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Research Day Program, 2016

Physical Therapy Department, Arcadia University

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Physical Therapy
Department
January 14, 2016

Clinical Practice: Critical Inquiry

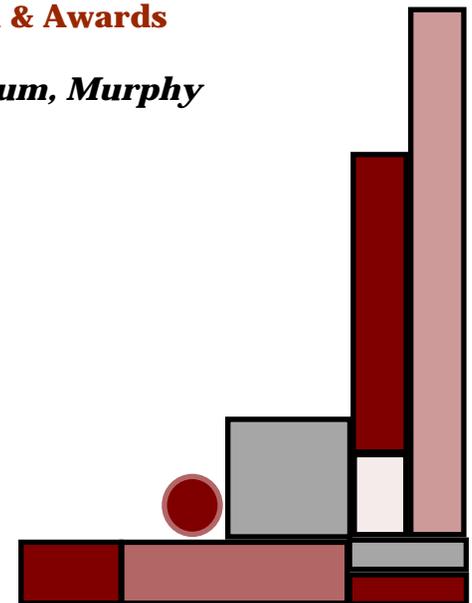
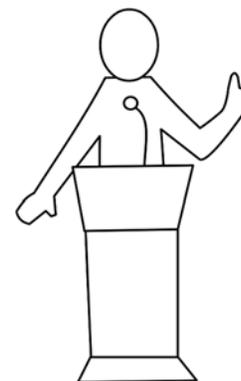


Poster Session
Great Room, The Commons

**Platform Session & Awards
Ceremony**
*Stiteler Auditorium, Murphy
Hall*

Department of Physical Therapy
Arcadia University

450 S Easton Rd
Glenside, PA 19038
(215) 572-2950



Welcome!

Dear Students, Faculty, and Friends,

This day is truly a highlight of our program. Our curriculum centers around applying evidence to make clinical decisions in an effort to offer the most effective care possible. Each of these projects represents a collaborative effort between students and faculty, aimed at developing new knowledge to understand mechanisms and offer new insights to inform clinical practice. Many of these projects will also be presented at national professional conferences; some will go on to publication. Rarely is research ever complete nor does it commonly offer a final answer, these projects are no exception. A key part of the process is to reflect carefully about what the data suggest as well as consider what issues remain to be addressed. We hope that you will interact with student-researchers and use this opportunity to learn, question, and reflect on the knowledge guiding our clinical practice!



Phil McClure, PT, PhD, FAPTA
Professor and Chair
Department of Physical Therapy

Notes

Notes

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Poster Session

11:30—2:30 pm

Arcadia Clinical Database Posters

- A. Does Cervical Traction Improve Outcome Measures in Patients Presenting with Neck Pain?
- B. Effects of Neurological Symptom Presence on Lower Back Pain Treatment Strategies and Patient Outcomes
- C. Shoulder Pathology and Quantifiable Measures
- D. Effects of Type of Interventions on Objective Functional Patient Outcomes: General Mobility Patients
- E. Using a Clinical Database to Examine Patient Achievement of Clinically Important Gait Speed Changes

Faculty-Student Research Posters

1. Assessing the Relevance of a Leadership Competency Model: A Framework for Healthcare Companies to Evaluate Current Assessment Tools: A Case Report
2. Complex Motor Skill Learning Transfers to Improvements in Simpler Functional Tasks
3. Effects of Manual, Instrument, and Electrical Stimulation Interventions on Myofascial Trigger Points in the Upper Quarter
4. The Effect of Dynamic Weight Support on the Gross Motor Skills of Typically Developing Infants
5. Muscle Mechanisms Underlying Recovery of Function After Hip Fracture
6. Feasibility and Clinical Utility of an Accelerometry-Based Command Following Paradigm in Disorders of Consciousness
7. Feasibility of a Health Promotion-Based Group Exercise Intervention for Adolescents and Young Adults with Down Syndrome
8. Comparison of Shoulder, Hip, and Trunk Rotation Range of Motion Variables in Collegiate Women's Soccer and Softball Players

Clinical Education Sites

Lancaster General Hospital
Lehigh Valley Hospital
M & M Physical Therapy
Magee Rehabilitation Hospital
Mercy Health System - Mercy Fitzgerald Hospital
Mercy Health System - Mercy Hospital of Philadelphia
Mercy Suburban Hospital
Moss-Einstein Hospital at Elkins Park
MossRehab - Elkins Park
MossRehab - Norristown
MossRehab - Sacred Heart Hospital
MossRehab - Tabor Road
MossRehab Einstein Center One
MossRehab Outpatient Center - Jenkintown
NovaCare - Bristol
NovaCare - Horsham
NovaCare - Voorhees
NovaCare Select - San Francisco
Paoli Memorial Hospital
Penn Home Care & Hospice Services
Penn State Milton S. Hershey Medical Center
Portneuf Medical Center
PT Solutions Physical Therapy
Roehampton Disablement Services Center
St. Barnabas Medical Center
St. Bartholomew's Hospital
St. Luke's University Health Network
Stanford Hospital & Clinics
Strive Physical Therapy & Sports Rehab - Burlington
Strive Physical Therapy & Sports Rehab - Cherry Hill
Strive Physical Therapy & Sports Rehab - Marlton
Strive Physical Therapy & Sports Rehab - Morrestown
Temple University Hospital
The Children's Institute
Theraplay
Three Dimensional Physical Therapy
TIRR Memorial Herman
TIRR Memorial Herman Adult and Pediatric Outpatient Rehabilitation
Triumph Physical Therapy
Upper Chesapeake Medical Center
VA Medical Center - Martinsburg
Valley Health Wellness and Fitness Center
Wallace & Nilan Physical Therapy
Wellspan Rehab at Adams Health
Willow Grove Physical Therapy

Clinical Education Sites

We are grateful for the support of the following facilities who participated in the clinical education of the PT Class of 2016.

Abington Health Lansdale Hospital
Abington Memorial Hospital
ATI Physical Therapy - Royersford
ATI Physical Therapy - Trooper
Austill's Rehabilitation Services
Bayada Home Health Care
BREAKTHRU Fitness and Physical Therapy
Brooks Rehabilitation
Bryn Mawr Rehab Hospital
BSR Physical Therapy
Buck's Physical Therapy and Sports Rehab - Newtown
Buck's Physical Therapy and Sports Rehab - Warminster
Capital Health System - Regional Medical Center
Central PA Rehabilitation Services
Children's Development Center
Children's Hospital of Philadelphia
Concentra - Mt. Laurel
Concentra - Pittsburgh
Cooper University Hospital
Dresher Physical Therapy at Blue Bell
E & A Therapy Inc.
Easter Seal Society - Montgomery County
Einstein Medical Center - Montgomery
Foulkeways Retirement Community
Fox Rehabilitation
Good Shepherd Physical Therapy - Coopersburg
Good Shepherd Physical Therapy - Souderton
GSPP Penn Institute for Rehab Medicine
GSPP Penn Therapy & Fitness - Arcadia
GSPP Penn Therapy & Fitness - Jenkintown
GSPP Penn Therapy & Fitness - Radnor
GSPP Penn Therapy & Fitness - Rittenhouse
GSPP Penn Therapy & Fitness - Weightman Hall
Hand & Ortho Physical Therapy Associates
Harris Health System
Hartz Physical Therapy
HealthSouth Geisinger Rehab Hospital
Holy Redeemer Hospital & Medical Center
Holy Spirit Hospital System
Hospital of the University of Pennsylvania
Intermountain Medical Center
Johns Hopkins Hospital
Lancaster General Health - Suburban Outpatient Pavilion

