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# 2024 AMSSM Oral Research Poster Presentations

(Clin J Sport Med 2024;34:177–245)

TOPIC: Pediatrics  
STUDY TYPE: Survey

## Mental Health, Physical Activity, and Adolescent Health-Related Quality Of Life

**Submitting Author/Presenter:** Amy Valasek, MD, MS, FAMSSM

Enas Alshaikh, PhD, Katherine Ellee Allison, BS, James Onate, PhD, ATC, Jingzhen Yang, PhD, MPH, and Julie Young, PhD, ATC

**Affiliation:** Nationwide Children's Hospital, The Ohio State University College of Medicine, Columbus, Ohio.

**Purpose:** Poor mental health and physical inactivity can diminish adolescent health-related quality of life (PQoL). This study assessed how anxiety, depression, sleep, physical activity (PA), musculoskeletal pain, and body mass index (BMI) are related to PQoL in adolescents.

**Methods and Study Design:** We recruited adolescents aged 12 to 18 from sports medicine clinic, adolescent medicine clinic, and a high school to complete survey packet. Surveys included the GAD-7, PHQ-9, PQoL, Pittsburgh Sleep Quality Inventory PSQI, physical activity, and pain. A structural equation model (SEM) examined how mental health, PA, pain, and BMI percentiles were associated with and affect PQoL.

**Results:** Of a total of 395 participants, 146 (37%) were male and average age of 15.8 (SD = 1.8). The average daily physical activity reported was 334 minutes. The average scores for anxiety symptoms, depression symptoms, and sleep were 4.1 (GAD-7), 4.7 (PHQ-9), and 5.3 (PSQI) on respective screenings. The average PQoL score was 78% on screening for this group. The latent variable of mental health was significantly associated with anxiety symptoms ( $B = 0.86$ ,  $P < 0.01$ ), depression symptoms ( $B = 0.91$ ,  $P < 0.01$ ), and sleep ( $B = 0.73$ ,  $P < 0.01$ ). The structural equation model accounted for 70% of the variability in PQoL. Specifically, low score of poor mental health ( $B = -0.81$ ,  $P < 0.01$ ) and high level of physical activity ( $B = 0.11$ ,  $P = 0.02$ ) was significantly associated with high PQoL score, respectively. While low pain score ( $B = -0.06$ ,  $P = 0.07$ ) and low BMI percentile ( $B = -0.04$ ,  $P = 0.27$ ) were associated with high PQoL score, the associations were not statistically significant.

**Conclusions:** Mental health and physical activity are significantly associated with PQoL in adolescents. Future research investigating mental health and physical activity relationships in diverse geographic locations is needed. Promotion of good physical health during adolescence can positively impact health-related quality of life and nurture into adulthood.

**Significance:** 1. Good mental health and physical activity significantly improved health-related quality of life in adolescents. 2. The mental health variable was inversely related to reported health-related quality of life in adolescents.

**Acknowledgements:** This study was funded by Nationwide Children's Intramural Grant.

TOPIC: HPV  
STUDY TYPE: Survey

## Exploring Opportunities to Improve Vaccination Rates in the Sports Medicine Setting

**Submitting Author/Presenter:** Justin Ceasar, BS

Cayce Onks, DO, MS, ATC, Eva Frank, PhD, LAT, ATC, Rebecca Hall, LAT, ATC, and Cole Hartert, LAT, ATC

**Affiliation:** Penn State College of Medicine, Hershey, PA.

**Purpose:** Human Papillomavirus (HPV) has one of the lowest vaccination rates. Though Sports Medicine teams are well suited to advocate for vaccination, Athletic Trainers' (ATs) historically haven't engaged. This study aims to examine ATs' knowledge of HPV and their perception of their role in vaccination.

**Methods and Study Design:** We designed a cross-sectional survey sent to middle school, high school, and collegiate ATs through the National Athletic Trainers' Association data collection service program. The survey consisted of a consent form, demographic, knowledge, and perception-based questions. An optional open-ended section was developed for ATs to leave comments on their thoughts about this topic.

**Results:** A total of 460 ATs participated in the study, with 59% of participants under the age of 40. A significant number of ATs did not display high levels of knowledge regarding HPV and HPV vaccination, with only 46% of all ATs scoring above 70% on the knowledge-based portion of the survey. Importantly, those with previous HPV-related training displayed significantly more knowledge (average score of 77.5%) versus those without training (64%). Those with HPV-related training also significantly felt that ATs are responsible for assisting with general medical conditions that may affect their athletes ( $P = 0.007$ ). Additionally, ATs previously offered ( $P = 0.0001$ ) or having received at least one dose of the HPV vaccine ( $P < 0.0001$ ) had significantly more knowledge on the survey. Finally, on average, ATs with higher levels of educational history (doctorate and master's versus bachelor's degree) tended to agree that ATs should play a role in educating their athletes about HPV and HPV vaccination.

**Conclusions:** HPV-related disease is a common preventable medical condition seen within the patient population that ATs treat. As such, ATs as allied health care providers are well suited to educate and advocate for HPV vaccination. However, knowledge levels are low within the athletic training community. This indicates a need for curricular change and the development of a novel approach for HPV

vaccination implementation within the athletic training setting.

**Significance:** This is the first attempt to understand if ATs could be an important partner in advocating for HPV vaccination. This advocacy could increase vaccination rates thus decreasing HPV infection and cervical cancer rates within this vulnerable population.

**Acknowledgements:** Funding was provided by the Department of Family and Community Medicine at Penn State COM and Lebanon Valley College Department of Athletic Training. Statistics by Research Data Analyst Sandeep Pradhan, MBBS, MPH. Numerous individuals piloted the survey p.

TOPIC: Ultrasound  
STUDY TYPE: Other

### **Accuracy and Benefit of a Novel Longitudinal Ultrasound-Guided Iliopsoas Tendon Injection after Total Hip Arthroplasty**

**Submitting Author/Presenter:** Matthew Kaufman, MD  
Chantal Nguyen, MD, Yue Meng, MD, and Eugene Roh, MD

*Affiliation: Stanford University, Redwood City, CA.*

**Purpose:** Post-THA patients' ultrasound imaging can be technically challenging due to distortion of the iliopsoas tendon by indwelling hardware. This abstract describes the accuracy and benefit of a new technique for performing ultrasound-guided needle placement for iliopsoas tendon sheath injections.

**Methods and Study Design:** Retrospective case series from June 2017 to December 2019 of those with previous total hip arthroscopy and iliopsoas impingement that had a longitudinal in-plane approach for an US-guided steroid injection. Confirmatory fluoroscopic tenograms were taken prior to injection to ensure accuracy. Pre and post VAS scores were used to assess pain. Patients were followed for 6 months to assess outcomes.

**Results:** Using an ultrasound-guided longitudinal in-plane approach provided direct visualization of the length of the iliopsoas tendon adjacent to acetabular hardware, multiple sonographic landmarks, and distribution of medication around the areas of mechanical stress. Within our study 19/26 (84.6%) had appropriate needle placement that was confirmed with fluoroscopic imaging and did not require repositioning, showing an accurate approach that provides direct visualization of the target. The accuracy in this approach stems from both the benefits of ultrasound and the improvement of visualization without distention from the arthroscopic components. Four patients received repeat injections and 3 patients ultimately pursued surgical intervention for recurrent symptoms or hardware failure. On average, VAS pain scores improved 61% after iliopsoas tendon injection, with mean pre-procedure pain of 5.8 (2.1) and mean post-procedure pain 2.4 (2.1) on a 10-point scale. A minority of patients, 2 out of 19, pursued further surgical intervention with tendon release.

**Conclusions:** Our novel technique of an ultrasound-guided longitudinal in-plane approach is viable for those with post-THA anatomy. This approach overcame technical challenges, provided direct visualization of the iliopsoas tendon adjacent to acetabular hardware, multiple sonographic landmarks, and

distribution of medication around the areas of mechanical stress with high accuracy, large reduction in pain scores and limited progression to surgery.

**Significance:** In conclusion, this series illustrated that a longitudinal in-plane approach for iliopsoas peritendinous injections using a 3-step sign provides an accurate and reliable method for ultrasound guidance and could limit need for fluoroscopy.

**Acknowledgements:** Anthony Kenrick MD, Derek Amanatullah MD.

TOPIC: Ultrasound  
STUDY TYPE: Other

### **Posterior Intra-articular Hip Injections: A Pilot Study Investigating a New Approach**

**Submitting Author/Presenter:** Matthew Kaufman, MD  
Chantal Nguyen, MD, Yue Meng, MD, and Eugene Roh, MD

*Affiliation: Stanford University, Redwood City, CA.*

**Purpose:** To investigate a novel posterior intra-articular hip injection approach while discussing the clinical pearls for methodology, accuracy, and related adverse events. The goal was to investigate if this approach could potentially be used in those where the typical anterior access would be challenging.

**Methods and Study Design:** Ten adults with hip osteoarthritis or femoral acetabular impingement with labral tearing were studied. In prone position, posterior structures were seen. Medication was injected at the head-neck junction of the femur in a inferolateral-superomedial approach. A fluoroscopic arthrogram evaluated accuracy. Needle location, contrast flow, anterior portal conversion rate and adverse events were tracked.

**Results:** A confirmatory fluoroscopic arthrogram showed appropriate needle placement via ultrasound guidance on first attempt in 9 patients. One patient was converted to the anterior approach due to inability to obtain the expected arthrogram from the posterior approach despite what looked like appropriate needle placement on both ultrasound and fluoroscopy. There were 2 patients with the needle tip noted to be in the inferior half of the femoral head-neck junction in the initial fluoroscopy images. Two patients (20%) demonstrated mild adverse events after this procedure. One patient reported increased urinary frequency that lasted for 3 days without any weakness, numbness, or neurological symptoms in the sciatic nerve distribution. Both adverse events were considered mild as they were self-limiting. Another patient reported new posterior and lateral leg numbness of the injected side 2 hours after the injection, which resolved by the following day. The patient that was converted to the anterior approach reported a moderate amount of pain as measured by VAS with the posterior approach.

**Conclusions:** In conclusion, ultrasound-guided posterior approach hip injections are accurate and without serious adverse events in our study. The posterior approach can be considered as an alternative approach for patients who cannot tolerate the anterior hip approach. Future studies can evaluate a broader patient population, including those with BMI > 35 and those without a native hip joint.

**Significance:** A posterior approach could be helpful for those who cannot tolerate an anterior approach, such as those with spasticity, skin lesions on the anterior hip, or difficult

anterior surface or bony anatomy. This study shows that this approach is viable.

**Acknowledgements:** Patricia Zhang, MD.

TOPIC: Musculoskeletal

STUDY TYPE: Other

## Flippin' Out Over Gymnast Wrist: Presentation and Treatment of Distal Radial Physeal Stress Syndrome

**Submitting Author/Presenter:** Naomi Brown, MD

David VanEenenaam, Joseph Yellin, MD, Scott Mahon, BS, and Apurva Shah, MD, MBA

*Affiliation: Children's Hospital of Philadelphia Philadelphia, PA.*

**Purpose:** Current literature on gymnast wrist is limited when describing the overall treatment outcomes. This study aimed to understand the demographics, treatment outcomes, and return-to-sport timelines in a large single tertiary care institution patient sample.

**Methods and Study Design:** Pediatric patients from 2016 to 2023 were identified using ICD-10 codes for "gymnast wrist" and wrist pain. Adults, acute fractures, non-gymnasts, and congenital etiologies were excluded. We collected patient data, Child Opportunity Index (COI), activity, treatment, radiographs, and outcomes. Statistical tests included  $\chi^2$ , *t*-test, and Wilcoxon rank-sum analysis.

**Results:** Seventy-eight wrists in 62 patients (60 female) with an average age of 11.8 (range 6.9-15.4) were included. Average time to presentation was 12.2 weeks after symptom onset. All patients had physeal wrist pain; 35.5% dominant sided, 38.7% nondominant sided and 25.8% bilaterally. Gymnastics participation/week averaged  $15.9 \pm 9.1$  hours. On initial wrist radiographs, 43 (69%) had distal radial physeal widening, 45 (73%) juxta-physeal sclerosis, and 12 (19%) positive ulnar variance. 55 (89%) were initially treated with splint/rest  $\pm$  PT, 5 (8%) short arm cast, and 2 (3%) underwent surgery. 32 (53%) patients had resolved tenderness and return to sport after initial non-operative treatment. Of those 32 patients, average time to resolved tenderness was 7.4 weeks and return to sport 8.6 weeks. Twenty-three percent of those initially treated conservatively developed recurrent symptoms requiring another period of rest. 7 (11%) patients progressed to physeal growth arrest, all eventually treated with ulnar shortening osteotomy.

**Conclusions:** Only about half of patients with gymnast wrist responded well to conservative treatment. Recurrence rates are high, necessitating extended breaks from competitive gymnastics. More than 10% of patients progressed to growth arrest requiring surgery.

**Significance:** Further prospective research is needed to identify risk factors for persistent or recurrent wrist pain in gymnasts and to identify who would do best with surgery.

**Acknowledgements:** Dr. Apurva Shah.

TOPIC: Training

STUDY TYPE: Survey

## Assessing the Beliefs and Impacts of Strength Training in Collegiate Gymnastics

**Submitting Author/Presenter:** Tammy Ng, MD

Tyler Bendrick, MD, Mary Swanstrom, ATC, Machel Wilson, PhD, Kevin Burnham, MD, and Marcia Faustin, MD

*Affiliation: University of California, Davis Health, Sacramento, CA.*

**Purpose:** There is scarce literature on the effects of strength training on performance and injury prevention in gymnastics. This study assessed perceptions of collegiate gymnasts and coaches regarding strength training after starting their inaugural training with a certified strength and conditioning coach.

**Methods and Study Design:** Anonymous surveys were distributed to gymnasts at a National Collegiate Athletic Association (NCAA) Division I gymnastics program. Survey responses were collected between August and September 2023. Descriptive statistics were performed to analyze demographics, characterize the current strength training program, and evaluate perceptions of injury rates regarding the impact of strength training.

**Results:** Of the 23 gymnasts surveyed, 17 (74%) responded. Mean age was 19.9 (SD = 1.48). All gymnasts reported participating in strength and conditioning, with a mean of 2.74 (SD = 1.20) sessions per week, lasting, on average, 55.6 (SD = 10.29) minutes per session. Most gymnasts agreed (35%) or strongly agreed (59%) that weight training may improve performance. All gymnasts either disagreed (59%) or strongly disagreed (41%) that weight training is not safe. Forty-one percent disagreed, 29% strongly disagreed, and 17% agreed that weight training may negatively impact body shape. Most gymnasts either disagreed (59%) or strongly disagreed (18%) that weight training decreases flexibility; 4 (24%) felt neutral. 94% (59% strongly agree, 35% agree) felt that weight training had positive impact on performance. More than half of the gymnasts either agreed (24%) or strongly agreed (29%) they had less injuries the season after implementing strength training, compared to prior seasons.

**Conclusions:** Most gymnasts expressed positive perceptions of the safety of strength and conditioning with a certified coach. A small number expressed concerns regarding the effects of weight training on body shape and flexibility. Still, the majority of gymnasts perceived an improvement in their gymnastics performance. Although the impact of strength training on injury prevention was mixed, more than half of the gymnasts perceived a decreased injury risk.

**Significance:** This pilot study demonstrates positive perceptions of strength training among collegiate gymnasts, including reduction in injury risk and improved performance, warranting further objective research on the effects of strength training in gymnastics.

**Acknowledgements:** The authors would like to thank the UC Davis Gymnasts and Coaches, UC Davis Intercollegiate Athletics Sports Medicine Team, UC Davis Sports Medicine Oversight and Continuous Quality Improvement Committee (SMOCQI), and the UC Davis Health Clinical and Tran.

TOPIC: Musculoskeletal

STUDY TYPE: Survey

## Ultrasound-Guided Shoulder Injections: A Randomized-Controlled Trial Assessing Patient Satisfaction

**Submitting Author/Presenter:** Connie Oh, MD

Harin Parikh, MD and Michael Stone, MD

*Affiliation: Cedars Sinai, West Hollywood, CA.*

**Purpose:** To investigate patient satisfaction between ultrasound guidance versus landmark guidance for injections

administered in the shoulder girdle and identify differences in efficacy of pain reduction between ultrasound guided and landmark guidance.

**Methods and Study Design:** This was a prospective randomized study evaluating patient satisfaction with and without US guided injections of the shoulder. Patients were randomized to US guided (US), or landmark guided injections (Non-US). Patient questionnaires were completed in office pre and post injection. Descriptive data was analyzed, student's *t*-test was used, pre-hoc power analysis was performed with beta set to 0.8.

**Results:** One hundred twenty patients met inclusion criteria—77 patients in the US group and 43 in the Non-US group. There were no statistically significant differences in demographics between groups. Average age in US group was  $64.7 \pm 13$ , and  $69.0 \pm 12.6$  years in the Non-US group. The most common location of injection was SA space ( $n = 58$ , 48.3%), followed by GH joint ( $n = 37$ , 30.8%), BT ( $n = 17$ , 14.2%), and AC joint ( $n = 8$ , 6.7%). There were no statistically significant differences in any of the satisfaction survey scores between the US and Non-US groups. Pain scores improved after injection in both groups (US  $\Delta 2.3$ ,  $P < 0.001$ ; Non-US  $\Delta 2.4$ ,  $P < 0.001$ ), however there were no statistically significant differences in pain scores between groups with or without US ( $P = 0.95$ ).

**Conclusions:** We did not detect differences in satisfaction or comfort in patients randomized to either the landmark guided or ultrasound guided injection groups. Moreover, though injection administration overall led to improvements in pain scores in both groups, there were no statistically significant differences between groups pertaining to the degree of improvement encountered.

**Significance:** US guided shoulder injections showed no benefit in patient satisfaction or pain scores compared to Non-US guided injections, however pain scores were improved in both groups. Routine use of US guided injections for the shoulder should be reassessed.

TOPIC: Epidemiology  
STUDY TYPE: Survey

### Figure Skating Injuries and Training Modifications Following Changes to the Competition Season Schedule

**Submitting Author/Presenter:** Connor G. Richmond, DO  
Michelle Djohan, MD and Christina Oleson, MD

**Affiliation:** Case Western University School of Medicine/ Metrohealth, Cleveland, OH.

**Purpose:** In 2022, US Figure Skating created a new National Qualifying Series (NQS), which resulted in earlier season events and reduced preparation time. The purpose of our study was to investigate the frequency of injuries and training modifications with the new competitive structure.

**Methods and Study Design:** Surveys were sent to over 24 skating clubs across the country. To participate, coaches needed at least one regional or higher-level skater in the NQS. Coach demographics, injury causes, frequency, and training adaptations were analyzed. A significant training related injury was defined as requiring more than one week off the ice or more than 2 weeks of adjustments to the training program.

**Results:** Twenty-seven coaches from 14 states completed the survey. Training data from 178 skaters was included in the

study. A significant training-related injury occurred in 27 figure skaters (15%). The majority of skaters who did not experience an injury had changes made to their training regimen (63%) compared to those with no changes (37%). Performing a new element was the most common mechanism of injury (41%) followed by overuse injury (33%). Significant differences were found between training facility level (international, national, sectional, and regional) and injury frequency ( $P = 0.048$ ). Those training at an international or national level facility had significantly lower injury rates compared with skaters training at regional or sectional facilities ( $P = 0.042$ ). There was no association between injury rates and off-ice strength and conditioning programs ( $P = 0.16$ ).

**Conclusions:** Skaters training at higher level facilities and those whose coaches proactively adjusted their training regimens were less likely to become injured. Training intensity modifications and extra vigilance when teaching new elements may prevent future injuries.

**Significance:** There are no prior studies investigating injury frequency or training adjustments with the new NQS timeline. Recognition of injury risk with schedule changes and interventions to avoid such injuries are essential for individual skaters' success.

