### DPT Research Day

### Class of 2022

Department of Physical Therapy & Athletic Training

College of Health Professions

Thursday, July 14, 2022

4:00– 8:15 pm

Grand Valley State University

Grand Rapids, MI

**Abstract Booklet**

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Presentation Track A

**SELF-REPORTED PHYSICAL THERAPY MANAGEMENT OF ADOLESCENT SPORT-RELATED CONCUSSION.** Danaher K, Hall H, Recknagel M, Rose J; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** A recent clinical practice guideline (CPG) is available to guide physical therapy management of the growing number of adolescent sport-related concussions (SRC). The purpose of this research was to discern the degree to which physical therapists (PTs) are following evidence-based recommendations in the examination of adolescent athletes post-concussion to guide return to play (RTP) and return to learn (RTL) decisions. **METHODS:** A novel 39-question survey was developed targeting United States (US) licensed PTs who regularly treat adolescent SRC. The survey was sent via email throughout the US to 222 physical therapy clinics as well as to individual PTs who publicly advertise management of concussions. Data analysis included descriptive statistics, Fisher Exact test, and Monte-Carlo simulation utilizing SAS version 9.4M7 with p<0.05 used to determine significance. **RESULTS:** Twenty-eight survey responses met the inclusion criteria. The majority of responses came from Michigan and from outpatient private practices. Most (64%) of the respondents reported familiarity with the 2020 CPG, and half (50%) incorporated the recommendations into their practice. Nearly all (85%) of the respondents regularly test cervical musculoskeletal, motor function, and vestibular-oculomotor function, and most (65%) regularly assess autonomic and exertional dysfunction. Most (74%) of the respondents were involved in the RTP decision, but fewer than half (42%) were involved in the RTL decision. There was no significant difference found between the groups with <10 years versus >10 years of experience in regularly performing specific tests and measures or in their involvement in the RTP and RTL process. **DISCUSSION:** Respondents consistently evaluated patients with SRC using evidence-based tests and measures across the domains of cervical musculoskeletal, motor function, and vestibular-oculomotor function. Assessment of autonomic and exertional dysfunction is less consistent. The majority of respondents utilize post-professional continuing education as their primary mode to inform clinical practice. PTs are generally more involved in RTP than in RTL. Wide variability in protocol selection and usage was noted for both RTP and RTL progressions. Collaboration with parents/guardians and physicians occurs most frequently during both the RTP and RTL processes. **CONCLUSIONS:** Whether or not they are aware of the 2020 CPG, individual clinicians generally follow recommendations for management of adolescent SRC, which benefits patient outcomes. Room for improvement exists in the consistent usage of tests and measures related to the autonomic and exertional dysfunction domains. Overall, PTs are currently more involved in RTP than in RTL decisions.

**STATIC POSTURAL CONTROL IN FEMALE ATHLETES AND NON-ATHLETES WITH SHARPENED ROMBERG BALANCE TEST.** Dary M, Hoop A, Zwarych K, Lee Y; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Concussions are a prevalent condition in athletics. Static balance is often used to assess acute and long-term symptoms. The Sharpened Romberg balance test is frequently used in acute assessment of concussion and in return to play criteria. Understanding the quantitative components of this balance exam in the female population is important to improve the value of the use of the exam. The purpose of this study was to examine differences in static balance reactions between female athletes and non-athletes during the performance of the Sharpened Romberg test. **METHODS:** Female athletes and non-athlete controls aged 18 to 30 were recruited from Grand Valley State University and the Grand Rapids area. Twenty-four subjects (14 athletes, 10 non-athletes) participated in the data collection. Each participant completed 12 Sharpened Romberg trials (3 trials of each condition: Sharpened Romberg left/right with eyes closed/open). Data was collected using force plates for center of pressure (COP), XSENS sensors for center of mass (COM), and a combination for the calculation of margin of stability (MOS). A three-way repeated measures ANOVA was performed with the alpha level set at 0.05. **RESULTS:** No significant differences were found with direct comparison of COP/COM/MOS outcomes between female athletes and female controls. All outcome measures demonstrated increased values when contrasting eyes closed against eyes open conditions. COM exhibited significant interactions between group x eye with female athletes demonstrating elevated values for variables of anterior/posterior (AP) and medial/lateral (ML) excursion, ML velocity, and sway area. **DISCUSSION:** Direct comparison between female athletes and non-athletes revealed no significant differences, and this finding could be due to similarities in exercise/training between the two groups. Increased variability of COP/COM outcomes in eyes closed conditions in athletes and non-athletes aligned with previous research that demonstrated changes in static postural control with removal of the visual system. Interactions between group x eye were found for COM with female athletes demonstrating increased values for AP/ML excursion, ML velocity, and sway area. These findings may be related to increased fine-tuning of postural control by female athletes. **CONCLUSIONS:** Significant differences were found in all outcome measures when comparing eyes closed to eyes open conditions with increased range, excursion, and velocity of COP/COM. No significant differences were directly correlated between female athletes and female control subjects. The lack of significant findings between athlete and non-athlete groups may be related to limited sample size and similarities between the two groups’ activity/exercise levels. Further research is required to expand the data set and to acquire increased numbers of subjects with a history of concussion to allow for comparison between subjects with and without history of concussion and to contrast female athletes of different sport classifications.

**EXAMINATION OF THE CLINICAL UTILITY OF EATING DISORDER AND DISORDERED EATING SCREENING TOOLS IN YOUNG ATHLETES: A SCOPING REVIEW.** Capulong ZA, Neumar SE, Teeter ME, Hoogenboom B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** A wide variety of screening tools have been used and studied within the body of evidence to identify eating disorders (ED) and disordered eating (DE) risk within the athletic population.The purpose of this scoping review was to examine the clinical utility of ED and DE screening tools as they apply to young athletes and to identify the most commonly used screening tools for male and female athletes. **METHODS:** The scoping review was conducted using the Johanna Briggs Institute Scoping review protocol and the associated PRISMA-ScR framework. Searches were conducted in PubMed, CINAHL Complete, PsycInfo, SPORTdiscus, and Web of Science Core Collection databases; and the articles were screened for eligibility by three independent reviewers based on the following inclusion criteria: randomized controlled trials, cohort studies, or cross-sectional studies published in English between the years 2011 and 2021; at least half of the athletes included within the study had to have competed in a non-aesthetic NCAA-sponsored sport and have a mean age between 14 and 24 years; and the study had to use an ED or DE screening tool for diagnostic purposes. Articles were excluded if the analysis of ED or DE in athletes was a secondary purpose or if less than 20 athletes participated in the study. Relevant data were extracted from each of the eligible articles for the purposes of this review. **RESULTS:** A total of 21 articles were included. Of these, nine included both male and female athletes, nine included females only, and three included males only. The most commonly used tools within these studies include the Eating Attitudes Test-26 (EAT-26), the *Sick, Control, One, Fat, Food* (SCOFF) questionnaire, and the Eating Disorder Inventory (EDI). Only two studies utilized a screening tool that was specifically designed for athletes: the Eating Disorder Screen for Athletes (EDSA) and the ATHLETE questionnaire. A total of six articles compared ED risk in athletes vs. nonathletes while including both male and female participants, a majority of which did not show athletes as being at higher risk for ED/DE when compared to nonathletes. Twelve of the 21 studies noted the limitation of participants underreporting ED/DE symptoms. **DISCUSSION:** There is a need for further research surrounding the development of ED screening tools that specifically target the athletic population. There is a significant gap in the research for assessing ED risk in males compared to a control group of nonathletes. Future research surrounding the development of screening tools should attempt to address the underreporting of DE/ED symptoms in athletes. **CONCLUSIONS:** These findings indicate that the EAT-26 has the highest clinical utility for use in diagnosing ED/DE risk within the population of interest. There is a need for continued research to further assess the utility of screening tools that identify ED/DE risk specifically in athletes (especially male athletes) for accurate identification of these conditions in both genders prior to or during participation in sport.

