

**DPT Research Day**

**Class of 2019**

Abstracts for Poster and

Platform Presentations

**Friday, July 12, 2019**

**8:30– 3:00 PM**

**Loosemore Auditorium**

**DeVos Campus**

**Grand Rapids, MI**

Platform Presentations

**EFFECT OF RESISTANCE BAND POSITIONING ON TRUNK AND LOWER EXTREMITY MUSCLE ACTIVITY AND CENTER OF MASS DURING SQUATTING.** Shetler K, Sulavik M, Witczak T, Hoogenboom B, Bennett J; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** The squat is one of the most popular exercises in both rehabilitation and strength training due to its functional relevance and its ability to activate multiple large muscle groups. There is little research on how the addition of elastic resistance bands to a squat impacts muscular activity and translation of center of mass (COM). The purpose of this study was to determine how the positioning of a CLX TheraBand© on the upper extremities during a resisted squat impacts lower extremity and core muscular activity as well as the translation of the body’s COM. **METHODS:** In this descriptive research study, 20 healthy subjects (9 females, 11 males; mean age of 24.95 years) were tested via surface electromyography (EMG) for their maximum voluntary isometric contraction (MVIC) in six selected muscles (rectus abdominis, erector spinae, gluteus medius, gluteus maximus, biceps femoris, and rectus femoris). Retroreflective markers were placed on the subjects to allow for 3D motion analysis using Vicon Nexus Motion Lab Systems (16 high-speed cameras and two force plates). The subjects performed six squats in each of four squatting conditions replicating common variations of the squat to a standardized depth and rate in a randomized order using a pre-selected CLX TheraBand© to provide resistance during squatting. All conditions had bands looped under the feet and included C1:band crossed behind legs and to opposite wrist with hands on hips; C2:band on wrists with hands clasped, elbows extended, and shoulders flexed to 90°; C3:band between deltoid and biceps with shoulders flexed to 90° and arms crossed; C4:band in hands with arms overhead. The maximum EMG data for each muscle during each condition was compared to its respective MVIC to normalize data as a %MVIC. Calculations were performed to determine the biceps femoris to rectus femoris (hamstring to quadriceps, or H:Q) ratio. Center of mass translation, %MVIC for each muscle, and H:Q ratio were compared between each condition. Effect size was calculated to help determine the magnitude of statistical significance. A p-value of 0.05 was used for comparison of individual muscles and COM, and a p-value of 0.0083 was used in analysis of the H:Q ratio. **RESULTS:** Due to data collection errors, C3 could not be analyzed for individual muscle EMG and COM comparisons. There was a statistically significant difference in the translation of COM between C1 and C2, with C2 having a greater translation (p=0.025). There were statistically significant differences in EMG activity of all muscles, with exception of the rectus abdominis, between at least two of the three conditions analyzed (p<0.05). C1 had a significantly lower H:Q ratio than C2 and C4, whereas C2 had a significantly greater H:Q ratio than C4 (p<0.0083). **DISCUSSION:** Altering the position of a resistance band during a squat does impact the body’s COM translation and likely the amount of muscular stability required. The EMG results from individual muscles demonstrate that resistance band position does have an impact on the extent of activation of specific muscles. H:Q ratios were impacted by resistance band positioning and were greater than those described in a large portion of the previous research. **CONCLUSION:** Altering the position of a resistance band during a squat impacts the translation of the body’s COM and muscular activation of the core and lower extremity musculature. Resistance band positions that challenge COM stability should be used later in rehabilitation, and band positioning may be selected based on which specific muscles are being targeted or protected during the squat. Furthermore, resistance band positioning can be utilized to maximize the H:Q ratio in certain rehabilitation programs.

**SHORT-TERM LONGITUDINAL DIFFERENCES IN DYNAMIC BALANCE DURING AMBULATION UNDER SINGLE- AND DUAL-TASK CONDITIONS IN DIVISION II FOOTBALL ATHLETES.** Beam K, Ostlund B, Zimmerman C, Alderink G, Lee Y; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION**: Sports-related concussions have a variety of negative implications, especially if athletes return to play (RTP) before complete neurologic recovery has occurred. Current RTP protocols focus on symptom management and resolution. Symptom resolution does not appear to correlate with complete neurologic recovery. Static and dynamic balance measures, such as changes in center of pressure (COP), and temporo-spatial parameters of gait may better demonstrate readiness to RTP. The purpose of this study was to examine temporo-spatial and dynamic balance variables under single- and dual-task conditions during self-paced walking one year apart during first double limb support and single limb support to determine the differences in non-concussed football players. **METHODS**: Healthy, non-concussed Division II collegiate football players (n: 7, age: 18.6+0.5 years, height: 188.0+5.5 cm, mass: 115.0+22.0 kg) participated. Five trials of each condition (single-task (ST) right limb, ST left limb, dual-task (DT) right limb and DT left limb) were conducted for year one and year two. Participants ambulated across a portable AMTI (Advanced Mechanical Technology, Inc., Watertown, MA) force platform which collected data at 200 Hz. The dependent variables included COP variables (max medial-lateral (M/L) excursion, mean M/L velocity, and mean anterior-posterior (A/P) velocity) during first double limb support and single limb support as well as temporo-spatial gait variables throughout gait. Data was exported into SAS JMP (SAS, Cary, NC), and a standard factorial ANOVA was used to analyze the data. A p value of less than 0.05 determined significance. **RESULTS**:Max M/L COP excursion was greater for single limb versus first double limb support (p < 0.0001) and for right lower extremity compared to left lower extremity within subject (p < 0.0001). With task, cadence, stride length, and stride speed were found to be significantly different (p < 0.0001, p = 0.0003, and p < 0.0001, respectively). Mean M/L COP velocity was greater for first double limb support versus single limb support (p < 0.0001) and for right lower extremity compared to left lower extremity within subject (p < 0.0001). Mean A/P COP velocity was greater in year two than in year one (p = 0.0068), in single-task versus dual-task (p = 0.0041), and for single limb support versus first double limb support (p < 0.0001). **DISCUSSION**: Our results suggest that A/P COP velocity could be used when considering differences in single limb support versus first double limb support because this potentially indicates a change in stability of an athlete. This study found mean A/P COP velocity to be greater in single-task versus dual-task, which is a similar finding to previous studies. Previous studies reported a decrease in cadence, stride length, and stride speed in dual-task compared to single-task conditions, which is similar to the findings in this study. The current study also found a difference in max M/L COP excursion between the athlete’s right and left lower extremities, which could indicate a difference in the ability to maintain stability depending on their dominant extremity. Differences between the lower extremities and stability should be investigated further for potential implications in RTP protocol development. **CONCLUSION**: Max M/L COP between the limbs and A/P COP between single limb and double limb support should be considered to determine an athlete’s stability during motor tasks.