Platform Session

- 3:00** Introduction and Greeting from the Chair
- 3:10** — 1. The Effects of Eccentric, Concentric, and
3:30 Isometric Contractions on Pain Sensitivity over the
Achilles Tendon
- 3:30** — 2. Functional Arm and Shoulder Test Performance in
3:50 High-School Athletes
- 3:50** — 3. Reliability and Feasibility of use for the
4:10 Functional Arm and Shoulder Test in Older Adults
- 4:10** — 4. Clinician Knowledge and Perceptions of the Col-
4:30 laborative Model of Clinical Education
- 4:30** — Break
4:50
- 4:50** — 5. The Effects of a Brief, Intense Exercise Program for
5:10 Individuals with Parkinson Disease
- 5:10** — 6. Test-Retest Reliability of the Sports and Perform-
5:30 ing Arts Module of the Disability of the Arm, Shoulder
and Hand Questionnaire
- 5:30** — 7. Factors Associated with Shoulder and Elbow Pain
5:50 in Youth Baseball Players
- 6:00** — Awards Ceremony
7:00

Arcadia Clinical Database

The Class of 2016 contributed information for a clinical database during their six-month internship. Each intern was to record de-identified information about their patients' episode of care during the second through fourth month of the internship. The records were used by the interns to reflect on their own physical therapy practice. The summary record for an episode of care was added to the class database if the episode of care was complete and the patient fit one of five areas of practice: acute care, general mobility deficit, low back pain, cervical spine pain, or shoulder problems. The records were compiled by the faculty database administrator to assure that all means of identifying a patient, facility or intern were removed before making the database available to the class for data analysis.

This year's data includes 970 records; 128 acute care, 430 general mobility, 183 low back pain, 72 neck pain and 157 shoulder dysfunction. All of the records include common information fields for patient characteristics and history, common interventions, and common outcomes. Each of the five areas of practice includes additional information fields for history, interventions, or outcomes specific to that area of practice. The overall database and practice areas have been analyzed and the posters will summarize the findings, discuss implications for clinical practice, and in some cases, compare records collected for the Classes of 2013, 2014 and 2015.

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Factors Associated with Shoulder and Elbow Pain in Youth Baseball Players

Students: Casey McKenna, Marcus Rowan, JongMyung Kim

Faculty: Elliot Greenberg, PT, DPT, PhD, OCS

Purpose: Upper extremity overuse injuries are a common problem for young throwing athletes. Identifying physical characteristics that impact the development of injuries is important. The purpose of this study was to evaluate how variations in humeral retrotorsion (HR), shoulder range of motion (ROM), strength, pitching velocity and playing history relate to complaints of shoulder / elbow pain in young baseball players.

Subjects: 85 male baseball players (mean age 11.48, range 8.09-14.31)

Methods: Humeral retrotorsion was assessed bilaterally with ultrasound utilizing previously described methods. Bilateral shoulder external rotation (ER), internal rotation (IR) ROM and strength were assessed at 90° of abduction utilizing a digital inclinometer and hand held dynamometer, respectively. Side-to-side differences in HR, total range of motion (TROM) and glenohumeral internal rotation deficit (GIRD) were calculated. Pitching velocity was assessed with professional grade radar. Demographics and information related to injury history, upper extremity pain and sports history were collected utilizing self-report questionnaire. Group differences between those reporting recent throwing-related shoulder/elbow pain (n=16) to those without pain (n=68) were examined using independent t-test.

Results: There was no difference in the degree of HR in the dominant arm, but there was a significant difference ($p < .05$) on the non-dominant side with the injured group having less retrotorsion (60.1° v 68.0°). Throwers with pain had greater GIRD (9.4° v 5.1°), pitching velocity (55.4 v 50.1mph), height (63.6 v 58.3in) and weight (113.7 vs. 89.3lbs).

Discussion: This study retrospectively identified characteristics that may contribute to the development of upper extremity overuse injuries in youth baseball players. Injured athletes had less HR on the non-dominant side, while there were no differences on the dominant side, indicating a requirement for more aggressive growth alterations brought on by the stress of throwing. Injured athletes demonstrated more GIRD, however the magnitude of this loss is less than established thresholds. Finally, the injured group was taller, heavier and threw faster, all of which may contribute to increased stress to the upper extremity during throwing. A detailed understanding of how physical characteristics contribute to the development of injuries is essential to develop effective injury prevention programs. Although there is no clear understanding of how HR relates to upper extremity injury, our findings indicate that the assessment of this factor may assist in identifying youth athletes at increased risk of injury. Our findings suggest that the threshold for IR ROM loss may be smaller for youth athletes requiring closer scrutiny. Finally, athletes that are bigger and throw harder may be at higher risk of injury

Does Cervical Traction Improve Outcome Measures in Patients Presenting with Neck Pain?

Students: Rebecca Harrison, Ashley Kelly, Elizabeth Spath

Faculty: Carol Oatis, PT, PhD; Janet Readinger, PT, DPT

Purpose: Literature classifies traction as level B evidence in patients with radicular symptoms in the Clinical Practice Guidelines for treating patients with neck pain, but suggests that more research is needed to determine the efficacy of this intervention. The purpose of this analysis was to determine if the use of traction is associated with improved outcomes in patients with neurological signs or symptoms related to cervical diagnoses.

Methods: The Neck Pain database had a total of 72 patients, for this data analysis those with neurological signs and symptoms (N=37) were considered. First, patients who received traction during their plan of care (N=17) were compared to those who did not (N=20). The medians and means were found, and simple t-tests done to determine if there were any significant differences between the groups in global rating of change (GROC), change in Neck Disability Index (NDI), or change in pain at best or worst. Then a subgroup that received traction more than 50% of visits (N=11) was considered and the above data was re-evaluated.

Results: When comparing traction to no traction, we found that there was no significant difference between the groups for GROC score, change in NDI score, initial pain at best and at worst, or change in pain at worst. Change in pain at best was statistically significant ($p = 0.017$), showing that those who did not receive traction had a larger pain reduction when compared to the group who received traction, but neither group had a meaningful change (traction:1.1, no traction:2.6). On average, both the traction and no traction groups had meaningful changes in pain (MCID=3 pt change) at worst (traction:4.7, no traction:4.9). When comparing those who received traction during at least 50% of their visits to patients who did not receive traction, no p-values were significant. However, since the p-values were much smaller for GROC scores, change in NDI, and change in pain at worst, they are closer to being significant in favor of traction than with the initial calculations, except change in pain at best; thus indicating a larger change in all other outcome measures. However, with a sample size so small, there is a poor representation of the total population and therefore a poor representation of what results would be seen.

Impact on Clinical Practice: Based on these results, further research needs to be done to determine the efficacy of traction in patients with radicular symptoms, and we cannot advocate its use at this time. Current literature suggests that there is a weak correlation between GROC scores and functional measures due to the subjectivity of the GROC (Garrison et al, 2012). Future studies may benefit from looking at objective measures such as grip strength, location of symptoms, or functional measure like Focus on Therapeutic Outcome to determine the efficacy of traction in this population.

Effects of Neurological Symptom Presence on Lower Back Pain Treatment Strategies and Patient Outcomes

Students: Meghan Fallon, Nicole Figley

Faculty: Marty Eastlack, PT, PhD; Brian Eckenrode, PT, DPT, OCS

Purpose: Recent research regarding patients with low back pain (LBP) and concomitant radicular symptoms has focused on outcomes in both acute and chronic LBP. The purpose of this analysis was to compare the physical therapy (PT) utilization and self report outcomes of patients with LBP presenting with or without lower extremity radicular symptoms following PT management. We also investigated if patients responding to a directional preference is associated with or without the presence of radicular symptoms, and explored the difference in outcomes of all patients with LBP when treated with directional preference-based and non-directional preference based programs.

