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**DPT Research Day**

**Class of 2015**

Abstracts for Poster and

Platform Presentations

**Friday, July 10, 2015**

**8:30– 3:00 PM**

**Loosemore Auditorium**

**DeVos Campus**

**Grand Rapids, MI**

**Platform Presentations**

**POWER MOBILITY TRAINING METHODS FOR CHILDREN WITH MULTIPLE AND SEVERE IMPAIRMENTS: A CASE APPLICATION.** Dingman C, Schmeltzer A, Vince A, Kenyon LK; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Children and adolescents who have multiple, severe disabilities are limited in their ability to use self-generated locomotion. Although recent research suggests that these children may benefit from power mobility use even though they may never become independent community drivers, there is limited evidence to support the use of specific power mobility training methods to help these children learn and develop beginning power mobility skills. This project describes the development and implementation of a standardized approach to individualizing power mobility training methods for use with children who have multiple, severe disabilities. **METHODS:** An extensive literature review identified critical components of previous training methods used in power mobility research. To create the initial training protocol, concepts related to the therapist as a responsive partner in the training process and the need to create an engaging, playful environment were combined with the selective use of verbal and physical prompts. These foundational concepts from the literature were combined with contemporary theories of motor control and neural plasticity as well as with previous research indicating that accidental activation of the power mobility access method (joystick or switch) may lead to the development of cause and effect skills. This initial training protocol was refined and adjusted through use with numerous children in the Grand Valley Power Mobility project. **RESULTS:** A multi-faceted power mobility training method was developed that incorporates the following steps: (1) motivational and reinforcement factors for each individual child are identified through a standardized parent interview; (2) child-specific goals related to the development of beginning power mobility skills are created using the Power Mobility Training Tool; (3) based on the information gathered in Steps 1 and 2, an engaging environment is designed to target the emergence of the specific power mobility skills; (4) an attendant control unit is used to selectively modify the direction and motion of the power mobility device and respond to the learning and safety needs of the child; and (5) individualized verbal and physical prompts are used to promote and encourage the child’s active participation in the training. Reflection-in-action and reflection-on action are utilized to ensure that the optimal training environment is created for each child and to help ensure training success. **DISCUSSION/CONCLUSION:** These power mobility training methods provide a standardized means by which to create individualized training programs designed to assist children with multiple, severe impairments in developing beginning power mobility skills.

**EFFECTS OF POWER MOBILITY TRAINING IN YOUNG CHILDREN WITH MULTIPLE, SEVERE IMPAIRMENTS: A CASE SERIES.** Gallagher CA, Hammond L, Webster LM, Kenyon LK, Farris JP, Aldrich NJ; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** Power mobility is increasingly being used as an intervention for children with neurodevelopmental conditions to allow these children to experience self-initiated movement and to reduce their mobility limitations. However, young children with multiple, severe impairments are often dismissed as too young or too physically involved for power wheelchairs, and adapted ride-on-toys may not provide the external support necessary for these children to explore and learn from their environments. Our Play & Mobility Device (PMD) provides a short-term solution that allows these children to practice power mobility skills. The purposes of this case series were to describe the use of an alternative power mobility device for young children with multiple, severe impairments and to assess the impact of power mobility training through various outcome measures. **CASE DESCRIPTION:** The PMD is a small, highly maneuverable motorized platform that is designed for children who weigh less than 40 pounds. Children are positioned in a forward-facing car seat that provides the seating support needed to practice using power mobility. The control system on the PMD interfaces with either a joystick or switches and can be adapted to meet the needs of each child. Three children with cerebral palsy (Gross Motor Function Classification System Levels IV-V), ages 17 months to 3.5 years, participated in the case series. Examination activities included the Pediatric Evaluation of Disability Inventory - Computer Adaptive Test (PEDI-CAT) and the Dimensions of Mastery Questionnaire (DMQ). Information from the Reinforcement Assessment for Individuals with Severe Disabilities and the Power Mobility Training Tool was used to create an individualized, engaging environment designed to elicit specific beginning power mobility skills for each participant. Intervention was provided 60 minutes per week for 12 weeks. The number of independent switch activations and the execution of beginning power mobility skills were documented at each session. **OUTCOMES:** Post-intervention PEDI-CAT scores increased in various domains for all participants. Post-intervention DMQ scores demonstrated improvements in Participants 1 and 2. Participants 1 and 3 were able to increase the number of switches used to drive during the training period. Participants 1 and 2 increased the number of independent switch activations between the initial and final training sessions. By the end of the training period, Participant 3 was able to drive down long hallways, maneuver around obstacles, and drive through doorways. **DISCUSSION:** The participants in this case series appeared to make improvements in their beginning power mobility skills. The power mobility training methods utilized provided a standardized way to individualize the training environment and to meet the specific needs of each participant. Additional research is planned to explore the impact of power mobility training in this unique population.