**RUNNER’S HEALTH CHOICES QUESTIONNAIRE: THE FEMALE COLLEGIATE CROSS-COUNTRY RUNNER’S PERSPECTIVE OF HEALTH AND EATING BEHAVIORS.** Garvin N, Kuhlman K, Saturley H, Stickler L, Hoogenboom B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** As female participation rates across sports continue to rise, there has also been a related increase in athletic injuries with speculation that some injuries among female athletes may be correlated with poor nutritional status or reduced caloric consumption. This is especially true in the female cross-country runner due to the intense training levels and the high emphasis on low body weight. However, to the researchers’ knowledge, there is no quantitative study to assess reasons for eating behaviors and perspectives about health in female collegiate cross-country runners. The primary purpose of this study was to assess the perspectives toward health as related to sport and the factors impacting eating behaviors in female collegiate cross-country runners. **METHODS:** The Runner’s Health Choices Questionnaire (RHCQ), a previously validated survey, was disseminated to collect quantitative data regarding reasons for eating behaviors and perspectives about health in female collegiate cross-country runners, ages 18-25, across NCAA Divisions I, II, and III. The survey was distributed through an online platform using Qualtrics. Data analysis consisted of the descriptive reporting of results to identify trends regarding the female collegiate cross-country runner’s perspectives on health and eating behaviors. A chi-square test of independence was performed to investigate the relationship between access to a registered dietician nutritionist (RDN) and division as well as the relationship between diet type and division at the level of p ≤ 0.05. **RESULTS:** A total of 353 female collegiate cross-country runners participated in the survey. The most common intrinsic factors that impacted overall diet type were *makes you feel healthy*, *enjoyment of food*, and *athletic performance enhancement.* Extrinsic factors such as *practice/race that day*, *creating a balanced diet*, and *choices in the cafeteria* were the top factors influencing daily meal decisions. There was a statistically significant relationship between access to an RDN/sports dietician (SD) and division (p = 0.000). There was insufficient evidence to conclude that there was a statistically significant relationship between diet type and division (p = 0.891). **DISCUSSION:** Eating behaviors and health perspectives in female collegiate cross-country runners are multifactorial and involve many intrinsic and extrinsic aspects. Athletes often use sources that are not reputable to obtain their nutritional information. Therefore, to combat this, a strong working relationship with an RDN/SD may be indicated for the athletic department personnel. Previous literature suggests that the management of the Triad is best provided by a multidisciplinary team, including physical therapists. Based on the most common factors influencing daily meal decisions, generalized education should be geared toward how the female cross-country runner can create a balanced diet, select healthy food choices given the options in the cafeteria, and consume the proper foods on practice/race days. Additionally, health care providers may explain the impact that intrinsic/extrinsic factors have on an athlete’s dietary choices and may help promote the formulation of an individualized plan for each athlete. **CONCLUSION:** It is essential that generalized nutrition education with an emphasis on intrinsic and extrinsic factors for food choices be provided to female collegiate athletes. Based on the athletes’ positive attitudes regarding nutritional change, it is imperative that these female athletes are provided adequate and reliable information to make educated health decisions, stressing the need for athletic department personnel to have a strong working relationship with an RDN/SD.

**MULTIPLE ATRAUMATIC HIP FRACTURES IN A 63-YEAR-OLD MALE: A CASE REPORT.** Oswalt CF, Hoogenboom BH; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** The prevalence of hip fracture in the United States is 957.3 per 100,000 women and 414.4 per 100,000 men. The incidence of post-operative periprosthetic femur fracture is reported to be 2.2%. The prognosis after a periprosthetic fracture is poor, and the mortality rate is increased. The purpose of this case report was to detail the functional and medical decline of a subject over the course of multiple episodes of care in a sub-acute rehabilitation facility after a series of non-traumatic (pre- and post-operative) fractures of the left hip to gain insight on risk factors and prognosis for future subjects who present similarly. **CASE DESCRIPTION:** The subject of this case report was a 63-year-old African-American male with a past medical history of a cholecystostomy drain, alcoholic cirrhosis of the liver with ascites, Type II diabetes mellitus, iron deficiency anemia, hypertension, a heart murmur, and hepatitis C. The subject had multiple admissions to a sub-acute rehabilitation facility related to atraumatic hip fractures and an atraumatic periprosthetic fracture of the proximal femur. His function was markedly decreased with a Timed Up and Go of 2 minutes/21 seconds, a Tinetti Performance Oriented Mobility Assessment score of 5/28, and a left hip pain rating of 8/10. The subject was treated in sub-acute rehabilitation with interventions focused on functional mobility required for discharge to home. Interventions included wheelchair mobility, transfer training, gait training, and therapeutic exercise for lower extremity strengthening. **OUTCOMES:** The last known surgical intervention for the subject was a revision total hip arthroplasty with cabling. Functional outcomes were ambulation with a front wheeled walker with non-weight bearing on the left lower extremity, stand pivot transfers with contact guard assistance and a front wheeled walker, and sit to stand transfers with minimum to moderate assistance and a front wheeled walker. Final outcomes for the subject of this case report were unavailable due to decreased mental competency limiting the subject’s ability to provide consent for access to medical records upon leaving the sub-acute rehabilitation facility. **DISCUSSION:** Understanding the risk factors for decreased bone mineral density and decreased bone health is crucial when working in rehabilitation. The subject of this case report had multiple risk factors including alcohol abuse, Hepatitis C, Type II diabetes mellitus, congestive heart failure, the use of Furosemide, and a prolonged decreased weight-bearing status that has been shown to decrease bone quality and increase risk of fracture. When working with subjects with a previous history of atraumatic fracture and multiple risk factors for decreased bone quality, it is important to modify activities to reduce the risk of fracture. Multiple fracture risk assessment tools are available online for clinicians, such as the Fracture Risk Assessment Tool (FRAX) and the Garvan Tool. Further research is required to determine the optimal surgical and rehabilitative interventions for atraumatic hip fracture along with the influences of functional antibiotic femur spacer type, total hip arthroplasty femur implant length, and weight-bearing status on bone health and long-term outcomes.

**EFFECTS OF ADVANCED TRAINING ON CLINICAL REASONING IN PHYSICAL THERAPY.** Bachelor PM, Haller SA, Hazekamp LM, Sobeck C; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Understanding clinical reasoning in physical therapy has been a topic of previous research, but the content is currently limited. It has not been determined how advanced training in the form of residency training, fellowship training, or the completion of a certification plays a role in the differences between clinical reasoning in the profession. **METHODS:** A cross-sectional survey was designed to assess the clinical reasoning of physical therapists with regards to intervention choice for a lumbopelvic case, including ranking the impairments in order of treatment focus and choosing an intervention for each impairment given. The results of 162 participants who met the inclusion criteria were analyzed using non-parametric correlation testing and chi-square analysis. Variables that were analyzed included years of experience, level of education, completion of residency and/or fellowship training, and completion of any type of certification. **RESULTS:** Manual therapy and Mechanical Diagnosis and Therapy (MDT) were the most commonly chosen interventions across all impairments with exception of right hip strength deficits, in which directional preference and therapeutic exercise were the most commonly selected intervention categories. Significant differences were found for prioritization of impairments and/or treatment selection for all variables assessed. **DISCUSSION:** Participants who completed a residency and/or a fellowship more frequently obtained an ABPTS certification in orthopedics and were more likely to choose manual therapy as an intervention choice, which is consistent with their extensive manual therapy and orthopedic training. Those with an MDT certification, with more years of experience, or with a master’s degree or less were more likely to choose repeated motions as an intervention choice, which aligns with the principles of MDT training. **CONCLUSION:** Advanced training impacts the prioritization of impairments as well as the intervention choice in relation to a lumbopelvic case in physical therapy.