**MANAGING BILATERAL PATELLOFEMORAL PAIN WITH PHYSICAL THERAPY INTERVENTIONS: A CASE REPORT.** Knight SV, Chesser BT; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** The incidence of patellofemoral pain syndrome is between 3% and 6% of the general population in the United States, and this syndrome is common among young, active females with a prevalence of 12% in this population. Clinical practice guidelines (CPGs) are written to guide practitioners in the examination and management of common pathologies that have been thoroughly investigated, such as patellofemoral pain. However, despite the number of available guidelines and the positive perception of CPGs, one study demonstrated that less than half of practicing physical therapists regularly use CPGs. The purpose of this case report was to demonstrate the application of the *Patellofemoral Pain: Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability, and Health* for the physical therapy evaluation and treatment of a patient with bilateral patellofemoral pain. **CASE DESCRIPTION:** The subject was a 25-year-old Caucasian female with a diagnosis of bilateral patellofemoral pain who was treated at an outpatient physical therapy clinic. She initially scored a 45/80 on the Lower Extremity Functional Scale (LEFS) and a 54/100 on the Lysholm Knee Scoring Scale (LKSS); and she reported 8/10 pain with activity on an 11-point Numeric Pain Rating Scale. Upon examination, the subject had decreased lower extremity strength and flexibility, pain with squatting, and a positive Clarke’s patellar grind test. Interventions focused on improving lower extremity strength, developing appropriate quadriceps activation, and decreasing pain. **OUTCOMES**: Within 12 visits, the subject’s LEFS score increased to 77/80, her LKSS score increased to 88/100, and her Numeric Pain Rating during activity decreased to 4/10. All of these outcomes exceeded the minimal clinically important difference. The subject also demonstrated improvements in strength, quadriceps muscular activation, and pain leading to increased tolerance for functional activities. **DISCUSSION**: A comprehensive plan of care was established to address the deficits found in the initial examination by applying the concepts described in the patellofemoral pain clinical practice guidelines. Physical therapists need to be confident in utilizing and implementing information from relevant guidelines in order to optimize the evaluation and treatment of common conditions, such as patellofemoral pain. Further research should be aimed at the application of established CPGs in current practice.

**INVESTIGATION OF THE LATERAL LUNGE: A QUASI-EXPERIMENTAL STUDY COMPARING KINEMATICS OF SELF-SELECTED AND FORMALLY INSTRUCTED LATERAL LUNGES.** Dawe CD, Havenaar BJ, Hernandez JM, Hoogenboom B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** The lateral lunge (LL) is a tri-planar movement that is commonly prescribed during physical therapy rehabilitation, but it has not been extensively studied. Thus, no formalized instructions exist for performance of the LL. The purpose of this study was to investigate the kinematics of the LL during “self-selected” and “formally instructed” conditions using the XSens MVN Awinda hardware and to compare a final condition to assess retention of the technique. **METHODS:** Twenty healthy, uninjured subjects (10 females, 10 males; mean age of 24.5 yrs) completed this quasi-experimental study. Data was collected using XSens MVN Awinda software and 8 XSens IMU sensors placed on bony landmarks of the pelvis, hips, knees, and ankles. Kinematics were tracked while the participants performed lunges under three different conditions: self-selected (C1), formally-instructed to 50% of the subject’s height with verbal cueing (C2), and reproduced (C3) which was an attempt to mimic C2 without distance or cueing. The moving leg was defined as the leg lunging away from the body, whereas the stationary leg remained grounded throughout the lunge. Data were analyzed for normality, and a repeated measures ANOVA was used to determine within conditions differences (alpha = 0.05). For significant differences between conditions, further post hoc analysis was performed. Effect sizes were calculated using Bonferroni’s correction, and various Pearson Correlations (alpha = 0.05) were also calculated. **RESULTS:** Statistically significant differences existed between C1 and C2 for left (L) moving leg hip flexion (FL), right (R) moving leg hip abduction (ABD), L moving leg hip ABD, R stationary leg hip ABD, and L moving leg knee FL. C1 and C3 showed statistically significant differences for L moving leg hip FL, L moving leg hip ABD, R stationary leg hip ABD, and L moving leg knee FL. C2 and C3 showed statistically significant differences for only L moving leg hip FL. Strong positive correlations were discovered between R step length and L hip ABD when lunging to the R, between knee FL and ankle dorsiflexion on the moving leg when lunging to both the R and the L, and between hip FL and knee FL on the moving leg when lunging only to the R. **DISCUSSION:** Based on the differences between C1 and C2 and between C1 and C3, subjects were able to successfully alter their native kinematics after being offered a standardized script for the LL. In addition, the statistical similarities between C2 and C3 indicate that the subjects were able to retain the altered kinematics and demonstrate motor learning of the task. Significant differences between conditions were found more commonly between L-sided kinematics for both the moving and the stationary legs. The reason for this anomaly is unclear. However, 18 subjects in the study were R-leg dominant, whereas only two subjects were L-leg dominant. The authors propose that subjects may have been more comfortable with lunging to their dominant side than to their non-dominant side. **CONCLUSIONS:** The current study used verbal cueing to successfully alter subjects’ kinematics and investigate the short-term retention of newly learned movements. Statistically significant differences between C1 and the other two conditions indicate that using similar procedures for LL instruction may be appropriate in a clinical setting.

**QUANTIFYING GAIT KINEMATIC RELIABILITY AND REPRODUCIBILITY USING XSENS MVN INERTIAL MEASUREMENT UNIT (IMU) SYSTEM.** Davis CB, Newman TM, Wesa RC, Alderink G, Zeitler D; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Three-dimensional optical motion capture technology is the gold standard for measuring gait kinematics, but it is expensive and non-portable. Although portable inertial measurement units (IMUs) have become more readily available, the research regarding the reliability of IMUs with respect to clinical gait analysis is scarce. Therefore, the primary purpose of this study was to determine the inter-trial, inter-session, and inter-rater reliability and reproducibility of sagittal plane joint angular kinematics of the hip, knee, and ankle provided by the Xsens MVN Awinda system. Secondarily, reliability of the gait spatiotemporal parameters was examined. **METHODS:** The study was a fully crossed random effects experimental design utilizing a sample of convenience (n = 3; age 27.33 ± 1.53 yrs.; mean height 174.4667 ± 10.32 cm; mean weight 84.967 ± 23.807 kg) with four raters. A full-body Xsens system was used with 17 total sensors placed at the head, trunk/pelvis, and each major extremity segment. Each subject completed three sessions with four trials per rater per session recorded. The system was calibrated after donning by each rater. Statistical analysis included random-effects ANOVA and the restricted maximum likelihood method. Variance within and between factors was described as a percentage of the total variance expressed by standard deviations (SD) derived from the grand mean. **RESULTS/DISCUSSION:** The majority of variance was due to subject-to-subject variability for both kinematic and spatiotemporal variables. Thus, the contribution from the controlled variables (rater and session) was not significant. Maximum hip extension in terminal stance had the largest subject-to-subject variation with a SD of 5.66 degrees. Knee flexion during loading response, ankle dorsiflexion during terminal stance, and ankle plantarflexion during pre-swing all had measured SDs close to or greater than 5 degrees. The factors of session, rater, and trial all had SDs close to zero. Examination of the spatiotemporal parameters revealed similar results with the subject-to-subject variance being the greatest component. Variance due to session was <1%, due to rater was <8%, and due to trial was <20% for all variables. This study is the first to report on the variance components using SDs for inter-trial, inter-session, and inter-rater reliability. **CONCLUSIONS:** The results of this study suggest that the Xsens MVN Awinda system has acceptable inter-trial, inter-session, and inter-rater reliability and reproducibility for the use of sagittal plane angular kinematics of the hip, knee, and ankle, as well as spatiotemporal parameters, as part of clinical gait analysis. Due to the limitations of this study, though, further research is warranted prior to concluding that the Xsens MVN Awinda system is suitable for clinical gait analysis in clinical practice. **ACKNOWLEDGEMENTS:** We would like to acknowledge Dr. Yunju Lee and Lauren Hickox, MS for their technical support.