TOPIC: Rehabilitation  
STUDY TYPE: Other

### Implementing a Remote Therapeutic Monitoring Program in a Sports Medicine Clinic: A Pilot Study

**Submitting Author/Presenter:** Hirotaka Nakagawa, MD

Justin Dzierzawski, MD, Kristin Mitchell, MS, ATC, LAT, Negar Ahmadian, BS, Marc Gruner, DO, Robert Bowers, DO, PhD, and Walter Sussman, DO

**Affiliation:** Tufts Medical Center.

**Purpose:** The purpose was to study adherence and treatment outcomes of a remote therapeutic monitoring (RTM) program implemented within a clinical setting.

**Methods and Study Design:** This was a retrospective study conducted at a non-operative sports medicine clinic, involving the first 30 patients enrolled in the RTM program from May 2022 to August 2022. Patient-Reported Outcomes Measurement Information System (PROMIS) pain and function scores were assessed at the program's start and at 4-week intervals until completion.

**Results:** Out of the 30 patients, 26 (87%) completed the initial assessment, and 23 patients (77%) had at least 2 PROMIS measures collected. The diagnoses were diverse, including gluteal tendinopathy (35%), lateral epicondylitis (13%), knee osteoarthritis (13%), hamstring tendinopathy (9%), rotator cuff tendinopathy (9%), Achilles tendinopathy (9%), patellar tendinopathy (4%), chronic Osgood Schlatter disease (4%), and 1 non-specified wrist pain (4%). Only 5 out of the 23 patients (22%) achieved the goal of at least 3 exercise sessions per week on average. On average, patients completed 1.9 sessions per week, and the program lasted an average of 15.7 weeks. Statistically significant improvement in PROMIS-Pain scores were seen for those who completed 4 PROMIS surveys at 3rd month ( $P = 0.007$ ) and those who completed 5 PROMIS surveys at 4th month ( $P = 0.035$ ). Statistically significant improvement in PROMIS-Function scores were seen for those who completed 5 PROMIS surveys at 4th month ( $P = 0.004$ ).

**Conclusions:** The pilot study demonstrated high adherence (77%) in initiating RTM upon prescription, a notably higher rate compared to that reported for conventional physical therapy in existing literature. Nonetheless, the study also revealed poor adherence (22%) in maintaining at least 3 sessions per week. Statistically significant enhancements in pain and functional levels were observed in individuals who completed more than 4 PROMIS surveys.

**Significance:** This pilot study demonstrated that RTM can be effectively implemented in a sports medicine clinic, resulting in improved function and reduced pain levels. RTM could potentially serve as a promising alternative to conventional physical therapy.

TOPIC: Mental Health  
STUDY TYPE: Survey

### The Yips in Baseball and Softball—Discoveries from a Survey of Athletic Trainers and Coaches

**Submitting Author/Presenter:** Jordan Knox, MD

Kyle Jones, MD, Michelle White, BS, Karishma Shah, BS, and Adrik Da Silva, BS

**Affiliation:** University of Utah Department of Family & Preventive Medicine, Salt Lake City, UT.

**Purpose:** Task-specific dystonia (the yips) is poorly understood and can be detrimental to sports performance. Common in golf, there are fewer reported cases in baseball. This study aimed to assess its prevalence in college baseball and softball players and explore coach and trainers' perceptions of the yips.

**Methods and Study Design:** This cross-sectional survey study was approved by the IRB. PAC-12 softball and baseball coaches and athletic trainers we invited by email to complete a web-based survey. Questions included both multiple-choice and free-response types, inquiring about personal and player experience with the yips. Data were aggregated and analyzed using Fisher's Exact test; significance set at 0.05.

**Results:** Thirteen coaches and 10 athletic trainers responded, for a response rate of 18.5% (23/124). Two of the 23 responses were from females (9%). Of baseball coaches, 11/43 (26%) responded; of softball coaches, 2/23 (9%) responded; and of athletic trainers that covered baseball and/or softball, 10/58 (17%) responded. Respondents were divided regarding whether the yips are something athletes are willing to talk about, with 11/23 (48%) indicating yes and 12/23 (52%) indicating no. Nearly 3-quarters (74%) of respondents reported psychological factors to be the perceived main cause of the yips, with the remaining 6/23 (24%) reporting multiple factors perceived as the main cause. Of all responses, only 4 (17%) had never had a player with the yips. The other 19/23 had coached or cared for at least one player in high school, college, and/or professional baseball. Four of the 23 respondents (one coach, 3 athletic trainers) reported ever personally experiencing the yips.

**Conclusions:** The yips in baseball may be more common than publicly acknowledged; athlete's unwillingness to talk about it may be a contributing factor. Psychological etiology is thought to be common cause. Further research design should take into account the perceived taboo nature of the topic.

**Significance:** With the paucity of research on the yips in softball and baseball, any data is vital to understand

perceptions and guide effective treatment. This small sample contributes to the emerging body of research, and may inform future research design.

**Acknowledgements:** This project was supported in part by the Health Studies Fund, Department of Family and Preventive Medicine, University of Utah.

TOPIC: Musculoskeletal  
STUDY TYPE: Other

### Investigation of Immediate Effects of Osteopathic Manipulation of Spine and Pelvis on Lacrosse Shot Accuracy and Power

**Submitting Author/Presenter:** Steven Gawrys, BS

Alexander Matthias, BS, Andrew Roush, BS, Holly Wilson, BS, Jillian Nicholas, BS, Chris Edwards, DO, Kevin Mangum, DO, and Brent Pickett, DO

**Affiliation:** Rocky Vista University, Ivins, Utah.

**Purpose:** To Evaluate the Effect of Osteopathic Manipulative Treatment (OMT) and key biomechanics contributing to lacrosse shot power and accuracy.

**Methods and Study Design:** Thirteen from the Salt Lake Storm, a Men's Senior-A Box Lacrosse Team were evaluated for lacrosse shot speed and accuracy. Speed was evaluated by giving the players 2 attempts at a high-velocity lacrosse shot and the highest miles per hour (MPH) was recorded. Accuracy was evaluated by shooting 10 yards from the goal and recording the proportion of the 5 shots that hit the 20.5" by 20.5" target.

**Results:** A total of 13 players participated in the study. All participants were adults who identified as male. A paired, 2-tailed *t*-test resulted in a mean accuracy difference of a marginal improvement of 0.08 ( $P = 0.829$ , 95% CI  $-0.68$  to  $0.84$ ) and a slight mean speed increase of 0.23 MPH ( $P = 0.804$ , 95% CI  $-1.75$  to  $2.21$ ).

**Conclusions:** Based on the results of the study, OMT focused on the lumbar and pelvis regions has failed to demonstrate a statistically significant benefit on shot accuracy or throwing power in a Men's Senior-A Box Lacrosse Team in the Box Lacrosse League.

**Significance:** These findings can be of use to researchers investigating OMT's effect on sports performance by either improving upon the limitations that are inherent in this study or investigating other body regions to evaluate the role of OMT in athlete care.

**Acknowledgements:** We would like to thank the athletes from the Salt Lake Storm Sr.-A Box Lacrosse Team for using their valuable time to participate in this study.

TOPIC: Epidemiology  
STUDY TYPE: Case-Control

### The Tommy John Epidemic: A 50 Year Analysis of UCL Surgeries Using Publicly Available Data in Profes

**Submitting Author/Presenter:** Jason Zaremski, MD, FAMSSM

Robert L. Bowers, DO, PhD, Marissa Pazik, MS, LAT, ATC, Peter K. Kriz, MD, and MaryBeth Horodyski, EdD, ATC, LAT, FNATA

**Affiliation:** University of Florida Gainesville, Florida.

**Purpose:** Ulnar collateral ligament-reconstructions (UCLR) in baseball players, first performed in 1974, have substantially increased in the past twenty years. The intent of this study was to analyze the data using a public dataset to assess for trends such as volume and average age of UCLR.

**Methods and Study Design:** Using publicly available data via the “Tommy John Surgery List” maintained by Mr. Jon Roegel (@MLBPlayerAnalys), an analysis of UCL surgical interventions (aka “Tommy John Surgery” in professional baseball players was undertaken to assess for trends. The link for the dataset is <https://docs.google.com/spreadsheets/d/1gQujXQQGOVNaiuwSN680Hq-FDVsCwvN-3AazykO-BON0/htmlview#gid=0>. Accessed 10/10/23).

**Results:** One thousand seven hundred eighty-two UCL surgeries have been performed in pro baseball players (89.6% pitchers, 3.7% catchers, and 6.7% infielders, outfielders, and designated hitters collectively). The United States (1328), Dominican Republic (183), and Venezuela (99) represent player country of origin most commonly. From 1974 to 1994 74 total UCL surgeries were performed. UCL surgical interventions subsequently increased from 224 (1995-2004) to 617 (2005-2014) to 870 (2015-present). There have been 148 revision surgeries since 1974 including 135 (91.2%) in pitchers. Mean time between initial and revision surgery was  $56.1 \pm 42.8$  months. Mean age of UCL surgical interventions has decreased 12.7% since 1974. From 1974 to 1994 the mean age was 26.6 years, 1995 to 2004, 25.4, 2005 to 2014, 23.7, and 2015 to present 23.2. At the Rookie and A-Ball levels of pro baseball, the number of UCL surgical interventions increased from 7 (1974-1994), to 58 (1995-2004), to 217 (2005-2014), to 437 (2015-present), an increase of more than 62-fold.

**Conclusions:** These data confirm that the incidence of elbow UCL surgeries has significantly increased over the last several decades. More troubling is that the average age of players undergoing these surgeries continues to decrease.

**Significance:** In light of these data, the baseball medicine community needs to better understand the primary risk factors for UCL injuries as well as develop improved injury prevention strategies.

TOPIC: Musculoskeletal

STUDY TYPE: Other

## A Targeted Diagnostic Approach to Persistent Periscapular Pain

**Submitting Author/Presenter:** Irene Kalbian, MD

Rebecca Maitin, DO and Richard Chang, MD

*Affiliation: Mount Sinai Hospital, New York City, NY.*

**Purpose:** The purpose of this case was to examine the utility of using targeted diagnostic tests to obtain a comprehensive evaluation and management plan for persistent periscapular pain consistent with long thoracic neuropathy that had not responded adequately to physical therapy aimed at this diagnosis.

**Methods and Study Design:** Patient records were reviewed including initial visit and follow up documentation, diagnostic tests including EMG and NCS studies, MRI of brachial plexus and shoulder, and shoulder and scapula xray, as well as prior physical therapy notes.

**Results:** Repeat electrodiagnostic tests revealed evidence of a mild, chronic right long thoracic neuropathy without signs

of active denervation. Of note, there was reduced sensory response of the right lateral cutaneous nerve suggesting additional lateral cord involvement and raising the possibility of a limited brachial neuritis etiology. However, MRI of the brachial plexus did not show evidence of plexus or nerve root abnormality. MRI shoulder also did not reveal any abnormalities of the long thoracic nerve or serratus anterior, but found mild rotator cuff tendinosis and anterior inferior labral tear. Patient was referred for further physical therapy for scapulothoracic stabilization, isometric strengthening, and shoulder range of motion exercises to prevent further dysfunction and promote neural recovery. Trigger point injections were offered for myofascial pain. He was counseled on activity modification including avoiding overhead activity and proper lifting technique. For inflammation, he will trial a longer course of prescription strength ibuprofen as well as gabapentin at bedtime.

**Conclusions:** Patient's complaint of right periscapular pain, medial scapula winging on exam, and history of injury while lifting suggests right long thoracic nerve injury with chronic compensatory myofascial pain of the rhomboids, trapezius and levator scapula. He will follow up after another 4 to 6 weeks. If the patient has not had adequate improvement then therapeutic next steps include US guided right serratus anterior plane block and hydrodissection

**Significance:** It is important to utilize strategic diagnostic tests to rule out additional pathologic processes that may contribute to persistent pain such as referred pain from the spine, brachial plexopathy, intra-articular labral disorders, or tendinopathy.

**Acknowledgements:** Co-authors Dr. Chang and Dr. Maitin for their collaboration.

TOPIC: Education

STUDY TYPE: Survey

## Improving Internal Medicine (IM) Resident Examination and Diagnostic Confidence Using an Examination Workshop Series

**Submitting Author/Presenter:** Melissa Le Roux, MD

Joshua Berkowitz, MD, Gregory Summerville, MD, Sandra Lee, PhD, Taylor Holmes, MD, Karen Kimel-Scott, MD, and Nailah Adams Morancie, MD

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**Purpose:** MSK complaints account for up to 30% of visits to primary care internists but many feel under prepared to manage them due to inadequate training. We aimed to evaluate the effectiveness of a series of 3 joint examination workshops with regards to resident confidence in examination and diagnostics.

**Methods and Study Design:** The setting was an academic half-day within UNC IM ambulatory curriculum. Participants were IM interns. An IM curriculum guide written by AMSSM members was used to design and implement knee, shoulder, and hip joint workshops. Surveys using 5-point Likert scales were used to assess confidence in examination and diagnostics, and were conducted at baseline and at 2 intervals following workshops.

**Results:** At baseline, IM interns (N = 22) agreed that MSK teaching is important in training, should be emphasized, and will help them take care of patients (means 4.4-4.7). They



responded neutrally about confidence in performing a knee examination (2.9) and diagnosing common knee ailments (2.9). They responded neutrally about confidence in performing a shoulder examination (2.8) and disagreed or felt neutral about diagnosing common shoulder ailments (2.5). They disagreed that they could confidently perform a hip examination (2.3) and responded neutrally about diagnosing common hip ailments (2.6). They felt neutral or agreed about confidence in taking focused joint histories (2.9-3.5). Following the workshops using paired t-tests we saw significant positive changes in all confidence statements ( $P$  values 0.001-0.02). IM interns ( $N = 19$ ) agreed that they could confidently perform an examination, diagnose common ailments, and take a focused history for the knee, shoulder, and hip joints (means all  $>4$ ).

**Conclusions:** Immediately after implementation of the workshops, we saw significant changes in confidence statements, with trainees tending to feel confident in performing an examination, diagnosing common ailments, and taking a focused history for the knee, shoulder, and hip joints. We will further assess durability of confidence gains by administering surveys 4 months post-workshop.

**Significance:** 1% of IM didactics are devoted to MSK topics despite residents rating as highly important. MSK education delivered as part of a foundation curriculum may allow residents to build confidence for clinics and expand on this knowledge in future years.

**Acknowledgements:** In addition to my UNC mentors, I would like to thank Drs. Kalli Hose and Anna Quan for their inspiration for this Med Ed project, as well as allowing me to share some of their educational content as supplementation to the workshops.

TOPIC: Musculoskeletal  
STUDY TYPE: Survey

### Training Factors Influencing Current Pain Levels in Retired Division 1 Female Athletes

**Submitting Author/Presenter:** Irene Kalbian, MD

Rebecca Maitin, DO, Andrew Delgado, PhD, Jasmin Harounian, MD, Katharine Holmes, BA, Miguel Escalon, MD, MPH, and Joseph Herrera, DO

*Affiliation: Department of Rehabilitation and Human Performance, The Icahn School of Medicine at Mount Sinai, New York, NY.*

**Purpose:** The purpose of this study was to evaluate how incidence and anatomic location of major injuries affects pain in the post-retirement period and examine impact of other collegiate and pre-collegiate training factors including age of sport specialization, time spent training, and injury treatment.

**Methods and Study Design:** A cross-sectional survey was shared with former NCAA D1 female athletes via social media. Data on demographics, age of sport specialization, hours spent training before and during college, sport-related injuries and treatment, and current musculoskeletal pain was collected. Descriptive statistics were used to present means. Multiple regression analysis assessed risk factors for current pain.

**Results:** The survey was completed by 389 of 501 respondents. More than 50% of respondents from each represented sport, except skiing, reported having current pain.

There were significant associations with pain intensity for multiple factors including experiencing injuries, having surgery, age of specialization and time spent training prior to college. Having any number of major injuries (1-4 versus 0) was associated with an increase in current pain intensity ranging from 0.96 points for 1 injury to 1.99 points for 4+ injuries. Having surgical treatment was associated with a 1.46 average point increase in pain intensity versus no surgery. Older age of sport specialization was associated with decreased odds of current pain with a 0.11 point decrease in pain intensity for every 1 year increase in specialization age. Furthermore, training 20+ hours per week before college was associated with a 0.91 point increase in average pain intensity versus 0 to 10 hours per week. Finally, respondents who reported.

**Conclusions:** Experiencing injury before, during or after college as well as undergoing surgery were factors associated with risk of increased pain in former D1 female athletes. Importantly, younger age of specialization and increased time spent training prior to college were also associated with increased pain. These findings suggest intensity of training and injuries from a young age can affect pain levels in female athletes in adulthood.

**Significance:** Our findings suggest that female athletes' youth sport and injury history contributes to their long-term physical health, longevity and quality of life, necessitating further research to better inform youth athletic participation.

TOPIC: Ultrasound  
STUDY TYPE: Other

### Inter-rater Reliability of Sonographic Assessment of Achilles Tendon, Patellar Tendon, and Plantar Fascia Videos

**Submitting Author/Presenter:** Dalton Brady, MD

Derek Stokes, MD, Daniel Cushman, MD, and Ryan Petersen, DPT

*Affiliation: University of Utah, Salt Lake City, Utah.*

**Purpose:** Prior studies have examined the reliability for sonographic assessment of a variety of structures, but used live subjects or still images. This study aims to determine the inter-rater reliability of interpreting sonographic videos of the Achilles tendon, patellar tendon, and plantar fascia.

**Methods and Study Design:** Collegiate athletes from a variety of sports were scanned by an experienced sonographer. Video recordings of the Achilles tendons, patellar tendons, and plantar fasciae were later reviewed by 4 blinded individuals with varying levels of training. Inter-rater reliability was assessed using kappa statistics focused on describing the magnitude of agreement.

**Results:** Videos from 40 athletes (240 total structures) were evaluated by all reviewers assessing for hypoechogenicity, thickening, and neovascularity. The experienced reviewer was utilized as the comparator for the other 3 reviewers who varied in level of training (moderate, minimal, and untrained). In the trained versus moderately-trained comparison, kappa values were near perfect (kappa 1.000 Achilles, 0.947 patellar, and 1.000 plantar fascia); Trained versus minimally trained (kappa values: 0.661 Achilles, 0.787 patellar, and 0.490 plantar fascia); Trained versus untrained (kappa values: 0.490 Achilles, 0.810 patellar, and 0.661 for plantar fascia).



**Conclusions:** This study suggests that inter-rater reliability utilizing dynamic video ultrasound recordings to identify tendinous abnormalities may be superior to static image review. This holds true across different levels of training, with an expected decrease in agreement when comparing moderately trained versus minimally trained, and untrained individuals to the experienced reviewer.

**Significance:** The results of this study provide value for future research protocols. When an accurate, blinded secondary interpretation of sonographic abnormalities is desired, dynamic video should be considered over static image review.

TOPIC: NCAA

STUDY TYPE: Case-Control

### Sleep Consistency as a Predictor for Increased Risk of Injuries in Division I Athletes

**Submitting Author/Presenter:** Jeremy Swisher, MD

Kimberly Burbank, MD, Zachary Sitton, MD, and Chris Miles, MD

*Affiliation: Wake Forest University School of Medicine.*

**Purpose:** This study aimed to analyze the impact of sleep consistency on the frequency of injuries in Division I women's soccer athletes. We also examined the epidemiology of resting heart rate, heart rate variability, and important sleep metrics.