**DPT STUDENTS’ PERCEPTIONS OF CLINICAL INSTRUCTOR EFFECTIVENESS.** Engel A, Kool P, Sievers M, Ozga K; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Physical Therapist education has evolved from a Rehabilitation Aide in the early 1900s to the current Doctor of Physical Therapy (DPT) degree. In 1984, Emery published a foundational study which identified Bachelor’s Degree PT students’ opinions regarding the importance and frequency of occurrence of clinical instructor (CI) behaviors. No studies of DPT students’ perceptions of CI behaviors were found in the literature. The purpose of this study was to identify the perceptions of DPT students in Michigan regarding the importance and frequency of CI behaviors and to compare these findings to those of Emery. **METHODS:** This pilot study was a cross sectional survey modeled after Emery’s 1984 study. An updated version of Emery’s survey items taken from the Clinical Instructor Education and Credentialing Program manual was used with permission. This web-based survey consisted of 43 CI behaviors in the categories of communication, interpersonal relations, professional skills, and teaching which were ranked for importance and frequency using a four-point scale with lower scores indicating greater importance and frequency. Means were calculated for the importance and frequency of each behavior, and the means were ranked. To rank the four behavior categories, weighted averages were determined for this study and Emery’s study. To determine the relationship between frequency and importance of each behavior, correlational analysis using both Pearson and Spearman was conducted for each of the 43 behaviors (p<0.01). The study subjects were DPT students who had completed all clinical education experiences in a DPT program in Michigan between the fall of 2011 and the summer of 2014 resulting in 726 potential participants. Subject recruitment was through an email distributed by the Academic Coordinators of Clinical Education/Directors of Clinical Education for each DPT program. **RESULTS:** The survey response rate was 14% with 103 completed responses. The mean scores for the importance of the 43 behaviors ranged from 1.05 to 2.34. Based on weighted average rank, interpersonal relations were most important followed by communication, professional skills, and teaching behaviors. The mean scores for the frequency of the 43 behaviors ranged from 1.25 to 2.86. The weighted average ranks for frequency mirrored the importance results. Twenty-three behaviors demonstrated a positive correlation between importance and frequency. **DISCUSSION:** The correlation coefficients for Emery’s data were weaker than those in this study, most notably in the teaching behaviors category, suggesting that CI behaviors perceived as more important are being demonstrated more frequently. The greatest contrast of this study’s findings to Emery’s was in the professional skills category. The DPT sample ranked professional skills as more important than did Emery’s sample, while the frequency of professional skills behaviors was perceived the same by each sample. DPT students reported increased frequency of interpersonal behaviors in CIs as compared to Emery’s students. **CONCLUSION:** Interpersonal relations behaviors and communication behaviors of CIs were rated as most important to DPT students with interpersonal relations and professional skill behaviors rated as more important to DPT students than to Emery’s undergraduate students. DPT students rated interpersonal and communication behaviors as frequently demonstrated by CIs, but professional skills behaviors were less frequently observed. DPT students rated teaching behaviors lower than the other behavior categories for both importance and frequency. **ACKNOWLEDGEMENTS:** Lisa Kenyon, PT, DPT, PhD, PCS; Paul Stephenson, PhD; Edriana Bougrat Fermin, PT, DPT; Jamie Seppamaki-McCabe, PT, DPT.

**CONCURRENT VALIDITY OF DAILY ACTIVITY DATA FROM MEDTRONIC ICD/CRT DEVICES AND THE ACTIGRAPH GT3X TRIAXIAL ACCELEROMETER IN PATIENTS WITH HEART FAILURE.** Cartwright K, Hanson K, Serba D, Shoemaker M; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** In individuals with heart failure (HF) and implantable cardioverter defibrillators (ICDs) or cardiac resynchronization devices (CRTs), low daily activity is associated with poorer prognosis, and declines in daily activity are predictive of HF-related hospitalization. The ICD/CRT daily activity measurement has the potential to serve as an accurate primary end-point in randomized trials investigating interventions to improve daily activity in patients with HF. A single prior study revealed moderate-to-high correlations with an external triaxial accelerometer but demonstrated high variability with differences of up to several hours. Therefore, the purpose of the present study was to further examine the concurrent validity of Medtronic® ICD- or CRT-based daily activity data using the Actigraph GT3X (Actigraph LLC., Pensacola, FL) accelerometer data in patients with HF. **METHODS:** This is a preliminary analysis of the first eight subjects completing the first phase of a controlled trial involving exercise- and psychosocial-based interventions to improve daily activity in HF. The hours of activity per day as measured by the Medtronic® ICD/CRT devices was compared to activity counts, steps per day, and activity hours per day of the Actigraph GT3X triaxial accelerometer. Daily activity was measured using both devices at baseline and at 3-month follow-up and was analyzed using Spearman correlation coefficients to measure intra-individual correlations and Bland Altman plots to examine agreement between the devices. **RESULTS:** Strong statistically significant correlations (p<0.05) were found between the Medtronic® ICD/CRT and GT3X for the 7-day average, the measurements for each day in the 7-day monitoring period, and the change in 7-day average between baseline and 3 months for each of the following measurements: activity counts (rs = 0.833, 0.854, 0.786, 0.602 respectively), activity hours per day (rs = 0.976, 0.884, 0.911, 0.755 respectively) and total steps per day (rs = 0.905, 0.881). The Bland Altman plots revealed approximately 0.8 hours less activity per day measured by the Medtronic® ICD/CRT compared to the Actigraph GT3X. Strong agreement for hours of activity per day was found between both devices for the 7-day average and the measurements for each day in the 7-day monitoring period. Similarly, there was strong agreement for change in hours of activity per day between baseline and 3 month follow-up. **DISCUSSION:** The present study suggests that Medtronic® ICD/CRT devices provide a valid, responsive measure of daily activity when compared to the previously validated Actigraph GT3X triaxial accelerometer. The consistent underestimation of daily activity by the ICD/CRT devices is likely due to its single axis accelerometer and threshold settings to detect primarily walking activity, whereas the GTX3 also measures less intensive non-ambulatory activities. **CONCLUSION:** The Medtronic® ICD/CRT devices may be used as a primary end-point in randomized trials investigating intervention effects on daily activity in patients with HF.

**EFFECTIVENESS OF THE WII AT IMPROVING BALANCE IN OLDER ADULTS: A SYSTEMATIC REVIEW.** Finch TJ, Macken AM, Smoyer CM, Kinne BL; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** The incidence of falls in the elderly, as well as fall-related nonfatal and fatal injuries, is rapidly growing in the United States. Traditional balance interventions have generally been the common treatment protocol for individuals with impaired postural control. Wii therapy may be able to provide an alternative balance intervention. The purpose of this systematic review was to evaluate the effectiveness of the Wii at improving balance in older adults without documented neurologic or orthopedic deficits. **METHODS:** A thorough investigation of the CINAHL Plus with Full Text, ProQuest Medical Library, and SPORTDiscus with Full Text databases was completed. The search terms utilized while analyzing the databases were “Wii” AND “randomized” AND “balance” OR “postural control” AND “elderly” OR “older adults”. In this systematic review, the inclusion criteria were: (1) individuals who were at least 60 years old and who did not have a documented neurologic or orthopedic condition; (2) an intervention group that was treated with Wii balance training; (3) a comparison group that was treated with traditional balance training or no intervention; (4) outcome measures specifically designed to objectively assess postural control; and (5) randomized controlled trials. The evidence level of each included study was assessed using the Oxford 2011 Centre for Evidence-Based Medicine Levels of Evidence. The methodological rigor of each included study was assessed using the PEDro Scale. **RESULTS:** A database search was performed, and a total of 440 articles were identified. Three additional articles were found via other sources. Eight studies were ultimately included in the qualitative analysis. All eight studies compared a Wii therapy group to a control group in which no intervention was provided, and the Wii therapy group generally demonstrated a statistically significant improvement in postural control compared to the control group. Four of the eight studies compared a Wii therapy group to a conventional therapy group, and these studies generally demonstrated no significant differences in postural control between the two groups. **DISCUSSION:** In three of the eight studies that compared a Wii therapy group to a control group, Wii therapy did not result in a statistically significant improvement in postural control when evaluated by a majority of the outcome measures. This finding may have been due to the length of the intervention and/or the specificity of the task. Although the four studies that compared a Wii therapy group to a conventional therapy group generally demonstrated no significant differences in postural control between the two groups, the majority of the participants in the Wii therapy groups expressed increased motivation. **CONCLUSION:** Wii balance training may be considered an effective alternative intervention for individuals with impaired postural control.