**QUANTIFYING CONCURRENT VALIDITY OF GAIT KINEMATICS PROVIDED BY XSENS MVN IMU SYSTEM.** Hoogstra W, Jesser E, Massingill B, Lee Y; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** In 3D human motion study, inertial measurement unit (IMU) systems offer purported benefits over optoelectronic measurement capture (OMC) systems in terms of portability, cost-effectiveness, and real-time analysis. Although the real-time movement analysis of functional daily activities outside a controlled laboratory environment introduces a variety of confounding variables that this study does not assess, the researchers propose that this data gives important clinical information a clinician may use to better assist patients without needing access to a specialized biomechanical laboratory. In this study, the researchers conducted a concurrent validity study of the Xsens system (IMU) and the Vicon system (OMC) comparing data collection of lower extremity movements during walking and jogging in healthy individuals to determine the degree of similarity of kinematic data collected between the two systems. **METHODS:** Ten healthy adults (4 females, 6 males; 24.9 ± 1.6 yrs.; 76.3 ± 19.8 kg) were recruited, provided consent, and served as participants in the study. Seventeen Xsens sensors were positioned at the midpoint of each body segment according to the Xsens manual. The Vicon system anatomical marker placement was applied by the researchers following the Plug-in Gait model. Angular displacements of the lower extremity were concurrently measured by both systems during walking and jogging trials. All trials were captured at 60 Hz for the Xsens system and at 120 Hz for the Vicon system. Further processing was done in MATLAB R2021a. Direct comparison and Bland-Altman (BA) analysis were conducted to capture and compare full gait cycles. Additional BA analysis was performed for only clinically significant points in the gait cycle. The clinically significant points for walking were defined at heel strike, midstance, and initial swing in each gait cycle; whereas selected points for jogging included initial contact, loading response, and early float for the sagittal, frontal, and transverse planes of motion. **RESULTS:** Overall, joint angular displacements of Xsens closely followed the trajectory of the Vicon data. The root-mean-square difference (RMSD) between Xsens and Vicon data ranged from 2° to 15° in the sagittal plane for both walking and jogging. The range of the minimum and maximum RMSD was smaller in the knee and ankle joints compared to the hip joint in the sagittal plane. However, the RMSD value varied from 1° to 25° and 2° to 40° in the coronal and the transverse planes, respectively. The BA assessments showed a specific pattern of errors (differences) in the Xsens data, whereas the distribution of errors in BA plots was supposed to be randomly scattered. This pattern was highly correlated with previous measurement errors in each trial of Xsens. **DISCUSSION:** Groupings of data between individual participants were found, suggesting that the error detected between the systems was subject dependent. In addition, BA plots indicated that the differences were smaller with large angular movements; whereas larger differences were observed with smaller angular movements. Because Vicon measures the position of static points and Xsens measures inertial movement, they differ fundamentally in how they capture motion. **CONCLUSIONS:** The Xsens IMU system did not show consistent validity when measuring exact joint angles during gait. However, overall wave patterns of gait kinematics were similar to the VICON system across time suggesting that the Xsens may be able to provide kinematic data in environments where a gait lab is not accessible. Further research should be conducted to determine the concurrent validity of the Xsens system’s measurement of joint kinematics in a non-laboratory setting.

**REHABILITATION FOLLOWING RIGHT POSTERIOR ELBOW DISLOCATION IN AN ADOLESCENT: A CASE REPORT.** Hedglen B, Green M; Grand Valley State University, Grand Rapids MI.

**BACKGROUND AND PURPOSE:** Elbow dislocation is the most common type of dislocation that occurs in the pediatric population. A posterior dislocation occurs most often, typically when a child sustains a fall on an outstretched hand (FOOSH). Dislocation may cause injury to ligaments and surrounding structures that are necessary for articular stability during functional movements. The structures that provide static and dynamic stability include the ulnar collateral ligament, triceps, brachialis, brachioradialis, biceps brachii, and anconeus. Injury to these structures often leads to decreased range of motion (ROM), stability, strength, and function. If a fracture is ruled out, the patient initially undergoes a closed reduction to reduce the elbow. Immobilization may take place for a short period of time followed by early mobilization through physical rehabilitation. Rehabilitation primarily focuses on regaining ROM, improving stability, and increasing strength to facilitate the patient’s ability to perform functional movements. It is critical that these impairments are addressed early to restore function and minimize future complications. Prognosis is good when a patient is treated without delay utilizing appropriate interventions following a posterior elbow dislocation. The purpose of this care report was to describe and analyze the effectiveness of selected physical therapy interventions utilized in the care of a pediatric patient following posterior elbow dislocation with closed reduction. **CASE DESCRIPTION:** The patient was a 17-year-old healthy female who was receiving care in an outpatient clinic 7 weeks after posteriorly dislocating her right elbow at cheerleading practice. The patient reported undergoing a closed reduction following the initial injury, at which time she was placed in a soft cast for immobilization. At the initial evaluation, the patient presented with decreased elbow ROM, strength, stability, and function. She reported a pain rating of 8/10 and an Upper Extremity Functional Index (UEFI) score of 46/80, indicating 58% function. Interventions included manual therapy, ROM, strengthening, stretching, modalities, and a home exercise program (HEP). ROM measurements, strength testing, and the UEFI were used to monitor functional progress throughout the plan of care. **OUTCOMES:** The patient made significant progress after only 7 sessions of physical therapy treatment. At discharge, improvements in elbow ROM and general strength were observed. Elbow extension AROM increased from -44 degrees to -1 degree. Biceps and triceps strength increased from 3+/5 to 4/5, and grip strength was roughly two times its initial rating. The patient reported no pain during functional movements and an UEFI score of 76/80, indicating 95% function. She reported not being able to perform higher levels of activity, including cheerleading, but this was not a goal for the patient. **DISCUSSION:** Initial high frequency of therapy attendance, the use of a conservative rehabilitation intervention progression, and adherence to a HEP likely contributed to the patient’s success, suggesting that significant functional gains may be possible to achieve in less than the expected duration of 8 to 12 weeks. Future research directed towards effective interventions to promote early mobilization following an initial period of immobilization after elbow dislocation is recommended.

