy children is unknown. The purpose of this study was to determine whether a 12-week home-based exercise intervention can improve post-exercise TOI response after peak exercise in children with CHD compared to controls.

**Methods:** Eight children with CHD (f/m = 4/4; mean  $\pm$  SD age:  $12 \pm 2$  yrs) with simple and complex lesions and seven healthy controls (f/m = 3/4; age:  $12 \pm 3$  yrs) were studied. Children with CHD completed a home-based exercise program 3 times/week for 12 weeks, in addition to 6 biweekly in-person sessions. Exercise tolerance was assessed with peak  $\dot{V}O_2$  testing to volitional fatigue on a cycle ergometer, followed by 4 minutes of 20-W recovery. Vastus lateralis TOI was continuously sampled during exercise and recovery via near-infrared spectroscopy. Post-exercise TOI recovery data was normalized from 0% (end-exercise) to 100% (4 min post-exercise) and data analyzed at set time points to characterize TOI time course changes (0s, 15s, 30s, 60s, 90s, 120s, 180s and 240s). Pre vs. post training changes in TOI were analyzed using paired *t*-tests. Significance was accepted when  $P < 0.05$ .

**Results:** Post-exercise TOI was significantly lower in CHD pre-training compared to controls at 15s ( $9 \pm 9$  vs.  $27 \pm 16\%$ ;  $P=0.018$ ) and 30s ( $32 \pm 17$  vs.  $72 \pm 35\%$ ;  $P=0.012$ ). Similarly, post-exercise TOI in CHD after exercise training was significantly lower than controls at 15s ( $9 \pm 7$  vs.  $27 \pm 16\%$ ;  $P=0.014$ ) and 30s ( $36 \pm 22$  vs.  $72 \pm 35\%$ ;  $P=0.030$ ).

**Conclusion:** Excessive post-exercise impairment in TOI recovery persists after home-based exercise in children with CHD compared to controls.

**Acknowledgements:** Canadian Institutes of Health Research; Saskatchewan Health Research Foundation; Mending Little Hearts Fund of Saskatchewan

## **Expanding Our Understanding of Knowledge and Beliefs about Chronic Pain and Exercise Among Physiotherapists**

Student: Mackenzie G. Marchant

Supervisor: Dr. Nancy Gyurcsik

Full Author List: Mackenzie G. Marchant, MSc., Miranda A. Cary, MSc., Jenelle Zapski, BSc., Jocelyn E. Blouin, MSc., Nancy C. Gyurcsik, PhD, & Danielle R. Brittain, PhD

**Introduction:** Twenty percent of adults experience chronic non-cancer pain. Although exercise is an evidence-based treatment, resulting in better pain management and improved function, most adults struggle to exercise. Physiotherapists are identified as key professionals who can promote exercise via client counselling. Yet, very little is known about psychosocial factors that are predictive of their intention to counsel. The study purpose was to examine whether physiotherapists' chronic pain knowledge, fear avoidance beliefs about exercise, and self-efficacy to counsel predicted their intention to counsel their clients on chronic pain and exercise, after controlling for years of physiotherapy practice.

**Methods:** Participants completed an online survey assessing pain knowledge, fear avoidance beliefs, self-efficacy, and intention to counsel. A two-step hierarchical multiple regression predicting intention was conducted to examine the purpose. Step 1 controlled for physiotherapists' years of practice. Step 2 included psychosocial variables that were significantly correlated with intention.

**Results:** Participants were 64 Canadian physiotherapists, practicing for  $15.72 \pm 13.95$  years. The psychosocial variables that were significantly correlated with intention included fear avoidance beliefs ( $r = -.35, p < .05$ ) and self-efficacy ( $r = .69, p < .01$ ). The overall regression model was significant ( $R^2$  adjusted = .46,  $p < .001$ ), with self-efficacy to counsel being the sole significant predictor of intention ( $\beta = .66, p < .001$ ).

**Conclusion:** Findings offer novel insight that higher confidence to counsel predicted greater intention to counsel clients on chronic pain and exercise, even after controlling for years of physiotherapy practice. Given these promising findings, future research should examine whether intention predicts actual counselling over time and, if so, whether intention mediates relationships between self-efficacy and counselling. Research should also examine whether counselling by physiotherapists predicts exercise adherence over time among their clients.

## Sex Differences in Older Adults During Forward Descents on Outstretched Arms

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**Introduction:** Falls are a leading cause of injuries in older adults, with forward falls on outstretched hands being one of the most common. Previous fall arrest capacity research has shown that older women absorb less energy than younger women during a controlled forward descent on the arms. Although women are at a higher risk for certain fall-related injuries, serious trauma are equally likely in men and women. In older adults, sex-related differences in fall arrest capacity are currently unknown. Our purpose was to examine fall arrest capacity differences between older men and women.