**Methods and Study Design:** Twenty-eight women's soccer athletes from Wake Forest University were analyzed retrospectively over 2 years (2021-2023), resulting in 10,893 unique lines of data. Baseline cardiovascular data, sleep architecture, and injury rates were calculated for each athlete. Sleep consistency was analyzed, and athletes were put in groups of poor sleep consistency ( $n = 14$ ) and good sleep consistency ( $n = 8$ ).

**Results:** The average total sleep time was 7 hours and 3 minutes. The average sleep consistency was 67.05. For those who had greater than 69 sleep consistency, RHR was 51.41 (compared to 59.76 for those with less than 66 sleep consistency), and HRV was 107.77 (compared to 82.38). This was despite less total sleep at 6 hours and 42 minutes compared to 7 hours and 16 minutes. The average number of injuries for a player during the study was 2.50. The average number of injuries for those with poor sleep consistency was 3.70, when controlling for high HRV (greater than 115). The average number of injuries for those with good sleep consistency was 1.75 ( $P = 0.04$ ). Among the athletes with ankle sprains specifically, sleep consistency in the month prior to injury was 64.87 as opposed to 69.35 during the injury ( $P = 0.0038$ ). In athletes who suffered concussions, sleep consistency slightly decreased during concussion to 68.76 from 70.53, but did not reach significance ( $P = 0.68$ ).

**Conclusions:** Division I soccer athletes sleep less than the recommended 8 hours a night and less than the average WHOOP user of 7.6 hours. When they had poor sleep consistency, there was an increased number of injuries compared to those with good sleep consistency. We controlled for high HRV due to the protective nature of a well-rested heart rate variability. In athletes with ankle sprains, sleep consistency was significantly lower the month before injury.

**Significance:** This research elucidates the importance of sleep consistency on injury risk in Division 1 athletes. This increased risk of injuries was despite more total sleep time,

which may indicate sleep consistency being more impactful than sleep extension.

**Acknowledgements:** We would like to thank WHOOP and Wake Forest University for their assistance in creating this dataset!

TOPIC: Ultrasound

STUDY TYPE: Cohort

### Natural History of the Development and Resolution of Patellar and Achilles Tendon Sonographic Abnormalities in NCAA Athletes

**Submitting Author/Presenter:** Derek Stokes, MD

Kristin S. Hilger, MS, Masaru Teramoto, PhD, MPH, PStat, Blake Corcoran, MD, Leyen Vu, DO, Michael Fredericson, MD, Sarah F. Eby, MD, PhD, and Daniel M. Cushman, MD, PhD

*Affiliation: University of Utah, Salt Lake City, UT.*

**Purpose:** The natural course of tendon morphologic changes in the athletic population is not well understood. Therefore, this study aimed to prospectively identify the natural history of the development and resolution of patellar tendon and Achilles tendon sonographic abnormalities in collegiate athletes.

**Methods and Study Design:** This was a prospective, observational study of collegiate student-athletes. Experienced sonographers recorded protocolized ultrasound video scans on bilateral patellar and Achilles tendons of student-athletes from 3 Division I programs during consecutive annual pre-season physicals. Blinded assessment of the videos was then performed identifying tendon changes between years 1 and 2.

**Results:** A total of 74 athletes were included (52 females;  $20.9 \pm 1.3$  years of age;  $22.7 \pm 2.7$  kg/m<sup>2</sup> of body mass index;  $9.3 \pm 3.2$  years of sport experience). Of those athletes, 20 (27%) participated in cross country/track, 18 (24.3%) basketball, 17 (23.0%) volleyball, 13 (17.6%) lacrosse, and 6 (8.1%) other. Of 147 patellar tendons included (1 structure was excluded due to ACL reconstruction), 88 (59.9%) were categorized as normal and 59 (40.1%) abnormal in year 1. In year 2, 84 of 88 (95.5%) patellar tendons remained normal and 4 of 88 (4.5%) transitioned to abnormal, while 59 of 59 (100%) remained abnormal, and 0 of 59 (0%) transitioned from abnormal to normal. Of 148 Achilles tendons, 124 (83.8%) were categorized as normal and 24 (16.2%) abnormal in year 1. In year 2, 124 of 124 (100.0%) remained normal and 0 of 124 (0.0%) transitioned to abnormal, while 23 of 24 (95.8%) remained abnormal and 1 of 24 (4.2%) transitioned from abnormal to normal.

**Conclusions:** The findings of this study demonstrate that sonographic tendon morphology (normal to abnormal or abnormal to normal) in collegiate athletes does not change significantly over a 1-year timespan. Further longitudinal studies are warranted to enhance our understanding of the natural history of tendinopathic changes in the athletic population and the significance of sonographic abnormalities.

**Significance:** Tendinopathy is a common injury in the NCAA athlete population. The natural history of the development and resolution of patellar and Achilles tendon sonographic abnormalities is important to understand to optimize performance, training, and rehab.

TOPIC: Pediatrics  
STUDY TYPE: Cohort

### The Epidemiology of Musculoskeletal Injuries in the Pediatric Population

**Submitting Author/Presenter:** Alexandra Abbott, MD

Kate Swertfager, BS, Summer Bloom, ATC, Nicholas Jackson, PhD, MPH, and Joshua Goldman, MD, MBA

*Affiliation: University of California, Los Angeles.*

**Purpose:** This retrospective cross-sectional study aims to update the epidemiology of musculoskeletal injury in the pediatric population. The cohort, from a high-volume orthopedic urgent care center, allows for the potential improvement in generalizability to the pediatric population in the United States.

**Methods and Study Design:** We examined data from 61,346 pediatric patients who presented for initial visits to a pediatric orthopedic urgent care from April 2019 to February 2023. We analyzed the demographics of the cohort, injury patterns, as well as associations between diagnoses and injury sites compared with age and sex.

**Results:** Among more comprehensive results, the following results can be highlighted. The mean age of our cohort was 10.5 years  $\pm$  4.4. 61% of patients were boys, and 39% were girls. Adolescents represented 48% of our cohort, followed sequentially by oldest to youngest age groups. 63% of injuries were fracture diagnoses and 37% were non-fracture diagnoses. The most common non-fracture injuries occurred in the wrist, ankle, foot, and elbow. Fracture location followed a similar anatomic distribution: wrist, hand, elbow, foot, and ankle. Toddlers and boys demonstrated the highest likelihood for fracture compared to other age groups and to girls respectively. 78% of upper extremity injuries and 45% of lower extremity injuries were diagnosed as fractures.

**Conclusions:** Our study characterizes current pediatric musculoskeletal injury epidemiology with precise diagnostic data from a large and diverse cohort. Prior literature with similar aims has been limited, underpowered, and with limitations based on the clinical nuances of study settings. We contribute a comprehensive update to the understanding of pediatric musculoskeletal injury and can improve clinicians' risk stratification.

**Significance:** We provide robust and specific diagnostic data to improve pediatric musculoskeletal injury epidemiology characterization. This update is important for guiding clinician curriculum, pretest probabilities, and risk assessments for pediatric subgroups.

TOPIC: Rehabilitation  
STUDY TYPE: Cohort

### MRI Findings in Clinically Suspected Posterior Interosseous Nerve (PIN) Neuritis

**Submitting Author/Presenter:** Eli Sepkowitz, MD

Anisha Javvaji, BS, Anjali Kashyap, BS, Brian Caplan, Yenpo Lin, MD, Antonio Madrazo, MD, and Vijay Vad, MD

*Affiliation: Northwell Health.*

**Purpose:** Lateral elbow pain affects 1 to 3% of the population. Posterior interosseous nerve (PIN) neuritis is a potential cause of lateral elbow pain but has many

overlapping symptoms with other elbow pathologies that cannot be distinguished solely by patient history, physical exam, or electrodiagnostic tools.

**Methods and Study Design:** We conducted a retrospective study evaluating the MRI findings of patients with clinically suspected PIN neuritis and compared them to a control group of patients with cubital tunnel syndrome. The MRI grading features evaluated various muscle attributes, nerve attributes, and additional considerations. Independent samples *t*-test and  $\chi^2$  test were used to compare the 2 cohorts.

**Results:** Ten patients with clinically suspected PIN neuritis and 10 control patients were included in the study. No significant differences for demographics (age, sex, BMI, and race) were found. 70% of the patients in the clinically suspected PIN cohort presented with PIN enlargement and was considered significant when compared to the control group ( $P = 0.01$ ).

**Conclusions:** These findings suggest nerve enlargement may be a characteristic MRI finding in patients with PIN. This will hopefully help differentiate PIN with other causes of lateral elbow pain. However, a larger sample size is necessary to assess more definitive MRI findings.

**Significance:** By incorporating magnetic resonance imaging (MRI) as a diagnostic tool, physicians may be able to differentiate PIN from other entities and therefore provide a targeted and accurate treatment strategy.

**Acknowledgements:** I'd like to thank all my collaborators for their hard work and dedication to the project and to AMSSM for an outlet to share my work with like-minded professionals.

TOPIC: Concussion  
STUDY TYPE: Cohort

### Evaluating Utilization Trends in Concussion: A Retrospective Cohort Analysis of a Large Database

**Submitting Author/Presenter:** Carlin Senter, MD, FAMSSM

Bethany Johnson-Kerner, MD, PhD, Gabrielle Ma, BA, and Margaret Kallus, BA

*Affiliation: UCSF, San Francisco, CA.*

**Purpose:** Concussion and persistent post-concussion symptoms are common problems faced by athletes; however, provider practices are largely undescribed. Here we describe evaluation and treatment trends for patients diagnosed with concussion without loss of consciousness.

**Methods and Study Design:** A retrospective cohort study from 2010 to 2019 was performed using the Mariner Patient Records Database (PearlDiver Technologies, Colorado Springs, CO), M91 Ortho subset. Patients having "concussion without loss of consciousness" were identified. Referral orders, imaging orders and medication prescriptions for these patients were tracked over time.

**Results:** 953,632 patients met inclusion criteria. 55% were female. 73% had commercial insurance. Pre-concussion diagnoses included pre-existing headache (21.2%), depression (20.6%) and neck pain (15.2%). Physical/occupational therapy was the most common referral (11.2%), followed by psychology/psychiatry referral (4.5%). The frequency of both referrals increased over time. 1/500 patients had a head computed tomography (CT) scan while 1/18 patients had brain magnetic resonance imaging (MRI). Opioids were the most prescribed medication class (20.4%), followed by non-

steroidal anti-inflammatory drugs (NSAIDs) (15.9%). Rates of opioid and benzodiazepine prescribing decreased, while rates of prescribing of NSAIDs, selective serotonin reuptake inhibitors and ondansetron increased. Ondansetron was the most likely prescribed medication in the < 10 age group (24.6%). NSAIDs were the most prescribed medication in the 10 to 18 age group (37.3%). Opioids were the most prescribed medication in the 19 to 65 and 65+ age groups (54.3% and 46.9% respectively).

**Conclusions:** We identified several healthcare trends for patients having concussion without loss of consciousness. The number of concussion cases more than doubled between 2010 and 2019. The frequency of referrals to physical/occupational therapy and psychiatry/psychology increased over time. MRI was ordered more frequently than CT. The top 5 medications prescribed were the same across all ages, while the frequency of these varied with age.

**Significance:** The trends found in this study can help clinicians understand the scope of concussion treatment, healthcare systems anticipate needs of patients with concussion, and researchers focus on studying these interventions to determine their value.

TOPIC: Education

STUDY TYPE: Survey

### Evaluation of the Impact of Resident Education in Movement Counseling

**Submitting Author/Presenter:** Elyssa Goldstein, DO

Andrew Glerum, DO, Nicholas Heter, DO, Austin Klomp, DO, Jonathan Westberg, DO, and Kathryn Vidlock, MD

*Affiliation: HealthONE Family Medicine Residency Aurora, CO.*

**Purpose:** Many patients in a primary care clinic do not get the recommended 150 minutes moderate intensity exercise and 2 days strength training per week. Residents face many obstacles to counseling patients. Our goal is to develop a curriculum for residents to educate and encourage movement with patients.

**Methods and Study Design:** Resident confidence levels in counseling exercise were assessed via survey. Participants then attended a 2 hour lecture addressing exercise in chronic diseases, exercise in aging adults, adult preparticipation evaluation, and obstacles to exercise. Residents were given handouts to give patients with exercise goals and examples. A follow-up survey was administered one month following the lecture.

**Results:** Based on the pre and post survey results, resident frequency in counseling patients on exercise increased at annual well visits and chronic disease visits although results were not statistically significant ( $P = 0.46$  and  $0.92$  respectively). Additionally, resident confidence in counseling patients without disease as well as those with obesity, OA, and CAD increased with statistically significant results. Resident confidence also increased when counseling patients with HTN, DM1, and DM2 although these results were not statistically significant. Resident confidence in discussing obstacles to exercise increased with  $P = 0.15$ , and confidence in knowing when to do further evaluation prior to starting exercise increased with  $P < 0.05$ . It is unclear if results translate to an increase in exercise frequency or a reduction in morbidity and mortality.

**Conclusions:** Although exercise has been shown to prevent chronic disease and reduce morbidity and mortality in many chronic diseases, residents face numerous obstacles when addressing barriers to movement with patients. This study suggests that residents who receive specific training and have access to exercise prescription handouts are better equipped and more likely to address exercise with their patients.

**Significance:** Given the results of this pilot study, it may be beneficial to include additional residency programs going forward. Future studies could include further education and measurement of clinical improvement.

TOPIC: Musculoskeletal

STUDY TYPE: Cohort

### Give it a Rest the Impact of Rest Days on Musculoskeletal Injuries Among Starting Pitchers in Major League Baseball

**Submitting Author/Presenter:** Matthew Waldrop, MD

Zachary Sitton, MD, Jeremy Swisher, MD, Stephen Davis, MA, and Kiran Mullur, MD

*Affiliation: Atrium Health Wake Forest Baptist Family Medicine Residency, Winston-Salem, NC.*

**Purpose:** Determine whether the recent implementation of additional rest days between starts by various Major League Baseball (MLB) teams correlated with a decrease in musculoskeletal (MSK) injuries and missed game time for starting pitchers during the 2022 and 2023 seasons.

**Methods and Study Design:** Data obtained from publicly available resources, including Baseball-Reference.com and fangraphs.com. Teams from the 2022 and 2023 MLB seasons were grouped by average rest days between starts (group A, <5 days; group B, >5 days). Injury incidence and average missed game time per 1,000 pitches were calculated for each group. Rates were compared with incidence rate ratios using Poisson regression.

**Results:** For the 2022 and 2023 regular seasons, the mean number of rest days between starts for all MLB teams was 4.80 days. Six total teams from 2022 to 2023 averaged 5 or more days rest between starts for the entire regular season. For teams that averaged 5 or more rest days between starts, starting pitchers spent 10.7 days on the IL per 1,000 pitches thrown due to MSK injuries, while starting pitchers for teams that averaged less than 5 days of rest spent 13.6 days on the IL per 1,000 pitches thrown due to MSK injuries (IRR, 0.78 [95% CI 0.72 to 0.85];  $P$  5 days of rest also averaged 0.93 more pitches per start than those on teams with <5 days rest ( $P = 0.0164$ ). Average IL stints due to MSK injuries per 1,000 pitches thrown were lower for starting pitchers on teams with >5 rest days (0.245 vs. 0.351); however, the difference was not statistically significant (IRR, 0.70 [95% CI 0.38-1.18];  $P = 0.1715$ ).

**Conclusions:** Starting pitchers on MLB teams that averaged 5 or more rest days between starts missed significantly less game time and averaged more pitches per start than starting pitchers on teams that averaged less than 5 days rest for the 2022 and 2023 regular seasons. There was no significant difference in average number of IL stints.

**Significance:** The study suggests that MLB teams should consider incorporating additional rest days between starts,

which may result in decreased missed game time due to musculoskeletal injuries among starting pitchers.

**Acknowledgements:** Thank you to baseball-reference.com and fangraphs.com for compiling and maintaining the accurate statistical data bases used in this study.

TOPIC: Education

Study Type:

### Comparison of Pediatric and Adult Case Poster Presentations from the 2023 Annual AMSSM Conference

**Submitting Author/Presenter:** Jacob Jones, MD

Joshua Gulbrandsen, Cassidy Schultz, BS, Bobby Van Pelt, MPH, Luke Radel, MD, David Soma, MD, Shane Miller, MD, and Jane Chung, MD

*Affiliation:* Scottish Rite for Children, Dallas, TX UT Southwestern Medical Center, Dallas, TX.

**Purpose:** AMSSM plays a significant role in sports medicine physician education. Less than 8% of its members are pediatrics residency-trained, which may lead to less pediatric focused sports education. This study compares pediatric and adult age-based case poster presentations from an AMSSM meeting.

**Methods and Study Design:** Data were extracted from accepted scientific case posters at the 2023 AMSSM Annual Meeting. Age, sex, sport discussed, state origin, and injury location were obtained. Sports were grouped by similarity and states were classified into the 5 regions of the US. Groups of pediatric-aged (<19) and adults (19+) were compared. Statistical analyses included descriptive statistics and  $\chi^2$ .

**Results:** Seven hundred forty-two out of the 751 cases were included. Nine were excluded due to missing or having non-numerical age data. The mean age presented was 29.4 years, with a median age of 21.0 years, and a mode age of 17.0 years. One third ( $n = 247$ ) of case posters were patients of pediatric age, with the other two thirds ( $n = 495$ ) adult age (19-92 years). Most cases presented involved the lower extremities (51.6%), and there were more male (64.2%) than female (35.7%) cases. Amongst all sports reported, football was presented the most (16.4%). In comparisons between the pediatric and adult-aged groups, there was no difference in representation of sexes between groups ( $P = 0.481$ ) and location of injury ( $P = 0.132$ ). Difference in sport played did exist with more football players in the pediatric population compared to adults ( $P = 0.001$ ) while more adults were represented in the running sports (67.6%).

**Conclusions:** At the 2023 AMSSM Conference, 1/3 of case poster presentations consisted of pediatric-aged patients despite less than 8% of the membership coming from a pediatric residency background. The mean age of cases presented was 21 (the upper limit of adolescence) while the mode age of 17 is also in the pediatric age range. There were differences in sports played between pediatric and adult posters presented.

**Significance:** With a high proportion of pediatric-aged case poster presentations, AMSSM should emphasize pediatric sports medicine specific education and research for all its members.

TOPIC: Mental

STUDY TYPE: Other

### Streamlining Access to Mental Health Services for University Athletes

**Submitting Author/Presenter:** William Cates, DO

*Affiliation:* Intermountain McKay-Dee Hospital Family Medicine Residency, Ogden, Utah.

**Purpose:** For this quality improvement project, our mission was to remove barriers to mental health care for university athletes. We aimed to increase the number of referrals in the 2022 to 2023 academic year by streamlining the mental health referral process.

**Methods and Study Design:** We created a decision tree and provided education to guide ATCs and coaching staff on referral guidance when an athlete presented with a mental health concern. We formalized a coordinated effort utilizing on-campus counseling services to triage athletes and determine the best next step for their needs more rapidly. The number of referred athletes was recorded and compared to the previous year.

**Results:** Fifteen referrals were received in the Fall 2022 semester alone, compared to the previous 13 referrals for the entire 2021 to 2022 academic year. Referrals displayed by percentage of team: F Cheer 5%, M Cheer 5%, Softball 7%, F Volleyball 13%, M Basketball 16%, Football 3%, M Track 1%, Total Players 5% of all teams (these team affiliations are hidden on the poster for privacy). Although data collection ended early in the spring semester due to personnel changes within the counseling center, data trends would suggest a continued upward trajectory of referrals and utilization of these services as spring sports resumed.

**Conclusions:** Improving resource availability and streamlining the referral process resulted in an increased utilization of mental health resources. The data collected during one semester surpassed the entire previous academic year. Anecdotally, ATCs and coaching staff reported greater clarity with next steps when confronted with an athlete with mental health issues.