**A COMPARISON OF PLATELET-RICH PLASMA INJECTION AND PHYSICAL THERAPY FOR TREATMENT OF ADHESIVE CAPSULITIS OF THE SHOULDER: A SYSTEMATIC REVIEW.** Niswonger K, Olson J, Venneman T, Goehring M; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION**: There are multiple treatment methods with varying evidence for adhesive capsulitis. Physical therapy (PT) is the primary conservative treatment for adhesive capsulitis. Nonoperative platelet-rich plasma (PRP) injections have recently been examined as a potentially effective treatment option for adhesive capsulitis. The primary purpose of this study was to perform a systematic review that compared the functional outcomes of nonoperative PRP injections vs. PT in patients with adhesive capsulitis as rated by the following measures: visual analog scale (VAS); range of motion (ROM); the disability of the arm, shoulder, and hand (DASH) scale; or the shoulder pain and disability index (SPADI). **METHODS**: Intervention strategies for the management of adhesive capsulitis included PRP injections and PT. PubMed, CINAHL Complete, Web of Science Core Collection, SPORTDiscus, and ProQuest Medical databases were utilized. Levels of evidence were established with the 2011 Evidence-Based Medicine scale. Methodological rigor was assessed using the criteria scale outlined in Medlicott and Harris. The screening, eligibility, and inclusion of studies were conducted by three doctorate of physical therapy students. **RESULTS**: Ten articles were included in the final analysis. Given the overall “weak” methodological rigor scores associated with six of the ten included studies, caution is needed when interpreting the evidence. PRP injections and PT both demonstrated improvements regarding functional outcome measures of the shoulder. **DISCUSSION**: The included studies had a favorable reflection on both PRP and PT interventions, suggesting that both interventions have a positive effect on ROM as well as on the selected functional outcome measures. There was evidence to suggest that PRP injections should be further explored as a viable alternative to other types of injections. The findings gave direction for further research related to the conservative management of adhesive capsulitis. **CONCLUSIONS**: There was some evidence to suggest that both PRP injections and PT are effective in significantly increasing ROM, reducing pain, and improving function in individuals with adhesive capsulitis. At this time, conclusions beyond this are difficult to concretely make given the limited comparisons between mainstay treatments and the quality of evidence of the present studies.

**PHYSICAL THERAPISTS’ CLINICAL REASONING PROCESS IN THE EXAMINATION AND INTERVENTION OF SCOLIOSIS.** Alexander S, McDaniels H, Rode M, Sobeck C, Stephenson P; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Scoliosis is a common spine condition identified in development throughout the lifespan. It can be best defined as an abnormal lateral curvature of the spine that is primarily idiopathic in nature. Establishing the optimal treatment technique to utilize with each patient requires a substantial amount of clinical reasoning skills. There are many different options for the treatment of scoliosis that range from surgical procedures to conservative treatments such as bracing and physical therapy interventions focused on promoting functional mobility and curve correction. The purpose of this study was to identify the key components of the physical examination of scoliosis and how the examination findings influence treatment. **METHODS:** An electronic survey was distributed to Grand Valley State University physical therapy alumni via email lists and social media. The survey was active for 6 weeks with a reminder email sent at 2 weeks. The survey included multiple choice, scale, and rank questions. All data was collected using Qualtrics survey editing software and was analyzed using Excel. **RESULTS**: The study was completed by a heterogeneous group of nine physical therapists. Demographics included licensed physical therapists with one to five years of experience who treated one to ten patients with scoliosis per year and who had taken continuing education courses related to scoliosis. Three of the physical therapists had obtained additional certifications including Schroth Certified Therapist from the International Society of Schema Therapy and Scoliosis Level 1 Certification from the Barcelona Scoliosis Physical Therapy School. It was evident from the results of this study that scoliosis can be treated conservatively. Responses revealed that therapists valued stretching the trunk side benders, trunk extensors, and hip flexors on the concave side as well as using general elongation techniques to correct the scoliotic curvature. **DISCUSSION**: This survey instrument produced limited responses to statistically examine treatment strategies for scoliosis that were valued by physical therapists. There was a trend that physical therapists valued the use of scoliosis-specific exercises. Although this trend could be expected from physical therapists with a background in scoliosis-specific training, it was also consistent among physical therapists without this specific training. This finding suggests value in that system of treatment. **CONCLUSIONS:** Although statistical analysis was not able to be assessed, there was valuable information obtained about the clinical decision-making process with respect to examination data and preferred intervention techniques from a heterogeneous group of physical therapists who treat patients with scoliosis. The results of this study highlighted the use of stretching the muscles on the concavity, strengthening the muscles on the convexity, and utilizing scoliosis-specific exercises to treat scoliosis conservatively.

**CLINICAL DECISION MAKING TO DETERMINE USE OF THORACIC**

**MANIPULATION TO TREAT DYSFUNCTION IN JOINTS SURROUNDING T-SPINE,**

**OR FOR SYMPATHETIC IMPACT.** Slawski E, Swales E, Terhall J, Sobeck C; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Studies have shown that high-velocity, low-amplitude manipulation (HVLAM) to the thoracic spine can have a sympatho-excitatory impact on the autonomic nervous system. Therefore, HVLAM is an effective treatment for systemic diseases such as complex regional pain syndrome (CRPS) and autonomic dysfunctions. In addition, manipulation of the thoracic spine can have impacts on adjacent regions of the body based upon the concept of regional interdependence. Despite these impacts, the thoracic spine is discussed disproportionately less in the literature when compared to the cervical and lumbopelvic regions. It is currently unclear whether this gap in the literature is impacting the number of clinicians performing HVLAM to the thoracic spine. The purpose of this study was to investigate physical therapists' decision making with regards to using thoracic spine manipulation to treat pathologies in the shoulder, cervical spine, and lumbar spine as well as its effect on the autonomic nervous system. **METHODS:** Participants were emailed a 25-question survey to identify their demographic characteristics and clinical practice patterns in relation to performing HVLAM to the thoracic spine. To complete the survey, clinicians were required to be licensed physical therapists in the United States who treat at least 10 patients per week and who perform HVLAM to the thoracic spine. Of the 113 responses, 54 individuals were lost due to technical errors; and 59 individuals met the inclusion criteria. Many clinicians did not fully complete the questionnaire, and only 13 clinicians answered the last question. Responses were sorted into fellowship-trained and non-fellowship-trained groups, and box-plots were created to compare group responses to each question. Based on satisfied assumptions, either Chi-Squared or Fisher’s Exact analysis was performed on each question to compare the two groups. Statistical analysis was performed at an alpha level of 0.05. **RESULTS:** When comparing the two groups, it was shown that there was a statistically significant difference in all CRPS-related symptoms. There was also a slight difference between groups in regional interdependence and contraindications with regard to the use of HVLAM as a treatment. However, due to limited data, no statistical analysis was performed with regards to decision-making on autonomic nervous system dysfunction and treatment. **DISCUSSION:** Individuals with Fellowship training were more likely to use thoracic manipulation when treating the cervical and lumbopelvic regions as compared to other clinicians. Four of the 16 possible listed contraindications had a statistically significant difference between those who took part in a Fellowship versus those who did not. Based on the findings of this particular survey, all areas relating to CRPS, both unilateral/bilateral and upper extremity/lower extremity, had clinicians more likely to manipulate if they had Fellowship training. Most clinicians were neither for nor against manipulation regarding the autonomic nervous system. Therefore, no conclusions could be made based upon the data received. **CONCLUSIONS:** The frequency of thoracic manipulation used as a treatment by clinicians may be related to their level of training in orthopedic and manual physical therapy.