**FORCE PLATFORM MEASURES OF BALANCE IMPAIRMENT: RELIABILITY AND VALIDITY IN INDIVIDUALS WITH PARKINSON’S DISEASE.** Burdis C, Marquis A, Piper N, Harro CC; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Parkinson's disease (PD) is a highly prevalent neurodegenerative disorder with incidence increasing annually in the growing elderly population in the United States. Complex movement and balance impairments in PD contribute to high fall risk and devastating consequences of fall-related injuries. Therefore, comprehensive balance assessment is warranted to identify intrinsic fall risk factors and direct intervention for fall prevention. The purpose of this study was to examine the test psychometric properties of three balance measures on the NeuroCom™ Force Platform (FP) system in persons with PD. **METHODS:** Forty-two community dwelling individuals with idiopathic PD (mean age 66.21 years, Hoehn & Yahr stage I-IV) were included in the study. Participants were included if they met the functional mobility criteria for the study and were excluded if they had other neurologic disorders, dementia, peripheral neuropathy, or deep brain stimulation. Test-retest reliability was assessed for the Limits of Stability (LOS), Motor Control Test (MCT), and Sensory Organization Test (SOT) by administering the FP tests twice within 10 days during the on time of PD medications. Intraclass correlation coefficients (ICC) were calculated to determine test-retest reliability of the FP measures. Minimal detectable change (MDC) was calculated using standard error of mean from ICC values. Concurrent validity was assessed by comparing the FP measures with criterion gait (10-meter walk test, 6-minute walk test), and clinical balance measures (Functional Gait Assessment [FGA], Mini Balance Evaluation Systems test [MiniBEST], Rapid Step Up test [RST]) using Pearson Product Moment correlations. Convergent validity of FP measures and PD characteristics was analyzed using both multiple linear regression and Pearson correlations. **RESULTS:** All FP variables demonstrated excellent test-retest reliability (ICC range 0.78-0.92) with the exception of LOS average reaction time and LOS falls, which were moderately reliable (ICC 0.69, 0.62). The strongest reliability was found for the MCT variables (average latency ICC=0.92, average amplitude ICC=0.92). SOT and LOS demonstrated fair to good correlations with gait and clinical balance measures. The strongest correlations were found between SOT composite equilibrium score and the balance measures, MiniBEST (r= 0.69), FGA (r= 0.60), and RST (r= -0.55). Convergent validity findings demonstrated significant relationships for both SOT composite equilibrium and MCT average latency with disease severity. **DISCUSSION:** FP measures are reliable and valid measures of balance impairment in persons with PD and are able to detect balance deficits in this population. One third of this study’s sample had SOT composite equilibrium scores below normative values, reflecting impairment in sensory integration for balance. Additionally, the SOT composite equilibrium and MCT average latency differentiated individuals based on disease severity, perhaps reflecting that these tests are sensitive indicators of decline in postural control with disease progression. **CONCLUSION:** A battery of balance measures is needed to accurately assess balance deficits at both the functional and impairment levels in PD. Force platform measures may provide valuable quantitative information about underlying balance impairments in PD to guide therapeutic interventions for fall risk reduction.

**EFFECT OF FATIGUE ON BALANCE RESPONSES IN PEOPLE WITH MULTIPLE SCLEROSIS AND IN PEOPLE WITH NO NEUROLOGIC DIAGNOSIS.** Kaiser M, Kay M, O’Neal E, Baker B, Anderson K; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Multiple sclerosis (MS) is a chronic autoimmune demyelinating disease affecting the central nervous system. Fatigue and impaired postural control are two common findings in people with multiple sclerosis. The purpose of the current study was to determine the effects of cardiovascular fatigue on balance in individuals with MS as compared to individuals without a neurological condition. **METHODS:** Forty-three participants, 22 individuals with MS (3 males, mean age 52.7 ± 10 years) and 21 individuals without MS (2 males, mean age 52.0 ± 10 years), participated in the study. The participants performed the Sensory Organization Test (SOT), Motor Control Test (MCT), and Limits of Stability (LOS) test before and after a step test to induce moderate cardiovascular fatigue of 3/10 on the Borg Rating of Perceived Exertion scale. Paired t tests were used to compare the difference in balance scores in those with MS before and after the fatiguing activity (posttest-pretest). Independent t tests were used to compare the difference in the change pre and post-test (posttest-pretest) between those with MS and controls and to compare the baseline balance performance between the two groups. **RESULTS:** For the MS group, there was no statistically significant difference found between results on the SOT (p = 0.144) or the MCT (p = 0.704) before and after a fatiguing activity. There was a statistically significant improvement in the LOS (p = 0.001) after the fatiguing event. There was no statistically significant difference found in the amount of change on the SOT, MCT, or LOS between the MS group and the control group before and after participating in a fatiguing activity. **DISCUSSION/CONCLUSION:** The present study confirms that individuals with MS have decreased balance as compared to those without MS at baseline. However, the current study suggests that a moderate level of cardiovascular fatigue does not significantly negatively impact immediate balance performance on these measures. Based on the improved scores on the post-exercise LOS, it could be suggested that people with MS modify their movement strategy to improve their performance.