**Methods:** To date, 22 older adults (11 females,  $M_{\text{age\_female}}=71.2\text{yrs}$ ,  $M_{\text{age\_male}}=72.8\text{yrs}$ , Range: 60-86yrs) have been analysed. Using a custom testing apparatus, participants completed three forward descent motions (similar to a push-up) starting with a body lean of  $60^\circ$  from horizontal. Participants lowered themselves by flexing their elbows with a target of  $90^\circ$  elbow flexion in 1.5 seconds. Force platforms (OR6-7, AMTI, Watertown, MA,  $fs=2000\text{Hz}$ ) under each hand recorded reaction forces. Upper extremity 3D kinematics were recorded using a motion capture system (VICON, Centennial, CO,  $fs=200\text{Hz}$ ). Independent t-tests (for demographics) and  $2 \times 2$  (arm  $\times$  sex) repeated measure ANOVAs were used to examine outcome variables.

**Results:** Males were significantly taller and heavier although body mass index was similar between sexes ( $M:29.6\pm3.9\text{m}^2\text{kg}^{-1}$ ,  $F:28.4\pm5.2\text{m}^2\text{kg}^{-1}$ ,  $p=0.54$ ). There were no effects of arm or sex by arm interactions on any outcome variables. Elbow ROM ( $M:67.4\pm4.7^\circ$ ,  $F:78.1\pm4.5^\circ$ ,  $p=0.11$ ) and peak elbow extensor moment ( $M:0.018\pm0.001$ ,  $F:0.015\pm0.001$ ,  $p=0.06$ ) were not different between sexes. Males started with a higher percent body weight on their hands ( $M:29.5\pm0.4\%BW$ ,  $F:27.4\pm0.3\%BW$ ,  $p=0.04$ ) and completed the movement faster ( $M:1.33\pm0.33\text{s}$ ,  $F:1.98\pm0.70\text{s}$ ,  $p=0.01$ ) leading to greater peak forces ( $M:40.2\pm0.7\%BW$ ,  $F:36.0\pm0.6\%BW$ ,  $p=0.03$ ). Overall energy absorption was similar between sexes ( $M:2.10\pm0.12$ ,  $F:2.14\pm0.11$ ,  $p=0.82$ ); however, males absorbed more energy during early movement.

**Conclusion:** Current data shows that older males have some differences in forward descent technique compared to older females but were similar in elbow mechanics and overall energy absorption. This indicates that older men and women may benefit equally from fall injury prevention programs.

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## Intentional Slips While Walking: Exploring the Association Between Segmental Kinematics and Stability Estimates

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**Introduction:** Common methods to estimate stability during a slip perturbation include the Feasible Stability Region (FSR) and Anterior/posterior (A/P) Margin of Stability (MOS). Vertical hip height can determine the likelihood of recovering from a loss of balance. Intentional falls are an extreme example of balance loss, have been used in stability training interventions. Since FSR and MOS have not been examined during intentional falls during walking, the relationships between these measures and segmental kinematics are not known. The purpose of this study is to examine the relationship between gait stability and segmental kinematics during an intentional slip-induced backwards loss of balance (BLOB).

**Methods:** Seventeen young healthy adults (11 males, age: 25±3 years, height: 173±8 cm, mass: 82±21 kg) walked at a self-selected velocity (0.92±0.28m/s). Participants used self-selected movements to intentionally fall backwards while walking over a slippery surface. Ten participants experienced a BLOB while seven participants tried to fall but had a forward recovery instead.

Segmental kinematics and total body centre of mass (COM) were extracted using OpenSim inverse kinematics. MOS and FSR were calculated with larger positive values indicating greater stability. Three time points were separately analysed; slip heel strike (SHS), contra-lateral toe off (CTO) and contra-lateral heel strike (CHS). Pearson’s correlations assessed the association between MOS and FSR to pelvis and torso segment velocities at each time point ( $\alpha=0.05$ ).

**Results and Discussion:** MOS was consistently only correlated with A/P segment velocities. FSR was only related to vertical velocities. While only A/P kinematics are used to calculate the FSR, it appears the downward motion of the hip, especially in persons experiencing a BLOB. Conversely, the recovery step from participants who did not experience a BLOB increased the variability in A/P segmental velocity for that group which may have led to the lack of association with FSR in that direction.