Presentation Track B

**EFFECTS OF NORDIC WALKING EXERCISE ON GAIT FUNCTION, MOTOR/NON-MOTOR SYMPTOMS, DAILY STEPS, AND EXERCISE BIOMARKERS IN INDIVIDUALS WITH PARKINSON’S DISEASE.** Coatney CM, Lentine VL, Lieffers LR, Quigley JJ, Rollins SG, Stewart JD, Harro CC, Shoemaker MJ, Khoo, SK, Hall J. Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Nordic walking (NW) is a mode of task-specific aerobic exercise that promotes enhanced interlimb coordination as well as walking speed and rhythm. Therefore, it may be beneficial for addressing Parkinson’s disease (PD)-related gait deficits and promoting increased physical activity. The purpose of this study was to: (1) investigate the immediate and long-term effects of NW exercise on walking function, motor/non-motor PD symptoms, and brain-derived neurotrophic levels in persons with mild to moderate idiopathic PD; (2) determine the feasibility of implementing an individualized, progressive NW exercise program; and (3) examine independent NW exercise engagement after a supervised training program to assess feasibility and sustainability of NW aerobic exercise. **METHODS:** Twelve community-dwelling participants (mean age 67.2 +/- 9.6 years) with mild to moderate idiopathic PD and varied degrees of gait dysfunction participated in the study. This study was a prospective, single cohort design that examined clinical measures at baseline, post-intervention (T1), and 3-month follow-up (T2). Participants engaged in 6 weeks of supervised NW exercise training with individualized instruction followed by 14 weeks of independent NW exercise with remote coaching. The primary gait outcome measures included the 6-Minute Walk Test (6-MinWT), 10-Meter Walk Test (10MWT), temporal-distance gait measures, Timed Up and Go Test (TUG), and dual task TUG tests. The primary PD measures included the Revised Movement Disorder Society-Unified Parkinson’s Disease Rating Scale (MDS-UPDRS), the Revised-Freezing of Gait (FoG) Questionnaire, the MDS-Nonmotor Symptom scale (NMS), and the Parkinson’s Fatigue Scale. Average daily steps were measured using the Fitbit Inspire. The Friedman test with post hoc Wilcoxon sign-ranked pairwise comparisons was used to compare baseline to T1, baseline to T2, and T1 to T2 timepoints with the Benjamini-Hochberg correction procedure applied. **RESULTS:** Significant improvements were found post-training in walking endurance, daily physical activity, gait speed, PD-motor symptoms, and functional mobility as evidenced by the 6-MinWT, daily step count, 10mWT, MDS-UPDRS, and TUG, respectively. Effect sizes ranged from 0.57 to 1.03. Although no statistically significant improvements were observed for non-motor symptoms as measured by the MDS-NMS, 9 of the 12 participants had improved non-motor symptoms. Improvements in the clinical measures were retained after engagement in 3 months of independent NW exercise. **DISCUSSION:** This study’s findings provide evidence that NW exercise is a safe and effective mode of aerobic exercise for individuals who have PD with varied disease duration and severity. Individualized and progressive NW training contributed to participant-specific PD gait improvements and resulted in sustained improvements in walking and motor function. Feasibility and safety were demonstrated by achievement of the target training goals, good adherence in both supervised and independent phases, and no adverse events over the 5-month study duration. **CONCLUSIONS:** NW exercise had therapeutic benefits for improving daily ambulatory activity as well as gait and motor function in individuals who have mild to moderate PD with varied gait abilities; and it was demonstrated to be a safe, feasible, and sustainable mode of independent exercise. **ACKNOWLEDGEMENTS:** Funding supported by the Grand Valley State University Center for Scholarly and Creative Excellence.

**DYNAMIC BALANCE IN THE GAIT CYCLE PRIOR TO A NINETY-DEGREE TURN IN INDIVIDUALS WITH AND WITHOUT PARKINSON’S DISEASE.** Kilvington D, Prevost R, Pryson P, Alderink G, Harro C, Zeitler D, Hickox L; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION**: Parkinson’s disease (PD) is a neurodegenerative disorder increasing in incidence worldwide. Fall-related injuries are a major health concern in the PD population. Falls often occur during mobility tasks, such as turning while walking, due to parkinsonian changes as well as due to normal age-related balance decline. There is a paucity of research that has examined the control of dynamic balance of those with PD prior to and during turns. Therefore, the purpose of this study was to analyze dynamic stability, as measured by Margin of Stability (MOS), in the gait cycle just preceding a 90-degree turn during walking in persons with PD compared to age-matched healthy adults. **METHODS**: Thirteen individuals with mild to moderate idiopathic PD (mean age 67.5 +/- 10.2 years) and 10 healthy age- and gender-matched controls (mean age 65.1 +/- years) participated in this study. Computerized gait analysis was used to capture self-paced walking and walking while making a 90-degree turn using the modified Plug-in Gait model and the Vicon Nexus motion analysis software (v2.6.1) (Oxford Metrics, UK). Spatiotemporal (ST) parameters and MOS variables (COP-COM, COP-XCOM, Umax-XCOM, and COP-COM Inclination Angle) at three points in the stance phase, first double support (FDS), mid-stance (MS), and second double support (SDS), were analyzed (Visual3D, C-Motion, Inc., Germantown, MD)in the gait cycle preceding the turn. The gait parameters and MOS variables for all three points during the stance phase of the gait cycle were compared between the PD participants and the healthy controls (Ctrl) with a two-factor ANOVA and post hoc analyses using two-sample t-tests with a Bonferroni correction. The significance level was set at alpha = 0.05. **RESULTS**: ST parameters were significantly different for all variables between the pre-turn gait cycle and normal walking within the PD group. Double limb support time, cadence, swing time, and cycle time were significantly different or trended towards significance between the PD group and the Ctrl group during pre-turn walking. During the pre-turn gait cycle, the PD group demonstrated significantly larger M/L MOS compared to the Ctrl group at MS and SDS for all MOS variables and at FDS for Umax-XCOM. In the A/P direction, Umax-XCOM at FDS was significantly larger for the PD group. **DISCUSSION**: Dynamic stability in the gait cycle preceding a 90-degree turn in persons with PD showed greater changes to M/L stability when compared to Ctrl as well as in A/P MOS at FDS for Umax-XCOM. A larger MOS in the PD group may be a compensatory strategy to increase stability. Changes in ST parameters such as increased double limb support time may be a compensation to reduce time spent in single limb support during MS, which has been found to be the most unstable point of gait. **CONCLUSIONS**: Biomechanical analysis of gait preceding turns could provide an understanding into the adaptations and early changes in gait with PD. This information may provide clinicians insight into creating targeted interventions regarding preparation for a safe and efficient turn strategy during walking in persons with PD.