**THE FUNCTIONAL MOVEMENT SCREEN AS A PREDICTOR OF INJURY IN NCAA DIVISION II COLLEGIATE CROSS COUNTRY RUNNERS.** Brostman M, Dittmer T, McKeel S, Rose R; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Participation in collegiate cross country has an inherent injury risk. The Functional Movement Screen (FMS) has been used to identify increased relative injury risk in collegiate soccer, volleyball, and basketball athletes. Increased injury risk based on FMS performance in collegiate cross country athletes has not been studied. The purpose of this study was to (1) establish a mean score using the FMS™ in a single NCAA division II cross country program, (2) determine if there is a significant difference in FMS™ scores between injured and non-injured runners, and (3) determine if the FMS™ score, in addition to other established intrinsic and extrinsic injury risk factors, is predictive of injury. **METHODS:** A sample of 48 (17 male, 31 female) NCAA Division II cross country runners participated in this study. Their eligibility year, gender, past history of injury (PHI), average weekly running mileage, and FMS™ composite scores were collected. Differences between injured and non-injured FMS composite mean and median scores were analyzed using the independent t-test and the Mann-Whitney U test, respectively. A receiver operator characteristic (ROC) curve was plotted to determine an FMS cut-point. Logistic regression using FMS composite score, gender, average running mileage, and previous history of injury as predictor variables was completed. **RESULTS:** Fifteen of the 48 athletes incurred a neuromusculoskeletal injury during the 2014 cross country season. Mean FMS for injured athletes (n=15) was 15.73 compared to 16.45 for non-injured athletes (n=33). This difference was not significant (p=.239). Median FMS scores were 16 for both injured and non-injured athletes (p=.499). The ROC area under curve (AUC) was not significant (AUC=.439; p=.505), and the ROC curve did not identify a viable cut score. The logistic regression final model included eligibility year, PHI, gender, and FMS™ composite scores. The Omnibus Test determined the model to be insignificant (p=.173). However, Hosmer-Lemeshow analysis determined the model to be of good fit (p=.075). The logistic regression showed that with the above variables included, the model was able to predict 94% of the athletes who did not sustain an injury correctly and 40% of those who did sustain an injury correctly for an overall prediction rate of 77.1%. **DISCUSSION:** The limitations of the study included sample size, sample being from a single university’s cross country team, inability to control training of the athletes, inability to control the number of competitive events run by each athlete, inability to control training outside of team training, range of mileage the athletes run, mileage being self-reported, and other variables which could affect an athlete’s performance. **CONCLUSION:** The results of this study suggest that mean FMS™ score is not predictive of injury in NCAA Division II cross country athletes. Additionally; gender, year of eligibility, PHI, and FMS™ composite scores are not predictive of injury in this sample. However, this study had numerous limitations that may have impacted the significance of the study. With limited research related to the FMS™ with runners, it is suggested that more research is needed prior to including the FMS™ as part of a pre-participation physical as a means to predict injury in cross country athletes. Additionally, future studies should consider sports specific movements and/or tests that capture the physical demands of cross country running.

**PREDICTION OF HIP JOINT CENTER LOCATION USING DAVIS AND SEIDEL METHODS: EFFECT ON HIP MOMENTS DURING GAIT OF NORMAL HEALTHY ADULTS.** Keniston N, Krikke A, Wiersma B, Hoogenboom B, Alderink G; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Gait analysis is a tool used by clinicians to identify gait deviations in order to treat individuals with a variety of conditions and previously diagnosed disorders. Clinical gait analysis requires the use of predictive regression equations to establish joint centers based on anatomical marker placement during 3-dimensional gait analysis (3DGA). Different marker sets, or models, are commonly used in 3DGA research. The Vicon Plug-in Gait (PIG) biomechanical model is currently one of the most widely referenced models used in gait analysis, and it uses regression equations to estimate hip joint center location first created by Davis et al. A different biomechanical model has been used at the Mary Free Bed (MFB) Motion Analysis Center since 1994. The MFB model uses different regression equations created by Seidel et al. to estimate hip joint center localization. This study focused on comparing hip joint center (HJC) locations between the Davis and Seidel marker placement models with a secondary purpose of analyzing the effect on hip joint kinetics. **METHODS:** Thirty-six subjects were randomly selected from a sample of 50 individuals who had previously volunteered for a normative gait study involving 3DGA. Anthropometric measurements were collected for leg length, joint width at the ankle and knee, and pelvic depth, height, and width. Eight Vicon MX-T40 cameras and Nexus motion capture software were used to track the positions of spherical retro-reflective markers attached to the head, arms, trunk, and lower extremities. Ground reaction forces were collected by two AMTI force platforms and synchronized with motion capture data. Joint kinematics and kinetics were calculated using Vicon Bodybuilder software. Custom Matlab code was used to extract and analyze HJC locations from the two models. Differences in HJC location and resulting hip moments between the two models were calculated using paired t-tests and Wilcoxon Signed Ranks Tests. **RESULTS:** Significant differences were observed in HJC x, y, and z coordinates between biomechanical models (p<0.05). There were no significant differences between internal hip extensor moments between the MFB and PIG models. There were significant differences between right and left hips for hip flexion and abduction peak moments (p<0.05). **DISCUSSION:** Past studies comparing the Davis HJC location to a gold standard imaging technique showed that Davis’ equations estimated the HJC medial and inferior to the true HJC. The mean Seidel HJC in this study was 21.54 mm posterior, 31.91 mm lateral, and 41.52 mm superior to the mean Davis HJC. This suggests that the estimated HJC from the Seidel equations may be more accurate in the frontal and transverse planes. This is significant because gait analysis in pathological populations often affect treatment decisions for the use of conservative, orthotic, and surgical interventions. **CONCLUSION:** The results of the current study demonstrated that the MFB model estimated HJC posterior, lateral, and superior to PIG HJC location. Therefore, the MFB model may calculate a more accurate representation of the anatomical HJC and prove to be a more appropriate model for the study of normal and pathological populations. **ACKNOWLEDGEMENTS:** Amy Lenz and Lauren Hickox.