Subjects: Eighty-nine patients treated by third-year physical therapy students in an outpatient setting over 6-months were included in the final data analysis. The patient population analyzed was 55% (n=49) female and 45% male (n=40). The majority of patients were between the ages of 30 and 65 (n=49), with 23.5% (n=21) of the total patient population ages 30-50 and 31.4% (n=28) ages 50-65. The majority of those included (62%, n=55) did not present with neurological symptoms, however 38% (n=34) did. Of the subjects analyzed, 51% demonstrated a directional preference, while 49% did not display a directional preference.

Methods: ANOVAs were used to determine if the presence of neurological symptoms had an effect on the GROC and Oswestry (ODI) outcome scores and utilization of PT services. To determine if a directional preference was associated with neurological symptoms, a Chi-squared was utilized. ANOVAs were also used to examine the GROC and ODI scores of patients treated with a direction-based program versus a non-direction based program.

Results: The presence of neurological symptoms and directional preference were not found to be a statistically significant predictor of patient outcomes for either the GROC (p=.180), ODI (p=.390), the utilization of PT services (p=.300) nor associated with the presence of neurological symptoms (p=.99) respectively. No significant difference was found between GROC (p=.218) or ODI (p=.199) when comparing those treated with and without direction-based programs.

Impact on Clinical Practice: The findings showed neurological symptoms and direction based programs did not affect outcome scores or utilization of PT services in our sample, which is consistent with current literature regarding long-term outcomes. The results may suggest that physical therapists should not consider the presence of neurological symptoms when establishing a prognosis and plan of care for a patient with LBP. Furthermore, the findings may support the treatment of functional deficits in patients as opposed to focusing on the specific parameters of a direction-based program.

Test-Retest Reliability of the Sports and Performing Arts Module of the Disability of the Arm, Shoulder and Hand Questionnaire

Students: Daniel Bresticker, Elizabeth Dalrymple, David Snyder

Faculty: Stephanie Muth PT, PhD, NCS

Purpose: To assess the test-retest reliability and validity of a commonly used shoulder pain questionnaire- The Sports and Performing Arts Module of the Disabilities of the Arm, Shoulder, and Hand Questionnaire (SPAM-DASH).

Methods: Fifteen participants between the ages of 18-65 who engage in sport or play an instrument 2+ times per week participation in this study. In addition, retrospective analysis of previously collected data from 30 additional similar participants were used to assess validity. All participants had shoulder pain that impacted their participation in work, school or recreation. During visit 1, participants completed the SPAM-DASH and the Penn Shoulder Score (PSS), which was used as the gold standard to assess validity of the SPAM-DASH. After being distracted by a cognitive task, participants completed the SPAM-DASH again. The next day participants returned to re-take the SPAM-DASH. An Intraclass Correlation Coefficient (ICC) was used to determine test-retest reliability and a Pearson product-moment correlation was used to assess test validity.

Results: The within day reliability was excellent with an ICC of .935 (.95 CI = .631 - .982). The between day reliability was very good with an ICC of .890 (.95 CI = .463 - .968). The Pearson Correlation between the PSS and SPAM-DASH was -.428 (p = 0.004), indicating a fair correlation that is directionally appropriate given that the PSS measures function and the SPAM-DASH assesses disability.

Conclusions/Clinical Significance: The SPAM-DASH is a 4-item sub-set of the QuickDASH. It is a reliable tool to assess disability related to patient-specified activities. Correlation to the PSS was fair but directionally appropriate, suggesting the SPAM-DASH may be quick and efficient alternative to the lengthy PSS. It also provides patient-specific information, unlike the rest of the Quick-DASH or PSS. The SPAM DASH may capture information missed due to the ceiling effect of the PSS or Quick DASH for the higher functioning and more active patient. More research is needed to assess the clinically important difference for the SPAM-DASH in order to better support its use in a clinical setting.

The Effects of a Brief, Intense Exercise Program for Individuals with Parkinson Disease

Students: Teresa Gero, Suzanne Johnson, Lauren McCole, Cassandra Sarago, Jessica Tarence, Kelly Wadlinger

Faculty: Janet Readinger PT, DPT; Kris von Nieda PT, DPT, MEd; Marty Eastlack PT, PhD; Karen Sawyer PT, DPT, MA

Purpose In a previous case series, individuals with Parkinson Disease (PD) safely completed a week-long intensive exercise program, Movement Camp 2014, with participants demonstrating some improvement in functional outcomes both immediately post-exercise as well as at 5-weeks post intervention. The previous case series measured change in gait speed, endurance, balance, disease severity, upper extremity function, and quality of life. The purpose of the present study was to examine the effects of a similar exercise program, Movement Camp 2015, approximately one year later, in a larger sample and including individuals with greater disease severity.

Case Description Nine individuals with PD participated in Movement Camp 2015, four of whom participated in Movement Camp 2014 as well. The camp consisted of 5.5 hours of exercise daily: 1.5 hours of group warm-up/down and mat activities, and 4 hours of functional gait, endurance, balance, and upper extremity activities. Outcome measures included the motor portion of the Unified Parkinson Disease Rating Scale (UPDRS), Mini-BESTest, seated rotation test, 10-meter walk test (fast), six-minute walk test (6MWT), nine-hole peg test (9HPT), five-time sit to stand (5xSTS).

Results Participants showed improvement in disease severity (UPDRS), balance (Mini-BEST), axial rotation (seated rotation test), fast gait speed (10-meter walk test), and endurance (6MWT) after completion of the camp, and at 6 week follow-up. At least 4/9 participants demonstrated immediate improvements in disease severity, balance, and axial rotation. Magnitudes of change exceeded the standard error of measure (SEM). At the 6 week follow-up, 6/9 participants demonstrated improved disease severity, 9/9 demonstrated improved balance, 6/9 demonstrated improved fast gait speed, and 2/9 demonstrated improved endurance. The greatest improvements were seen in the seated rotation test, with 8/9 participants demonstrating changes greater than the minimal detectable change (MDC) at immediate post-test and at follow-up. At least 3/4 of the returning participants maintained improvements from the previous camp's 5 week follow-up testing to this year's baseline testing in endurance, 5xSTS, and fast gait speed.

Conclusion All participants successfully completed the intensive exercise program. Participants in this study had a greater disease severity versus the previous group of participants, suggesting that intensive exercise is still feasible with broader inclusion. Additionally, the results suggest that a week-long intensive exercise program has a positive and lasting effect on functional mobility of individuals with PD.

Shoulder Pathology and Quantifiable Measures

Students: Rachel Hill, Tiffany Stanley

Faculty: Scott Stackhouse, PT, PhD; Phil McClure, PT, PhD

Purpose: This study aims to determine if there is a correlation between specific shoulder diagnoses and associated global rating of change (GROC) or Disability of the Arm, Shoulder, and Hand short form (QuickDASH) scores.

Methods: Data was collected by Student Physical Therapists during a 4 month timeframe from patients in outpatient clinical settings. The deidentified patient information was used to measure progress by objective measures; most commonly the GROC and Quick DASH for patients with shoulder pathologies.

Data for 185 patients was collected; however, only 132 had a medical diagnosis involving the shoulder. The most prevalent age groups of all patients were between 50-65 (37.9%) and 30-50 (20.5%) years old. There were 75 male and 57 female patients.