**Significance:** Data supports the correlation between ongoing mental health issues with performance and injury risk. We created an easy-to-use system to address this component of athlete wellbeing resulting in increased referrals to mental health services.

**Acknowledgements:** Dr. Clark Madsen, Alex Leonardi, Jason Katte, Kayla Morgan.

TOPIC: Concussion

STUDY TYPE: Other

### Difference in Pediatric Concussion Patients Between Urban Hospital and Satellite Specialty Care Clinic Setting

**Submitting Author/Presenter:** Jonathan Santana, DO

Tishya Wren, PhD, Keila Hirokawa, BA, Yeng Vue, MA, and Anita Hamilton, PhD, ABPP-CN

*Affiliation:* Children's Hospital Los Angeles, Los Angeles, CA.

**Purpose:** Urban hospitals have developed satellite clinics to improve access to care, but few studies have evaluated

potential differences in the patients presenting to these locations. This study examines differences in pediatric concussion patients based on the location of initial presentation.

**Methods and Study Design:** A convenience sample of concussion patients at a large tertiary children's hospital system were compared based on whether they initially presented to the main hospital or to a satellite specialty care clinic. Continuous variables are presented as median (IQR) and categorical variables as n (%) with statistical comparisons performed using nonparametric statistics.

**Results:** Among 307 patients included (178 male; age 2-20 years), 65% (201/307) were initially seen at the hospital-based clinic. Patients presenting to the hospital clinic were younger (14.8 vs. 18.8 years,  $P = 0.005$ ), more likely to be male (62% vs. 51%,  $P = 0.09$ ), and less likely to have private insurance (41% vs. 85%,  $P < 0.001$ ) with lower Child Opportunity Index (COI, 41.5 vs. 85 of 100,  $P < 0.001$ ). Their concussion was less likely to be sports related (57% vs 81%,  $P < 0.001$ ), and they presented significantly later (26.5 vs. 10 days post-injury,  $P < 0.001$ ). There was no difference between groups in the number of symptoms reported immediately after injury or at initial presentation ( $P > 0.38$ ), but patients presenting to the hospital-based clinic had a higher rate of loss of consciousness (33% vs. 18%,  $P = 0.008$ ) associated with the higher proportion of non-sports injuries.

**Conclusions:** Access to concussion specialty care was more rapid (~2 weeks faster) at satellite clinic locations compared to a hospital-based clinic in a densely urban location. Services primarily benefitted affluent families with private insurance underscoring the continued need to improve access among families facing demographic, socioeconomic, transportation, insurance, or other barriers to receiving timely concussion care.

**Significance:** Satellite clinics can provide more rapid access to specialty concussion care, but utilization by patients of lower socioeconomic status is limited, delaying care and placing patients at higher risk for prolonged concussion recovery.

TOPIC: Other

STUDY TYPE: Other

## Helmet Use Rates and Modifying Factors in Professional Surfing

**Submitting Author/Presenter:** Nicole Nagayama, BS

Noelle Terrero, BA, Mitchell Anderson, MD, Patricia Kelshaw, PhD, ATC, and Daniel Herman, MD, PhD

*Affiliation:* University of California, Davis Sacramento, California.

**Purpose:** World Surf League (WSL) athletes have previously endorsed moderate levels of agreement with helmet use; however, objective use rates are unknown. The purpose of this study was to quantify helmet use frequency and identify surfer and environmental factors that influence helmet use among WSL surfers.

**Methods and Study Design:** Surfer demographics, wave factors (barreling, height), and helmet use were collected using WSL videos and surfer data from 2017 to 2022. Chi Squared and Mann-Whitney  $U$  tests were used for comparisons between helmeted (HA) and non-helmeted athletes (NHA).

Regression analyses were used to identify variables predictive of use ( $\alpha = 0.05$ ).

**Results:** Data was collected on 4702 ( $M = 3278$ ;  $F = 1424$ ) Championship, Challenger, and Longboard Series athletes. Athletes used helmets at only 6 events, so analyses were confined to these events. Athletes in the Women's Championship Tour were observed to wear helmets during 2022 at Teahupo'o and Pipeline. The HA group within the women's tour ( $N = 7$ ) rode a higher percentage of barreling waves (86.4% vs. 56.0%;  $P = 0.010$ ) compared to the NHA group ( $N = 23$ ). Athletes in the Men's Championship Tour were observed to wear helmets during 2021 at Margaret River, 2022 at Teahupo'o, and 2019 and 2022 at Pipeline. The HA group within the men's tour ( $N = 5$ ) had greater height (Median 1.80, IQR 1.75-1.83m) and lower BMI (23.8, 23.3-24.7kg/m<sup>2</sup>) compared to the NHA group ( $N = 127$ ; 1.91, 22.3-23.9 m;  $P = 0.033$ , and 22.3, 22.3-23.9kg/m<sup>2</sup>;  $P = 0.031$ , respectively). The men's HA group surfed a higher percentage of barreling waves (83.3 vs. 71.8%); however, this was not significant ( $P = 0.282$ ). No variables loaded into regression models for either sex. No athletes were observed using helmets in the Challenger or Longboard Tours.

**Conclusions:** Helmet use was exceptionally low, particularly compared to a recent study which noted that >50% of WSL athletes endorsed a history of prior helmet use. Helmet use was associated with high-performance levels (Championship Tour; greater percentage of barreling waves rode) and with specific sites with characteristics potentially associated with high injury risk (large barreling waves breaking over shallow coral reef bottoms).

**Significance:** Due to the very low levels of helmet adoption and the parameters associated with helmet use, additional research is needed to better assess barriers to helmet use, the potential for risk compensation, and helmet efficacy against injury.

TOPIC: Education

STUDY TYPE: Survey

## A Sports Medicine Didactics Series Effect on FM Residents MSK Knowledge and Confidence

**Submitting Author/Presenter:** Michael Sweda, MD

Ramyar Sigarchy, MD and Nicholas D'Angelo, MD

*Affiliation:* HCA Florida Orange Park Hospital, Orange Park, Florida.

**Purpose:** Studies have found primary care residents lack knowledge in musculoskeletal (MSK) topics. The purpose of this study was to measure the effect of a didactics series on family medicine residents' knowledge and confidence in MSK and sports medicine topics.

**Methods and Study Design:** A validated MSK knowledge assessment, the MSK30, and a questionnaire administered to 16 family medicine residents at 3 points of a 24-week MSK didactics series were used to assess residents' knowledge and confidence in and prior education and training in MSK topics, respectively. The scores at the 3 times were compared to determine the effect of the series on residents' knowledge and confidence.

**Results:** There was no statistical significance in all measures except one at the 12-week mark of the didactic series. 25% of residents felt more confident in their overall knowledge of the

musculoskeletal system. The overall mean MSK30 score prior to the series was 20.93 and at the 12-week mark was 21.43 ( $P$ -value = 0.5284). Those with less than 12 weeks of prior MSK education saw an increase in mean MSK30 score from 20, compared to those with more than 12 weeks of prior MSK education 0.45 prior to the series starting to 21.54 at the 12-week mark. Those with >12 weeks saw a decrease in mean scoring from 22 prior to the series to 21.20 at the 12-week mark. The one significant result indicated that less residents felt confident in their ability to diagnose the most common MSK complaints at the 12-week mark when compared to prior to beginning the series (pre: 43.75% vs 12 weeks: 37.50%) ( $P$ -value = 0.02).

**Conclusions:** At 12 weeks, decreased levels of confidence was the only statistically significant difference in the assessments. This may be due to low power from the small sample. Stressors of the environment when administering the MSK30 and questionnaire may be another reason. An additional administration of the assessments must be conducted at 24 weeks to determine if the didactics series will be beneficial for residents' knowledge of MSK topics.

**Significance:** Up to the halfway point, this study did not show any statistically significant improvement in family medicine residents' knowledge or confidence in diagnosing, working up, and treating MSK complaints.

TOPIC: Concussion  
STUDY TYPE: Survey

### Sports-Related Concussion Knowledge and Reporting Habits: A Survey of US Collegiate Student-Athletes and Athletic Trainers

**Submitting Author/Presenter:** Sydnie B. Vo, MD

Yone-Kawe Lin, BS, Chathura Siriwardhana, PhD, and Andrew W. Nichols, MD

*Affiliation: Sports Medicine Fellowship, Department of Family Medicine & Community Health, John A. Burns School of Medicine, University of Hawai'i at Mānoa, Honolulu, Hawai'i.*

**Purpose:** The purpose of this study is to assess sports-related concussion (SRC) knowledge levels in US collegiate student-athletes (S-As) and athletic trainers (ATs) and identify factors that influence the reporting of SRC by S-As.

**Methods and Study Design:** A validated 41-item survey assessing demographics and SRC knowledge was administered to NCAA D-1 S-As and ATs at 1 institution. S-As were questioned on their prior SRC history and reporting habits. SRC knowledge was scored and variables influencing reporting were identified. Data were compared using non-parametric and categorical significance tests. Statistical significance was set at  $P < 0.05$ .

**Results:** Survey response rates were 67% (350/520) for S-As and 100% (11/11) for ATs. S-As represented 21 sports, (mean age 20.3 y, range 18-24, 54% male). SRC knowledge scores were significantly lower in male S-As (median score = 70%; IQR = 50%-83%) compared to females (77%; 50%-87%). There was also a significant between-group difference in SRC knowledge scores between collision/contact sport (77%; 63%-87%) and non-contact sport (70%; 50%-83%) S-As. SRC knowledge did not differ based on year in school. Twenty-nine percent ( $n = 102$ ) of the S-As experienced a prior SRC, of which 67% ( $n = 68$ ) reported their injury to a health

care professional, coach, or parent. Male and collision/contact sport S-As were significantly less likely to report SRC compared to female and limited-contact or non-contact sport S-As. There was no difference in SRC knowledge between those who did or did not report their injury ( $P = 0.997$ ). SRC knowledge scores were significantly higher in ATs (97%; 88%-98%) than S-As (73%; 50%-86%).

**Conclusions:** S-As have widely variable knowledge of the signs/symptoms of SRC, with female and collision/contact sport S-As scoring the highest. Most S-As with SRC reported it to an authority figure, but male and collision/contact sport S-As were less likely to do so. SRC knowledge did not differ between those who reported or did not report their SRC, suggesting other factors affected this behavior. As expected, ATs have higher SRC knowledge compared to S-As.

**Significance:** SRC knowledge levels vary among S-As, suggesting that enhanced SRC education efforts may be justified among all S-As, and in particular, for certain high-risk groups. Future studies can endeavor to optimize education methodology.

**Acknowledgements:** We would like to thank the Sports Medicine physicians who helped administer the survey during Fall 2023.

TOPIC: REGENMED  
STUDY TYPE: Case-Control

### Treatment of Fully Reduced HMGB1 With Metformin Improves Nonunion Bone Fracture Healing In Diabetic

**Submitting Author/Presenter:** Roshawn Brown, MD

Jarrett Cain, MD, Jianying Zhang, PhD, James Wang, PhD, Kengo Shimozaki, MD, and MaCalus Hogan, MD

*Affiliation: UPMC, Pittsburgh, PA.*

**Purpose:** Diabetes is known to interfere with bone homeostasis. Fully reduced HMGB1 (frHMGB1) has been found to enhance wound healing. However, the activity of HMGB1 can be inhibited by Metformin (Met). We tested the hypothesis that application of frHMGB1 with metformin improves nonunion bone fracture healing.

**Methods and Study Design:** Thirty-two diabetic rats were used. The tibia bones of each were fractured. There were 4 groups with 8 rats/group: the rats in group-1 were without additional treatment. Group-2 were injected Met daily; group-3 were injected with frHMGB1 into wound area weekly; the rats in group-4 were injected daily (Met) and weekly (frHMGB1).

**Results:** Micro-CT scout view images showed that unhealed bone fractures in group 1 as evidenced by large gap between 2 thin fractured bones. Although the gap was found in group 2, the gap was much smaller, and the fractured bone was much thicker with higher bone density than those of untreated bone fractures. There was no gap found in group 3 bone area. The area was filled with high density of bone tissues. Group 4 demonstrated less healing and bone density compared to group 3 but improved relative to groups 1 and 2. The IP injection with metformin decreased both levels of HMGB1 and IL-F0621 concentrations in rat serum. H & E staining showed large unhealed wound area with little bone tissues found in the fractured bone area without treatment. The frHMGB1 local injection enhanced bone fracture healing by recruiting cells to the wound area. Although Met-IP injection

slowed down the healing, the healed bone tissue with high cell density and small gap area.

**Conclusions:** Our results indicated that in diabetic rats, nonunion bone fracture occurred easily once they were injured. The frHMGB1 treatment enhanced nonunion bone fracture healing by promoting cell proliferation, fibroblast migration and collagen I and collagen III production. Met injection inhibited frHMGB1 activity but may improve the healing quality.

**Significance:** The frHMGB1 treatment enhanced diabetic nonunion bone fracture healing but may form scar tissue; metformin injection slowed down the bone fracture healing but may help to form high quality bone tissue and reduced scar tissue formation.

**Acknowledgements:** This work was supported in part by the American Orthopaedic Foot & Ankle Society Grant FP00016180; NIH under award number AR070340, and Pittsburgh Foundation Awards (AD2021-120108; AD2021-120112).

TOPIC: Education  
STUDY TYPE: Survey

### **Sideline Coverage Crash Course: Impact of a Single Athletic Coverage Workshop on Resident Knowledge**

**Submitting Author/Presenter:** Roshawn Brown, MD

Connor Fultz, MD, Eric Super, MD, George Raum, DO, and Ryan Nussbaum, DO

*Affiliation:* UPMC, Pittsburgh, PA.

**Purpose:** This quality improvement project aimed to evaluate the improvement in the preparation for athletic sideline care provided by resident physicians in a physical medicine & residency program through a hybrid workshop utilizing recorded modules and a 1.5 hour in person course.

**Methods and Study Design:** A hybrid course was designed to cover high-yield issues faced by the sideline physician. In-person topics included: Cardiac Arrest, Cervical Spine Injury, Dislocations, Acute Fractures, and Acute Hemorrhage. Recorded topics covered Exertional Heat Illness and Concussion. A quiz/confidence scale was given before and after the modules, while general feedback was collected via an open form.

**Results:** Twelve residents completed the full course workshop and the pre/post-quizzes. The course was delivered by one attending sports medicine physician, 2 sports medicine fellow physicians and 3 athletic trainers from a Division 1 University. The course lasted 1.5 hours and was delivered without any unforeseen issues. There was a significant improvement in subjective resident confidence in their ability to cover on the sidelines from a score of 55% to 78% ( $P$ -value less than 0.5). There was improvement in the quiz scores from 45% to 68% from pre- to post-workshop scores ( $P$ -value less than 0.5). There was an improvement in the frequency of correct answers for all questions outside of questions regarding dislocation reduction and coverage logistics. Resident feedback was overwhelmingly positive. Improvements suggested included: using anatomical models to demonstrate dislocations and reductions, and increased time for hands-on practice for tourniquet application as well as spine boarding.

**Conclusions:** A single sideline coverage course is enough to increase resident knowledge and confidence in providing

sports medicine coverage. Future courses should focus on kinesthetic learning with anatomical models, practice for motor-based skills such as spine boarding, and investigation of the efficacy of pre-recorded material for the education of non-physical skills. Knowledge quiz questions will be modified for future iterations.

**Significance:** This QI project serves as a launching point for the design of future sideline coverage courses. The hybrid model delivers accessible content in a timely manner and successfully increases knowledge and confidence in the sideline care of athletes.

**Acknowledgements:** We would like to acknowledge the time and efforts of the Duquesne University Athletic Training Staff for their time in effort in leading sections of this workshop.

TOPIC: Epidemiology  
STUDY TYPE: Cohort

### **Incidence of Bone Stress Injuries in Division 1 Collegiate Athletes between 2016 and 2022**

**Submitting Author/Presenter:** Katherine Fahy, MD

Kimberly Harmon, MD and Bridget Whelan, MPH  
*Affiliation:* University of Washington, Seattle, WA.

**Purpose:** Bone stress injuries (BSI) are overuse injuries that occur on a continuum. Previous epidemiologic research has focused on stress fractures, which misses a large subset of bone stress injuries. The purpose of this study was to examine the rate of BSI in collegiate athletes.

**Methods and Study Design:** De-identified injury data on D1 collegiate athletes was collected during the 2016 to 2022 competitive seasons using the Pac-12 Health Analytics Program. Included injuries were labeled as “bone stress,” “stress fracture,” or “stress reaction.” The number of BSI was divided by athlete-years (AY) per sport and multiplied by 100 to calculate incidence per 100 AY (or percentage of athletes per year).

**Results:** There were 66,064 total injuries with 1487 BSI (2.3%). 55.14% were classified stress reactions, 29.52% stress fractures and 15.33% bone stress injuries. 4.3% of athletes per year experienced BSI. Female athletes accounted for 42.4% of the total injuries but 66.2% of BSI. Female sex and type of sport were associated with BSI when controlling for age and history of prior BSI ( $P$  less than 0.001) Females had higher rates of BSI than males in all matched sports. The highest yearly rates of BSI were women’s cross-country (15.8%), men’s cross-country (10.9%), women’s gymnastics (10.3%), women’s track (9.34%), women’s rowing (8.7%), women’s basketball (8.7%), women’s tennis (6.0%), men’s track (5.5%), and men’s rowing (5.4%). Track and cross-country athletes had predominantly lower extremity BSI with 67.7% of these injuries occurring below the knee and 29.2% occurring in the thigh, hip and pelvis. Rowers had primarily BSI of the ribs (81%).

**Conclusions:** BSI incidence is high in D1 collegiate female and endurance athletes (cross country, track and rowing). Incidence is also high in female gymnasts, tennis and basketball players. Track and cross-country BSI occurred mainly in lower extremities while rowing BSI occurred in ribs. Future sport-specific research could identify risk factors such as biomechanics, overuse or relative energy deficiency in sport (RED-S) and guide prevention measures.



**Significance:** This research shows the high incidence of BSI in certain groups of collegiate athletes and highlights the need for more sport-specific interventional studies to decrease BSI rates.

**Acknowledgements:** We would like to acknowledge the Pac-12 Health Analytics Program.

TOPIC: Heat Illness  
STUDY TYPE: Cohort

### Secondary School Activity Modifications Based on Pre-Event WBGT Readings

**Submitting Author/Presenter:** Thomas Jason Meredith, MD  
Adam Rosen, PhD, Colleen Vogel, MS, and Samuel Wilkins, PhD

**Affiliation:** University of Nebraska Medical Center, Omaha, NE.

**Purpose:** Wet Bulb Globe Temperature (WBGT) is considered best practice to monitor heat stress for sports. Many state athletic associations develop heat illness guidelines for schools to follow. The purpose of this study was to observe which activity modifications were made based on pre-event WBGT readings.

**Methods and Study Design:** Cohort design. Athletic trainers recorded daily pre-event WBGT (pWBGT) readings during activity using Kestral 5400 devices during August and September 2023. WBGT data and specific activity modifications were submitted electronically daily if outdoor activities were scheduled. All data was collected in WBGT geographic region 2. Activity modification frequencies were reported based on pWBGT reading.

**Results:** Thirty-eight high school athletic trainers participated in the study, recording a total of 504 unique data entries (mean pWBGT:  $78.94 \pm 6.72$ ). Thirty-four (6.7%) total pWBGT readings were reported in the “black” range. Green was the most frequent pWBGT category recorded (55.2%), followed by Yellow (28.3%), Black (6.7%), Orange (6.3%), and finally Red (2.0%). Modifications recommended by athletic trainers were followed by coaches/administrators 90.7% of the time. When pWBGT readings were in the black range, activities were only cancelled 38.2% of the time, however, activity location was modified 88.2% of the time. Cold water immersion was available 84.2% of the times it was recommended based on pWBGT readings. Outdoor activities had cold drinking water (100%), cold sports drink (35.9%), access to a shaded area (75.1%), ice towels (26.1%), misting stations (12.9%), and easy access to air-conditioned facilities (90.6%).