**AQUATIC THERAPY VERSUS LAND THERAPY FOR GAIT DEFICITS POST-STROKE: A SYSTEMATIC REVIEW.** Donselar AE, Elliott TR, Oravitz OM, Kinne BL; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** In addition to traditional land therapy, the use of aquatic therapy has gained traction in the last few years as a viable treatment option for a multitude of populations, including individuals post-stroke. The purpose of this systematic review was to evaluate the effectiveness of aquatic therapy as compared to land therapy on the improvement of gait deficits in individuals post-stroke. **METHODS:** The databases accessed during the search process for this systematic review included CINAHL Complete, Proquest Medical Database, and PubMed. (“Cerebrovascular accident” OR CVA OR stroke) AND (“aquatic therapy” OR “pool therapy” OR hydrotherapy) AND (ambulation OR gait OR walking) AND (randomized OR randomised) were the search terms used. The inclusion criteria that were used for this systematic review included (1) adults post-stroke who have gait deficits; (2) aquatic therapy as at least part of the intervention; (3) land therapy as at least part of the comparative intervention; (4) outcome measures that assess gait; and (5) randomized controlled trials. The Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence scale was used to appraise the evidence level of the studies included in this systematic review. The PEDro scale was used to appraise the methodological rigor of the studies included in this systematic review. **RESULTS:** The PRISMA 2020 flow diagram shows that 390 articles were found using three online databases (CINAHL Complete, Proquest Medical Database, and PubMed). Ten studies were included in this systematic review. Walking speed, step length on affected side, step length on non-affected side, and time of support on affected side in the Saleh et al. study; the Functional Ambulation Category in the Zhang et al. study and in the Tripp and Krakowstudy; the 2-Minute Walk Test in the Zhu et al. study; and speed, semistep length, cadence, stance phase, swing phase, and double support phase in the Furnari et al. study indicated that aquatic therapy or aquatic therapy plus land therapy promoted significantly greater improvements in the gait deficits of individuals following a stroke as compared to land therapy. Stance time, swing time, step time difference, step length, and walking velocity in the Kim et al. study; the Timed Up and Go Test in the Eyvaz et al. study, in the Chan et al. study, and in the Zhu et al.study; the 2-Minute Walk Testin the Chan et al. study; and the gait part of the Modified Motor Assessment Scalein the Noh et al. study indicated that there was no significant difference in treatment outcomes when aquatic therapy or aquatic therapy plus land therapy was administered as compared to when land therapy was applied. **DISCUSSION:** Other than step length difference in one study,it was found that if there was a significant difference in outcomes between groups, aquatic therapy or aquatic therapy plus land therapy was significantly more effective than land therapy in improving the participants’ gait. If there was no significant difference in outcomes between groups, there were other added benefits (greater muscle relaxation, reduced joint stress, and a decreased fear of falling) of incorporating an aquatic component into a stroke rehabilitation program. It was also found that the treatment parameters of each included study (number of minutes per day, number of days per week, and number of total weeks that the intervention was provided) did not appear to be directly related to the study’s outcomes. **CONCLUSIONS:** The incorporation of aquatic therapy into the rehabilitation program of individuals post-stroke is recommended.

**CLINICAL REASONING IN PEDIATRIC WHEELCHAIR SKILLS TRAINING: A MODIFIED THINK-ALOUD STUDY.** Vanderest S, Ray JB, McNally DJ, Kenyon LK; Grand Valley State University Grand Rapids, MI.

**INTRODUCTION:** Wheelchair skills training is a critical element of holistic development for children who use manual and power wheelchairs. Because of emerging research in this area, it is critical that practicing clinicians are equipped with the appropriate knowledge and skills to meet the needs of children who use a wheelchair. The purpose of this study was ​​to explore the factors clinicians consider when planning and providing wheelchair skills training for children. **METHODS:** One-on-one semi-structured interviews were conducted with clinicians via Zoom using a modified think-aloud method. Inclusion criteria consisted of clinicians involved in providing wheelchair skills training to children 18 years of age or younger. Exclusion criteria consisted of an inability to partake in the interview in English. During the interview, participants watched videos of children performing four wheelchair skills and answered a series of questions prior to and following each video. The interviews were transcribed verbatim. The factors participants considered when planning and providing wheelchair skills training to children were identified through a deductive process of directed content analysis using the International Classification of Functioning, Disability and Health (ICF). Three researchers independently identified these factors in each transcript. Discrepancies were resolved through a consensus process until a single list of factors identified across all four wheelchair skills was created. Each researcher then independently categorized the individual factors using the ICF coding system. Factors were classified by both Chapter and by Level 1 and Level 2 codes, representing nested concept areas within the ICF. Level 2 codes, the most specific descriptors available within the ICF, were identified wherever possible to provide the most detailed description of each specific factor. Discrepancies between the codes were again resolved through a consensus process, and unresolved discrepancies were resolved through discussion with the principal investigator. **RESULTS:** This study included 28 participants representing 14 different countries that encompassed each inhabitable continent. Three hundred fifty-five ICF codes were extracted from the 28 transcripts. The codes were distributed over the 4 ICF domains as follows: 42% activities and participation, 31% body functions, 19% environmental factors, and 7% body structures. Within these 4 domains, the ICF chapter subcategories of mental functions, mobility, and neuromusculoskeletal and movement-related functions had the largest number of codes identified at 46, 41, and 30 codes, respectively. Chapter, Level 1, and Level 2 codes in their respective ICF domains further illustrated the hierarchy within each ICF domain. **DISCUSSION:** The distribution of codes over all four of the ICF domains suggests that clinicians consider factors which span a large breadth of domains and areas of the human experience. **CONCLUSIONS:** This study illustrates the many factors in the different ICF domains clinicians consider when planning and providing pediatric manual and power wheelchair skill interventions.

**THE CURRENT STATE OF STUDENTS’ WHEELCHAIR USE IN US SCHOOLS: A SURVEY STUDY.** Straw L, Wassermann M, Yasick E, Kenyon LK; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** School-based occupational and physical therapy services in the United States (US), as provided under federal, state, and local mandates, serve to support students with disabilities in obtaining a free and appropriate public education. Little is known about students’ use of wheelchairs (WCs) in US schools. The primary purposes of this study were to explore both the current state of WC use in US schools and the respondents’ involvement in various tasks related to WC provision and training. **METHODS:** This descriptive, cross-sectional survey study used a web-based survey designed to collect primarily quantitative data pertaining to the types of WCs students use at school, therapists’ perceptions regarding the significant factors in facilitating or hindering student WC use at school, and the frequency at which therapists perform various tasks related to WC prescription and training. Open-ended questions included factors that facilitate students’ independence in WC use at school as well as the influence of the COVID-19 pandemic on WC provision and use in the school setting. The survey was reviewed and piloted by an expert panel prior to data collection. Recruitment methods included the use of social media, professional list serves, key professional contacts, and relevant electronic newsletters. **RESULTS:** Of the 867 individuals who accessed the survey, 776 therapists providing services to students ≥ 3 years of age within a US school system met the inclusion/exclusion criteria and entered the survey. Therapists from all 50 states responded to the survey. A majority of the respondents (92.36%) reported working with students who use a WC of any type during at least part of the school day. Dependent manual WCs that do not permit self-propulsion were reported as the most commonly used WCs in US schools followed closely by manual WCs permitting self-propulsion. 68.97% of the respondents reported working with at least one student who used a power WC at school. Both student-related factors and non-student-related factors were identified as significantly facilitating and significantly hindering WC use at school. A majority of the respondents indicated limited involvement in tasks related to WC service provision. Support from teachers, classroom staff, and parents; improved building accessibility, including WC mobility goals in students’ Individual Education Programs; and training teachers and classroom staff in safely and effectively working with students to learn and perform WC skills were identified as factors that help students achieve maximal independence with WC use at school. Of the 36.79% respondents indicating that COVID-19 had influenced the provision or use of WCs in their school, the switch to virtual/remote learning during the pandemic was felt to decrease opportunities for students to obtain a WC and to practice WC skills. **DISCUSSION:** Providing education to caregivers and school staff may assist in overcoming barriers to students’ WC use and may promote greater independence. Future research in these areas is indicated. **CONCLUSIONS:** These findings highlight the need for all members of a student’s interdisciplinary educational team to be involved in supporting WC use at school.