This data analysis will provide descriptive statistics on the diagnostic composition, acuity of symptoms, number of visits, and the GROC and change in QuickDASH for each of the common diagnoses. A Pearson coefficient was used to determine the correlation between the GROC and change in QuickDash. Descriptive analysis for impingement and SLAP lesion were not used due to the small sample size of available data.

Results: The most common shoulder diagnoses were rotator cuff pathology (35.6%), shoulder impingement (19.7%) and adhesive capsulitis (12.9%). Additional diagnoses were shoulder instability (3.0%), SLAP tear lesion (1.5%) or had a specific diagnosis that was not part of above listed categories and considered miscellaneous (27.3%). The majority of patients (69.5%), reported symptom duration between 15 days and 6 months. 11.4% of patients reported acute symptoms (<15 days) and 19.1% reported chronic symptoms (>6 months). The average number of physical therapy visits for all categories was 14.3, with impingement being the least (12) and SLAP tear being the most (25).

The average GROC score for the diagnoses are: adhesive capsulitis=5.4; impingement=5.7; rotator cuff pathology=5.3. The average change in QuickDASH scores the diagnoses are: adhesive capsulitis=29.7%; impingement=27%; rotator cuff pathology=29.4%.

The correlation across all shoulder pathologies between the GROC and change in QuickDash was -0.098. The correlation between GROC and change in QuickDASH for each of the diagnostic categories are as followed: adhesive capsulitis=0.277; impingement=0.076; rotator cuff pathology=0.084.

Effects of Type of Interventions on Objective Functional Patient Outcomes: General Mobility Patients

Students: John Hill, Kelly Purcell, Sarah Kopfman

Faculty: Kathleen Mangione, PT, PhD, FAPTA; Shailesh Kantak, PT, PhD

Purpose: Previous research has shown that a variety of intervention types can have a positive impact on patients. The purpose of this analysis was to examine which intervention types have the largest positive functional impact on patients with diagnoses that fit a general mobility classification.

Subjects: Patients were treated by third year Doctor of Physical Therapy (DPT) students during a six month clinical internship. Included in the data analysis were 415 patients with diagnoses that fit into the general mobility category. Of the subjects included, 34% (n = 140) had a neurological condition, 15% (n = 63) had an orthopedic condition, and 51% (n =212) were described as "other." Initial examination and evaluation, symptom duration, objective functional measures, and treatment response data were collected throughout the course of care. Of the 415 patients, 48.2% (n=200) were female and 47.2% (n=196) were male. The majority of patients were between the ages of 30 and 75 with 15.6 % (n=65) ages 30 to 49, 33.1% (n=138) ages 50 to 64, and 18.5% (n=77) ages 65 to 74. Out of the total number of patients, 36% (n = 150) were receiving treatment for surgical procedures. Due to 73% of the patient population being in the outpatient setting, the results focus on the outpatient population.

Methods: Descriptive analysis was performed to categorize data looking at data demographics and changes in various outcome measures including the Timed Up and Go (TUG), gait speed, and the 6 minute walk test (6MWT). Per outcome measure, analysis was performed to determine the frequency of type of intervention used to address change in specific outcome measure.

Results: Gait speed was the most commonly used outcome measure for the general mobility population. Average change in gait speed was 0.27 m/s (SD 0.07 m/s), TUG scores decreased in time by an average of 5.51 seconds (SD 12.46 sec), and the 6MWT showed an average change in distance of 118.44 m (SD 136.54 m). For all the outcome measures, SPTs utilized progressive resistance exercises during most sessions, followed by gait training and functional training.

Impact on Clinical Practice: General mobility is a broad category that includes various physical therapy diagnoses and patient impairments. The present data analyses depict the common outcome measures used for the outpatient population and the intervention categories that are associated with the largest positive functional impact. It is important for physical therapy clinicians to apply outcome measures and better characterize interventions to daily practice in order to monitor and achieve maximum results for patients' functional success.

Clinician Knowledge and Perceptions of the Collaborative Model of Clinical Education

Students: Christian Porter, Benjamin Sacks, Hsu-Hung Yeh

Faculty: Susan Tomlinson, PT, DPT; Janet Readinger, PT, DPT; Stephen Banks, PT, DPT; Brian Olkowski, PT, DPT

Purpose/Hypothesis: As physical therapy enrollment grows, providing quality clinical placements is challenging. Most clinical experiences utilize a one clinical instructor (CI) to one student supervisory model. The collaborative model of clinical education (CMCE) is a successful learning model that has one CI mentoring more than one student. Despite support of the CMCE in literature and use in other health professions, physical therapy has been slow to adopt the model. The purpose of this study is to describe clinician perceptions of the CMCE to understand their knowledge, perceived advantages, disadvantages, and barriers.

Materials/Methods: A 24 question web-based survey was emailed to 2,932 CIs and/or Center Coordinators of Clinical Education (CCCE) affiliated with one academic program in the Clinical Performance Instrument. Descriptive and non-parametric analysis of relationships and group differences were performed.

Results: The response rate was 13% (n=383). Respondents represented 22 states; 49% practiced from 0-10 years and 51% for 11+ years; 67% were credentialed CIs; 43% practiced in outpatient, 26% in acute care, and 19% in inpatient rehab; 32% had experience as a CI or student in the CMCE. From survey results, no correlation was found between years of experience and perceptions of the CMCE. The major advantage was development of teamwork skills (71%); the major disadvantage was reduced one-on-one time with students (67%). The biggest barrier was limited physical space most prevalent in outpatient (50%) followed by rehab (37%) and acute (29%). While 31% of all respondents agreed that the CMCE improves productivity, more acute care respondents disagreed (45%) than rehab (32%) or outpatient (24%) (p<0.05). Clinicians with CMCE experience as CIs or students were more likely than those without experience to agree (p<0.05) that the CMCE is feasible in their practice settings, improves the quality of physical therapy, improves productivity, provides an adequate learning experience, and is supported with sufficient evidence. The 182 clinicians who agreed they were confident in the ability to provide the CMCE were more likely to agree (p<0.05) that the CMCE is feasible in their setting, is an adequate learning experience, and is supported with sufficient evidence.

Conclusions: Knowledge and perceptions of the CMCE were not related to years of experience suggesting acceptance of the model may not have changed. The largest perceived barriers were space in outpatient and productivity in acute care. Factors that correspond with positive perceptions of CMCE include student or CI experience with the CMCE and confidence in providing the CMCE.

Reliability and Feasibility of use for the Functional Arm and Shoulder Test in Older Adults

Students: Dylan Marks, Daniel Safford, Jeffrey Turner

Faculty: Phil McClure, PT, PhD; Kshamata Shah, PT, PhD

Purpose: Previous work in our lab has established sufficient clinical feasibility, and between session reliability of the Functional Arm and Shoulder Test (FAST) in healthy asymptomatic young adults to expand this test in older adults. The purpose of this study is to establish the reliability, feasibility and age-related norms of the FAST in older asymptomatic individuals over age 65.

Subjects: 33 asymptomatic older adults (mean age 79.2 (6.5); 13 M) without active shoulder or cervical pathology, and who were considered able to perform the test safely.