**TREATMENT OF ADULT SCOLIOSIS WITH PHYSICAL THERAPY AND THE HOSPICE PHILOSOPHY: A CASE REPORT.** Knopf B, Sobeck C; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** Adult scoliosis is predicted to be present in 6-10% of the population over the age of 50 and 7.5% in the low back population, and it can result in decreased ventilation, decreased range of motion (ROM) and mobility of the spine, increased pain, and abnormal posture. The current literature is lacking in guidelines for utilizing physical therapy (PT) in the treatment of an adult with scoliosis and Parkinson’s disease (PD) in the hospice setting. Hospice shares similar ideals with PT including a focus on increasing functional independence, pain management, patient education, and the utilization of an interdisciplinary team. The purpose of the case report was to document the treatment of a patient with scoliosis and PD through the lens of hospice care. **CASE DESCRIPTION:** The patient was a 67-year-old female diagnosed with left thoracic scoliosis and progressing PD. Upon initial examination, she presented with low back pain, right shoulder pain, decreased ROM, and decreased functional independence. Treatment focused on increasing ROM, increasing functional independence, and decreasing pain through manual therapy and therapeutic exercise. PT occurred over 4 months and consisted of manual therapy techniques, ROM exercises, and therapeutic exercises. These treatments were utilized to reflect the goals of hospice which included client-centered care, a focus on improving the patient’s environment, maximizing the patient’s function, pain management, and a team approach. **OUTCOMES:** The patient reported her pain decreased from an NPRS of 6/10 at the initial examination to an NPRS of 2/10 at discharge. Her functional improvements included undisturbed sleep, increased ability to complete transfers, and increased participation in her community. **DISCUSSION:** This case report demonstrated the ability for PT and hospice to treat the chronic symptoms of adult scoliosis as part of a collaborative model. Further research is needed to investigate this collaborative model for patients with scoliosis as well as with other conditions.

**THE EFFECT OF EXTREMITY STRENGTH TRAINING ON FIBROMYALGIA SYMPTOMS AND DISEASE IMPACT IN AN EXISTING MULTIDISCIPLINARY TREATMENT PROGRAM.** Case M, Colby M, Kas T, Vaughn D; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Fibromyalgia (FM) is a chronic disease characterized by widespread pain and fatigue. Recent research recognizes FM as a dysfunction of pain processing in the central nervous system. There is growing evidence in support of combined aerobic and strengthening exercise and the utilization of a multidisciplinary treatment approach for patients with FM. However, to date, no study has evaluated the impact of adding one specific intervention to the combination of all of these variables. The purpose of this study was to compare whether implementation of extremity strengthening to a pre-existing 10-week multidisciplinary program has clinically significant effects on symptoms associated with FM. **METHODS:** This was a comparative study design of patients between the ages of 18 – 65 with the medical diagnosis of FM enrolled in Mary Free Bed Hospital’s Chronic Pain Program in Grand Rapids, Michigan. A retrospective analysis was used to collect patient data from past charts. The control group (n=40) and experimental group (n=39) received the same multidisciplinary treatment except that the experimental group performed upper and lower extremity strengthening exercises selected by the treating physical therapist. The Fibromyalgia Impact Questionnaire (FIQ) was administered at evaluation and discharge from the program in order to measure change of perceived level of impairment. The difference between the initial and final FIQ scores was used to compare the two groups. **RESULTS:** Statistically significant changes in FIQ scores were found for both groups. The authors are 95% confident that the average change in FIQ score from evaluation to discharge for the control group is between 19.35 to 29.83 points and is between 22.66 to 32.49 points for the exercise group. The addition of extremity strengthening in the experimental group produced an average 4 points (5%) greater reduction in FIQ score. However, these results were not considered statistically significant. **DISCUSSION:** Both groups had approximately three times the Minimal Clinically Important Difference score indicated for the FIQ. This statistically significant finding speaks to the success of this multidisciplinary program for patients with FM, as evidenced by the control group’s 39% improvement in FIQ score and the experimental group’s improvement of 44%. To the authors’ knowledge, this is the greatest FIQ score percent improvement reported in the literature to date, as compared to previous studies that evaluated the influence of multidisciplinary treatment on patients with FM using the FIQ as the outcome measure. While a 4-point difference in FIQ score between groups may not be statistically significant, the authors attribute this difference, in part, to the fact that the groups’ interventions were similar.  **CONCLUSION**: This study appears to validate the success of a multidisciplinary approach in treating patients with FM with the possibility for further benefit with the addition of extremity strengthening exercises. A further controlled study is warranted to continue to examine the statistical and clinical significance of adding extremity strengthening exercises to a multidisciplinary approach. **ACKNOWLEDGEMENTS:** Teresa Miller, PT for her valuable contributions and influence in this study; Mary Green, PT, NCS, JD for her professional input as part of the research committee; Dr. Sango Otieno for statistical assistance; and previous student research investigators (Katherine Rogowski, DPT, Marta Stern, DPT, and Erin Willett, DPT).