**CLINICAL DECISION-MAKING TO DETERMINE USE OF HIGH-VELOCITY, LOW-AMPLITUDE LUMBAR MANIPULATION IN PATIENTS PRESENTING WITH LOW BACK PAIN.** Badner WR, Crockatt CE, Winner KR, Sobeck C; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Lifetime prevalence of low back pain (LBP) in the United States may be as high as 84% of the population and can lead to significant loss of function and disability. Physical therapists (PTs) may utilize high-velocity, low-amplitude (HVLA) lumbar manipulation for the treatment of LBP. However, there is a gap in the literature describing PTs’ clinical decision-making process for utilizing this technique as an intervention. The purpose of this study was to determine what indicators were considered by clinicians during their clinical decision-making process when identifying patients on whom they would perform HVLA manipulation to the lumbar spine. **METHODS:** A 19-question quantitative electronic survey was emailed to members of professional physical therapy organizations and to select post-professional physical therapy programs. Participation was voluntary, and participants were included in the study if they were licensed PTs who treated at least 10 musculoskeletal patients per week, performed HVLA lumbar manipulation as an intervention, and lived in the United States. There were 257 respondents who consented to participate in the study, and 194 met the inclusion criteria (75.5%). A Likelihood Ratio Test was performed to determine if a relationship existed between the level of training, years of experience, and entry-level degree of the clinicians and their self-selected importance of specific findings from the patient examination and history when deciding to use HVLA manipulation to the lumbar spine. Statistical significance was set at p < 0.05 and a Bonferroni adjustment was utilized. **RESULTS:** Statistical significance was found for performance of HVLA lumbar spine manipulation on multiple patient presentations with respect to level of specialty training (p = 0.000). There were no statistically significant findings regarding indications for HVLA lumbar spine manipulation with respect to entry-level degree or years of experience. There were no statistically significant findings across all three groups with regards to prior screening for beliefs about pain, subjective questioning prior to manipulation, manipulation technique utilized, and continued manipulation based on outcome. **DISCUSSION:** Clinicians’ years of experience and entry-level degree had little impact on the factors that they considered in their clinical decision-making process when utilizing HVLA lumbar spine manipulation. Level of specialty training had the most significance on what patient presentations clinicians determined would benefit from HVLA lumbar spine manipulation as an intervention (i.e., concordant pain displaying no directional preference, unilateral low back pain radiating above the knee, segmental lumbar hypomobility, lower lumbar level segmental irritation, and upper lumbar level segmental irritation). Clinicians who had a higher level of specialty training indicated that they were more likely to perform manipulations on those specific patient presentations in comparison to participants with less specialty training. **CONCLUSION:** The level of specialty training was more significant than the entry-level degree or years of experience in PTs’ clinical decision-making process regarding indications for HVLA lumbar spine manipulation. The level of specialty training was the most significant factor in a clinician’s clinical decision-making process with respect to patient presentation and performance of HVLA lumbar spine manipulation in patients presenting with LBP.

**NORDIC WALKING TRAINING IN PERSONS WITH PARKINSON’S DISEASE: INDIVIDUALIZED PRESCRIPTION - A CASE SERIES.** Horak IT, Valley KJ, Wagner DA, Harro CC; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** Parkinson’s disease (PD) is a highly prevalent neurodegenerative disorder resulting in both motor and non-motor symptoms. Physical therapy interventions prioritize gait and balance dysfunction to optimize safe mobility in persons with PD. Nordic Walking (NW) is a high intensity, aerobic walking exercise with Nordic walking poles which requires large amplitude limb movements and interlimb coordination to produce a smooth, rhythmic walking pattern. The purpose of this case series was twofold: (1) to describe the application of a customized NW training program in individuals with varied PD gait dysfunction and examine the outcomes specific to gait function, motor, and non-motor symptoms; and (2) to assess NW independent engagement and long-term retention following a supervised NW training program. **CASE DESCRIPTION:** Three individuals (2 men, 1 woman; ages 59-69 years old) participated in this case series. Participant 1 was in Hoehn and Yahr (H&Y) stage II and was experiencing mild motor impairments, reduced unilateral arm swing, and mild gait hypokinesia. Participant 2 was in H&Y stage III and had motor apraxia, balance deficits, gait arrhythmicity, and frequent freezing of gait. He also had a significant history of frequent falls. Participant 3 was in H&Y stage III with moderate bilateral PD motor symptoms, balance deficits, and multiple gait impairments. His other significant comorbidities included low back pain and impaired cardiovascular endurance. Supervised NW training was conducted for 15 one-hour sessions over a 6-week period on an outdoor track and over varied terrains. NW training was individually customized and progressed for each participant. Key principles trainers emphasized were increasing movement amplitude, walking effort and speed; engagement of upper extremities and power push off in the NW pattern; and facilitating a smooth gait rhythm. Participants were also asked to complete independent NW exercise at home 2-3 times weekly over the duration of the intervention period as well as during a 3-month follow-up phase. Primary outcome measures examined gait and mobility function at both time points. Secondary outcome measures examined PD motor and non-motor symptoms using standardized measures. **OUTCOMES:** There was high adherence during both training and 3-month follow-up phases with no adverse events reported. All participants improved post-training in fast walking speed, walking endurance and speed for sustained distances, and PD motor symptoms as evident in the 10-Meter Walk test, 6-Minute Walk test, and Unified Parkinson’s Disease Rating Scale-motor scores, respectively. These changes exceeded the Minimal Detectable Change for these measures in PD. Additionally, participants improved in the Timed Up and Go (TUG) and dual task-TUG tests. Participant 2 had a 44.4% decline in freezing episodes and a marked reduction in fall rate post-training. Participants’ gait and mobility gains were retained at the 3-month follow-up. **DISCUSSION:** Improvements in walking distance and average speed during 6-Minute Walk test following NW training are clinically meaningful and salient to community ambulation in persons with PD. Our findings are consistent with previous research regarding the therapeutic benefit of NW on gait function and reducing motor symptoms in PD. These gains may be attributed to the intensive aerobic exercise and locomotor-specific training elements of NW. Our case series also supports that by following a customized, supervised NW training program, individuals with PD with varied levels of disease severity and gait dysfunction can safely engage in independent NW home exercise and retain gains made during training. **ACKNOWLEDGEMENTS:** MPTA Institute for Education and Research- Large Grant Recipient.

**EFFECTIVENESS OF HOME-BASED VIRTUAL REALITY ON VESTIBULAR REHABILITATION OUTCOMES: A SYSTEMATIC REVIEW.** Owens KJ, Rajala BA, Ticknor SK, Kinne BL; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** The vestibular system is a complex network with multiple areas for dysfunction. With the advancement of technology, researchers have been exploring the use of virtual reality for treating vestibular dysfunction. Because home-based exercises are the preferred method of vestibular rehabilitation treatments, the purpose of this systematic review was to examine the effectiveness of home-based virtual reality systems on vestibular rehabilitation outcomes. **METHODS:** The following databases were examined: CINAHL Complete, ProQuest Medical Database, and PubMed. The following search terms were utilized: “video OR computer” AND “vestibular” AND “home”. The inclusion criteria consisted of (1) adults who have a vestibular dysfunction; (2) home-based virtual reality systems as a component of the intervention; (3) standard vestibular rehabilitation or no treatment as the comparison intervention if the study is a randomized controlled trial; (4) valid and reliable vestibular outcome measures; and (5) studies that are classified as level 2, level 3, or level 4 evidence. The evidence level for all of the included articles was evaluated using the Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence, and the methodological rigor for all of the included articles was evaluated using a ten-item tool created by Medlicott and Harris. **RESULTS:** The online databases identified 3123 articles, and two additional articles were found using other sources. Seven articles met the inclusion criteria and were qualitatively analyzed. The case series demonstrated that the primary goals of vestibular rehabilitation could be achieved through the use of virtual reality interventions. Three of the randomized controlled trials that compared the use of virtual reality interventions to traditional vestibular rehabilitation found that the two treatment approaches were equally effective in terms of the short-term results. One of the randomized controlled trials that compared the use of a combination of traditional vestibular rehabilitation and virtual reality interventions to traditional vestibular rehabilitation alone found that the combination intervention group demonstrated greater improvements than the control group in the short-term. The final two studies examined the long-term effects of a home-based virtual reality program and found an overall long-term maintenance of the functional improvements. **DISCUSSION:** The use of home-based virtual reality interventions was able to achieve the primary goals of vestibular rehabilitation and was equally as effective as traditional vestibular rehabilitation. Individuals who participate in virtual reality interventions may also note higher enjoyment levels, lower fatigue levels, and less difficulty with their balance as compared to individuals who participate in traditional vestibular rehabilitation. It may be most beneficial if virtual reality interventions are combined with traditional vestibular rehabilitation. **CONCLUSION:** Clinicians should consider a combination of home-based virtual reality interventions and traditional vestibular rehabilitation to treat individuals with vestibular dysfunction.