**Conclusions:** Our study showed improved compliance to our state level guidelines in the prevention of heat illness. Various techniques were used to address “black” range temperatures; unfortunately, no modifications continue to occur in this extreme heat range. Room for improvement exists in several areas including coach/administrators following athletic trainer recommendations and having a cold-water immersion available when guidelines dictate.

**Significance:** Team physicians should collaborate with athletic trainers, coaches, and administrators to develop institution-specific written heat policies that follow state athletic association guidelines and national best practices.

**Acknowledgements:** We would like to thank the certified athletic trainers in Nebraska who helped collect data for this project.

TOPIC: Epidemiology  
STUDY TYPE: Cohort

### Comparison of Injuries Sustained on Grass and Artificial Turf by USL1 Mens Soccer Team. Part 1: Match Related Injuries

**Submitting Author/Presenter:** Michael Osterholt, MD  
Jason Meredith, MD

**Affiliation:** University of Nebraska Medical Center, Omaha, NE.

**Purpose:** Athlete health and safety on artificial turf (AT) surfaces is a reoccurring topic for debate. This study aims to analyze and compare the incidence, type, and location of injuries sustained on AT and natural grass (NG) for matches of a United Soccer League, League 1 (USL1) men’s soccer team.

**Methods and Study Design:** Union Omaha’s ATC documented injury data including match location (playing surface), anatomic location of injury, and type of injury sustained. Team physicians retrospectively reviewed injury data for 3 USL1 seasons (2020-2022). Injury incidence rates, calculated with 95% confidence intervals, were reported in terms of number of injuries per 1000 player hours.

**Results:** Three-year cumulative data for Match exposure hours resulted with 428 hours of exposure time on AT and 1085 hours on NG. A total of 69 injuries were registered on AT versus 175 injuries on NG. Overall incidence of match related injuries was 161.26 injuries per 1000 player hours on AT compared to an identical rate of 161.26 injuries per 1000 players hour on NG (Incidence ratio 1.00; *P* Value 1.00). Lower limb injuries accounted for the majority of injuries on AT and NG with an incidence of 112.18 and 118.87 per 1000 player hours respectively (Incidence ratio 0.94; *P* Value 0.732). Muscle/Tendon and contusion injuries were the most common type of injury on AT and NG. Incidence of muscle/tendon and contusion injuries on AT were 67.78 and 44.41 per 1000 player hours respectively, compared to 57.13 and 60.82 on NG (Incidence ratio muscle/tendon 1.16; *P* Value 0.447) (Incidence ratio contusion 0.73; *P* value 0.227).

**Conclusions:** There was no statistically significant difference between the overall incidence of match related injuries sustained on AT and NG per 1000 player hours of a USL1 men’s soccer team. Furthermore, no statistically significant differences were seen when injuries were broken down into location and type of injury sustained.

**Significance:** Durability and ease of maintenance make artificial turf an attractive field of choice. This study adds to the collection of research that suggests new generation artificial turf is a safe alternative to natural grass in men’s professional soccer.

**Acknowledgements:** Justin Annin, ATC who attention to detail in his injury logs made this retrospective research project possible. Dr. Jenenne A. Geske for completing all our statistical analysis.

TOPIC: Mental Health

STUDY TYPE: Survey

### Scaling New Heights a Comprehensive Analysis of Rock Climbing's Impact on Mental Health

Submitting Author/Presenter: Kathy Chen, BS

Altamash Raja, DO, RMSK, CSCS

Affiliation: Rowan-Virtua School of Osteopathic Medicine, Stratford, NJ.

**Purpose:** There have been very few studies dedicated to the use of rock climbing as a therapy in the United States. With the ever-growing prevalence of mental health disorders and as climbing gains more traction, it is important that we explore the potential of climbing as a form of therapeutic treatment.

**Methods and Study Design:** The databases used to perform the initial literature review were PubMed and Scopus. A survey was drafted and released to the general public via Qualtrics.com and responses were collected and analyzed.

**Results:** The survey received 748 responses with a 100% completion rate. The general consensus of 73.1% showed that rock climbing has a positive effect on mental health amongst climbers. When discussing mental health, rock climbers primarily reported having a history with depression, anxiety, etc. 46.8% described themselves as introverts, but when rock climbing, a reported 74.1% engaged in social behavior, which could be an association or indicator for the increase in mental health. Reports show that medication and therapy had "Neutral" beneficence, 31.9% and 40.8%, respectively. Compared to medications, 73.3% of individuals reported a stronger than "Neutral" beneficial response from rock climbing. Similarly, 64.8% of individuals reported a better response to rock climbing over attending therapy sessions.

**Conclusions:** This research fills a significant gap in the body of knowledge by focusing on American climbers and their perspectives on the sport's potential to influence their mental health. The findings of this study shed light on the positive influence that rock climbing, and specifically bouldering, may have on mental health.

**Significance:** Future trials for conducting bouldering psychotherapy (BPT) should be focused on the risk-taking mindset, problem-solving, mindfulness techniques, and social nature that the sport presents. Overall, there is potential in introducing BPT in the US.

**Acknowledgements:** Swetha Sundaram, David F. Lo, MBS, Ahmed Gawash, Charalampos Papachristou PhD, Altamash E. Raja, DO, RMSK, CSCS

TOPIC: Rehabilitation

STUDY TYPE: Cohort

### Effect of Cetylated Fatty Acid Supplementation on Low Back Facet Joint Arthritis

Submitting Author/Presenter: Eli Sepkowitz, MD

Anjali Kashyap, BS, Anisha Javvaji, BS, Brian Caplan, BS, Antonio Madrazo-Ibarra, MD, Kaitlin Carroll, BS, and Vijay Vad, MD

Affiliation: Northwell Health Department of PM&amp;R, Manhasset, New York.

**Purpose:** This study investigates if short term Cetylated Fatty Acid (CFA) supplementation, including an oral gel and

transdermal patch, reduce pain and disability in patients with low back pain related to Facet Joint Arthritis (FJA).

**Methods and Study Design:** The study included 28 patients diagnosed with FJA based on symptoms and radiologic criteria. The primary outcome was the Roland Morris Disability (RMDQ) questionnaire. The secondary outcomes were the Numeric Pain Rating Scale (NPRS) and adverse events. Clinical evaluations were performed at baseline and after a 30-day supplementation of one 8-hour patch and twice-daily oral CFAs.

**Results:** After 30 days of supplementation, analysis showed statistically significant reduction in RMDQ scores ( $P$  value = 0.002). 79.1% of patients were determined to be responders by fulfilling the calculated Minimal Clinically Important Difference (MCID) for RMDQ at 30-days. NPRS current and worst scores both improved significantly ( $P$ -value < 0.05) from baseline to 30 days.

**Conclusions:** The study found that a combined 4-week oral and transdermal CFA system did significantly reduce patient reported disability and pain outcomes. Interestingly, over 25% of patients experienced mild to moderate GI and skin irritation side effects from intervention. While necessary follow-up studies, including a larger cohort and control group, are to be pursued, CFA supplementation shows potential in improving LBP and overall function for patients.

**Significance:** Current pain management protocol for FJA have limited effectiveness and a wide range of undesirable side effects. CFAs offer a potential solution to both anti-inflammatory pain management and patient health and warrant further investigation.

**Acknowledgements:** Study funded by Vad Foundation.

TOPIC: Epidemiology

STUDY TYPE: Cohort

### Comparison of Prevalence of Knee Injuries between Division I Men's and Women's Ice Hockey Athletes

Submitting Author/Presenter: William Nace, DO

Kevin Lennon, ATC, Kendra McCamey, MD, and James Borchers, MD, MPH

Affiliation: The Ohio State University Family Medicine Department, The Ohio State University Jameson Crane Sports Medicine Institute, Columbus, Ohio.

**Purpose:** To compare the prevalence of knee injuries of Division 1 Men's and Women's ice hockey athletes over a 7 year time period to better understand the similarities and differences between the athletes and highlight the importance injury prevention programs to help prevent these injuries.

**Methods and Study Design:** Cohort study involving 189 men's and 148 women's ice hockey student athletes at a division I university from 2016 to 2022. At the completion of their season athletes were asked, via end of season physical, if they have suffered an injury to their knee and were asked to give details. Male athletes who had suffered a knee injury were divided by those who did not, this was also done for females.

**Results:** Out of 189 responses for male athletes 14 reported a previous or current knee injury during that competition year (7.4%). Female athletes reported 7 knee injuries out of the 148 responses (4.7%). The most common type of knee injury for male athletes was a meniscal injury (42%), followed by ACL (28%), MCL (28%) and PCL (14%). It is noted these percentages do total over 100 due to the fact that several of

these occurred simultaneously in the same athlete. The most common type of knee injury in women were MCL injuries (57%), followed by ACL (29%), and finally patellar subluxation (14%).

**Conclusions:** The average number of male ice hockey athletes with knee injuries was found to be higher than female ice hockey athletes, 7.4% compared to 4.7%. Interestingly the injury patterns are different with men primarily having meniscal injuries and women more often having MCL injuries. This is in contrast with previous studies showing that women primarily have more knee injuries while men have more shoulder injuries.

**Significance:** Given the rising popularity of girl's and women's hockey it is important to understand the similarities and differences of injuries in ice hockey, especially given the differences in rules such as prohibiting body checking in women's hockey.

**Acknowledgements:** Thank you to Kevin Lennon ATC for the help with data collection for this study and thank you to our great ice hockey athletes involved in this study.

TOPIC: Musculoskeletal  
STUDY TYPE: Cohort

### Functions of Intrinsic Muscles of the Foot in Dancers by Active Exercise and Electrical Stimulation

**Submitting Author/Presenter:** Samantha Dominguez, BA Carolyn Cooper, BS, BA, Mark Holling, DPT, and James Jastifer, MD

*Affiliation:* Western Michigan University, Homer Stryker MD School of Medicine.

**Purpose:** The intrinsic muscles of the foot play an important role in foot posture and control during gait. The contribution these muscles make to arch height, foot shape, have not been quantified yet in different athlete populations, including dancers, versus a control group.

**Methods and Study Design:** Sixteen volunteers enrolled in dance class with at least 1 year of experience underwent measurement of foot length and arch height measurement. This was followed by activation of the intrinsic muscles (short foot exercise), followed by electrical stimulation (ESTIM), followed by a repeat of the SFE. These measurements were taken using imaging software and compared to control group measurements.

**Results:** The foot length and height measurements were statistically significantly different between tests (both  $P$  less than 0.0001) for the dance group. For the control group there was no difference between short foot exercise and ESTIM for height or length (all  $P$  greater than 0.109). For the dance group, there was significant difference between both SFEs that had shorter length and higher MLA height when compared to ESTIM (Both  $P$  less than 0.01). There was significant difference for percentage change in all conditions between the dancer group and control group for MLA height (all  $P$  less than 0.0001) but not for foot length change (all  $P$  greater than 0.1)

**Conclusions:** This study demonstrates that the intrinsic muscles of the foot contribute to arch height and foot length within the dancer population. Short foot exercise and ESTIM had different effects on foot length and MLA height, showing how dancers are able to change foot shape more through their

own activation of both extrinsic and intrinsic foot muscles than ESTIM alone.

**Significance:** The short foot exercise had a greater effect on foot shape than electrical stimulation and both modalities may be considered by teachers and dancers as a means of improving technique and strengthening after injury or for specific muscle improvement.

**Acknowledgements:** Thanks to Debby Norton and Kalamazoo Ballet Arts School of Dance for their participation.

TOPIC: Pediatrics  
STUDY TYPE: Other

### Single and Multisite Traumatic Injuries in Pediatric Skiers and Snowboarders

**Submitting Author/Presenter:** Michael Lieu, BS, Kinesiology Ruikang (Kong Kong) Liu, MD, David Howell, PhD, Morteza Khodaei, MD, MPH, Aaron Provance, MD, and Lauren Pierpoint, PhD

*Affiliation:* LSU Health Shreveport, Shreveport, Louisiana.

**Purpose:** To evaluate pediatric ski and snowboard injury patterns at a ski resort, comparing those who sustained a fracture in one body region to those who sustained a fracture and a second injury in a separate body region.

**Methods and Study Design:** We examined 797 patients age 3 to 17 diagnosed with at least one fracture from skiing or snowboarding incidents at a single ski resort. All images were reviewed by 2 independent physicians. Independent samples t-test was used to compare single site fractures only to fractures with a secondary injury at a separate body region. Body regions were upper extremity, head/neck, torso, and lower extremity.

**Results:** Seven hundred ninety-seven total patients had at least one fracture diagnosis, with 756 being single site fractures only and 41 being fractures with a second injury at another body area. Fractures in the upper extremity was the most common injury in both groups at 61%. The most common second injury was second fracture at 51%, followed by concussion at 32%. The head/neck area was the most likely location for the second injury at 44% followed by upper extremity at 34%. Compared to the single region fracture group, those with a fracture plus a second injury had a significantly higher percentage of skiers (68% vs 42%;  $P = 0.001$ ), injury mechanism involving collision with an object or person (32% vs 10%;  $P$  less than 0.001), and transfer to a local hospital (46% vs 24%;  $P = 0.001$ ). No significant differences were found when comparing age, sex, self-rated ability, or terrain where the injury occurred.

**Conclusions:** Among pediatric skiers and snowboarders with a fracture injury, the upper extremity was the most commonly injured area. The most common secondary injury was a second fracture followed by a concussion, and the most common second injury location was the head/neck. Those with a multi-site injury had a higher proportion that were skiers, involved collision with an object/person, or were transferred to a local hospital.

**Significance:** This is one of the few studies to compare injury patterns for single versus multi-site injuries among pediatric skiers and snowboarders, and will help add to the literature on epidemiologic data for this population.

**Acknowledgements:** The authors thank the Denver Health Winter Park Medical Center and all team members involved in data collection and interpretation.

TOPIC: Ultrasound  
STUDY TYPE: Cohort

### Time Needed for Musculoskeletal Ultrasound in the Primary Care Setting

**Submitting Author/Presenter:** James Wilcox, MD, FAAFP  
Camilo Aguilar, MD  
*Affiliation: Indiana University School of Medicine, Indianapolis, IN.*

**Purpose:** Some studies have looked at time needed for POCUS exams, but none have looked at the time added to patient visits from the patient perspective for musculoskeletal examinations in the primary care setting. This study looks to determine the time added to patient visits by musculoskeletal ultrasound.

**Methods and Study Design:** Patient charts were retrospectively evaluated from 8/11/2021 to 7/30/2022, recording the time stamp of when the physician started seeing the patient, and the time stamp of when the physician concluded the visit with the patient. The clinic visits where ultrasound was used were compared with 120 randomly selected visits with the same clinician where ultrasound was not used.

**Results:** Over the 12 month period, 305 ultrasound examinations were performed in the primary care office, where 68 ultrasound examinations were determined to be musculoskeletal or soft tissue exams. The average patient visit with US was 42.3 minutes, and the average patient visit without US was 30.6 minutes. The average time added for musculoskeletal ultrasound was 11.6 minutes. Each individual test type was small, but shoulder ultrasound was the longest, with an average of 46.5 minutes added to the patient visit, and hip was the shortest, with only 1.9 minutes added to the examination. The most commonly performed examination of the Knee, 15% of the US examinations, added only 3.0 minutes to the time of the patient visit. Interestingly, if multiple examinations were performed (like elbow and wrist) time added was 19.4 minutes, but if the joint evaluated was bilateral, the time for the patient visit actually decreased by 3.8 minutes compared to the average patient visit.

**Conclusions:** While the number for each individual evaluation is small and unable to apply a robust statistical analysis, the overall difference in time added to the patient encounter in a primary care visit was statistically significant at 11.6 minutes added to the average visit. This is similar to other studies which review time added to ultrasound evaluations in other practice settings like the emergency department.

**Significance:** While this study is small in nature, it is the first study to look at time added by musculoskeletal ultrasound examinations to patient care visits in a primary care office. This study can start future research in office time for US examinations.

**Acknowledgements:** This project was supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) as part of an award totaling \$17.8 million with 10 percent financed with non-governmental sources. The contents.

TOPIC: Cardiology  
STUDY TYPE: Other

### Sudden Cardiac Arrest in Full Contact Martial Arts Gyms, and Comparison of Outcomes With Versus Without AED

**Submitting Author/Presenter:** Juan Miguel Dela Cruz, MD  
Daniel Diaz, DO, CAQSM, Robert Hernandez, MD, CAQSM, and Sabrina Serrano, MD, MS  
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**Purpose:** The study aims are: determining the incidence of sudden cardiac death and its circumstances from blunt force trauma in full contact martial arts gyms, and determining the need for Automatic Electronic Defibrillators (AED) by comparing outcomes when an AED was used versus when none was present.

**Methods and Study Design:** The study will need data from the last decade, looking at calls for emergency medical services to visit these gyms. This will be obtained through the Healthcare Access Information (HCAI) Department of LA County. Circumstances will be evaluated for use of AED, transport to ED, diagnosis of sudden cardiac arrest, and outcomes. These outcomes will be compared, using an independent *t*-test.

**Results:** Request for data was submitted to the HCAI asking for incidence of sudden cardiac arrest in full contact martial arts gyms training in boxing, brazilian jiu jitsu, kick boxing, mix martial arts, and Muay Thai. Investigators will then compare outcomes between use of an AED versus outcomes where an AED was not present. Demographic information of persons having gone through such events will be used to help with determining high risk groups. Null hypothesis is that there is no difference between outcomes of sudden cardiac arrest in a full contact gym where an AED was used versus outcomes when it was not used or present. Investigators are postulating that although the incidence of blunt force trauma causing sudden cardiac death in a full contact martial arts gym is rare, an AED will make a positive difference in outcome. Persons who have gone through such events will have a better chance of survival with an AED.

**Conclusions:** Presence of an AED in combination with resuscitation attempts have improved outcomes with a survival rate of 47%. It could be recommended that standardizing the presence of an AED in exercise facilities given blunt force trauma to the chest can potentially induce commotio cordis. Regardless of incidence, potential for such a catastrophic event should be taken seriously given rise in interest in full contact martial arts training.

**Significance:** Sudden Cardiac death in exercise facilities are uncommon with annualized incidence rate of 0.024 arrests/site each year. Most injuries in fighters usually occur in training. The prevalence of sudden cardiac death in the gym has yet to be evaluated.

**Acknowledgements:** The investigators would like to acknowledge AltaMed Health in their unwavering support. Much thanks to Dr. Daniel Diaz, our program director, and Drs. Robert Hernandez and Marvin Valencia.

TOPIC: Running  
STUDY TYPE: RCT

### The Impact of Echinacea Supplementation on Aerobic Capacity and Erythropoiesis: A Systematic Review and Meta-Analysis

**Submitting Author/Presenter:** Stephanie Deccy, MD  
Callie Bartkowiak, MD, Nathan Rodricks, DO, Marc-Edwin Saint-Louis, MD, and Kristopher Paultre, MD

*Affiliation: University of Miami Sports Medicine Institute, Miami, FL.*

**Purpose:** The World Athletic Anti-Doping Agency (WADA) bans substances that increase erythropoietin (EPO) levels. Echinacea, a common herbal supplement, has previously been studied for EPO-enhancing effects. The purpose of this study is to determine whether echinacea has performance-enhancing properties.

**Methods and Study Design:** A search strategy was developed to identify randomized controlled trials studying the impact of echinacea on sport performance. Included studies underwent data extraction related to study design and pre- and post-intervention outcome measures of interest. Effect size was measured as the standardized mean difference (SMD) using Hedges' *g*. Data were analyzed using Meta-Mar.