**Poster Presentations**

**INTERACTIVE METRONOME AS AN INTERVENTION FOR A CHILD DIAGNOSED WITH FETAL ALCOHOL SPECTRUM DISORDER: A CASE REPORT.** Daly T, Goehring M, Kenyon LK; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** Alcohol toxicity has the potential to disrupt the migration, proliferation, and organization of the brain cells in a developing fetus. Fetal alcohol spectrum disorder (FASD) is a neurodevelopmental disorder that is associated with a wide spectrum of developmental delays, cognitive impairments, and behavioral deficits. Children with FASD may present with motor impairments in the areas of motor planning, motor coordination, fine motor skills, and gross motor skills. The purpose of this case report was to illustrate the use of Interactive Metronome® (IM) as an adjunct to traditional physical therapy interventions to improve coordination in a child diagnosed with FASD. IM is a neuro-motor training modality designed to improve an individual’s neurological and motor coordination in the areas of timing, rhythm, and synchronization. IM requires periods of sustained attention and promotes the user to adjust his or her motor patterns to achieve increased accuracy with the metronome reference tone. IM intervention provides real-time audio and visual feedback that respond to the user’s gross and fine motor coordination. **CASE DESCRIPTION:** The patient in this case was a 6-year-old female with FASD who presented to outpatient physical therapy with concerns related to difficulties with motor coordination and balance. The examination included assessment of the patient’s fine and gross motor skills using the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2). The BOT-2 is an individually administered test that uses goal-directed activities to measure composite skills including gross motor skills, body coordination, strength, and agility in individuals aged 4 through 21. At examination, the patient demonstrated impairments in multiple areas with the largest scoring deficits in the BOT-2 gross motor subtests of bilateral coordination and balance. The physical therapist determined the patient’s diagnosis was lack of coordination. The patient underwent an 8-month period of receiving traditional physical therapy interventions and training with IM. **OUTCOMES:** Eight months after completing IM training and traditional therapy interventions, the patient demonstrated improvements in BOT-2 gross motor subtests of bilateral coordination, balance, and upper-limb coordination. The patient also appeared to enjoy IM training activities and appeared to be more focused when completing IM activities than when partaking in more traditional physical therapy interventions. Although the patient displayed improvements on the BOT-2, she continued to demonstrate motor overflow and postural compensations with challenging motor tasks. These results indicate IM may have assisted with functional improvements. **DISCUSSION:** Current literature regarding physical therapy treatment specific to children diagnosed with FASD suggests there are limited resources for clinicians treating these patients. Recent evidence advocates that cognitive elements of function, including selective attention and motivation, need to be addressed in FASD rehabilitation. IM has been found to provide physiological adaptations including increased attention capability, motor functioning, and perceptual-motor functioning. IM also offers a task-oriented, goal-directed, and motivating therapeutic intervention. However, further study regarding IM pertaining to children diagnosed with FASD is recommended.

**ACTIVITY AND PARTICIPATION LEVELS IN 6-11 YEAR OLD CHILDREN WITH CEREBRAL PALSY: A PILOT STUDY, YEAR THREE.** Kreiner K, Michals K, Shankle K, Peck J, Kenyon LK, Shoemaker MJ; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Cerebral palsy (CP) is the leading cause of developmental delay and disability in children. As compared to typically developing peers, children with CP demonstrate decreased activity levels and prefer informal, less structured activities. Presently, few studies have objectively measured the activity levels of children with CP using an accelerometer. Additionally, there is limited research on the type of activities in which children with CP typically participate and whether these are activities that the children enjoy. The purposes of this study were to examine the amount of physical activity accumulated per day and the intensity and nature of functional and recreational activities in ambulatory children with CP. The findings share the recommendation that a clinician talk with children and their families about the health benefits of increased physical activity. **METHODS:** Six males and two females with a diagnosis of CP, ages 6-11, were classified using the Gross Motor Function Classification System-Expanded and Revised (GMFCS-ER). Each child wore an RT3 tri-axial accelerometer for 2 school days and 2 weekend days consecutively and completed an associated daily activity log with caregiver assistance. Activity and participation preferences were measured using the Children’s Assessment of Participation and Enjoyment/Preferences for Activities of Children (CAPE/PAC). **RESULTS:** Five of the eight participants demonstrated increased activity counts on weekend days as compared to weekdays. The majority of activity counts for all children fell within the light category (41-950 counts/minute). Participants with GMFCS level I (n=4) demonstrated higher moderate/vigorous activity counts as compared to children at GMFCS levels II (n=2) and III (n=2). Four of the eight participants (3 GMFCS Level I; 1 GMFCS Level III) accumulated the recommended 60 minutes of moderate to vigorous activity on all 4 days. All eight participants preferred more solitary, low intensity, home-based activities and reported high enjoyment when completing these activities. **DISCUSSION:** Only four of the eight children in this study met the guideline of 60 minutes of moderate/vigorous activity each day. Future research is needed to determine if children with CP are at an increased risk for future secondary impairments related to a sedentary lifestyle. Five of the eight children demonstrated their highest activity counts during the weekend, specifically when playing with other children. These findings suggest that children with CP may demonstrate increased activity levels when interacting with their typically developing peers as compared to when performing solitary activities. **CONCLUSION:** Only 50% of the children in this study achieved the recommended guidelines of 60 minutes of moderate to vigorous activity each day. Activities that resulted in achieving the moderate to vigorous levels included bike riding, playing with peers, working in the yard, and participating in classroom activities. These activities typically occurred outside of the home and were more social in nature. However, our results demonstrated that these children tended to spend the majority of their time participating in home-based and solitary activities. In order to encourage increased activity and improved health in children with CP, education is important for these children and their families about the benefits of community-based activities and social interaction.

**EFFECT OF HIPPOTHERAPY ON GAIT IN AN INDIVIDUAL WITH TBI.** Couturier M, Vaughn B, Watts C, Baker B, Macauley B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Hippotherapy is a therapeutic approach used by health professionals to improve neuromuscular function through horseback riding as part of rehabilitation. Hippotherapy has been shown in various studies to improve balance and gait parameters as well as to decrease spasticity with certain neurological conditions. The purpose of this study was to determine whether hippotherapy could improve gait in an individual following a traumatic brain injury. **METHODS:** A 28-year-old male individual was recruited in Mexico as part of a combined physical therapy and speech language pathology service trip. This individual had suffered a severe traumatic brain injury 14 years previously in a motor vehicle accident resulting in a severely ataxic gait, impaired balance, and a moderate cognitive impairment. This individual received hippotherapy 20 minutes per day for 10 continuous days. The subject was videotaped walking before and after each therapy session. Gait and balance parameters including velocity, cadence, stride length, step length, trunk sway, and losses of balance were assessed via video analysis using Dartfish Software. A Simple Linear Regression Test was performed to determine whether a relationship existed between gait parameters and treatment days and to determine if the treatment dose is a significant predictor of improvement in gait performance for single treatment sessions. Correlation testing was used to evaluate the strength of the relationship between the measured parameters and the days of intervention. A p-value < 0.05 was used for all statistical analyses to determine statistical significance. **RESULTS:** A linear regression analysis showed a positive improvement in velocity, cadence, step length, and stride length with the progression in days of intervention. A strong correlation was noted between velocity and days of treatment whereas cadence, step length, and stride length demonstrated a moderate correlation with days of treatment. Trunk sway and loss of balance did not show a significant linear regression with days of treatment and exhibited weak correlation to days of treatment. A single treatment session was not a statistically significant predictor of gait performance for any variable. **DISCUSSION:** Linear regression analysis results infer that if the intervention were to have been performed for a longer duration of time and if the sample size were larger, there may have been statistically significant changes in velocity, cadence, step length, and stride length between sessions and over time. Based on the results of this study, future research is needed to determine whether a longer intervention period using hippotherapy would produce any significant improvements in gait and balance parameters. **CONCLUSION:** Hippotherapy, when used as a short-term intervention of 10 days or less, as seen in this study, shows a positive trend of improvement in gait impairments and balance deficits in individuals with traumatic brain injury. Further research is needed to determine the effects of hippotherapy in a larger sample size and as a long-term intervention following a traumatic brain injury.