**THE EFFECT OF DAILY FATIGUE ON BALANCE IN INDIVIDUALS WITH MULTIPLE SCLEROSIS: A CONTINUATION STUDY.** Hoffman A, Kimble K, Stagner N, Baker B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Multiple Sclerosis (MS) is the scarring of neurologic tissue that can be categorized into four different types and that affects nearly 2.3 million individuals worldwide. There is currently no cure for MS. The disease adversely affects the daily function, mobility, and participation of those who have it. Individuals with MS experience fatigue as one of the most prevalent primary symptoms, especially a specific type of fatigue that is unique to MS. The purpose of this study was to determine if change in fatigue is a significant predictor of change in balance in the MS population. **METHODS:** Participants were recruited through a convenience sample from various local MS support groups. Inclusion and exclusion criteria were assessed, and written informed consent was completed. The individuals were randomized into one of two groups to determine the time of day that their first session would occur. A VAS-F scale was completed at both sessions to obtain a current fatigue level for the participant. Three tests, Motor Control Test (MCT), Sensory Organization Test (SOT), and Limits of Stability (LOS), were randomized for each individual. Each participant completed all three of the tests using the Neuro-Com. **RESULTS:** Eighteen participants were able to complete the study. A regression analysis was performed to discover if a correlation existed between the participants’ score on each balance test and their score on the VAS-F. Regression weights and p-values were obtained to determine the statistical significance. None of the tests provided a p-value < 0.05. Therefore, it was determined that change in fatigue was not a significant predictor of change in balance between the two sessions for any Neuro-Com subtest. **DISCUSSION:** While change in fatigue is not a significant predictor of change in balance, the results of this study demonstrated that the Neuro-Com is an accurate predictor of balance in the population with MS regardless of the level of fatigue that the individual is experiencing. Sixteen of the 18 participants reported increased fatigue in the afternoon, demonstrating that the population with MS experiences an increase in fatigue as the day progresses. Although balance was not changed by the level of fatigue, other components of physical or mental health might be altered by a change in fatigue later in the day. **CONCLUSION:** This study found that the subjective score on the VAS-F was not a significant predictor of balance in the population with MS. Change in fatigue did not correlate to a change in score on various Neuro-Com balance tests.

**BEYOND LOCOMOTION: A SYSTEMATIC REVIEW OF THE DEVELOPMENTAL IMPACT OF SELF-GENERATED MOBILITY.** Beauchamp E, Dominiak C, Harrison C, Veldman S, Kenyon LK, Farris J; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Independent mobility has been touted as a crucial developmental milestone that begins a developmental cascade across motor and non-motor domains. Understanding the impact of independent mobility in typically developing children is of interest to health professionals and child educators because it may provide a framework off which to base interventions (such as power mobility) for children who cannot move independently. Although current evidence on the benefits of self-generated mobility in typically developing children is used to support such interventions, there has not been a systematic review published in this area. Therefore, the purpose of this systematic review was to explore and critically appraise the published research about how the emergence of independent mobility in typically developing young children influences development in non-motor domains. **METHODS:** A literature search of PubMed, CINAHL, PsycInfo, and World of Science (Core Collection) was conducted utilizing the assistance of a research librarian. The inclusion criteria were peer-reviewed, primary source, quantitative studies published in English that focused on typically developing subjects ≤ 24 months, and study purposes relating to the effect of independent mobility on non-motor functional developmental domains. The exclusion criteria were conference proceedings, review articles, studies involving children with known developmental delays or atypical development, and studies involving self-generated mobility through power mobility devices. Screening, eligibility, data extraction, determination of level of evidence, and evaluation of scientific rigor were all conducted independently by four student researchers. Resolution of any discrepancies was achieved via the consensus of a fifth researcher. Utilizing pre-existing tools from the University of Newcastle and McMaster University, each of the researchers performed a thorough rigor assessment of each study included in the review. **RESULTS:** From the initial database search, a total of 4446 unique citations were identified. Among these, 32 articles representing 45 separate studies satisfied the inclusion/exclusion criteria. Methodological rigor scores of the included studies ranged from 52.9% to 87.5%, with a mean score of 71.2%. The identified effects of self-generated mobility were categorized into the following non-motor developmental domains: Language and Memory, Social Interactions, Interactions with Objects, Spatial Orientation, Emotional Behavioral Responses, and Connecting Intention to Action. **DISCUSSION:** All of the included studies, except one, found that the onset of independent mobility has a positive impact on development in non-motor domains for typically developing infants. Subsequently, self-generated mobility affects an infant’s ability to carry out activities such as learning and applying knowledge, communication, and mobility. Infants with the opportunity to move independently can participate in their environment and engage in interpersonal interactions, which are essential components of participation at this stage of life and which lead to further opportunities for growth and development. **CONCLUSION:** This systematic review supports the widely held belief that self-generated mobility in infants facilitates development across multiple non-motor domains and impacts their ability to interact and participate within their environment. Further research is needed to elucidate the impact of independent mobility on typically developing individuals as well as the potential impact in individuals who are not typically developing to promote optimal developmental experiences for all children.