**Results:** The database search yielded 502 studies, 496 of which were excluded in the 2-reviewer screening process. Six studies with a total of 107 athletes were included in the analysis. The average CONSORT score for the studies was 13. The length of supplementation between pre- and post-intervention measurements varied between study, ranging from 28 to 42 days. All studies dosed the echinacea at 8000 mg daily. For hemoglobin (Hb) and hematocrit (Hct) levels, there were small, positive effect sizes when comparing the difference in pre- and post-intervention levels between the echinacea and placebo groups, at 0.38 ( $P = 0.02$ , 95% CI  $-0.04$  to  $0.80$ ,  $I^2 = 70\%$ ) and 0.34 ( $P < 0.01$ , 95% CI  $-0.10$  to  $0.78$ ,  $I^2 = 86\%$ ), respectively. With respect to EPO, the effect size of  $-0.19$  ( $P = 0.05$ , 95% CI  $-0.75$  to  $0.17$ ,  $I^2 = 67\%$ ) demonstrated no difference between the echinacea and placebo groups. There was no statistically significant change in VO2 max (effect size  $-0.20$ ,  $P = 0.95$ , 95% CI  $-0.60$  to  $0.21$ ,  $I^2 = 0\%$ ).

**Conclusions:** Echinacea did not have a significant effect on the outcomes of interest. While small, positive effect sizes were observed for both Hb and Hct, these findings did not reach statistical significance. Furthermore, whether a modest increase in Hb or Hct might translate to a performance advantage in athletes is not understood. Limitations include small sample size. Future research should explore the impact of echinacea on direct performance metrics.

**Significance:** Echinacea supplementation did not have a significant effect on EPO, hemoglobin, hematocrit, or VO2 max levels in athletes. Athletes may safely supplement with echinacea without violating WADA policies.

**Acknowledgements:** I would like to acknowledge my mentor Dr. Kristopher Paultre for guiding this research and the team of listed authors who contributed to this study. In addition, I would like to thank the authors and participants of the included studies for their contributions.

TOPIC: Concussion  
STUDY TYPE: Other

### Engaging Community Members to Develop an Evidence-Based Strategy to Improve Head Impact Safety in Youth Football

**Submitting Author/Presenter:** Christopher M. Miles, MD, FAMSSM

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*Affiliation: Department of Family and Community Medicine, Wake Forest School of Medicine, Winston-Salem, NC.*

**Purpose:** The objective of this study was to develop an evidence-based multi-component intervention and implementation plan to reduce head impact exposure (HIE) and concussion risk during youth football practices, using a community-engaged and co-design approach.

**Methods and Study Design:** A stakeholder team ( $n = 12$ ) of youth and high school coaches, administrators, parents, an athletic trainer, and a university director of player development participated in monthly meetings to co-design the intervention and implementation plan. The purpose and timeline were defined. Two teams (12U, 13U) pilot tested the intervention while wearing mouthpieces measuring head impact biomechanics.

**Results:** Intervention targets were: (1) improve knowledge and skills of youth football coaches in effective practice planning and use of safe drills, and (2) change attitudes and beliefs toward contact in practice. We co-created an intervention guided by Social Cognitive Theory and Diffusion of Innovation and defined short- and long-term outcomes. High school coaches were identified as key to development and implementation of the intervention and early adopters. The intervention includes use of practice plans, a booklet aligned with state guidelines for contact in practice, a pre-season coaches' clinic, and peer mentorship during season. When the teams followed the intervention, coaches spent less time on "live" (ie, full speed) drills and athletes averaged 1 to 2 head acceleration events per player per practice: 83% lower than controls. One team stopped following the intervention mid-season; HIE increased. This team had 4 concussions (2 prior to and 2 after ceasing the intervention).

**Conclusions:** The intervention was effective at reducing head impact exposure. Organizational support and prioritization of safety positively influenced implementation outcomes. Negative team performance and parental/coach beliefs toward tackling in practice negatively influenced outcomes. Results of this study demonstrate the value of engaging community members in the co-design and implementation of evidence-based injury prevention programs in youth sports.

**Significance:** Youth community sports often have limited resources and volunteer staff, making implementation of injury prevention strategies a challenge. Engaging the community can facilitate the creation of acceptable injury prevention strategies in youth sports.

**Acknowledgements:** The research team would like to acknowledge the assistance of Robert Patterson and Alexis McCoy for their assistance in this work.

TOPIC: Pediatrics  
STUDY TYPE: Cohort

### Participation in Girls Flag Football: What Does Grit Got To Do With It?

**Submitting Author/Presenter:** Aubrey Armento, MD  
Madison Brna, BS, Lindsey Kemp, BS, Greg Walker, MD,  
and David Howell, PhD, ATC

*Affiliation: University of Colorado School Medicine, Department of Orthopedics, Aurora, CO.*

**Purpose:** Evaluate differences in grit (the perseverance to pursue long-term goals despite setbacks and challenges) between girls participating in a high school flag football (FF) season vs non-athlete controls, and between FF athletes who did or did not sustain an in-season injury.

**Methods and Study Design:** FF athletes and non-athlete controls completed the Short Grit Scale (Grit-S) pre- and post-season. FF athletes reported injuries and exposures weekly in-season. We used a linear mixed model to assess the relationships between Grit-S scores with group (FF/non-athlete) and time (pre/post season), and a *t*-test to evaluate differences in change in grit scores between injured/non-injured FF athletes.

**Results:** We enrolled 83 female high school FF athletes (54% were first-time FF players; average age 16.3, SD = 1.1) and 15 female non-athlete controls (average age 16.2, SD = 1.4). 87% of the FF athletes and 93% of the non-athletes completed the follow-up. At pre-season, the average Grit-S score (range 0-5) for the FF athletes was 3.27 (SD = 0.62), and 2.89 (SD = 0.64) for the controls. For Grit-S scores, there was a significant effect of group (coefficient = 0.37, 95% CI [0.04, 0.71], *P* = 0.03), but no significant effect of time (coefficient = 0.11, 95% CI [-0.33, 0.56], *P* = 0.62) or interactions between group and time (coefficient = -0.05, 95% CI [-0.54, 0.43], *P* = 0.83). Among FF athletes who did (*n* = 19) and did not (*n* = 64) sustain a sport-related injury during the season, there was no significant difference in the change in grit scores from pre- to post-season (*P* = 0.96; Cohen's *d* = 0.02).

**Conclusions:** Grit is likely an innate characteristic but is influenced by environmental factors and can be developed over time. Girls who played FF demonstrated more grit than non-athlete controls, but grit did not significantly change over the course of the FF season. Sustaining an injury during the season was not associated with change in grit among the FF athletes.

**Significance:** It is helpful to understand the relationship of sport participation and grit, which is associated with less burnout and anxiety. Future work can assess grit over multiple seasons, among other sports, and during recovery from sport-related injuries.

**Acknowledgements:** Thank you to the Broncos Foundation for supporting this research work.

TOPIC: Education  
STUDY TYPE: Cohort

### Stretch & Exercise Education's Effect on Pain and Injury in Collegiate Club Lacrosse Players

**Submitting Author/Presenter:** Steven Gawrys, BS  
Holly Wilson, BS, Alexander Matthias, BS, Andrew Roush, BS, ATC, David VandeMerwe, BS, Isain Zapata, PhD, Ben Wilde, DO, and Brent Pickett, DO

*Affiliation: Rocky Vista University, Ivins, Utah.*

**Purpose:** The objective of this follow-up study is to investigate stretch and exercise educational interventions and their effect on pain levels and injury rates in club collegiate men's lacrosse athletes.

**Methods and Study Design:** An educational lecture was provided to treatment group teams outlining stretches and exercises from injury prevention programs. Surveys were given to treatment and control group athletes to evaluate pain and injuries at the beginning and end of the season. Results were analyzed by generalized linear models using Gaussian or multinomial responses based on the characteristics of the variables.

**Results:** After exclusion criteria, the treatment group included 66 in the spring. The control group included 46 in the spring. Pain at the end of the season showed a significant improvement of 1.549 (out of self-reported scale of 10) in the treatment group compared to the control group *p*-value of 0.0001. The difference in types of injuries between the control and treatment groups yielded a *P*-value of 0.0063. The difference in the average number of practices missed improved by 0.579. However, the difference has no significance with a *P*-value of 0.5970. The difference in average total visits to the trainer improved by 0.636. However the difference was not significant with a *P*-value of 0.5834. Treatment group reported higher rates of stretching after practice than in the control group (*P*-value of 0.0089). There was no significant difference in treatment or control groups concerning access to team-provided athletic trainers (*P*-value = 0.8964), or access to team physicians (*P*-value = 0.3507).

**Conclusions:** This study's intervention failed to show a significant difference in the number of practices or games missed (Improvement of 0.58 *P* = 0.6141). Despite the marginal improvement of practices and games missed, the results showed significant improvements in overall pain levels of the treatment groups by 1.549 (out of self-reported scale of 10) *P*-value of 0.0005.

**Significance:** While the intervention did not show a significant effect on time missed, the improvement in levels of pain reported by the athletes warrants further research into cost-effective injury prevention resources for club collegiate athletes.

**Acknowledgements:** We would like to thank the teams and athletes who participated in our study and completed our survey. We would like to thank Salty Lacrosse and Crispy Lacrosse for offering online coupons for their products as an incentive for athletes to fill out the survey.

TOPIC: Swim Medicine  
STUDY TYPE: Survey

### Assessment of Female Athlete Triad Awareness in Female Collegiate Swimmers

**Submitting Author/Presenter:** Alexis Coslick, DO, MS  
Victoria Bergstein, BS, Jessica Schmerler, BS, Ryan Roemich, PhD, Andrew Cosgarea, MD, and Dawn LaPorte, MD  
*Affiliation: Johns Hopkins University, Baltimore, MD.*

**Purpose:** Our objective was to quantify knowledge about the Triad and REDs among collegiate swimmers before and after an educational intervention

**Methods and Study Design:** Members of 2 DIII women's varsity swim teams completed a 48 question Triad and REDs

survey. Participants then attended a 20-minute educational session focused on Triad risk factors and prevention, after which they completed a post-session survey. The post-session survey contained 13 additional questions using a Likert scale. Pre- and post-session data were analyzed using Microsoft Excel.

**Results:** Thirty-three swimmers completed the pre-session survey, and 31 completed the post-session survey. Pre-session, 9.1 % of respondents named one or more Triad components, compared to 96.8 % after ( $P < 0.0001$ ). 9.1 % could define the REDs acronym pre-session, compared to 87.1 % after ( $P < 0.0001$ ). Participants better understood the Triad post-session (mean Likert score 1.23) and found the session helpful (mean 1.23), but in a hypothetical scenario, felt relatively uncomfortable contacting medical staff about Triad symptoms (mean 1.87,  $P = 0.0002$ ). Of the 35.5 % who believed they may be experiencing Triad components, 72.7 % indicated the session motivated them to seek help.

**Conclusions:** Female collegiate swimmers' low baseline Triad and REDs knowledge improved significantly after an educational intervention. Survey responses highlighted the importance of heightened Triad awareness, but also its continued stigmatization. That the session encouraged swimmers with self-identified Triad symptoms to seek help underscores the importance of continued education efforts, especially in sports lacking adequate screening.

**Significance:** Triad and REDs risk factors are underrecognized in swimmers who are less likely to present with bone stress injuries because of swimming's non-weightbearing nature. This may be a missed population that could benefit from education and screening.

**Acknowledgements:** We would like to thank Johns Hopkins University and Stevenson University women's swim teams.

TOPIC: Artificial Intelligence  
STUDY TYPE: Survey

### A Comparison of Diagnostic Accuracy Between ChatGPT and Fellowship-Trained Sports Medicine Faculty

**Submitting Author/Presenter:** Kimberly Burbank, MD

Zach Sitton, MD, Jeremy Swisher, MD, Kiran Mullur, MD, Matthew Waldrop, MD, and Steve Davis, MA

*Affiliation:* Wake Forest University School of Medicine, Winston-Salem, NC.

**Purpose:** This study evaluates the diagnostic accuracy of ChatGPT, a widely accessible artificial intelligence program, with sports medicine clinical vignettes, and compares it with the diagnostic accuracy of fellowship-trained sports medicine physicians.

**Methods and Study Design:** Ten clinical vignettes from reputable sources with 4 to 5 multiple-choice answers each were typed verbatim into ChatGPT on 3 separate interfaces. These same vignettes were given virtually to 6 fellowship-trained sports medicine physicians. The results were compared using descriptive statistics and a *t*-test. Statistical significance was defined as a *P*-value less than 0.05.

**Results:** The fellowship-trained sports medicine physicians' average score on the ten-question test was 93.33 % compared to ChatGPT's score of 88.9 %. This was not a statistically significant difference,  $P = 0.1628$ . The 2 questions that were

answered incorrectly by ChatGPT throughout the study were answered correctly by all fellowship-trained sports medicine physicians.

**Conclusions:** AI has emerged as a potential tool to assist the medical community. While its use poses significant ethical and legal concerns, its potential to improve diagnostic accuracy warrants consideration. In this study, ChatGPT was non-inferior to fellowship-trained sports medicine physicians when analyzing and answering multiple-choice clinical vignettes related to sports medicine.

**Significance:** This study elucidates the potential benefit of utilizing artificial intelligence within the sports medicine realm. The ability of AI to quickly decipher information to answer specific questions could be valuable in the clinical setting.

**Acknowledgements:** Thank you to the Wake Forest University sports medicine fellowship faculty for their participation in this study!

TOPIC: NCAA  
STUDY TYPE: Cohort

### Assessing Sleep in NCAA Division I Athletes a Study of Sleep Extension Feasibility

**Submitting Author/Presenter:** Basil Ike, DO

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*Affiliation:* University of California, Los Angeles, Division of Sports Medicine, Department of Family Medicine.

**Purpose:** To investigate the feasibility of a sleep extension intervention in NCAA Division I athletes.

**Methods and Study Design:** Baseline sleep data was collected during a 2-week period from NCAA Division I athletes in Women's Soccer, Men's Soccer, Baseball, and Football. Subjects were then instructed to extend their total sleep time to 10 hours per night for 2 weeks. All sleep baseline and extension data was purposefully collected in the off-season, remote from school exams. WHOOP bands recorded all sleep metrics.

**Results:** The study compared Total Sleep Time (hours) and Sleep Consistency (%) between the baseline sleep phase and the sleep extension phase. Sample size varied for both metrics, ranging from 46 to 49 participants respectively. There was a statistically significant increase in Sleep Consistency during the sleep extension phase (Baseline: 60.09 (SD) 12.6 % vs. Extension: 64.42 (SD) 12.4 %,  $P = 0.01095$ ) using the Paired-Samples *t*-Test. However, Total Sleep Time showed no significant difference between the 2 phases (Baseline: 7.625 (SD) 0.879 hours vs. Extension: 7.504 (SD) 0.859 hours,  $P = 0.2696$ ) using the Wilcoxon Signed Rank Test. In conclusion, sleep extension efforts improved sleep consistency but did not significantly impact total sleep time.

**Conclusions:** Our findings demonstrate that a sleep extension intervention can enhance sleep consistency in NCAA Division I athletes but doesn't significantly impact total sleep time. Sleep extension may be challenging for collegiate athletes given the time-intensive demands of both academics and sports. While sleep extension may be feasible in professional sports, it does not appear to be so in the college setting.

**Significance:** This study assesses the feasibility of sleep extension in NCAA Division I athletes. While the extension



intervention improved sleep consistency, it did not improve total sleep time, questioning the feasibility of extension in collegiate sports.

**Acknowledgements:** We would like to thank the student athletes, student athletic trainers, and housestaff for their support of this study. We would also like to thank WHOOP, Inc. for their statistical support, validated tracking devices, and research funding.

TOPIC: Education  
STUDY TYPE: Other

### **YouTube as a Source of Information on Relative Energy Deficiency in Sport (REDs): Content Quality Analysis**

**Submitting Author/Presenter:** Alexandra Kamieniecki, MD  
Andrew James, DO and Kyle Ashland, MD

*Affiliation: Novant Health Family Medicine residency program, Charlotte, North Carolina.*

**Purpose:** The Female Athlete Triad now known as Relative Energy Deficiency in Sport continues to evolve, especially with the most recent 2023 IOC consensus statement. Studies show there is still low awareness of REDs. We aimed to evaluate the current content quality of YouTube videos on REDs.

**Methods and Study Design:** The first 30 videos for each of the following search terms were taken for analysis: “REDs,” “Relative energy deficiency in sport,” “Low energy availability in sport,” and “Female Athlete triad.” The quality of each video was evaluated by 2 current Family Medicine residents with sports medicine interests and one board-certified sports medicine physician independently using the DISCERN instrument.

**Results:** After the exclusion criteria, 49 videos were graded using the DISCERN instrument with interpretation of the total DISCERN score as excellent (63-75), good (51-62), fair (39-50), poor (27-38), and very poor (16-26). The average score of all videos was 36.33 indicating overall poor quality of videos. 69.39% of videos were determined poor quality. The intraclass correlation coefficient (ICC) amongst 3 raters for the sum of 15 scores and Q16 (overall quality) was 0.852 (95% CI 0.477-0.912) and 0.813 (95% CI 0.804-0.912), respectively. Both of the ICCs are indicative of good reliability. The highest rating of all videos included “RED-S” by Demystifying Medicine McMasters (Youtube ID: AVD—7b-MuNg) with an average DISCERN score of 65.66. Only 4 videos out of 49 were determined excellent quality meaning a DISCERN score of >63. Only 52% of videos discussed a multi-disciplinary team approach and 62% mentioned more than 3 organ systems affected by REDs.

**Conclusions:** The overall quality of YouTube videos on REDs is poor. Athletes and coaches obtaining health information on YouTube regarding REDs may receive incomplete comprehension. This may lead to misinterpretation of the severity of disease, treatment, and prevention of REDs. We recommend physicians refer patients to quality sources of information which may include our top-rated video if a patient wishes to use YouTube as a source of medical information.

**Significance:** Studies show that there is an increased need for physician awareness, diagnosis, and treatment of REDs. Primary prevention of REDs includes spreading awareness and knowledge of health and performance sequelae of REDs among athletes.

**Acknowledgements:** The authors would like to thank Qiang An MBBS, MSPH and Samuel D. Pettersson for their support.

TOPIC: Ultrasound  
STUDY TYPE:

### **The Effect of Repetitive Exercise on Rotator Cuff Tensile Change Evaluated With Elastography**

**Submitting Author/Presenter:** Austin Coale, BS

Stephanie Pittman, MS, Coby Dorsey, BS, Farhan Chowdry, BS, and David Berkoff, MD

*Affiliation: University of North Carolina School of Medicine.*

**Purpose:** To identify changes in rotator cuff stiffness after a single bout of exercise as measured by ultrasound elastography.

**Methods and Study Design:** Ten healthy subjects (both shoulders) with no history of rotator cuff injury, rotator cuff surgery, and an average age of 23.7 were enrolled in this prospective interventional trial. Each subject had a baseline scan then completed a standardized exercise program followed by another scan and daily evaluations until the results returned to within 10% of baseline.

**Results:** Elastography measurements were collected medial, superior, inferior, and lateral to the infraspinatus tendon, and the deltoid was used as a baseline standard. Strain values from the 4 measurement locations were averaged and divided by the deltoid number. Average strain was 0.5 at baseline, 0.7 immediately post-exercise, 0.6 on follow-up day 1, and 0.4 on follow-up day 2. The data was plotted, and the average of all 4 locations appeared similar in amount of change and shape of trend to the data collected from each individual location. This suggests that using the average values was appropriate for data analysis. There were statically significant differences between every timepoint. BL-post 0.24, ( $P < 0.0001$ ), post-day1 (decrease of 0.14,  $P < 0.0001$ ), day 1-day 2 (decrease of 0.15,  $P < 0.0001$ ), and BL-day2 (decrease of 0.05,  $P < 0.005$ )

**Conclusions:** These results demonstrate that the infraspinatus muscle stiffness increases immediately after exercise and takes up to 48 hours to return to within 10% of baseline. We also found that at day 2 there continued to be an overcorrection with the infraspinatus remaining softer at this time point.