Methods: The FAST took 10-12 minutes to complete on both arms and consisted of 3 constructs of measurement – range of motion (ROM), endurance, and strength that had emerged from functional task questions included in self-report questionnaires. The ROM task included touching the hand to back of head and lumbar spine for 30 seconds, endurance task included rotating hand with towel on wall at shoulder height externally (ER) and internally (IR) each for 60 seconds, strength task involved lifting a gallon jug of water from counter height to a shelf height for 30 seconds. Total repetitions for each task were noted at half and end time points. Data was collected by 1 of 5 testers on two separate occasions 7-14 days apart. Between-session reliability (ICC 2,1) and measurement error (SEM and MDC) were calculated for each task and the total score. Scores were compared using paired t-tests and Pearson correlation coefficient.

Results: The ICC, SEM and MDC values for the between-session reliability for the total test scores were as follows: right 0.92 (0.83-0.96, 95%CI), SEM 19.3, MDC 53.6 repetitions and left 0.95 (0.89-0.97, 95%CI), SEM 14.2, MDC 39.4 repetitions. The ICC values for individual tasks ranged from 0.81 – 0.93. The mean (SD) values for each task were: ROM 24.0 (8.8), endurance ER 77.0 (25.6), endurance IR 83.4 (26.1), and strength 13.6 (6.2). There was no difference ($p > 0.05$) in the right and left values for the tasks, except for IR endurance with absolute mean differences between sides ranging from 2.4 to 10.3 repetitions ($p = 0.01$). The half and end time scores for all tasks were strongly correlated ($r = 0.91 - 0.99$, $p < 0.01$).

Conclusions & Discussion: These results show excellent between session reliability for the FAST in older adults. There was no difference bilaterally, except for IR endurance task, suggesting that an uninvolved side may be used as a baseline measure in patients with shoulder problems. All half and end time scores were strongly correlated, indicating that it may be possible to reduce testing time by 50%. These results suggest that the FAST is a feasible and reliable tool for measuring functional performance in older adults. Establishing healthy age-related norms of FAST scores will enhance outcome measurement.

Using a Clinical Database to Examine Patient Achievement of Clinically Important Gait Speed Changes

Students: Allyssa Chamberlain, Jessica Hartman

Faculty: Kristin Day, PT, PhD, NCS; Susan Tomlinson, PT, DPT

Purpose: Our purpose is two-fold: 1) to assess whether a relationship exists between gait speed changes meeting/not meeting minimal clinically important differences (MCID) and self-reported Global Rating of Change (GROC) scores in the acute care setting and 2) to compare data for patients meeting/not meeting MCIDs to identify trends in diagnoses and PT service utilization.

Subjects: The Class of 2016 Acute Care Database recorded 128 patients; 24 (12 males) met criteria for our analysis. Patients ranged from 30-85+ years and had an average of 3.5 comorbidities. PT treatments lasted an average of 6.3 visits over an average length of stay (LOS) of 8.8 days. Demographics and diagnoses of patients utilized in our data analysis represent a diverse patient population.

Methods: Established population-specific MCIDs for gait speed were used to categorize patients into MCID-met versus MCID-not met groups. For each group, *Pearson's r correlation* was applied using changes in gait speed and GROC. Patient diagnoses, number of PT visits, average LOS, and frequency/type of intervention then were examined for each group.

Results: 11 of 24 patients met the MCID (0.1 m/s = community dwelling ages 65+ and THA or 0.16 m/s = CVA). The relationship between gait speed change and GROC was moderate in the MCID-met group ($r = 0.57$) and weak in the MCID-not met group ($r = 0.22$). In the MCID-met group, the most common diagnostic category was CVA (63.6%) followed by Cardiovascular (18.2%), THA (9.1%), and Other (9.1%). LOS and PT visits averaged 14.3 days and 8.0 visits, respectively. During those visits, the most frequent interventions included gait training (6.0), functional training (5.5), and patient education (4.1). In contrast, the MCID-not met group had more patients with THAs (46.2%), CVA (23.1%), Trauma (15.4%), Cardiovascular (7.7%), and Other (7.7%). The LOS and PT visits were also less, averaging 5 days and 4.9 visits, respectively. Interventions focused on gait training (4.1), bed mobility (3.4), and transfer training (3.2).

Impact on Clinical Practice: Our results indicate patients with the greatest changes in gait speed were better able to recognize improvement. Not surprisingly, patients who improved the most overall received more PT visits with a higher frequency of interventions aimed at improving ambulatory status and patient education. These results may indicate that patient education is an integral part of a patient's perception of improvement. Additionally, patients who did not meet the MCID received fewer visits from therapy. This result points to a possible area for patient advocacy: increased therapeutic hours prior to discharge from hospitals.

Assessing the Relevance of a Leadership Competency Model: A Framework for Healthcare Companies to Evaluate Current Assessment Tools: A Case Report

Students: Jolene Foster, Jeffrey Turner

Faculty: Michael P. Johnson, PT, PhD; Larry Baidar, OT, MASCL

Purpose: The aim of this project was to assess the relevance of the Leadership Competency Model in today's changing healthcare environment and provide consultation to a home health care agency to improve the current model. The results can be used as a framework for other companies wishing to evaluate the relevance an assessment tool being utilized. The use of this framework may encourage companies to stay current in business trends, reduce resources utilized, and allow employees to have an active role in their company.

Case Description: A unique five phased assessment was developed to examine the relevance of a home health care agency's Leadership Competency Model. Phase 1, Company Immersion, was to gain exposure to the company's structure and culture. Phase 2, Literature Immersion, included a review of relevant literature to gain knowledge of current themes in business, leadership, and healthcare administration. Phase 3, Expert Interviews, included a standardized questionnaire given to local health administration experts to assess each competency within the Leadership Competency Model. Phases 4 and 5 consisted of a comparative analysis of the Leadership Competency Model and expert interview results and recommendation development through an Expert Derived Model.

Results: The comparative analysis of the Leadership Competency Model's key behaviors and the common themes from expert interviews were used to create the Expert Derived Model. These recommendations included: "ability to create an action plan", "leader's ability to assess direct reports' skills in being client focused", "effective communication needs to be hard-wired into daily operation, "the ability of the leader to recognize their own strengths and weaknesses through self-reflection and self-assessment", "the leader looks for opportunities for everyone to succeed; being team-minded", "educating and sharing results of business metrics to all employees of the organization", "build a diverse team of experts with varying strengths and skills", and "provision of resources to encourage continuing education and professional organization involvement".

Discussion: This organized framework can be used as a tool within a business healthcare environment to provide an internal method to assess the relevance of an evaluative tool through literature research, understanding company values and culture, and speaking with experts in the field. Future research should examine the efficacy of such an organizational framework and its ability to be incorporated as a tool for leadership competency evaluation.

Functional Arm and Shoulder Test Performance in High-School Athletes

Students: Timothy Baker, Sarah Lopez, Amanda Sternberg

Faculty: Phil McClure, PT, PhD; Kshamata Shah, PT, PhD

Purpose: There is currently no standard or consistently used clinical test of shoulder functional performance. Current tests are high level and not suitable for all patient populations. The purpose of this study was to further investigate previously designed Functional Arm and Shoulder Test (FAST) to obtain normative data on asymptomatic high-school athletes.

Subjects: 37 high-school athletes (19M, mean age 16.1 (1.3) years) involved in sports or exercise at least 2 times/week. Participants were excluded if they had history of shoulder problems (within 6 months), surgical repairs, or recent dislocations (<6 weeks).