**Table 1.** Pearson correlation values between the FSR and segment velocities in the A/P and vertical directions.

Time Point	A/P Velocity		Vertical Velocity	
	Pelvis	Torso	Pelvis	Torso
SHS	r=-0.018	r=0.346	r=0.757 **	r=0.721 **
CTO	r=0.199	r=0.339	r=0.732 *	r=0.796 **
CHS	r=0.760 **	r=0.866 **	r=-0.258	r=-0.173

[\* p <0.05, \*\* p<0.001]

**Acknowledgements:** Funding provided by the Saskatchewan Health Research Foundation

## Exploring Self-compassion and Versions of Masculinity in Men Athletes

Student: Nathan A. Reis

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**Introduction:** Despite a growing body of literature on self-compassion in sport, little research has focused exclusively on *men* athletes. Being self-compassionate entails being moved by one's own suffering along with a desire to alleviate that suffering (Neff, 2003), and it has been identified as a promising way for *women* athletes to manage emotionally painful sport experiences (e.g., perceived failures and inadequacies) in constructive and healthy ways (Mosewich et al., 2013; Ferguson et al., 2015). The purpose of this research was to (a) replicate a subset of findings from previous self-compassion research on women athletes and general populations of men, and (b) extend previous research on men athletes by exploring the role of self-compassion within diverse versions of masculinity.

**Methods:** Participants ( $N = 172$ ,  $M_{age} = 22.8$  years) from a variety of sports completed an online survey. To assess correlations and semi-partial correlations, Pearson correlations were used. To test for significant moderation, hierarchical multiple regression analyses were used.

**Results:** Self-compassion was related to most variables (e.g., psychological well-being, fear of negative evaluation, state self-criticism, internalized shame, reactions to a hypothetical sport-specific scenario) in hypothesized (i.e., adaptive) directions and predicted unique variance beyond self-esteem in the majority of variables. In addition, self-compassion was differentially related to inclusive and hegemonic masculinity, as well as moderated relationships between masculinity variables and both autonomy and attitudes towards gay men.

**Conclusion:** Our findings support self-compassion as an effective resource for men athletes, and one that might buffer the emotionally difficult experiences that occur in men's sports.

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## **Reproducibility of Target Force and fMRI Activation During Submaximal Handgrip Contractions**

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Supervisor: Dr. Jon Farthing

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**Introduction:** The purpose of this study was to investigate the reproducibility of functional MRI scans involving a motor task.

**Methods:** Eleven healthy participants (6 female;  $28.3 \pm 6.1$  yrs;  $1.69 \pm 0.08$  m;  $74.9 \pm 15.23$  kg) underwent two MRI sessions at least two days apart to perform a handgrip task. Separate scans were acquired at three sub-maximal intensities (25, 50, 75%) of maximal voluntary contraction (MVC) in random order. Motor cortex activation was processed using a novel relative threshold method to determine a window of activation using the highest threshold value before brain activation disappeared and the lowest threshold value for which the map was first 'clean' (i.e. no false activation found). The 50% value between these two thresholds was used to compute the maps. Different activation thresholds were used for each participant, occasion, and condition (range: 0.54-0.81). Coefficient of variation (CV%) values were calculated for handgrip MVC force, sub-maximal forces, corresponding voxel number and intensity of activation in motor cortex

**Results:** Reproducibility (CV%) of handgrip MVC was 7.6%, while sub-maximal handgrip intensities (20, 50, 75% MVC) were 6.9-7.6%, 8.4-9.4%, and 16.9-17.6%, respectively. For the number of voxels the CV for the 25, 50, and 75% MVC conditions were 28.4%, 18.4% and 20.7%, respectively. For signal intensity, the CV was 4.7%, 6.5%, and 4.2% respectively.

**Conclusion:** Motor output was more variable with increasing intensity. Signal intensity was more reproducible than voxel number. Handgrip contractions at 50% MVC produced the most stable motor output and activation maps. These findings are useful when designing intervention studies to detect fMRI changes in motor cortex activation.

## **Children with Autism Spectrum Disorder Have Sustained Bone Deficits in the Radius and Tibia Shaft: 1-year Follow-Up**

Student: Mahdi Rostami Haji Abadi

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**Introduction:** Poor bone development during childhood may explain an elevated risk of fracture in individuals with ASD. Previous studies reported 13-30% lower aBMD z-scores for total body, lumbar spine, hip and femoral neck measures in children with ASD when compared to TD children while aBMD changes were comparable. One study also indicated 10-20% deficit in bone microstructure and strength at the distal radius and tibia in children with ASD. The literature has limited prospective evidence of bone mass, structure and estimated strength development in children with ASD. Our objective was to compare radius and tibia bone mass, structure and estimated strength between children with ASD and their TD controls at baseline and after 1-year follow-up.