**USE OF THE FUNCTION IN SITTING TEST IN A LONG-TERM ACUTE CARE HOSPITAL: A CASE REPORT.** Heck KM, Green M; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** Physical therapy intervention in a long-term acute care (LTAC) setting is often complicated by sudden changes in medical status, respiratory complications, delirium, and/or patient refusal. In today’s health care environment, it is imperative to objectively measure patient progress to justify continued medical services. In an LTAC setting, therapists may find a paucity of outcome measures that can apply to their patients and show real progress without a large floor effect. Recent research has supported the use of the Function in Sitting Test (FIST) both in acute care and inpatient rehab settings. However, it has not been validated in the LTAC setting. This case will describe and discuss a patient transferred to a LTAC setting with multiple comorbidities, cognitive deficits, and severely impaired functional status and will look at use of the FIST to determine progress throughout a complicated length of stay. **CASE DESCRIPTION:** The patient was a 64-year-old male transferred to an LTAC hospital for ventilator weaning. His complicated hospital course included a pneumomediastinum post-surgical repair for a perforated esophagus, bibasilar atelectasis, tonic-clonic seizure activity, hypoxic respiratory failure, delirium, and a past history of schizophrenia. On evaluation, the patient had severe deficits in cognition, strength, balance, and endurance and was non-ambulatory. Physical therapy sessions occurred 5 times per week for 30-45 minutes and included transfer practice, gait training, and sitting and standing balance activities. **OUTCOMES:** The patient demonstrated improvements in transfers from dependent to minimum assist. Ambulation improved from 110 feet with moderate assist of 2 in week 1 to 200 feet with a front-wheeled walker and minimum assist by week 5. A clinically significant change was also evident in his sitting balance based on the FIST with a 30.4% increase in 5 weeks (Week 1 7/56=12.5%; Week 3 11/56=19.6%; Week 5 24/56=42.9%). **DISCUSSION:** The FIST is a feasible outcome measure to demonstrate functional improvements in LTAC settings where other evidence-based measures may show a floor effect. More research is needed to validate the FIST in settings such as the LTAC and with medically complex individuals. **ACKNOWLEDGEMENTS:** Thank you to the Good Shepherd Penn Partners LTAC rehab team and specifically to Aaron Thrush, DPT, MPH for his clinical expertise and mentorship with this patient.

**A SYSTEMATIC REVIEW OF THE APPROPRIATENESS, PREVENTABILITY AND SEVERITY OF ADVERSE EVENTS ASSOCIATED WITH SPINAL MANIPULATION PERFORMED BY PHYSICAL THERAPISTS.** Gokee D, Szocinski J, Young B, Vaughn D; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Spinal manipulations (SM) and the safety of their use are often at the center of much debate. Although adverse events (AE) are rare, establishing a way for clinicians to become more aware of and efficient in preventing AEs is a constant area of study. The primary purpose of this study was to retrospectively analyze all available case reports regarding SM performed by physical therapists (PT) in either the cervical, thoracic, or lumbopelvic region that led to a significant AE. **METHODS:** The format for this review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Case reports were included if they involved an individual who experienced an AE associated with SM (cervical, thoracic, lumbopelvic) performed by a PT. Pubmed and CINAHL databases were searched using either a combination of keywords or MESH terms yielding five relevant articles. One additional article was identified through a grey literature search. The main summary measures collected for this review were whether the SM was considered appropriate/inappropriate, whether the SM was considered preventable/unpreventable, and whether the AE was considered mild, moderate, or severe. Appropriateness was determined by identifying whether or not evidence supports the efficacy of the SM used in each case. Preventability was determined by identifying whether or not there were contraindications that should have stopped the PT from performing the SM. **RESULTS:** Our results indicated that 67% (n=4) of the SM performed by physical therapists were considered appropriate. In the remaining articles, this variable could not be determined. Fifty percent (n=3) of the AEs that occurred were considered preventable. In the remaining articles, preventability could not be determined. The severity of the adverse event was considered major for 50% (n=3) of the cases and moderate for the remaining three cases. **DISCUSSION:** The most common trend for all three summary measures was appropriate, preventable, and major. The six cases presented a large variety of circumstances leading to each AE. Cases 1 and 6 both involved hazardous manipulation techniques with Case 1 also including an AE that resulted despite a negative vertebrobasilar artery insufficiency screen. Case 2 involved a patient who received multiple manipulations with no positive changes. Cases 3 and 4 included patients with undiagnosed neoplasms. There was a low number of published case reports identified through the search, which may be indicative of under-reporting. **CONCLUSION:** The most common trend was appropriate and preventable. All AEs were categorized as either moderate or major. Although many patients may benefit from a SM, contraindications need to be thoroughly ruled out before proceeding with this intervention. The low numbers of case reports found are unlikely to fully represent all AEs that have occurred with SM by PTs. PTs should be encouraged to report AEs so that more generalizable correlations can be identified in future studies. **ACKNOWLEDGEMENTS:** Eric Manrose and James Hartlein.