Methods: The FAST test included range of motion (ROM), endurance and strength tasks. ROM task included touching hand to back of head and lumbar spine for 30 seconds, endurance task included rotating hand with towel on wall at shoulder height externally (ER) and internally (IR) each for 60 seconds, strength task involved lifting a gallon jug of water from counter height to shelf height for 30 seconds. It took a total of 10-12 minutes to complete the test on both arms. Total repetitions (reps) for each task and reps at half and end time points for endurance task were noted. Previous work in our lab has established age related norms and sufficient reliability (ICC = 0.74 (0.31-0.89, 95% CI)) of the FAST in college-aged individuals (mean age 27.7 (1.1) years). Total FAST scores and individual task scores for males and females, and high-school athletes and college-aged individuals were compared using independent sample t-test. Pearson's correlation coefficient was used to examine differences in endurance task scores at 30 and 60 seconds in ER and IR directions.

Results: Overall, mean (sd) FAST scores were lower for high-school athletes (222.8 (50.7) reps) vs. college-aged individuals (266.5 (43.8) reps) ($P < 0.001$). Mean total FAST scores were higher for males vs. females in high-school students (247.2 (54.4) reps vs. 195.5 (28.2) reps) ($P < 0.001$). Strong correlations ranging 0.991 – 0.994 were found comparing ER and IR endurance task scores at 30 and 60 seconds.

Conclusions: These preliminary findings suggest this clinical test is sensitive enough to detect differences in functional performance that exists between closely related age groups and between males and females. The results also suggest that decreasing the endurance task from 60 seconds to 30 seconds may be justified.

The Effects of Eccentric, Concentric, and Isometric Contractions on Pain Sensitivity over the Achilles Tendon

Students: Elizabeth Lane, Diane Weeks, Junsik Yoon

Faculty: Scott Stackhouse, PT, PhD; Brian Eckenrode, PT, DPT, MS, OCS

Purpose: There is mixed evidence on the superiority of eccentric-only exercise in reducing pain in chronic tendinopathies. The purpose of this study was to investigate the effects of plantarflexion exercise (eccentric, concentric, or isometric) on pain sensitivity measures over the Achilles tendon. We hypothesized that there will be no between-group differences in the effects on pain sensitivity when contraction duration is equivalent across groups.

Subjects: To date, 58 adults were screened and 33 were found eligible (age=25.0; SD=2.7) and block-randomized by sex into eccentric(ECC), concentric(CON), or isometric(ISO) groups.

Methods: After eligibility screening and consent, subjects completed a series of questionnaires on pain and anxiety. Participants had their dominant side Achilles tendon assessed for pressure pain threshold (PPT), heat pain threshold (HPT), and heat temporal summation (HTS). The study timeline was as follows: Baseline 1, 48-hr washout, Baseline 2, 1-week intervention, and next day Post-intervention assessment. After the Baseline 2 assessment, participants were instructed in specific exercise according to group assignment: CON, ECC, or ISO plantarflexion contractions. One investigator observed and gave feedback during their first 3 sets of 15 reps of exercise. All contraction durations were to last 5 sec and subjects were asked to complete 3 sets of 15 reps 2x/day for 7 days.

Results: There were no differences between groups on pain and anxiety questionnaires and for exercise compliance ($p > 0.05$). Excluded participants were mostly male due to not meeting a HPT of $\leq 46.5^\circ\text{C}$. Sex breakdown per group was: CON-8 female, 3 male; ECC-8 female, 3 male; ISO-8 female, 2 male. Preliminary analysis was performed by calculating absolute and standardized effects sizes of the change scores (post-intervention minus the average baseline) for PPT, HPT, and HTS. HPT increased in CON by 2.31°C (95%CI=1.41 to 3.20; $\delta=1.22$), ECC by 1.45°C (95%CI=0.64 to 2.37; $\delta=0.79$), and ISO by 2.34°C (95%CI=1.51 to 3.18; $\delta=1.07$). HTS decreased in CON by 9.03mm (95%CI=3.58 to -21.65; $\delta=-0.50$), ECC by 12.18mm (95%CI=-2.42 to -21.94; $\delta=-0.89$), and ISO by 7.40mm (95%CI=-1.12 to -13.68; $\delta=-0.35$). There was no consistent change in PPT across groups although the ECC group had an increased PPT of 1.14kg (95%CI=-0.82 to 3.09; $\delta=0.34$). Data collection will continue to include 10 females and males in each treatment group as per prior sample size estimate.

Conclusions: Preliminarily, all exercise groups similarly reduced pain sensitivity for HPT and HTS when contraction durations were equivalent. Additionally, eccentric exercise may decrease sensitivity to PPT. Future direction would include study of pain sensitivity in people with Achilles tendinopathy.

Contraction duration, not contraction type, may be an important variable that impacts hypoalgesic effects in people with chronic tendinopathies.

Complex Motor Skill Learning Transfers to Improvements in Simpler Functional Tasks

Students: Paula Bermel, Sarah Gurgal, Allison Heck, Janet Hertz, Gabby Kissinger, Allison Maffei

Faculty: Shailesh Kantak, PT, PhD; Nazaneen Zahedi, BS; Robert McGrath, BME

Purpose: Learning motor skills is an important part of rehabilitation. Given limited time for therapy, patients should intensely practice certain motor skills that may transfer to functional activities. One factor to consider when choosing therapeutic practice is task complexity. Therefore, we investigated practice effects of a complex arm motor task on speed-accuracy tradeoff and transfer to a simple reaching task. We hypothesized that patients will learn and retain performance improvements in the task and transfer this information to a non-practiced one.

Methods: Participants with unilateral chronic stroke (N = 14; mean age=55.69) were recruited from Moss Rehabilitation's patient registry. After completing the Mini Mental Scale, Fugl-Meyer and upper extremity proprioception, participants completed two sets of baseline goal-directed planar reaching tasks (PRT). Then over two consecutive days, participants practiced a complex task to navigate a cursor with their paretic arm through a virtual track as fast as possible without crossing the borders of the track. Performance changes were characterized by improvements in accuracy within prescribed movement time ranges, and learning was quantified by changes in the speed-accuracy tradeoff (SATO) at baseline compared to a day after practice ended. To assess transfer to a non-practiced functional task, we examined the pre-post changes in goal-directed PRT to three different targets.

Results: SATO data was synthesized to find average accuracies for each day, and pre-post change in accuracy indicated complex skill learning. For PRT, position data was differentiated to obtain tangential velocities and acceleration. Outcome measures for the PRT included movement time, average peak velocity, average peak acceleration, average time to peak velocity and average time to peak acceleration. Excel was used to create bar graphs to compare pre and post averages. Student t-tests and an ANOVA were conducted.

As hypothesized, all participants improved in the practiced complex task and retained the improvements over 24 hours. Also, for the non-practiced task, there were reduced movement times, higher peak velocities and shorter time-to-peak velocities after practice.

Discussion: Patients with stroke are able to learn and retain complex motor skills with their paretic arm while also transferring this improved performance to an untrained task. Clinically, this suggests that complex task practice may be helpful in driving performance improvements for simpler, non-practiced tasks. Limitations include a small sample size and a lack of a comparison group. Further research is needed to understand what parameters transfer between tasks and how to best structure practice for transfer in patients post stroke.

Effects of Manual, Instrument, and Electrical Stimulation Interventions on Myofascial Trigger Points in the Upper Quarter

Students: Rachael Giordano, Sarah Glynn, Kelsey Harm

Faculty: Scott Stackhouse, PT, PhD; Brian Eckenrode, PT, DPT, MS, OCS

Purpose: Myofascial pain and the presence of myofascial trigger points (MTrPs) is a common clinical problem that has been linked to peripheral and central nervous system sensitization. There are few studies that compare the effects of different interventions on decreasing pain sensitivity of MTrPs of the upper trapezius (UT) and levator scapulae (LS). Additionally, there currently is no controlled study investigating the effects of instrument-assisted soft tissue mobilization (IASTM) on MTrPs. This study was conducted with the purpose of comparing the effects of two forms of electrical stimulation, manual ischemic compression, and IASTM on the pain sensitivity of MTrPs of the UT and LS.