**THE USE OF ELECTROENCEPHALOGRAPHY TO MEASURE NEUROPLASTIC CHANGES IN THE BRAIN FOLLOWING PHYSICAL THERAPY INTERVENTIONS: A SYSTEMATIC REVIEW.** Bradford B, Curtis P, VanderWoude K, Kenyon LK; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** It is well established that the central nervous system (CNS) undergoes adaptive changes over time. This capacity for adaptation, called neuroplasticity, is how the CNS encodes experiences and gains in skills and behaviors. Electroencephalography (EEG) has been proposed as a way in which to explore neuroplastic changes following interventions, thus providing information about the effectiveness of physical therapy interventions. The purpose of this systematic review was to explore and critically appraise the use of EEG to detect neuroplastic changes in the brain following physical therapy interventions. **METHODS:** An electronic literature search of PubMed, CINAHL, and Web of Science (Core Collection) was conducted in consultation with a research librarian. Inclusion criteria were (1) the use of EEG matrices as an outcome measure; (2) a well-defined, specific, and reproducible physical therapy intervention; and (3) peer-reviewed, primary source quantitative studies that were published in English. Studies were excluded if none of the participant groups represented physical therapy patient/client populations. Studies using EEG as an intervention as well as studies involving visual or auditory evoked potentials were also excluded. Screening, eligibility, and inclusion of studies as well as data extraction, determination of level of evidence, and evaluation of scientific rigor were independently conducted by three researchers. All disagreements were resolved through consensus with a fourth researcher. Rigor assessment was performed using the Quality Assessment Tool for Quantitative Studies (QATQS). **RESULTS:** A total of 3,602 unique citations were identified in the searches. Of these, 30 studies met the inclusion/exclusion criteria. Included studies utilized the following research designs: randomized controlled trial (n=5), controlled clinical trial (n=10), cohort studies (n=12), and cohort analytic studies (n=3). Neurological populations were most prominently represented in the included studies. Of the 18 studies that employed a control group, 14 used equivalent control groups and four used typical adults as controls. Four studies had a strong quality rating, six had a moderate quality rating, and 20 had a weak quality rating. The methods that collected and recorded EEG varied greatly among the included studies but were used most frequently to measure changes in power, frequency, and coherence following intervention. **DISCUSSION:** EEG data collection techniques, lead configurations, analysis methods, and protocols were highly variable in the published studies involving the use of EEG to detect neuroplastic changes in the brain following physical therapy interventions. EEG is useful because it is non-invasive and less expensive than other alternative methods for measuring neuroplasticity. EEG may allow for the detection of nuanced neuroplastic changes in populations with atypical brain development. Current research indicates that individual neurodevelopment, especially within the atypically developing brain, may not be adequately valued in the context of a group mean sample and may be more appropriately assessed through single-subject research designs. **CONCLUSION:** Included studies consistently demonstrated the use of EEG matrices to detect neuroplastic changes following physical therapy interventions. Given the variability of EEG techniques, the apparent lack of consensus regarding “best practice” in the use of EEG, and the weak quality rating of the included studies, the use of EEG to assess neuroplastic changes following physical therapy interventions is in its infancy.

Poster Presentations

**THE EFFECTS OF CENTRAL AND PERIPHERAL DRY NEEDLING ON LATENT MYOFASCIAL TRIGGER POINTS: A RANDOMIZED CONTROLLED TRIAL.** Doorn AL, Henning JT, Lehman JD, Rose J; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Myofascial trigger points (MTrPs) are a common source of musculoskeletal pain and dysfunction, but they may also be present in asymptomatic individuals. Researchers have proposed both local and remote contributors to MTrP formation. Two MTrP treatment approaches include peripheral dry needling of MTrPs and central dry needling of paraspinal muscles at the corresponding segmental level. The purpose of this study was to compare the effectiveness of peripheral and central dry needling in the treatment of latent MTrPs. **METHODS:** The research design was a double-blind, randomized controlled trial. The subjects included 48 asymptomatic individuals, ages 18-63, with at least 3 MTrPs in their infraspinatus and deltoid. Treatment groups included peripheral dry needling of MTrPs, central dry needling of the C4-C6 paraspinals, or sham dry needling (control). Outcome measures included numeric pain rating scale (NPRS), pain pressure threshold (PPT), manual muscle testing (MMT), and ultrasound to include B-mode imaging, elastography, and resistivity index (RI). Outcome measures were performed prior to intervention, immediately post-intervention, and 7 days post-intervention. Statistical analysis included repeated measures ANOVA for between/within group analysis of PPT, HHD, RI, and NPRS measurements; one-way ANOVA for homogeneity of groups at baseline; paired sample t-test to assess changes in MTrP dimensions; and Chi square test and Fisher’s exact test to compare elastography change between groups. Alpha was set at 0.05 for all statistical tests used. **RESULTS:** No significant differences existed between treatment groups for PPT, MMT, RI, or NPRS at baseline, day 0 follow-up, or day 7 follow-up. A significant decrease in MMT was found in the deltoid of the peripheral treatment group between baseline and day 0 follow up (p = 0.034). No other significant group-time interactions were observed for MMT, PPT, NPRS, or RI. A decrease in MTrP depth at day 0 follow-up was noted with return to baseline in the infraspinatus of the central dry needling group and the deltoid of the sham group. No other significant morphology changes were observed. Significant decreases in MTrP depth were seen in the deltoid of the central dry needling group (p = 0.048) and in the infraspinatus of the sham group (p < 0.001). A significant difference in the incidence of elastography change was noted between sham and peripheral dry needling (p = 0.001) and between sham and central dry needling (p = 0.0014). No significant difference in elastography was noted between central and peripheral dry needling. **DISCUSSION:** Decrease in deltoid muscle strength immediately following dry needling is supported in the literature. Similar results have been linked to intramuscular edema and post-needling soreness. However, this finding was not observed in the infraspinatus. A lack of significance in the other outcome measures may be attributed to the use of latent trigger points in asymptomatic individuals or to the lack of multiple treatment sessions. Elastography findings suggest decreased MTrP stiffness with central and peripheral dry needling when compared to sham treatment. However, inconsistent findings regarding morphology changes suggest a need for further research regarding visualization of MTrPs using ultrasound. **CONCLUSION:** Peripheral dry needling of the deltoid muscle was associated with a decrease in isometric strength between pre-intervention and day 0 follow-up measures. All other between group and within group comparisons of PPT, HHD, NPRS, and RI did not display significant changes. Although elastography imaging suggests beneficial effects of central and peripheral dry needling on MTrP stiffness, further research is necessary to determine the reliability and validity of MTrP visualization using diagnostic ultrasound.

**THE INFLUENCE OF DRY NEEDLING AS A COMPLEMENTARY INTERVENTION FOR PATIENTS WITH LOW BACK PAIN WHO ARE PARTIAL-RESPONDERS TO MDT-BASED TREATMENT: A CASE SERIES.** Lubinski R, Randall M, Sullivan M, Vaughn D; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** Low back pain (LBP) is a common health problem and a major cause of job-related disability in the world. Mechanical Diagnosis and Therapy (MDT) is widely used to diagnose and treat LBP. However, no attention is given in this system to the increased tissue tension caused by trigger points (TPs). Muscle imbalances caused by TPs in the surrounding lumbar and gluteal musculature often contribute to the prevalence and/or persistence of LBP. The purpose of this case series was to describe the use of Dry Needling (DN) to manage concurrent TPs in individuals with LBP who showed only a partial response to MDT treatment. **CASE DESCRIPTION:** Patient one was a 49-year-old female referred to physical therapy with a diagnosis of bilateral hip pain and LBP. The patient had LBP that was intermittent for the past 30 years and hip pain that started within the last year. Difficult positions for her included sitting cross legged, sitting in a chair, standing, and sleeping. Her initial FOTO score was 49/100, and her Oswestry Disability Index (ODI) score was 44.4%. Patient two was a 55-year-old female referred to physical therapy with a diagnosis of LBP and right hip pain which started several years ago with a gradual, insidious onset. The patient was active, playing tennis at least twice per week. Her pain was aggravated by sitting, forward bending, sleeping, side stepping, and stepping across her body. Her FOTO score at intake was 75/100, and her ODI score was 16%. Patient three was a 54-year-old male with a diagnosis of chronic bilateral LBP without sciatica. He sustained an initial injury approximately one year prior while performing crunches and sit-ups. His primary problems were difficulty sleeping and pain with exercise and walking. His initial FOTO score was 54/100, and his ODI score was 26.7%. Interventions for all patients included lumbar extension exercises and dynamic stabilization, soft tissue mobilization, lumbar PA mobilizations, HVLAT to the thoraco-lumbar junction, core/hip strengthening, hip flexor stretches, and posture/pain education. Mild improvements were noted following the initial interventions; and all patients were deemed partial responders to MDT-based intervention, prompting initiation of DN into their treatment sessions. **OUTCOMES:** All three patients showed an improvement of 4 to 13 points in FOTO scores, moving each one into a stage one level above their initial assessment. All three patients demonstrated improvements in their ODI, ranging from 4% to 50%. **DISCUSSION:** DN was introduced in three cases once the patient failed to show progress from the MDT-based treatment. Following the initiation of DN, all patients showed improvements in their FOTO scores, pain levels, and functional abilities. This case series suggests that DN may be a safe and effective adjunctive treatment for partial responders to MDT. However, more extensive studies are needed to confirm these findings. **ACKNOWLEDGEMENTS:** Brian Gilbert and Edo Zylstra.