**Significance:** These results begin to show both how tissue stiffness is affected by load as well as how recovery timing may influence readiness to compete and possibly risk of future injury.

**Acknowledgements:** Thank you to Dr. Berkoff and the UNC Sports Medicine Group for their support during the data collection and analysis of this project.

TOPIC: Musculoskeletal  
STUDY TYPE: Other

### **A Study of Patient Treatment Preferences and Willingness to Enroll in a RCT Among Patients With Knee Osteoarthritis**

**Submitting Author/Presenter:** Alexandra DiVasta, BS

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**Affiliation:** *Jacobs School of Medicine and Biomedical Sciences, Buffalo, NY.*

**Purpose:** This study aimed to: (1) describe patient attitudes about conservative knee osteoarthritis (OA) treatments, specifically physical therapy (PT) and injection and (2) assess the likelihood that a patient will enroll in an RCT for conservative care of OA.

**Methods and Study Design:** Patients aged 45 to 85 presenting to an orthopedic clinic with knee pain were interviewed for 15 to 20 minutes with study team members. We asked patients about their experiences with research, their willingness to participate in a hypothetical RCT, and experiences with injection, PT, and surgery. Team members wrote summaries of observations about each participant. Data was interpreted in team meetings.

**Results:** To obtain a convenience sample of 20 respondents, we needed to request that 22 patients participate (91% response rate). Of 20 people interviewed, 80% ( $n = 16$ ) had a history of PT. Of those, 81% ( $n = 13$ ) would get PT again. Of the 20 people interviewed, 88% ( $n = 17$ ) had a history of injection. Of those, 88% ( $n = 15$ ) would get an injection again. Twenty-six percent of patients wanted to avoid surgery as long as possible. Seventy-three percent ( $n = 14$ ) were willing to receive an injection in a randomized study and 89.5% ( $n = 17$ ) were willing to receive physical therapy in a randomized study. While 70% ( $n = 14$ ) stated “yes” they would likely enroll in a hypothetical RCT of conservative OA treatment, only 36% ( $n = 5$ ) of willing patients were deemed to be good candidates for research based on verbal and nonverbal information gathered and assessed by the research team. Patients were primarily female (70%), African American (75%), and had a mean age of 63. Most (65%) had a high school education level or less and 15% were currently working (most were retired or on disability).

**Conclusions:** OA patient openness to both injection and PT treatment was high, and 70% of patients said they would enroll in an RCT of PT and/or injection. However, only 36% of willing patients were believed by the research team to be good candidates for that study. Reasons for not being a good candidate included a lack of reliable transportation, being content with their current treatment regimen, or too busy with work, childcare or other considerations.

**Significance:** Improvement of orthopedic care relies on the ability to enroll patients in clinical trials to identify the most beneficial treatments for certain conditions. Future research is needed to identify and address barriers to enrolling OA patients in a RCT.

TOPIC: Musculoskeletal  
STUDY TYPE: Other

### **Clinical Outcomes of Adolescent Idiopathic Scoliosis Rehabilitation in Hawaii: A Pilot Study**

**Submitting Author/Presenter:** Kirra Borrello, BS

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**Affiliation:** *John A. Burns School of Medicine, Honolulu, Hawaii.*

**Purpose:** Research suggests scoliosis-specific rehabilitation may decrease Cobb angles & improve quality of life. This study aims to describe the change in radiographic & clinical outcomes following physiotherapy scoliosis-specific exercises

(PSSE) in adolescent idiopathic scoliosis (AIS) patients in Hawaii.

**Methods and Study Design:** A retrospective chart review was conducted of all patients ( $n = 31$ ) who were diagnosed with scoliosis at age 12 to 17 and received physical therapy at a local community hospital. Cobb angles and lumbar range of motion were measured before and after prescribed PSSE and compared using nonparametric, paired  $t$ -tests.

**Results:** Eighty percent of patients either maintained or improved (decreased) their Cobb angle over the course of PSSE, with only 4 patients' Cobb angle increasing 3 degrees or more (which is defined as clinically relevant). Following the course of PSSE, patients' range of motion became more symmetrical in both lateral flexion and rotation. Lateral flexion symmetry improved most in patients who reported no participation in organized sports/activities and whole-body activities, as opposed to those who play unilateral sports like volleyball and softball.

**Conclusions:** Our pilot study found that PSSE may limit curve progression and help to maintain/improve both radiographic and clinical outcomes in AIS patients. Additionally, participation in sport and organized activities, as well as the type of activity may influence PSSE outcomes.

**Significance:** Compared to the alternatives of uncomfortable bracing and surgery, PSSE is a promising treatment for AIS. Future research may investigate the novel examination of clinical outcomes such as range of motion.

**Acknowledgements:** Jennifer Mikami and Andras Bratincsak, MD; Hawaii Pacific Health Summer Student Research Program.

TOPIC: Concussion  
STUDY TYPE: Other

### **Concussion Risk in the NFL Based on Time of Season**

**Submitting Author/Presenter:** Alexis Coslick, DO, MS

Victoria Bergstein, BA and Ryan Roemmich, PhD

**Affiliation:** *Johns Hopkins University Baltimore, MD.*

**Purpose:** We hypothesize that the number of concussions would be higher later in the season.

**Methods and Study Design:** The open-access Pro Football Reference Database published by Sports Reference LLC was retrospectively reviewed recording concussions, demographics, and games played from the 2009 to 2010 to the 2019 to 2020 NFL seasons. We performed a repeated measures ANOVA with month as the within-subjects factor. We performed post-hoc pairwise comparisons using a Holm-Bonferroni correction for multiple comparisons.

**Results:** We observed a significant main effect of Month on the number of concussions recorded per game ( $F(4,40) = 25.87, P < 0.001$ ). When performing the post-hoc pairwise comparisons, we observed that there were significantly fewer concussions per game reported in games played in January or later when compared to all other months (all  $P < 0.001$ ). We also observed that there were significantly more concussions per game reported in games played in November when compared to both September ( $P = 0.035$ ) and October ( $P = 0.045$ ). There were no other statistically significant pairwise comparisons.

**Conclusions:** After controlling for demographics and games played, the incidence of concussion was highest in November and the lowest in January during the NFL seasons.

**Significance:** It is important to study risk factors that could predispose players to concussion and implement changes. Understanding that time in the season poses an increased risk, measures can be taken to minimize the risk.

TOPIC: Pediatrics

STUDY TYPE: Other

### Identifying Sport and Demographic Trends in Follow-up among Pediatric Patients With Patellofemoral Pain Syndrome

**Submitting Author/Presenter:** Logen Breehl, DO

Carey Wagoner, DO, Paige Daily, MD, Neil McNinch, MS, RN, PSTAT, and John C. Wigal II, DO

*Affiliation:* Akron Children's Hospital-Akron, Ohio.

**Purpose:** To find the percentage of patients diagnosed with patellofemoral pain syndrome (PFP) at Akron Children's Sports Medicine clinics that attend the follow-up visit. Secondary goals include identifying demographic or sports specific trends in follow-up that may affect compliance.

**Methods and Study Design:** Inclusion: Patients under 18 yo diagnosed with PFP or associated diagnoses by Sports Medicine from 2017 to 2022. Exclusion: Diagnosis made outside Sports Medicine, at follow-up, or follow-up completed >6 months later. Independent Samples *t*-test and  $\chi^2$  Test of Independence used to assess relationship to follow-up by age and number of sports played, demographic, sports, and clinical information.

**Results:** A total of 691 cases met inclusion criteria. 66.8% of these patients were female and 33.2% were male. 64.0% of patients completed follow-up visits. 41.7% of males and 33.2% of females did not follow-up, which was significant (*P*-value 0.027). There were no significant differences found between the age, number of sports played, or year of study by follow-up (*P*-value = 0.049, 0.689, & 0.338). Football was the only sport with significantly higher rate of follow-up (*P* value: 0.030). Interventions provided: 86.7% of patients referred to physical therapy (PT), 7.3% received a home exercise program (HEP) only, and 6.1% received other interventions, most commonly bracing completed in isolation without HEP or PT. There was a significant association between intervention and follow-up: 66.9% of those in the PT group, 48.0% in the HEP group, and 41.5% in the other group completed follow-up respectively (*P*-value < 0.001).

**Conclusions:** Our study found statistically significant differences in follow-up based on sex and type of interventions used. Football athletes were also noted to follow-up more frequently than other athletes. The majority of patients received a HEP or PT referral which also coincides well with current practice recommendations.

**Significance:** This study provided data to identify patients that are less likely to follow-up. It is a start to future studies involving interventions to improve follow-up. This study could be replicated at other clinics to help target their patient population.

**Acknowledgements:** Akron Children's Hospital Sports Medicine Department, Rebecca D. Considine Research Institute Akron Children's Hospital.

TOPIC: Other

STUDY TYPE: Cohort

### Concordance of Patient Perceived Sports Bra Size With Objective Measurement

**Submitting Author/Presenter:** Katherine Rizzone, MD, MPH  
Elaine Xu, BS, Michael Maloney, MD, Rebecca Grant, PhD, Sarah Lesko, MD, Bianca Edison, MD, MS, and Courtney Jones, MPH, PhD

*Affiliation:* University of Rochester Medical Center.

**Purpose:** Sports bras are an essential piece of sporting equipment for women to participate in physical activity. Bra fit appropriateness/accuracy has not been previously studied in an American or adolescent population. Our hypothesis was that most women and girls are not wearing appropriately fitting bras.

**Methods and Study Design:** This was a cross-sectional study of women and girls ages 11 to 64 who were seen in the University of Rochester Medical Center's Department of Orthopaedics. Participants self-reported their bra size and then underwent bra size measurement using a uniform method to obtain band and bust size to calculate cup size. Statistical analyses were performed to assess for concordance.

**Results:** There were 69 participants in the cohort. Mean age was  $22.5 \pm 12.4$  years and 88.4% were white. The most commonly self-reported band size was 34 (36.2%), cup size B (32.2%) and the most commonly reported comprehensive bra size was 34A (20.7%). The most commonly measured band size was 34 (37.7%), cup size C (24.6%) and the most commonly measured comprehensive size was 34B (17.4%). Of the 58 reported band sizes, 56.9% did not match the objectively measured band size, with 87.9% of discordance being underestimations. Of the 59 reported cup sizes, 44.1% did not match the objectively measured cup size, with 61.5% of discordance being overestimations. For cup and band size combined, there was 58.1% discordance between self-reported and objective measurements. Of the 64 reported sports bra sizes, 56.3% did not match the objectively measured size. Concordance did not significantly differ based on bra cup size, body mass index, or Area of Deprivation Index. Women who correctly identified their cup size were older ( $25.6 \pm 14.27$ ) than those who did not ( $19.7 \pm 9.8$ ) (*P* = 0.054).

**Conclusions:** Our results show that there is a large discordance between self-reported and objectively measured sports bra size. Women tend to underestimate band size and overestimate cup size, which parallels societal standards for the ideal body type. Next steps are to purposefully recruit a more representative cohort to better reflect the demographics of American women and compare data in athletes versus non-athletes and obese and non-obese women.

**Significance:** Improper bra fit may prevent women from comfortably participating in activity. This may be an important contributor to the noted gender disparities in activity and obesity. This is an area of sports medicine that must be researched further.

**Acknowledgements:** URSMD OME clinical research training grant.

TOPIC: Running  
STUDY TYPE: Other

### A Retrospective Research Study of a Marathon Runner With Hip Pain

**Submitting Author/Presenter:** Alex James, BS, MD  
Mohammad Jamali, PT, DPT, OCS

*Affiliation:* Landmark Medical Center, Woonsocket, RI.

**Purpose:** The objectives are to delineate the process of differential diagnosis in runners who present with lateral hip pain, to discuss the role of orthobiologic treatment in management of intra-articular hip pathologies, and to elaborate on the role of interdisciplinary management of runner's hip pain.

**Methods and Study Design:** This study was a retrospective single subject study. No IRB approval was required. Hip Disability and Osteoarthritis Outcome Score (HOOS), the Global Rating of Change Score (GROC), and Numerical Pain Rating Scale (NPRS) were used to document patient outcomes.

**Results:** A 40+ male runner who was training for the Boston Marathon, was referred by PCP with greater trochanter pain 12 months prior to his race. Home stretches and massage were not effective. Patient denied groin or low back pain. MRA of the hip demonstrates degenerative tearing of the labrum with superior lateral cartilage defect. Proposed treatments were platelet-rich plasma (PRP), bone marrow aspirate concentrate (BMAC) and micro fragmented adipose injection (MFAT). Patient was treated with PRP injection and was able to reach his goal.

**Conclusions:** Hip pathologies in runners can encompass extra-articular (tendonitis, bursitis) and/or intra-articular (labral tear, chondral lesions). This patient presented with lateral hip pain (7/10) for 10 months which was initially perceived to be extra-articular. Multimodal interventions including lengthy physical therapy consisting of blood flow restriction (BFR), underwater treadmill walking, neuromuscular re education were incorporated for the patient

**Significance:** When runners present with a hip pain that does not respond to first line treatment, a differential diagnosis of intra-articular pathology must be considered. Often, both extra and intra-articular findings underlie the patient's complaint.

**Acknowledgements:** The authors received no financial support for this study.

TOPIC: Musculoskeletal  
STUDY TYPE: Survey

### Hemoglobin A1c Thresholds Among Physicians Relative to Large Joint Corticosteroid Injections

**Submitting Author/Presenter:** Molly McDermott, DO  
Matthew Kampert, DO

*Affiliation:* Cleveland Clinic, Cleveland, OH.

**Purpose:** The purpose of this research is to identify the difference among physicians at the Cleveland Clinic trained to perform large joint corticosteroid injections based on a patient with diabetes mellitus' hemoglobin A1c.

**Methods and Study Design:** Providers from the Cleveland Clinic were selected as the sample population in the departments of Orthopaedics/Sports Medicine, Family Medicine, Internal Medicine, and Endocrinology. An email was sent to

the Cleveland Clinic email address once weekly for 3 weeks from January to February 2023 of each participant with a 7-question anonymous, voluntary survey.

**Results:** Initially sent to 611 providers, the survey was narrowed down to 609 due to 2 email domain errors. Response rate increased from 118 (19.4%) after week 1 to 177 (29.1%) following week 3. Of the 177, the majority of providers were Orthopaedics/Sports Medicine (73, 41.2%) followed by Internal Medicine (38, 21.5%), Family Medicine (31, 17.5%), Endocrinology (29, 16.4%), and Other (6, 3.4%). For the purpose of comparison, departments were further collapsed into 2 groups: Orthopedics/Sports Medicine and Other. The median hemoglobin A1c for the Orthopedics/Sports Medicine is 8.0%, which is the same as the median A1c level for Other. There are no statistically significant differences in A1c level between them. Of the 177 participants that responded, 140 provided responses as to why that was the target hemoglobin A1c selected. The qualitative data collected as part of the survey fit into 12 categories with the risk of hyperglycemia and its potential complications being the largest category.

**Conclusions:** While a hemoglobin A1c of 8.0 is the preferred target of the majority of Cleveland Clinic physicians in this survey, more research is needed to prove this is a safe goal for patients with diabetes mellitus for their short and long-term health outcomes.

**Significance:** As a pilot study, it can inform future studies with use of continuous glucose monitors to assess the degree of elevation in blood glucose levels following a large joint injection transiently as well as long-term in patients with diabetes mellitus.

**Acknowledgements:** I would like to acknowledge Matthew Kampert DO (research mentor), Richard Figler MD and Kurt Spindler MD (for their contribution and mentorship), Melissa Biacci and Robert Hartley (REDCap management), Chao Zhang (statistician), and lastly Jennifer Baldwin.

TOPIC: Concussion  
STUDY TYPE: Cohort

### Compliance of a NCAA D1 University's Concussion Management Plan With the 2023 NCAA Concussion Safety

**Submitting Author/Presenter:** Chris Hong, DO

Luis Crespo, MD, Iridi Pavliqoti, MD, and Amanda Philips, MD

*Affiliation:* LSU HSC, Lafayette, Louisiana.

**Purpose:** To examine a NCAA Division I university's Concussion Management Plan (CMP) for compliance with the new 2023 NCAA updated Concussion Safety Protocol Checklist (CSPC) in an effort to identify deficiencies in protocols, policies, and documentation in student athlete charts.

**Methods and Study Design:** Medical records of all student athletes who experienced concussions during the 2022 to 2023 spring & fall academic year were reviewed for compliance with the 50 components of the new 2023 NCAA CSPC. The overall compliance rate including item and category-level compliance was assessed and compared by demographic information.

**Results:** Compliance rates per category of the 2023 NCAA CSPC: Pre-Season Education 90.2% (120/133), Pre-

Participation Assessment 36.8% (42/114), Recognition & Diagnosis of Concussion 73.7% (112/152), Initial Suspected Concussion Evaluation 86.8% (99/114), Concussion Emergency Action Plan 0% (0/19), Off-Field Same-Day & Up To 3-Day Post-Concussion Management 34.2% (13/38), Subacute Management 0% (0/38), Rest & Exercise 94.7% (36/38), Re-Evaluation Plan 0% (0/19), Return-To-Learn 11.8% (18/152), Return-To-Sport 25.2% (48/190) & Reducing Head Impact Exposure 0% (0/19). The overall compliance rate for all categories was 47.6% (488/1026). None of the categories achieved a 100% compliance rate, with the lowest rates associated with Concussion Emergency Action Plan, Subacute Management, Re-Evaluation Plan, and Reducing Head Impact Exposure. None of the athletic teams achieved a 100% compliance rate, with soccer having the lowest rates.

**Conclusions:** Overall compliance rate and category-level compliance with the 2023 NCAA CSPC requirements were low, and there is opportunity for current CMP protocols, policies, and documentation to be updated to obtain compliance with the new 2023 NCAA CSPC updates.

**Significance:** The findings of this study will be used to update the university's CMP documents for compliance with the 2023 NCAA CSPC.

**Acknowledgements:** Sincere appreciation to the staff and faculty of the LSU HSC Sports Medicine Program, with special thanks to Dr. Amanda Philips, our program director, and Iridi Pavliqoti, our dedicated faculty member, for their invaluable guidance and support in the deve.

TOPIC: Musculoskeletal

STUDY TYPE: Cohort

### Patient Demographics Does Not Correlate With Patient Reported Quality of Knee and Hip Osteoarthritis

**Submitting Author/Presenter:** Jane Jurayj, BA

Benjamin Ricciardi, MA, Caroline Thirukumaran, MBBS, MHA, PhD, Kathryn Miller, MD, Courtney Jones, PhD, MPH, and Katherine Rizzone, MD, MPH

**Affiliation:** University of Rochester School of Medicine and Dentistry, Rochester, NY.

**Purpose:** To assess patient-reported quality of osteoarthritis (OA) care using the OsteoArthritis Quality Indicator (OA-QI) and explore associated clinical and demographic factors for appropriate OA management. Our findings were compared to standard recommendations for OA care.

**Methods and Study Design:** Participants were recruited from clinics in an academic orthopaedics department. Adults over 22 years with knee or hip arthritis completed the OA-QI in clinic to assess quality of non-surgical OA care (medications, recommendations for lifestyle changes, referrals) and demographic/clinical variables were extracted from the chart. The primary outcome was OA-QI score, which is out of 100 points.