Hypotheses: We hypothesized that high frequency motor-level electrical stimulation will demonstrate statistically significant decreases in pain sensitivity in the upper quarter both immediately after and 24 hr after treatment when compared to low-frequency motor-level stimulation, IASTM and manual ischemic compression interventions. We hypothesized that high frequency motor-level stimulation would be superior to low frequency motor-level stimulation due to the greater number of pulses delivered to the subjects (30,000 vs 2,400).

Methods: All subjects were screened for presence of MTrPs in the upper trapezius or levator scapulae muscles via palpation. In order to be included in the study subjects were required to meet the following inclusion criteria: age 18-60 yo, presence of palpable band in UT or LS, referred pain with deep pressure, & local pain $\geq 3/10$ with compression. Subjects were not included in the study if they reported any current chronic or acute pain in other body areas, exhibit signs of cervical radiculopathy/subacromial pain syndrome, or other head, neck or shoulder pain not related to the MTrP's. Subjects completed the Fear of Pain and Pain catastrophizing questionnaires prior to baseline testing. Subjects were block-randomized into treatment groups based on sex and then baseline testing was performed. Testing was performed to determine pressure and thermal pain sensitivity to regions of the upper extremity and neck innervated by the cervical segments C4, C5, & C6 at 3 time points: pre-treatment, immediately post-treatment, and the following morning. C4 was assessed at site of the MTrP, C5 at the acromion process, and C6 at the thenar eminence. Subjects were given a 5 min break following initial testing. One of the following interventions were then provided: high frequency electrical stimulation, low frequency electrical stimulation, instrument assisted soft tissue mobilization (IASTM), manual ischemic compression, or a control of sensory-threshold electrical stimulation.

Discussion/conclusion: Data analysis will be performed upon further subject testing.

Comparison of Shoulder, Hip, and Trunk Rotation Range of Motion Variables in Collegiate Women's Soccer and Softball Players

Students: Alexandra Sable, Gerard Smith, Alexander Weinert

Faculty: Brian Eckenrode, PT, DPT, MS, OCS; Michael Parlatore, PT, DPT

Purpose: Throwing and kicking sports require adequate joint range of motion (ROM) to allow the trunk to transfer momentum to the extremities. Limited trunk ROM may be associated with upper extremity injury in throwing athletes; however, the contribution of thoracic rotation ROM to lower extremity (LE) injuries is less well known. The purpose of this study is to examine the differences in shoulder, hip, and thoracic rotation ROM between sport and past injury history in female soccer and softball players.

Subjects: Thirty-two Division III female athletes (17 soccer, 15 softball; age: 19.2 ± 1.1 years (range 18-21 years); body mass index: $23.36 \text{ kg/m}^2 \pm 2.3$ (range $20.1-28.8 \text{ kg/m}^2$) were recruited. Exclusion criteria included surgery within the last 6 months or pain preventing participation in team activities.

Methods: Athletes attended 1 testing session in which self-report injury history was obtained and ROM measurements were taken of seated thoracic rotation, prone hip internal and external rotation, supine shoulder internal and external rotation with the shoulder at 90° of abduction, and supine shoulder horizontal abduction and adduction. Following 2 practice trials, each measurement was recorded 3 times on each extremity. History of upper or lower ligamentous or capsular injury, cartilage or labral tear, or fracture was considered positive for injury.

Results: No significant differences were found between female soccer and softball players for thoracic rotation, shoulder rotation, shoulder horizontal abduction/adduction, or hip rotation ROM between the dominant and non-dominant extremity ($p > .05$). Of the 17 female soccer players, 9 reported history of major hip, knee, or ankle injury. Total hip rotation ROM arc in the dominant (primary kicking) leg of female soccer players was significantly greater ($p < .05$) in players without a prior LE injury ($92.21^\circ \pm 14.14$) compared to those with a prior injury ($79.22^\circ \pm 9.95$). Four out of seven soccer players (57%) who had $\leq 30^\circ$ of hip internal rotation in their dominant limb reported a prior history of LE injury.

Conclusion: In this preliminary study, there were no significant differences between the kicking and throwing athletes for the shoulder, hip, and trunk rotation ROM values examined. Female soccer players with a prior history of a major LE injury exhibited less total hip rotation ROM arc.

Clinical Relevance: Our preliminary findings are similar to previous literature, which has reported decreased hip rotation ROM in soccer players with a history of ACL injury. Hip joint hypomobility may be associated with LE injury in collegiate female soccer players. Further research should examine the optimal ROM values for rehabilitation and injury prevention purposes.

Feasibility of a Health Promotion-Based Group Exercise Intervention for Adolescents and Young Adults with Down Syndrome

Students: Casey Haddaway, Diane Kim, Lauren Salter

Faculty: Ann Harrington, PT, DPT, PhD, PCS

Background & Purpose: Down syndrome (DS) is a chromosomal abnormality causing physical, sensory and cognitive impairments in 1 in every 700 babies born in the United States. Common deficits in individuals with DS include delayed cognitive and gross motor development, hypotonia, and balance and coordination deficits. Individuals with DS tend to be less physically active when compared to typically developing individuals and individuals with intellectual disabilities alone, leading to elevated body mass. This increases the risk for other serious health concerns and poor self-image. This case series examined the effect of a structured exercise program, including self-selected activities, on strength, balance, coordination, and self-efficacy in adolescents and young adults with DS.

Case Description: Three female subjects (mean age=19 years) participated in a 12-week, two-phase physical therapy intervention designed to motivate behavioral change using the Social Cognitive Theory. Phase one consisted of 6 weeks of structured group physical therapy focused on cardiovascular exercise, strengthening, sports activities and caregiver education. Phase two consisted of 6 weeks of individualized, guided home exercise programs that were monitored and progressed weekly. Outcomes were assessed at baseline, 6, and 12 weeks and included Subject and Caregiver surveys of Exercise Self Efficacy Scale and Pediatric Quality of Life (PedsQL), grip strength, isometric knee extensor strength, Bruininks-Oseretsky Test of Motor Proficiency-2 (BOT-2), and spatio-temporal gait parameters collected at free speed, fast speed and running.

Outcomes: All subjects completed the 12-week intervention. Two subjects were able to complete all tests and measures, while Subject 2 was limited in her ability to complete the subject-reported self-efficacy and BOT-2 due to intellectual disability and behavioral impairment. Subjects 1 and 3 demonstrated an improved score in some components of the PedsQL and 2/3 composite subtests of the BOT-2 at post-testing compared to baseline. Only Subject 2 demonstrated increased isometric quadriceps and grip strength at post-testing compared to baseline.

Discussion: While it has been previously reported that exercise is beneficial to the health of individuals with Down syndrome, heterogeneity in the phenotypic presentation in intellectual disability, behavior and motivation also impacts performance and participation in a training program. This project is ongoing and a larger sample size is needed to identify statistically significant changes with the proposed protocol. Additionally, follow-up data following a 6-week washout period was not yet available when data were analyzed.