**Effects of dry needling with intramuscular electrical stimulation on chronic UNILATERAL elbow pain: a case report.** Bessette SF, Green M; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** The primary purpose of this case report was to demonstrate the utility of dry needling (DN) with intramuscular electrical stimulation (IES) in a patient with chronic unilateral elbow pain. A secondary purpose was to illustrate that dry needling is a valuable and, in some cases, necessary treatment that should be considered part of physical therapists’ scope of practice in every state. **CASE DESCRIPTION:** Case reports have been published on the use of DN with and without IES in the treatment of many neurogenic and idiopathic conditions. However, none have described a case in which DN with IES was initiated after a period of conservative treatment without DN. In this case, a 53-year-old woman presented to physical therapy with a three-year history of idiopathic unremitting unilateral elbow pain with associated shoulder pain and loss of range of motion. She was unable to lift, grip, work at the computer, cross-country ski, or play pickleball without pain. Numerous therapies had failed to relieve her pain including traditional physical therapy, laser therapy, cortisone injections, Rolfing, Trigenics, myofascial work, radial nerve release surgery, and craniosacral therapy. Her presentation was consistent with myofascial pain syndrome as her elbow pain could only be reproduced with palpation of trigger points in the ipsilateral upper trapezius, infraspinatus, and distal triceps. The patient was treated for four sessions with manual therapy (trigger point release, IASTM, and soft tissue massage) and therapeutic exercises. Her range of motion and pain would improve immediately following treatment but would return between sessions to previous levels. DN with IES of the trigger points in the ipsilateral limb was applied for the following eight treatments in addition to a progression of therapeutic exercise. **OUTCOMES:** The patient’s pain levels decreased significantly only after the initiation of DN in the fifth treatment session. On a 0-10 scale, her “worst” pain decreased from 7 to 4, and her “least” pain decreased from 1 to 0. Her shoulder functional internal and external rotation improved from dysfunctional and painful to within normal limits and pain-free, and she was able to resume recreational activities and sleep undisturbed by pain. **DISCUSSION:** DN was most likely a significant factor reducing the patient’s chronic elbow pain and allowing her to return to her regular recreational and work activities. This patient’s previous bouts of acupuncture and physical therapy without the use of DN had proven inadequate to reduce her pain and restore her function. This case illustrates the importance that dry needling can have on myofascial pain when performed by a skilled physical therapist. **ACKNOWLEDGEMENTS:** I would like to acknowledge my faculty mentor in this project, Mary Green, PT, JD.

**THE EVIDENCE FOR THE IMMEDIATE EFFECTIVENESS OF MOBILIZATIONS WITH MOVEMENT OR SUSTAINED NATURAL APOPHYSEAL GLIDES AS DEMONSTRATED IN SINGLE-INTERVENTION OUTCOMES: A SYSTEMATIC REVIEW.** Pakkala K, Ruthenberg A, VanderWoude S, Vaughn D; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION**: Mulligan’s mobilization with movement (MWM) is a technique employed by physical therapists to treat musculoskeletal dysfunctions, specifically positional faults defined as biomechanical changes of joint articulations. This intervention is proposed to target a positional fault and to move the affected segment into a corrected position. The focus of this systematic review was to investigate the ability of manual therapists to correct positional faults using MWM throughout the spine and extremities as evidenced by improved outcomes (i.e., pain, function, ROM) in one treatment session. **METHODS:** An electronic literature search of PEDro, PubMed, Web of Science, and CINAHL was completed (May 2018) by three reviewers. The inclusion criteria were articles where: (1) only one treatment with MWM was used; (2) the participants had primary musculoskeletal conditions of the trunk, upper extremities, or lower extremities; (3) randomized controlled trials were published in full text; and (4) outcome measures were designed to assess pain, function, or range of motion. The exclusion criteria were: (1) no English translation of the article; (2) the use of outcome measures other than those listed in the inclusion criteria; (3) evidence level below Level 2; (4) the use of more than one treatment session; (5) the used of non-specific techniques that did not require palpation; and (6) the use of interventions aimed at neurological or other non-musculoskeletal conditions or at asymptomatic populations. **RESULTS**: A total of 696 articles were identified after the initial search was undertaken (PubMed = 145, PEDro = 98, CINAHL = 238, Web of Science = 215). Eleven articles met the inclusion/exclusion criteria after title, abstract, and full text review. **DISCUSSION:** Based on the statistical and clinical significance, effect sizes, rigor, and number of included studies, the authors of the current systematic review came to the following conclusions: (1) there was moderate evidence for increasing ROM at the spine, hip, and shoulder and for decreasing pain intensity using a single intervention of MWM; (2) there was promising, but limited, evidence for improvements in function; (3) there was minimal to no support for increasing pain pressure threshold or thermal pressure threshold; and (4) there was weak evidence for the treatment of lateral epicondylitis or for the improvement of weight-bearing ankle dorsiflexion using a single intervention of MWM. **CONCLUSION**: The purpose of this systematic review was to examine the immediate effects of MWM in treating the joints of the extremities and spine. This systematic review offered weak to moderate support for the immediate, positive effects of MWM on pain, function, and ROM outcome measures across a variety of spinal and peripheral joints.

**ASSESSING THE INTER-RATER RELIABILITY OF JOINT KINEMATICS AND KINETICS USING THE PLUG-IN GAIT AND OXFORD FOOT MODELS DURING TREADMILL RUNNING.** Matheson K, Nesburg L, Werme R, Alderink G, Lee Y; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Three-dimensional gait analysis (3DGA) is a comprehensive examination of an individual's kinematic and kinetic data for walking and running gait. There is currently a lack of research that defines the reliability of 3DGA while running. The purpose of this study was to examine the combined use of the Oxford Foot Model (OFM) and Plug-in Gait Model (PiG) to determine inter-rater reliability of joint kinematics and kinetics between two novice marker placers while contributing to a normative data collection on shod running in healthy adults. **METHODS:** This exploratory study included 20 healthy runners (12 females, 8 males), ten of whom returned for a second session (6 females, 4 males). A 15 Vicon camera setup filming at 120 Hz (8 T-40S, 5 MX40, and 2 MXF40 models) was used with an AMTI instrumented treadmill (Advanced Mechanical Technology, Inc., Watertown, MA). Markers were placed by two third-year Doctor of Physical Therapy students over two separate testing sessions. Markers were placed directly on the foot through pre-cut holes in standardized running shoes (Mizuno Wave Runners). Data were gathered at three speeds (6.21 mph, 7.45 mph, and 8.60 mph); were reduced using Vicon Nexus, v 2.8.1.; and were exported to Visual 3D (C-Motion, Inc., Germantown, MD) to determine joint kinematics and kinetics. A variance components mixed model analysis was utilized to assess the variance associated with intrinsic and extrinsic sources of error, with total therapist session variation representing inter-rater reliability, and with alpha set at < 0.05. **RESULTS:** Total therapist variation across joint angles of the combined PiG and OFM ranged from 0.8°-7.8°. Kinematic variability in joint angles due to therapist using the PiG was greatest in the sagittal plane for the trunk relative to the pelvis and hip as well as in the transverse plane of the hip and knee. Variability in joint angles due to therapist using the OFM was greatest for all planes of the forefoot relative to the hindfoot as well as for the hallux in the sagittal plane. Twenty-four of the 28 segments/joints had a significant Wald p-value in at least one total therapist variation component. Variability due to therapist for net internal moments and powers was negligible. **DISCUSSION:** Kinematic variability tended to be greater for foot kinematics. It is believed that much of the variability found in the kinematic analysis was attributable to soft tissue artifact and to inconsistencies in marker placement. Due to the large contribution of ground reaction force to joint moment and power calculations, the therapist had little to no impact on kinetic analyses. **CONCLUSION:** This study found that the PiG and OFM combined model shows reasonable to good inter-rater reliability and has the potential to be used in future gait studies to create a more holistic, full-body model. The use of a variance component model is plausible and clinically useful in studying the reliability of 3D gait.