**LOWER EXTREMITY STRENGTH AND SINGLE LIMB SQUAT KINEMATICS**

**GREATER THAN ONE-YEAR FOLLOWING ACL RECONSTRUCTION SURGERY: A PILOT STUDY.** Carter J, Horjus J, Meinema B, Stickler L; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** The anterior cruciate ligament (ACL) is a major source of lower extremity stability for movement in multiples planes of motion. Females participating in sports are four to six times more likely to tear their ACL than males, and noncontact mechanisms account for 70 to 80 percent of all ACL injuries. It has been suggested that proximal muscle strength relates to joint kinematics and that poor kinematics during activity may predispose females to ACL ruptures. Thus, the purpose of this study was to assess and compare side-to-side hip and knee strength with frontal plane kinematics of a single limb squat in females at least one-year post-ACL reconstruction surgery. **METHODS:** This was an observational cohort study. Thirteen female subjects, an average of 5.84 ± 2.62 years post-ACL reconstruction surgery, were recruited. The participants performed single limb squats on each leg, and frontal plane projection angle (FPPA) was measured using Dartfish video analysis. Hip extension, abduction, and external rotation and knee extension strength data was gathered via dynamometry. Paired samples t-tests and a related samples Wilcoxen Signed Ranked test were performed to compare differences in strength for each muscle group between the reconstructed and non-reconstructed side and differences in knee FPPA during single limb squats on the reconstructed and non-reconstructed side, respectively. A Pearson Correlation Coefficient was calculated for FPPA on the reconstructed and non-reconstructed limbs and the strength of each muscle group on the respective limb. Significance level was set to p ≤ 0.05. **RESULTS:** A significant difference was found between the average maximum hip extension strength on the reconstructed limb compared to the non-reconstructed limb. No significant differences were found between limbs for hip abduction, hip external rotation, and knee extension strength or for FPPA. No significant correlation between muscle strength and FPPA was found. **DISCUSSION:** The results suggest that the different rehabilitation protocols underwent by the participants adequately targeted three of the tested muscle groups, and strength was effectively maintained in the years following rehabilitation. The significant difference in hip extension strength measured between the reconstructed and non-reconstructed sides may have been influenced by the specific rehabilitation protocols (unknown to the researchers) underwent by participants in this study. An increased focus on gluteus maximus strength during rehabilitation or maintenance programs would be beneficial for females who have undergone an ACL reconstruction surgery. The results of the present study found no significant differences in FPPA between limbs, indicating neuromuscular education for other hip and knee musculature appears to be effective and should be continued. **CONCLUSION:** Changes in ACL rehabilitation protocols over the years to emphasize both strength and neuromuscular control of patients may have attributed to the present study which found hip extension strength deficits in females greater than one-year post-ACL reconstruction when comparing the reconstructed to the non-reconstructed limb. This significant finding did not appear to be related to FPPA, and no significant correlations were found between other hip and knee musculature. However, continued research with larger sample sizes is needed to see if further changes in rehabilitation protocols after ACL reconstruction are indicated for this population. **ACKNOWLEDGEMENTS:** Thank you to our faculty mentor, Laurie Stickler; our faculty collaborators, Heather Gulgin and John Gabrosek; and the participants who volunteered their time to participate in our study.

**RHOMBOID MUSCLE THICKNESS USING REHABILITATIVE ULTRASOUND IMAGING IN ASYMPTOMATIC INDIVIDUALS.** Hanks DR, Lawrence PL, Lomonaco-Harig M; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** The rhomboid muscle is an important proximal scapular stabilizer for upper extremity function. A subgroup of surgical patients with chronic shoulder dysfunction caused by medial scapular border muscle detachment, including the rhomboid muscle, has been recently described in the literature. The paucity of knowledge about this diagnosis and a lack of effective imaging methods warrant research to establish an effective method to image the rhomboid muscle. Rehabilitative ultrasound imaging (RUSI) has been shown in the literature to be valid and reliable for imaging the thickness in many muscles. The purpose of this study was to (1) assess inter-rater reliability of a method for measuring rhomboid muscle thickness near the medial border of the scapulae using RUSI and (2) collect descriptive statistics of rhomboid muscle thickness in asymptomatic individuals. **METHODS:** This study followed an exploratory and reliability study design. Forty-seven participants (13 male, 34 female) volunteered for the study (mean age ± SD = 25.6 ± 8.7 years; mean BMI ± SD = 24.1 ± 4.8 kg\*(m2)-1). Height, weight, hand dominance, and age were recorded for all participants. RUSI measurements were taken by two mildly-trained physical therapy student raters at two different points along the medial border of each scapula with participants in a standardized prone position. The raters performed measurements separately and were blind to the other rater's measurements. The RUSI equipment used was a Shenzen Mindray DP-50 with a linear ray, high frequency 8.5MHz transducer. An intra-class coefficient class 2 (ICC2,1) was used to assess inter-rater reliability. Paired and independent t-tests were conducted to compare rhomboid thickness between dominant and non-dominant sides, between superior and inferior measurement points, and between male and females. An ANCOVA was used to analyze the relationship of rhomboid thickness to BMI according to arm dominance and sex. Statistical significance was determined with an alpha of 0.05 for all t-tests and ANCOVA tests. **RESULTS:** The ICC2,1 for the study was 0.70 between the two raters. A significantly (P < 0.05) greater mean rhomboid thickness was found in males (1.49 ± 0.27 cm) versus females (1.26 ± 0.20 cm) when accounting for BMI, at the dominant side versus the non-dominant side in males and females (mean difference = 0.06 & 0.09 cm, respectively); and at the inferior points versus the superior points in males and females (mean difference = 0.15 & 0.05, respectively). There was not a significant correlation between rhomboid thickness and BMI. **DISCUSSION:** The applied methodology yielded a moderate inter-rater reliability using RUSI to measure rhomboid thickness by novice operators. This may affirm the usability of RUSI and the consistency of the standardized procedures. Thickness differences between the sexes is consistent with the literature. Thickness differences between dominant/non-dominant and superior/inferior measurements may be due to muscle recruitment regularity or morphology. **CONCLUSION:** The main findings of this study suggest that (1) RUSI has at least a moderate inter-rater reliability for measuring rhomboid muscle thickness and (2) males display significantly thicker rhomboid muscles than females in the asymptomatic population. This study serves as an initial step towards filling the gap in clinical knowledge about rhomboid muscle characteristics and injury that should be expanded on with future research. **ACKNOWLEDGEMENTS:** Sango Otieno and the GVSU Statistical Consulting Center, Miriam Teft of the GVSU Diagnostic Sonography Program, and the GVSU DPT faculty and students.