The Effect of Dynamic Weight Support on the Gross Motor Skills of Typically Developing Infants

Students: Laura Hutira, Carolyn Kantner, Rebecca Nitz

Faculty: Laura Prosser, PT, PhD

Purpose: The development of sufficient postural control and lower extremity strength are considered to be the rate limiting factors in the achievement of independent walking. The degree to which each factor contributes to this critical motor milestone is unknown. Understanding this relationship will inform early rehabilitative practices for infants and toddlers with physical disabilities. This study investigated the influence of dynamic body weight support on the motor behavior of typically developing infants. If lower extremity strength is the major limiting factor to infant walking, the children in our study should experience an increase in their gross motor/walking skills as they receive more weight support.

Methods: Participants were screened using the Bayley Scales of Infant Development to confirm typical motor and cognitive development. They were then fitted in a DBWS harness in a contained play area and the Gross Motor Function Measure (GMFM-66) was scored during four different conditions (harness only, 0% BWS, 20% BWS, 40% BWS). Next the participants' postural control was measured using a Neurocom force plate. Videos recording the body weight support sessions were analyzed using Datavyu software and the GMFM scores were calculated with the Gross Motor Ability Estimator. Postural control center of pressure time series data were analyzed in Microsoft Excel for excursion in A-P and M-L planes. Data were analyzed using paired t-tests.

Results: Sixteen children, 9 to 13.5 months of age, participated, with 21% currently walking. Nine had evaluable postural control data, and 8 had evaluable motor ability data. For the postural control section a total of 563.1 seconds of usable data was found. The average excursion in the M-L direction was 4.75 and was 6.92 in the A-P direction. The average GMFM score for each weight support condition was as follows: free 51.1, 0% 48.8, 20% 51.7, and 40% 51.5. Between free and 0% conditions we found no significant difference ($p=0.16$). P-values for 0% and 20% conditions ($p=0.18$), 0% and 40% ($p=0.13$), and 20% and 40% ($p=0.42$) showed no statistically significant change between conditions; however, when comparing 0% BWS to the child's best GMFM score there is a 93% probability that the change in score was not due to chance ($p=0.07$). Figure 1a demonstrates no significant correlation between postural control and change in the GMFM scores between conditions ($r=0.18$, $p=0.07$). Figure 1b shows correlation between baseline GMFM score and change in motor ability ($r=-0.57$, $p=0.003$).

Discussion: Children with lower baseline motor ability demonstrated the largest response to DBWS. The clinical implication of this research is that children with significant physical disabilities may demonstrate increased motor skills with DBWS, suggesting that its use as an intervention tool should be investigated.

Muscle Mechanisms Underlying Recovery of Function After Hip Fracture

Students: Nicholas Bertsch, Matthew Garnjost, Alex Schweitzer

Faculty: Marty Eastlack, PT, PhD; Rebecca L Craik, PT, PhD

Purpose: People with hip fractures often have lower extremity (LE) muscle imbalances that lead to asymmetry during gait and functional tasks such as sit to stand (STS). This study is part of a larger study (CAP grant) looking at two interventions (PUSH vs PULSE) in people post hip fracture. Our study is investigating LE muscle changes in response to interventions at 3 time points: baseline, post-intervention and 40 weeks post randomization. We hypothesize that the strengthening (PUSH) group will have better muscle quality (MQ) and fewer asymmetries than the PULSE group. Our purpose is to describe baseline measures for 6 subjects enrolled in the ancillary study.

Subjects: Six people post-hip fracture; 3 males, 3 females were an average age 83.6 (range: 68-94). Average time between fracture and date of testing is 84 days (range: 59-125).

Methods: Baseline measures included gait asymmetry, preferred gait speed (PGS), STS mechanics, MQ and muscle thickness (MT). The GaitMat II™ was used to measure PGS, single support time (SST) and step length (SL). Force plates, one under each foot, were used to examine STS loading symmetry (force in N). MT and MQ of the gluteus medius, rectus femoris (RF) and lateral gastrocnemius (LG) muscles were assessed using ultrasound (GE Logiq e). Image J software was used to analyze US images for MT (cm) and echo intensity (grayscale, IU).

Results: Two subjects had an uninvolved SST of 20% greater than the involved limb. One subject had an uninvolved SL of 10% greater than the involved LE. PGS for the subjects ranged between 0.54 to 0.86 m/s, average speed was 0.70 m/s. Four subjects placed 20% more force through their uninvolved LE during STS. Two subjects had RF MT differences greater than the SEM (0.27 cm). One subject had LG MT differences greater than 0.27 cm. Two subjects had significant (SEM = 13.59) MQ differences for the RF.

Conclusion: The baseline data is consistent with descriptions of people with hip fractures and is different from age referenced standards of healthy adults. Blanc et al found SST asymmetry to be between -2.3% and 2.09% for healthy adults ages 51+. All of our subjects were outside this range. Brach et al found that the norm for PGS in healthy adults is 1.0-1.2 m/s. All the subjects had a PGS that was at least 0.1 m/s slower. Four subjects had significantly poorer MQ in their involved LE compared to age matched norms. We can suggest from the data that MQ differences exist when compared bilaterally in RF and LG muscle groups, which can affect functional symmetry.

Clinical Relevance: The data suggests the need for early intervention physical therapy post-hip fracture to restore MQ and functional symmetry. Differences in MQ and involved extremity loading suggest areas for targeted intervention.

Feasibility and Clinical Utility of an Accelerometry-Based Command Following Paradigm in Disorders of Consciousness

Students: Kelley Borgard, Kimberly Poehlmann

Faculty: Kristin V Day, PT, PhD, NCS; John Whyte, MD, PhD

Purpose: Accurate diagnosis of an individual's level of consciousness after severe brain injury is crucial to securing access to rehabilitation. Clinical diagnostic tools include both standardized and individualized quantitative behavioral assessments; however, these approaches rely on a clinician's visual judgment, often resulting in a misdiagnosis of vegetative state (VS) when underlying conscious processes remain. This project explores the feasibility of using accelerometry to assess command following in persons with disorders of consciousness (DoC) after brain injury.

Methods: Six individuals diagnosed with DoCs who were undergoing inpatient rehabilitation participated in this study as part of a larger trial. Data collections were attempted weekly. Audio-recorded commands to "move hands" or to "hold still" were randomly administered over 60 trials, with 10 sec response intervals. Accelerometers attached to the participants' hands recorded motion. Acceleration data were extracted into epochs and grouped by command. The mean of 3D accelerations from each trial within each command type was calculated. Wilcoxon Signed Rank tests were conducted ($p < .05$). Coma Recovery Scale-Revised (CRS-R) also were performed to compare clinical diagnostic findings with accelerometry data.

Results: Number of usable data collections per participant ranged from 1 to 3. Availability and quality of data were impacted by factors such as diaphoresis, hypertonicity, and automatic motor responses which limited prolonged accelerometer attachment; availability around inpatient therapy schedules; and medical statuses. Overall, great heterogeneity was observed among participants. In one individual, both accelerometry and CRS-R consistently confirmed a diagnosis of VS ($p > 0.05$). However, in a second person with a CRS-R diagnosis of VS, accelerometry revealed command following ($p = 0.019$). In the other four individuals, the CRS-R was superior in detecting command following earlier and continued to show such evidence on subsequent evaluations when accelerometry did not. Importantly, all individuals who demonstrated command following via accelerometry were unable to consistently show such behavior across test sessions.

Discussion: While accelerometry is capable of detecting consciousness using an upper extremity paradigm, in our sample, the gold standard behavioral assessment was better. Accelerometry is feasible to implement, but may be complicated by patient and environmental factors in the inpatient setting. Clinicians should be aware that a patient's unique deficits may require an individualized paradigm. Further study into which patients are suitable for accelerometry and how it is best applied in the clinical setting will enable development of a sensitive method for measuring consciousness.