**MODE AND INTENSITY OF PHYSICAL ACTIVITY DURING THE POST-ACUTE PHASE OF A SPORT-RELATED CONCUSSION: A SYSTEMATIC REVIEW.** Koch E, Vicari K, Walenta K, Baker B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Sports-related concussions (SRCs) have received national attention in recent years due to their increased prevalence in youth. An SRC is an injury that results from a direct blow to the head, neck, or body which transmits a strong force causing neurological impairment. Recent research has recommended active rehabilitation within the first week post-SRC after 24 to 48 hours of physical and cognitive rest. The post-acute phase is defined as 48 hours to seven days post-SRC. As treatment focus shifts towards earlier physical exertion, specifically during the post-acute phase, it is imperative to evaluate the most effective mode and intensity of physical activity to reduce symptoms and improve outcomes. The purpose of this systematic review was: (1) to investigate the most effective mode of physical activity during the post-acute phase of SRC to optimize recovery and (2) to assess the most effective intensity of exercise during the post-acute phase of SRC to optimize recovery. **METHODS:** The Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed, SPORTDiscus, and Web of Science databases were used to search the terms “brain concussion” AND “exercise” and variations of these terms. Inclusion criteria for the systematic review were as follows: (1) original research; (2) participants younger than 25 years old; (3) concussion as the primary source of injury; (4) intervention with specified intensity or mode of exercise following a concussion; and (5) at least one group initiating exercise on an average of within seven days following the concussion. The evidence level for each included study was evaluated using the 2011 Oxford Center for Evidence-Based Medicine Guide. The methodological rigor for each included study was evaluated using a scale adapted from Medlicott and Harris. **RESULTS:** Two thousand sixty-eight records were identified through database searching. Nine studies were found to be eligible and were included in this systematic review. The methodological quality of the literature was limited. Three included studies were classified as moderately strong evidence, and the remaining six studies were considered weak evidence. Six of the nine studies used a cycle ergometer, and four studies used a treadmill as the mode of exercise. Three studies utilized a low-intensity intervention, four studies utilized moderate intensity, and eight studies incorporated some component of high-intensity exercise. **DISCUSSION:** Studies utilizing a cycle ergometer during the post-acute phase determined this mode to be safe. Use of a treadmill during the post-acute phase may improve recovery time and symptom severity. However, an adapted Bruce Protocol may negatively influence recovery time. Low intensity exercise initiated during the post-acute phase was non-detrimental and may improve recovery time and symptom resolution. Moderate intensity exercise during the post-acute phase was found to be safe and may improve outcomes. Two of the four studies indicated that moderate intensity was superior to low intensity. High intensity exercise during the post-acute phase may have either a positive or a negative influence on recovery time and symptom severity. **CONCLUSION:** Cycle ergometer and treadmill utilization were not aversive during the post-acute phase of SRC. Therefore, therapists should consider an individualized approach to exercise mode prescription during this phase while carefully considering exercise intensity. Although the volume of literature at this time is limited, therapists should consider prescribing individualized, moderate intensity exercise when treating patients during the post-acute phase of SRC. **ACKNOWLEDGEMENTS:** Betsy Williams, MSLIS.

**QUANTIFICATION OF SEASONAL VARIATION IN DAILY PHYSICAL ACTIVITY IN INDIVIDUALS WITH HEART FAILURE AND ICD/CRT DEVICES.** Ferrick AE, Fischer CA, Schuurman CS, Shoemaker MJ, Cartwright K, McLeod J, Schuman E, Van Dam A, Dickinson MG; Grand Valley State University, Grand Rapids, MI.

**INTRODUCATION:** Understanding seasonal variation of daily physical activity (PA) in patients with heart failure (HF) has important implications for the planning and interpretation of clinical trials, but its presence and magnitude have yet to be established. The purpose of the present study was to determine the presence and magnitude of seasonal variation in daily PA in community dwelling individuals with HF through the use of several analytic approaches. **METHODS:** A retrospective chart review of 168 patients with HF and Medtronic Implantable Cardioverter Defibrillator/Cardiac Resynchronization Therapy (ICD/CRT) devices was performed. Data included in the analyses (Autocorrelation, Analysis of Covariance, One-Way Analysis of Variance) were clinical characteristics, the Patient Activity measure of daily PA from the ICD/CRT devices, and the temperature and hours of daylight over the one-year period of November 1, 2017 - October 31, 2018. **RESULTS:** Visual analysis and autocorrelation demonstrated seasonal variation in daily PA. Daily PA seasonal difference between winter and summer months was 0.41 hours per day/24 minutes per day/2.87 hours per week/14.9%. This seasonal effect on daily PA was significantly greater in those with < 8 comorbid conditions and an overall activity level of > 2.2 hours per day compared to those with multiple comorbidities and a low overall activity level (0.74 vs. 0.09 hours per day). **DISCUSSION:** The present study affirms the seasonality of daily PA in patients with HF and ICD/CRT devices and reveals a disproportionate seasonal effect on those with fewer comorbidities and higher overall activity levels. **CONCLUSION:** Seasonal variation should be accounted for when interpreting change in daily PA in clinical practice and when designing and interpreting the results of clinical trials investigating interventions to improve daily PA. **ACKNOWLEDGEMENTS:** The Spectrum Health Cardiac Device Clinic and Spectrum Health Frederik Meijer Heart and Vascular Institute.