**Methods:** We followed 13 children with ASD (12 boys) (mean age at baseline: 10.2, SD 2.8 yrs) and 32 TD children (15 boys) (mean age 10.7, 1.7 yrs). We used our standard protocols to obtain radius and tibia peripheral quantitative computed tomography (pQCT) scans at the distal and shaft sites of the radius and tibia at baseline and after one year. Outcomes included total area, and cortical content as well as density-weighted polar section modulus, a strength measure assessing resistance to torsional loading. As there were no between-group differences in age, body size or maturity (age from peak height velocity), we used MANOVA to compare bone outcomes between the groups at baseline. We normalized follow-up bone outcomes to 1-year change. We used repeated measures MANOVA to compare 1-year changes between the groups.

**Results:** There was a significant main effect of the group (Wilks' Lambda = 0.413,  $F(1, 35) = 2.233$ ,  $p=0.044$ ) but no interaction between group  $\times$  time (Wilks' Lambda = 0.643,  $F(1, 35) = 0.871$ ,  $p>0.05$ ). At baseline, radius shaft total area, cortical area, cortical content and estimated bone strength were 22-37% lower in children with ASD when compared to TD children. Tibia shaft cortical area and cortical content were 19-22% lower.

**Conclusion:** Observed 19-37% deficits in bone mass, structure and strength at radius and tibia shafts in children with ASD were sustained over 1-year follow-up.

## Grip Strength Helps Differentiate Boys with Lower Distal Radius Bone Strength

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Supervisor: Dr. Saija Kontulainen

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**Introduction** Grip strength has been associated with bone size and strength at the radius shaft in children. However, the role of grip strength in predicting variance in distal radius bone strength, specifically bone failure load and stiffness obtained from high-resolution imaging and finite element (FE) analysis, has not yet been reported. Our objectives were to test following hypotheses: (1) grip strength would independently predict distal radius bone failure load and stiffness at the distal radius in children; and (2) children with grip strength below the 50th percentile would have lower failure load and stiffness at the distal radius when compared to those with grip strength equal or above the 50th percentile.

**Methods:** We recruited 160 typically developing children (ages 7-14yrs) from local schools. We included 137 (75 girls) participants (mean age 10.5yrs, SD 1.8) with valid maximal grip strength (kg) measurement and high-resolution peripheral quantitative computed tomography (HR-pQCT) scans at the distal radius of dominant limb. We analyzed scans with manufacturer-provided FE software to obtain bone failure load (N) and stiffness (kN/mm). We tested Hypothesis #1 using hierarchical regression analyses to predict variance in failure load or stiffness by entering grip strength in the (base) model with forearm muscle area. We report change in model fit ( $\Delta R^2$ ) and standardized beta coefficient (std. $\beta$ ) for predictors. To address Hypothesis #2, participants were first categorized as having a grip strength <50th or  $\geq$ 50th percentile groups, based on Canadian grip strength reference values. We compared bone failure load and stiffness between groups using MANCOVA, adjusting for maturity in boys and body mass and forearm muscle area in girls.

**Results:** Grip strength improved model fit when included with muscle area to predict variance in failure load and stiffness in both boys and girls ( $\Delta R^2$ :0.03-0.15, std. $\beta$ : 0.29-0.48,  $p < 0.05$ ). Boys with a grip strength <50th percentile had 18% and 19% lower distal radius failure load and stiffness, respectively, than boys with the grip strength  $\geq$ 50th percentile group ( $p < 0.01$ ). In girls, there were no differences in failure load and stiffness between the groups.

**Conclusions:** Grip strength independently predicted distal radius failure load and stiffness in both boys and girls. Boys with grip strengths below the 50th percentile had, on average, 18-19% lower failure load and stiffness than their peers with grip strengths equal or above the 50th percentile of Canadian grip strength reference data.

# WHAT IS KINESIOLOGY?

*Exercise Physiology*

*Physical Activity*

*Biomechanics*

*Sport Psychology*

*Cardiovascular  
Physiology*

*Bone  
Health*

*Nutrition*

*Growth &  
Development*

*Indigenous  
Health*

*Education*

*Chronic Disease  
Management*

*Neuromuscular  
Physiology*

**LEADING AND INSPIRING MOVEMENT,  
HEALTH, AND PERFORMANCE**

*Illustration by: Mackenzie Bone*