**ASSESSING THE INFLUENCE OF POWER MOBILITY DEVICE USE ON CAREGIVERS’ PERCEPTIONS OF THEIR YOUNG CHILD WITH CEREBRAL PALSY.** Lambert R, Marsman K, Vasseur M, Kenyon LK, Aldrich NJ; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** In the United States, nearly 800,000 people live with cerebral palsy (CP). Children who have CP, or who are at risk for CP, make up the largest group of individuals affected by disability. Across their lifespan, many people with CP use power mobility devices, such as scooters and wheelchairs, to support their mobility and their participation in home and community settings. Although lower level research supports the use of power mobility devices by infants and toddlers, younger children have historically been denied access to power mobility. As such, there is a need for research related to power mobility interventions for children with CP who are less than 3 years old and who have delayed gross motor skills. The overall aims of this large, multi-site clinical trial were to: (1) evaluate the developmental and participation outcomes of a power mobility intervention for young children with CP and (2) compare the use patterns of two different power mobility options, the Permobil® Explorer Mini and a modified ride-on toy car. This abstract reflects the data gathered in Michigan regarding parental perceptions of their child with CP at three different time points in the study: baseline, midpoint device crossover, and at the end of the study. **METHODS:** A multi-site, mixed-methods, randomized, counterbalanced AB crossover clinical trial was conducted with eight caregiver-child dyads from each site (Michigan, Oregon, Washington) for a total of 24 participants. The inclusion criteria consisted of children aged 12 to 36 months with a diagnosis of CP and any level of associated motor ability (GMFCS I-V) or children at risk for cerebral palsy. The exclusion criteria consisted of having the inability to maintain a seated position with or without support, not tolerating upright sitting with or without support for 30 minutes, or living in a household where English was not spoken proficiently. Caregiver-child dyads utilized each power mobility device for an 8-week period. Parent perceptions were assessed using a set of standard interview questions prior to, during, and following the trials of each powered mobility device. The interview questions were transcribed verbatim and were input into the Linguistic Inquiry and Word Count analysis 2015 (LIWC), a text analysis program that calculates the degree to which various categories of words are used in text. Through this method of transcription, qualitative data is quantified. LIWC results were divided into various categories including four summary variables: Analytical Thinking, Clout, Authenticity, and Emotional Tone. **RESULTS:**Six caregiver-child dyads from Michigan participated in this study. The LIWC analyses of the six parental interviews at the three different time points (resulting in a total of 18 transcripts) were visualized as line graphs using the average summary variable scores of the three participants from each intervention group, demonstrating various trends between time points for each of the variables. **DISCUSSION/CONCLUSIONS:**Data indicated that there may be differences in parents’ perceptions of their children before, during, or after using each of these power mobility devices. Analysis of the full data set gathered in the multi-site study (72 transcripts) are needed to draw both statistically and clinically meaningful conclusions. **ACKNOWLEDGEMENTS**: Funding provided by the National Institutes of Health through CPROGRESS.

**PARENTAL PERSPECTIVES OF CHILDREN’S SOCIAL COGNITION.** Bolcer KA, Thomson AJ, Yarbrough RJ, Kenyon LK, Aldrich NJ; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Social cognition is a critical component to navigating social interactions and to developing meaningful relationships involving the development and abilities described by Theory of Mind (ToM). ToM is defined as the ability to which a person can represent and interpret mental states of their own and others, such as desires, emotions, beliefs, intentions, and other inner states, that allows an individual to understand and predict behaviors. While it is an ability within itself, it is one which has meaningful implications for many other skills and functional abilities that arise in development. Although ToM has been examined for over four decades, the literature has yet to be extended to children with multiple severe disabilities (MSDs). Therefore, the purposes of this study were to examine the socio-cognitive abilities of children with MSDs through the lens of their parents’ narratives, and to explore the use of outcome measures, validated for typically developing (TD) children, in children with MSDs. **METHODS**: The sample included eight parent-child dyads: six with children who had MSDs and two with TD children age- and gender-matched to two of the MSD dyads. Five of the children in the MSD sample were diagnosed with cerebral palsy, and one was diagnosed with spina bifida. Each parent participated in two online sessions. Session one included parental assessment of the children’s ToM abilities using the Child Social Understanding Score (CSUS) as well as the children’s and their own communicative abilities using the Adaptive Behavior Assessment System (ABAS) via a Qualtrics survey and a standard evaluation platform, respectively. Session two (via Zoom) included a parental mind-mindedness (MM) interview about their child and a storytelling task with their child. The MM interviews and stories were transcribed verbatim. The MM was assessed after coding using CLAN. The stories were analyzed using LIWC2015. **RESULTS**: For the children with MSDs, parents reported lower MM scores (*M* = .30, *SD* = .33) than the average score reported in the literature (*M* = .36, SD = .23). However, this difference was not statistically significant (p= .33). Parental reports of children’s communicative abilities were positively correlated with children’s ToM abilities (p = .02) as well as with parental MM scores (p = .045). LIWC analyses of the storytelling task also revealed significant relationships. Emotional Tone was significantly related to children’s ToM abilities, *r*(4) = .86, p = .03. The percentage of cognitive state words during the storytelling task was also significantly related to children’s communicative abilities, *r*(4) = .85, p = .03 as well as to parental MM *r*(4) = .82, p = .046. Based on these correlations, a simultaneous linear regression was conducted to evaluate the contribution of each predictor of children’s ToM abilities (CSUS scores). Results indicated that both children’s communicative abilities (ABAS scores) and parental Emotional Tone significantly predicted children’s CSUS scores after controlling for the children’s age. **DISCUSSION:** The results reflect patterns of socio-cognitive development well-established with typically developing children. Both parental discourse during the storytelling task and the children’s own effective communication predicted greater ToM abilities. **CONCLUSIONS**: The findings suggest that the current protocol successfully captured ToM development within children living with MSDs. Thus, future research evaluating its use including a larger population of children with and without MSDs is warranted. **ACKNOWLEDGEMENTS**: This research was supported by a CRCAI grant, from the CSCE at GVSU.