**STUDENT BEHAVIORS THAT POSITIVELY IMPACT A CLINICAL EDUCATION EXPERIENCE: A DELPHI STUDY.** Black M, Periard A, Witte B, Ozga K, Kenyon L; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Doctor of Physical Therapy (DPT) programs accredited by the Commission on Accreditation in Physical Therapy Education (CAPTE) are required to include a minimum of 30 weeks of full-time clinical education experiences. During clinical education, students apply and integrate the knowledge, skills, and behaviors essential for physical therapist (PT) practice in a real practice setting. The Directors of Clinical Education/Academic Coordinators of Clinical Education (DCEs/ACCEs) for the academic program aim to positively impact the quality of the clinical education experience via relationship building with clinical organizations. During a student’s clinical education experience, clinical instructors (CIs) provide students with mentorship through the development of clinical reasoning and the knowledge, skills, and behaviors needed for PT practice. CIs design and implement learning experiences to engage students in the management of patients common to each practice setting. Previous research regarding student behaviors in clinical education is limited and shows variability in the expectations of CIs and DCEs/ACCEs. The purpose of this study was to capture the perspectives of CIs and DCEs/ACCEs for DPT students to develop a consensus regarding the student PT behaviors that positively impact a clinical education experience. **METHODS:** A Delphi process was utilized, which uses data collection rounds with a panel of participants considered to be experts in the topic. Email was used to recruit participants. The aim of the recruitment efforts was to obtain a sample consisting of CIs and DCEs/ACCEs from all CAPTE regions who represented a broad range of years in clinical practice and clinical instruction. Purposive selection and snowball sampling techniques were used. Once all participants were identified, each participant received an emailed survey invitation from Survey Monkey followed by reminder emails as needed. The survey consisted of four open-ended questions about positive student PT behaviors that impact the clinical education experience as well as demographic questions. **RESULTS:** Participants were obtained from all nine CAPTE regions. A total of 17 CIs and 14 DCEs/ACCEs participated in the first-round survey of the Delphi study. The first-round survey generated 145 potential behaviors with 74 of these potential behaviors identified by only CIs, 28 by only DCEs/ACCEs, and 43 by both CIs and DCEs/ACCEs. **DISCUSSION:** Behaviors identified by both CIs and DCEs/ACCEs included seeking and accepting feedback, asking questions, various behaviors related to communication, flexibility, preparing, self-directed learning, professionalism, engagement/valuing experience regardless of area of interest, and timeliness. Additional behaviors identified by DCEs/ACCEs were adult learning, developing flexibility with teaching/learning style, advocating for patients, considering the whole patient, and patient education skills. Additional responses by CIs included accurate note taking, applying evidence, refraining from use of personal cell phone, valuing patient confidentiality, humility, and emotional stability in the ICU and pediatric settings. This study identified behaviors both similar to and different from those found in previous research. Additional survey rounds are needed to clarify the identified behaviors and to reach a consensus. **CONCLUSION:** After the completion of additional survey rounds, academic faculty in DPT programs may use the findings from this study to educate student PTs in the behaviors that may positively impact their clinical education experiences. CIs may use the findings to assess student PT behaviors and to provide related feedback to students during clinical education experiences.

**EFFECTS OF ASSISTIVE DEVICES ON POSTURAL SWAY DURING A SIMULATED FALL FORWARD.** Badr R, Bove B, Jewett P, Goehring M; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION**: Walkers are utilized to provide balance and stability to those who may require extra support, especially during ambulation or other functional tasks. Few studies have assessed the effectiveness between walker types on stability during a forward fall. The purpose of this study was to determine how much the amount of postural sway in single limb stance during a simulated forward fall is impacted by utilizing three different walker types designed to promote stability. It was hypothesized that the lowest amount of postural sway would be found with the standard walker followed by the front wheeled walker with straight wheels and that the greatest amount of postural sway would be found with the front wheeled walker with caster wheels. **METHODS:** The NeuroCom© Balance Platform Master was utilized to simulate various trials of forward falls via its moving force plate to measure and compare the amount of forward postural sway experienced when utilizing three different walker types. Twenty-three healthy adults between the ages of 22 and 39 participated in the study. Each participant experienced a total of 19 simulated falls with one being a practice trial in which data was not recorded. Data was collected on 18 trials which were divided into 3 conditions, each using a different walker type in randomized order. Each condition included a total of 6 trials of simulated forward falls while standing on one leg. Trials 1-3 were completed on the participant’s dominant leg, and trials 4-6 were completed on the participant’s non-dominant leg. **RESULTS:** Both the standard walker and the front wheeled walker with straight wheels provided significantly less postural sway, and therefore more stability, in single limb stance during the simulated forward fall as compared to the front wheeled walker with caster wheels. There was no significant difference in postural sway between the standard walker and the front wheeled walker with straight wheels. Although leg dominance did not significantly impact postural sway, the biggest difference in relationship to within-walker condition leg dominance was with the front wheeled walker with caster wheels as more postural instability was noted when standing on the non-dominant leg. **DISCUSSION:** Walkers are utilized across the lifespan to improve stability for individuals who are at risk of falls. This study suggests that a standard walker and a front wheeled walker with straight wheels provide more stability during a forward fall than does a front wheeled walker with caster wheels. Because the difference between the standard walker and the front wheeled walker with straight wheels was negligible, this suggests that more emphasis can be placed on energy conservation considerations rather than on stability demands when deciding on the optimal walker prescription for a patient. **CONCLUSION:** This study suggests that a standard walker and a front wheeled walker with straight wheels provide more stability than a front wheeled walker with caster wheels during a forward fall. Further research is warranted to determine if there would be similar findings if testing was conducted on a high fall risk population. **ACKNOWLEDGEMENTS:** GVSU Statistical Department.

**EFFECTIVENESS OF THE WII FOR PEDIATRIC REHABILITATION IN INDIVIDUALS WITH CEREBRAL PALSY: A SYSTEMATIC REVIEW.** Blythe SA, Ridge LD, Tomaszewski RE, Chesser BT, Kinne BL; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Cerebral palsy (CP) is the most common cause of physical disability in early childhood with an estimated prevalence of 2 per 1000 live births in the general population.Two of the most prominent gross motor activities affected by CP are balance and gait. The Nintendo Wii is a virtual reality system that has become increasingly popular in neurorehabilitation and research because it provides an innovative method for training balance and lower extremity function. The purpose of this systematic review was to evaluate the effectiveness of the Nintendo Wii for improving gait and standing balance in individuals with CP. **METHODS**: A comprehensive literature search of CINAHL Complete, MEDLINE, and ProQuest Medical Database was performed using the search terms “Wii” AND “cerebral palsy” AND “balance OR postural control OR stability OR ambulation OR gait OR walking”. Studies that fulfilled the following inclusion criteria were used for the systematic review: (1) individuals, 21 years of age or younger, with a diagnosis of CP; (2) an intervention group that received rehabilitation using the Nintendo Wii as part of the treatment plan; (3) a comparison group that received traditional treatment methods or no intervention; (4) reliable and valid primary outcome measures that evaluated changes in standing balance and/or gait; and (5) randomized controlled trials. The evidence level for each study included in the systematic review was established using the Oxford Center for Evidence-Based Medicine 2011 Levels of Evidence, and the methodological rigor for each study included in the systematic review was established using the PEDro Scale. **RESULTS**: Three electronic databases revealed 327 articles. Based on the inclusion and exclusion criteria, six articles were used in this systematic review. One study found that rehabilitation using the Nintendo Wii was better than no intervention. Two studies found that rehabilitation using the Nintendo Wii was generally better than traditional treatment methods. Two studies found that the Nintendo Wii in combination with traditional treatment was better than traditional treatment alone, and only one study found no significant difference between the combination intervention group and the traditional control group. **DISCUSSION**: This systematic review showed that rehabilitation using the Nintendo Wii is generally more effective than no treatment or traditional treatment methods when used to improve standing balance and gait in individuals, 21 years of age or younger, with a diagnosis of CP. It also showed that use of the Nintendo Wii may be even more effective when used in combination with traditional treatment methods. Findings suggest that the Nintendo Wii is an appropriate option for long-term rehabilitation as several benefits have been identified. **CONCLUSION**: Therapists should consider using the Nintendo Wii, alone or in combination with traditional treatment methods designed to improve standing balance and gait, when treating individuals with CP.