**INTERVENTIONS FOR APOGEOTROPIC HORIZONTAL CANAL BENIGN PAROXYSMAL POSITIONAL VERIGO: A SYSTEMATIC REVIEW.** Breuer RE, Fitkin OM, Kelly RL, Kinne BL; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** Benign paroxysmal positional vertigo (BPPV) is named for the semicircular canal that is affected: posterior canal BPPV, anterior canal BPPV, or horizontal canal BPPV. The vertigo associated with horizontal canal BPPV is usually more intense than that associated with the other two types of BPPV. Therefore, the purpose of this systematic review was to evaluate the effectiveness of current treatment options for apogeotropic horizontal canal BPPV. **METHODS:** The databases accessed were CINAHL Complete, PubMed, and Web of Science. The search terms utilized were (ageotropic OR apogeotropic) AND (horizontal OR lateral) AND vertigo. The inclusion criteria were as follows: (1) individuals with apogeotropic horizontal canal BPPV; (2) replicable maneuvers that are specifically designed to treat apogeotropic horizontal canal BPPV and that are performed by a healthcare professional; (3) an outcome measure of nystagmus resolution, vertigo resolution, and/or a conversion into geotropic horizontal canal BPPV; and (4) studies with an evidence level of 2 or 3. The 2011 Levels of Evidence from the Oxford Centre for Evidence-Based Medicine was utilized to assess the evidence level of the included studies. A 10-item tool developed by Medlicott and Harris was utilized to assess the methodological rigor of the included studies. **RESULTS:** Four hundred fourteen records were identified through a search of three online databases. Based upon the inclusion and exclusion criteria, 12 articles were included in this systematic review. The effectiveness of the maneuvers after one treatment session ranged from 17.3% to 100.0%. In general, the maneuvers used for the treatment of apogeotropic horizontal canal BPPV had lower rates of effectiveness than did the maneuvers used for the treatment of geotropic horizontal canal BPPV. Despite the relative difficulty with the resolution of apogeotropic horizontal canal BPPV, treatment maneuvers were found to be more effective than sham maneuvers in three of the studies. **DISCUSSION:** Three of the included maneuvers (the Gufoni maneuver, the Zuma maneuver, and the Cupulolith Repositioning maneuver) demonstrated 100% efficacy after only one treatment session. The Gufoni maneuver may be preferable for individuals who are elderly, obese, or have problems with their mobility because it does not require the individual to perform a roll. Although the Zuma maneuver is also easy to perform on these types of individuals, only one study has been completed on this maneuver. Because the Cupulolith Repositioning maneuver is a roll maneuver, it may not be tolerated by all individuals. **CONCLUSIONS:** Based upon treatment efficacy, it is recommended that clinicians consider the use of the Gufoni maneuver, the Zuma maneuver, or the Cupulolith Repositioning maneuver when treating individuals with apogeotropic horizontal canal BPPV. However, the Gufoni maneuver may be the best maneuver to initially consider because it has been more well-studied than the Zuma maneuver and it may be more comfortable for certain types of individuals.

**PHYSICAL THERAPY INTERVENTION FOR AN INDIVIDUAL WITH IMPAIRED BALANCE DUE TO LONG COVID: A CASE REPORT.** Slowik A, Shoemaker M; Grand Valley State University, Grand Rapids, MI.

**BACKGROUND AND PURPOSE:** SARS-CoV-2 (COVID-19) is part of a diverse group of viruses called Coronaviruses. Symptoms include fever, cough, and chest discomfort with more severe cases including dyspnea, acute respiratory distress syndrome, thromboembolic disease, and myocardial injury. Long COVID is a situation in which symptoms last more than three months after initial symptom onset. Most of the literature regarding Long COVID describes current understanding, risk factors, symptom management, and treatment. However, there is little research describing Long COVID-associated balance impairments and appropriate physical therapist management. The purpose of the present case report was to highlight the physical therapy intervention of a patient with impaired balance associated with Long COVID. **CASE DESCRIPTION:** A 73-year-old female presented with impaired balance after being hospitalized for nine days with COVID-19. Upon discharge from the hospital, her primary symptoms included difficulty ambulating, speaking, and completing her ADLs as well as poor balance and significant brain fog. The patient was discharged to an inpatient rehabilitation facility followed by ongoing outpatient physical therapy for 1.5 years prior to her presentation at our clinic. Relevant and confounding comorbidities included a history of three prior low back surgeries, a cervical fusion, diabetes, granuloma annulare, and stage 3 kidney failure. The Berg balance scale was performed with a score of 35/56. During the Modified Romberg’s test on a firm surface with eyes open, the patient was able to maintain the position for only 5 seconds, indicating poor balance. The patient demonstrated a fear of falling as well as significant limitations in completing her ADLs due to impaired strength, balance, and activity tolerance. These limitations were associated with her COVID-related hospitalization resulting in acute (and now chronic) inactivity and with Long COVID in conjunction with chronic low back pain and diabetic peripheral neuropathy. The patient’s symptoms determined the intensity of exercise and the frequency of rest periods. This treatment approach followed fall prevention clinical practice guidelines that focused on lower extremity resistance exercises and balance training. Gait training focused on being more efficient when ambulating and on increasing endurance to help decrease the level of fatigue the patient experienced. During all sessions, the patient’s heart rate and symptoms were monitored. **OUTCOMES:** The patient was able to ambulate without an assistive device for 10 to 15 minutes without having to sit down. Her Berg balance scale score improved to a 44/56, and her strength improved to a 4/5. She reported feeling safer while completing her ADLs independently, and she was able to do more without feeling so fatigued. The patient had not experienced any falls since the start of therapy, and she felt as if she had achieved all of her goals. **DISCUSSION:** In patients with impaired balance associated with Long COVID, physical therapy may be used to improve balance and address other factors impacted by COVID-19 such as decreased strength and endurance. Long COVID is still a relatively new diagnosis. Therefore, more research needs to be completed to support physical therapy interventions with Long COVID.

**STUDENTS’ PERCEPTIONS OF THE PHYSICAL THERAPY PRO BONO EXPERIENCE - A SURVEY STUDY.** Bennett TY, Metzger SM, Mueller RE, Stickler L, Hoogenboom B; Grand Valley State University, Grand Rapids, MI.

**INTRODUCTION:** There is a significant need for pro bono healthcare given populations that are largely underserved and underinsured and that have barriers to accessing healthcare. Many physical therapist education programs in the United States have integrated pro bono clinical experiences into their programs. These experiences may simply be the opportunity to volunteer or may be a program requirement in the form of service-learning. Pro bono experiences involve working with patients from diverse backgrounds with different socioeconomic needs, decreased access to healthcare, and decreased health literacy. Such exposure provides students with the opportunity to practice skills in an unfamiliar environment with unique demands. The purpose of this study was to assess the students’ perceived impact of participating in pro bono physical therapy clinics through the development of a survey utilizing data gathered from prior qualitative studies. **METHODS:** The study included a cross-sectional survey. The questionnairewas distributed through Qualtrics to 105 PT program directors or faculty advisors listed on the Pro Bono Network’s website via emails gathered from the Commission on Accreditation in Physical Therapy Education to distribute to their student body. Inclusion criteria were as follows: all participants must be current physical therapy students enrolled in a physical therapy graduate program and must have served at a physical therapy pro bono clinic for a minimum of three hours. Responses were analyzed through the use of Chi-square testing and descriptive statistics. **RESULTS:** One hundred fifty studentscompleted the survey. Of these respondents, 51.3% participated via service-learning and 44.0% were volunteers. 79.3% of the students reported that involvement in the pro bono clinic changed their views on access to healthcare. The top skills/abilities perceived to be most impacted by pro bono involvement were communication, professional behaviors, awareness of strengths and weaknesses, compassion/caring, and duty to serve the profession. There was no significant relationship among the following variables: leadership status and communication (p = 0.0875); leadership status and time management (p = 0.4743); service-learning or volunteer and desire for future involvement (p = 0.1097); or number of clinical rotations and level of impact (p = 0.3275). Additionally, no relationship was found between hours spent in the clinic and perceived skill development in a total of 16 categories, all with p-values > 0.05. **DISCUSSION:** Students perceived their experiences in the pro bono setting as highly impactful in contributing to the development of many tangible and intangible skills and behaviors regardless of the capacity, manner, or reason (service-learning vs. volunteerism) for involvement. The unique environment and opportunity to interact and learn from a diverse population may play a role in the perceived impact. Thus, physical therapist educational programs can confidently incorporate pro bono opportunities for students and have flexibility for the type of pro bono experiences they offer to their students. **CONCLUSIONS:** Pro bono involvement is a potentially powerful learning tool for students as evidenced by a perceived increase in skill acquisition and professional development. This may help prepare physical therapists who are ready to serve diverse communities as professionals.