**Results:** There were 107 participants, with a mean age of 68, mean BMI 32, 65% female, 11% BIPOC, 7 % new patients, 30% private payer. Two sample *t*-tests comparing mean OA-QI scores did not show significant differences in means when examined by gender, race, ethnicity, Area Deprivation Index (ADI), previous injury to the joint or surgery to the joint. OA-QI scores for new patients ( $M = 60.6$ ,  $SD = 22.06$ ) were significantly lower than OA-QI scores for

returning patients ( $M = 74.03$ ,  $SD = 14.61$ ) ( $P = 0.03$ ). OA-QI scores were significantly lower in participants that were referred to surgery ( $M = 68.0$ ,  $SD = 17.93$ ) than participants who were not referred ( $M = 75.2$ ,  $SD = 13.87$ ) ( $P = 0.05$ ). BMI and new patient status were independent predictors of OA-QI score after adjustment for age and CCI. For every one-point increase in BMI, the OA-QI score increased by 0.422 ( $P = 0.04$ ), and being a new patient was associated with a 13.21 decrease in OA-QI score compared to being a return patient ( $P = 0.02$ ).

**Conclusions:** Patient reported OA care received varied by certain factors. Returning patients and heavier patients received greater quality of care, but care did not show gender, racial, or area deprivation disparities. While the lower pass rates in new patients can be explained by fewer opportunities to receive OA education and care, they point to a need to cover basic principles of OA progression early on in the OA care pathway.

**Significance:** Despite existing guidelines for OA management, patient reported quality of the OA information received was variable, and subpopulations of patients may receive substandard care. Future steps need to continue to examine and address these disparities.

**Acknowledgements:** University of Rochester Clinical and Translational Research Summer Award.

TOPIC: Concussion

STUDY TYPE: Survey

### Pilot Project: Incidence of Concussions in the Division III Fall Sports Collegiate Athletes With Depressive Symptomatology

**Submitting Author/Presenter:** Alexander Porter, DO

Lin Shen, DO

**Affiliation:** WellSpan Health Primary Care Sports Medicine Fellowship.

**Purpose:** Screen collegiate athletes to determine if depressive symptomatology correlates with an increased incidence of concussions. Mental health plays a role in the athlete's ability to recover<sup>1</sup>, but the literature has not looked at the athletes' depressive symptomatology prior to concussion.

**Methods and Study Design:** PHQ-9 was sent to all Fall sport athletes using REDCap, and 40 athletes responded. 8% of the responding athletes screened positive for depressive symptomatology. Two hundred eighty-two athletes were tracked throughout the season for the development of concussions. Diagnosed by the team physician evaluation with SCAT5, impact testing, and Sway.

**Results:** Depressive symptomatology showed no correlation with the incidence of concussion. Over the 2023 fall season, 15 sports-related concussions occurred with 17,878 athlete exposures (AE) (8.4 per 10,000 AE and 9.45 per 10,000 athlete-at-risk (AAR)). Among all men's and women's contact sports, men's football had the highest incidence of concussions (12.9 per 10,000 AE and 14.6 per 10,000 AAR). For non-contact sports, cheer had the highest incidence of concussions (39.7 per 10,000 AE). Four student athletes completed the survey and also developed concussions. The data did not support a strong linear correlation between return to sport and depressive symptomatology. Of the athletes that developed a sports-related concussion,

2 athletes did not recover from the concussions by the end of the season, and no athlete had a repeated concussion during the season.

**Conclusions:** The study failed to find an association between depressive symptomatology and the incidence of concussion. Prolonged return to play, previously identified in persons with a pre-existing mental health diagnosis, was not seen in the study. Future research can explore the use of the Sport Mental Health Assessment Tool to investigate other mental health diagnoses and if it makes athletes more susceptible to sports-related concussions.

**Significance:** Depressive symptomatology did not present an increased risk for concussions. Athletes with depression can be encouraged to participate in sports. Future research can evaluate if other mental health diagnoses increase the risk of concussion.

**Acknowledgements:** WellSpan Health research support from the librarian, Melissa Noel, and Ted Bell, the statistician. Gettysburg College athletic trainers, Mike Cantle and Shelby Sherman, helped with the collection of data. 1. Iverson, GL, et al. Systematic Review.

TOPIC: Musculoskeletal  
STUDY TYPE: Cohort

## The Efficacy of Ultrasound-Guided Nerve Blocks and Hydrodissections in Patients With Saphenous Neuralgia

**Submitting Author/Presenter:** Kari J. Rezac, DO

Daniel C. Herman, MD, PhD

*Affiliation: University of California, Davis, Sacramento, California.*

**Purpose:** There is currently a lack of data regarding treatment options and success rates for saphenous neuralgia. The purpose of this study was to evaluate the efficacy of ultrasound-guided nerve blocks and hydrodissections as treatments, as well as the factors associated with therapeutic success.

**Methods and Study Design:** This was a prospective cohort study. N = 35 knees (31 patients) with saphenous neuralgia confirmed by nerve block at Hunter's Canal were included. Cases with recurrent pain after the block underwent nerve hydrodissection. Analyses of response rates and comparisons on the basis of patient characteristics between treatment groups using t, Mann-Whitney-U, and  $\chi^2$  tests ( $\alpha = 0.05$ ) were conducted.

**Results:** 65.7% of cases experienced pain relief from the initial diagnostic nerve block without subsequent return of pain or the need for any further treatment. 12 knees (34.3%) had temporary relief (Mean  $\pm$  SD =  $3.9 \pm 2.7$  weeks). Of those experiencing recurrence, 91.7% found sustained relief ( $>80\%$  improvement lasting  $>6$  months) after hydrodissection. Three had subsequent recurrence after 6 months; these cases responded to repeat hydrodissections. There were no differences between cases responding to the initial block vs those needing hydrodissection by age ( $42.3 \pm 21.5$  vs  $35.4 \pm 20.7$  years,  $P = 0.369$ ), female sex (87.0% vs 75%,  $P = 0.373$ ), BMI (26.8 IQR 20.0-33.7 vs 30.1 IQR 25.2-33.9 kg/m<sup>2</sup>,  $P = 0.151$ ), pain levels (8 IQR 6-9 vs 8.5 IQR 7-9,  $P =$

0.310), or presence of distal leg symptoms (43.8% vs 66.7%,  $P = 0.861$ ) or a positive Hunter's Canal squeeze test (73.9% vs 91.7%,  $P = 0.213$ ). A greater percentage of patients requiring hydrodissection (71.4% vs 9.5%,  $P = 0.021$ ) were found to have neuropathic pain on exam.

**Conclusions:** Ultrasound-guided nerve blocks and hydrodissections are very effective treatments for patients with saphenous neuralgia. Therapeutic success with the initial nerve block was high across a range of patient characteristics including age, sex, BMI, pain levels, distal leg symptoms, and presence of a positive Hunter's Canal squeeze test, but patients with neuropathic pain on examination were more likely to require progression to hydrodissections.

**Significance:** This study enhances our knowledge regarding treatments for saphenous neuralgia. Additional research is needed to help identify patients with this condition early in their management given the efficacy of nerve blocks and hydrodissections.

TOPIC: Other  
STUDY TYPE: RCT

## Socktober Fest

**Submitting Author/Presenter:** Davis Mills, DO, MBA

Thomas Bell, MD and Luci Olewinski, MD

*Affiliation: University of Tennessee Medical Center, Knoxville, TN.*

**Purpose:** Sock Doping is a cultural belief, mainly among road cyclists, that wearing brightly colored or patterned socks confers a performance advantage. The goal of this study is to see if sock doping or belief in sock doping confers an advantage in completion of a hill climb time trial.

**Methods and Study Design:** Experienced (self-identified) cyclists completed 2 best-effort time trials on their own bicycles randomized to plain (white or kit congruent) socks or doped socks (brightly patterned or kit non-congruent) worn first/second. Belief in the sock doping was assessed. All riders felt their doped socks met criteria for sock doping regardless of their belief in a performance benefit.

**Results:** Of 9 riders, 5 believed in sock doping and 4 did not. Average time for the first vs second trial (T1, T2) up Sherrod Road, a 640-meter featured climb in the 2017 to 2023 USA Cycling Road Race National Championships (average gradient of 9.7%, max gradient of 17.8%) was 207.1 s vs 209.4 s. Three riders had a faster time on T2. Riders who believed in sock doping had similar times in doped (D) v plain (P) socks, T1D: 222.1s (58.5) v T1P 223.6s (30.1) ( $P = 0.978$ ); T2D 226.3s (54.7) v T2P 217.8s (40.4) ( $P = 0.865$ ) (independent 2-sample t-test,  $\alpha 0.05$ ). Three of the 5 believers were faster in doped socks; 3 of 4 non-believers were faster in plain socks independent of T1 v T2. An ad hoc assessment of benefit of plain socks for non-believers was not done as we had not asked if riders believed their plain socks were plain. Riders that believed (b) in sock doping had slower times (non-believe = nb), T1b 222.8s (44.0) v T1nb 187.6s (46.3) ( $P = 0.282$ ); T2b 222.9s (43.9) v T2nb 192.7s (32.8) ( $P = 0.292$ ).

**Conclusions:** Sock doping did not confer a performance advantage for believers or non-believers. While 60% of

believers had a faster time in doped socks, the difference was not statistically significant. Repeating our study with a larger sample size will help better explore these associations and clarify the trend of believers having slower times. A small refinement of the study could explore the converse benefit of plain socks for nonbelievers.

**Significance:** In our small sample size neither sock doping nor belief in sock doping while wearing doped socks results in a performance advantage in short hill climb time trial.

TOPIC: Ultrasound  
STUDY TYPE: Survey

### Ultrasound Utilization in Rib BSI

**Submitting Author/Presenter:** Danielle Magrini, DO

*Affiliation: The Orlin & Cohen Orthopedic Group at Northwell Long Island, NY.*

**Purpose:** The diagnosis of bones stress injury can be a challenge. Rib injuries in rowers are a major source of disability and lost time from training. If a rib stress injury is suspected a lack of consensus exists on imaging modalities utilized. Ultrasound is a novel imaging modality that is gaining momentum.

**Methods and Study Design:** The design of this project was a redcap survey, approved by the AMSSM research committee and distributed through the AMSSM membership via an email blast. A series of questions to familiarize the author on which AMSSM members used US in practice and if they evaluated for BSI. Also what athletes presented with cc: BSI and how did AMSSM work up the pain through various imaging modalities.

**Results:** The survey subjects were on average 9.75 years post fellowship. Seventy-two percent of respondents were formally US trained during fellowship and 100% utilize US as part of their clinical practice. The majority of respondents treat a pediatric through adult population. 74% (n = 118) of respondents utilize US to assess bony pathology and 73% of those 118 used it to assess for BSI. The overwhelming majority of respondents treated rib pain in athletes with 51% thinking rib pain was not a diagnostic challenge while 48% felt that it was very challenging. 55% of respondents did not treat rowers. Aside from rowers, rib pain was noted in a majority of other sports with baseball (49%) football (69%) and weight lifters (46%) being the top 3 to succumb. When it comes to the workup, in a descending order of preference, respondents relied on: X-ray (104, 70.7%), MRI, (98, 66.7%), Ultrasound (53, 36.1%), CT (34, 23.1%), Bone scan, (32, 21.8%), other (please list) (1, 0.7%) 90% of those using US did not have a protocol.

**Conclusions:** In conclusion, rib BSI is a possible career ending injury at the elite crew level with an incidence reported anywhere from 6 to 22%. Diagnosis can be a challenge; early diagnosis possibly reducing the amount of water time lost. AMSSM members typically utilize US in practice. Many use US to deduce if BSI could be present; but many also rely on other modalities. Very few implement an algorithm/standard protocol for workup.

**Significance:** In a time when US is widely used by PCSM physicians and rib BSI can be a challenging diagnosis, a validated rib scanning protocol for AMSSM members seems needed and achievable. This in turn could lead to a more prompt diagnosis and treatment plan.

**Acknowledgements:** A very special thanks to PRISM RIG members from BSI and MSK US.

TOPIC: Pediatrics  
STUDY TYPE: Other

### Factors Influencing Bicycle Use Amongst Youth

**Submitting Author/Presenter:** Howard Sanders, MD, MS

Kyle Nagle, MD, MPH and Jennifer Rosenthal, MD, MAS  
*Affiliation: University of Washington and Seattle Children's Hospital, Seattle, WA.*

**Purpose:** To identify factors influencing bicycle use amongst children.

**Methods and Study Design:** This was a qualitative interview study of parents/guardians of children aged 4 to 18 years who presented to a UC Davis clinic or were at UC Davis Medical Center. Topics included bicycle access, barriers to use, caregiver concerns, and perceived benefits of cycling. Interviews were recorded, transcribed, and content analysis was performed using an inductive coding scheme with Atlas.ti software.

**Results:** Interviews were conducted until thematic saturation was reached—20 in total. Eighty-five percent reported that their children had regular access to a bicycle. Two cited cost as a barrier to bicycle access. The reported income in one of these interviews was less than \$15,000 USD per year, and income was unreported in the other. Eighty-five percent reported that their children could ride a bicycle. One did not learn because the child expressed a preference for riding a scooter, and the other 2 had differences in physical abilities. The most cited barriers to increased bicycle riding were lack of proximity to a safe riding location, limited time, the need for supervision, and child physical abilities. Car safety and self-inflicted injury were the most cited concerns with regards to children and bicycle riding, in which each were mentioned in half of the interviews. With regards to perceived benefits of cycling, 11 different benefits were cited, and the most cited benefit was exercise.

**Conclusions:** This study was conducted due to the current lack of research into barriers that exist to bicycle access and use amongst children and youth. Given the well-documented benefits of cycling, it is important to understand these barriers so that efforts can be directed to address them. This study revealed that the most cited barriers to increased bicycle riding was proximity to a safe riding location, limited time, and the need for supervision.

**Significance:** Findings in this study reveal that the built environment and infrastructural planning may play a significant role in encouraging and/or suppressing bicycle use amongst children and highlights the need for further inquiry into this subject.

**Acknowledgements:** I would like to thank my mentors Jen Rosenthal, MD, MAS at UC Davis and Kyle Nagle, MD, MPH at UW/Seattle Children's Hospital.

TOPIC: Training  
STUDY TYPE: Other

### From Theory to Practice: Renewed Support for Menstrual Phase Periodization

**Submitting Author/Presenter:** Nikia Evans, MS



Melissa Novak, DO and Connor Evans, BS

*Affiliation: Oregon Health & Science University, Portland, Oregon.*

**Purpose:** The aim of this scoping review is to synthesize emerging research on menstrual phase-specific interventions in female athletes, identifying common themes and gaps. Additionally, we propose a practical protocol, offering an updated guide for practitioners and laying the foundation for future research.

**Methods and Study Design:** Our process followed an established 5-step scoping review process published by the Journal of Graduate Medical Education. A search of PubMed and SportDiscuss electronic databases identified 523 relevant publications, of which 184 met screening criteria for final inclusion and data extraction. Thematic analysis was utilized to synthesize patterns across diverse methodologies.

**Results:** Amid significant methodological variability, common themes included training interventions with diverse and conflicting results, likely influenced by oxidative stress and phase-specific physiological adaptations, promising trends for nutritional intervention, and limited study of sleep patterns warranting further exploration. A few best practices based on the available literature, and included in our protocol, are broadly summarized below. Female athletes of reproductive age should track hormonal status against training and recovery to determine individual patterns and needs. Female athletes, coaches, and their families should consider: (1) Focusing more on higher volume and intensity during the early follicular phase and around ovulation and more on recovery during the late luteal phase and menstruation. (2) Increasing the consumption of carbohydrates, protein, and hydrating fluids during the luteal phase. 3) Supplementing for better quality of sleep during the menstrual phase.

**Conclusions:** Despite a lack in standardized methodologies and significant current gaps in knowledge, practitioners can feel encouraged by the recent surge in research focused on the female athlete. Best practices, grounded in available literature, emphasize the need for personalized diet, training, and recovery strategies across menstrual phases. This framework supports practitioners to better understand the evolving evidence and biological systems at play.

**Significance:** In an era where teams and individual elite athletes now routinely personalize periodization based on nearly ubiquitous wearable technologies, reevaluation of the impact of female hormones is long overdue. Not only for performance, but health as well!

**Acknowledgements:** Gratitude is extended to the dozens of enthusiastic female athletes who have expressed interest and excitement in participating in ongoing and future studies, contributing significantly to the advancement of knowledge in this field! Special thanks to Oreg

TOPIC: Education

STUDY TYPE: Cohort

## Creating a Family Medicine Sports Medicine Curriculum Using Simulation

**Submitting Author/Presenter:** Benjamin Oliver, MD  
Dustin Marshall, MD and Jeffrey Wisinski, DO

*Affiliation: Prisma Health Midlands, Family Medicine Residency, University of South Carolina School of Medicine, Columbia, SC.*

**Purpose:** The purpose of this study was to determine whether incorporating a simulated standardized patient curriculum into a didactic curriculum increased the competency and comfort level of family medicine residents with sports medicine and musculoskeletal conditions.

**Methods and Study Design:** This study was an observational cohort study. Current family medicine residents took a pre-test with questions taken from the MSK 30 Competency Test. Residents then completed a simulation that included 3 standardized patients presenting with common conditions during a sports PPE. Residents took the competency test again 1 to 3 days later and were asked for feedback about the teaching method.

**Results:** There were 15 participants in the study, with 10 completing the pre- and posttest. The participants who dropped out had to either leave the simulation early or were unable to complete the post test. Though the sample was small, the Shapiro Wilk test for normality suggested a normal distribution between test answers. The results showed a statistically significant improvement in mean score averages from 48% to 70% ( $P = 0.012$ ) and median score averages improved from 60 to 80 % ( $P = 0.027$ ) post intervention. When assessing individual questions, using the Fischer's Exact test, the questions focused on exam findings showed significant improvement after intervention with 10 % correct to 80 % correct ( $P = 0.006$ ). The rest of the questions showed either no change or better, but the results were not statistically significant. Participant feedback stated that the standardized patient simulation was enjoyable and a great way to learn.

**Conclusions:** This study supports previous research showing that family medicine residents underperform in sports medicine. While our study population was small, the statistically significant improvement on test scores supports the impact of simulation on education. Residents reported that this was an effective and enjoyable way to learn. Future research could include a larger population and evaluate in-training exam scores to better establish efficacy.

**Significance:** This study could help improve musculoskeletal education in primary care residencies as well as improve the baseline musculoskeletal/sports medicine competency of physicians prior to entering sports medicine fellowship.

TOPIC: Concussion

STUDY TYPE: Case-Control

## The Clinical Utility and Future Applicability of Salivary MicroRNA in Concussion Management

**Submitting Author/Presenter:** Kyle Plante, MD, MPH

Mohammad Haider, MD, PhD, John Leddy, MD, FACS, FACP, FAMSSM, Praveen Arany, DDS, PhD, and Haley Chizuk, PhD, MS, ATC

*Affiliation: UBMD Orthopaedics and Sports Medicine, Jacobs School of Medicine and Biomedical Sciences, University at Buffalo, Buffalo, NY.*

**Purpose:** The diagnosis and management of sport-related concussion (SRC) rely on subjective measures. Objective biomarkers, such as microRNA (miRNA), may improve the diagnosis and treatment of SRC. We assessed the modulation of miRNA throughout concussion recovery during an aerobic exercise intervention.

**Methods and Study Design:** Athletes with acute SRC ( $n = 32$ , 66% male,  $15.6 \pm 1.4$  y) and healthy controls ( $n = 28$ ,

66% male,  $16.0 \pm 1.6$  y) provided saliva samples and completed standard clinical exams weekly (Day 0, 7 and 14). Participants were randomly prescribed aerobic exercise at high (5 days/wk, 30 min) or low volumes (3 days/wk, 20 min). A panel of 12 pre-identified miRNAs was assessed with an RT-qPCR (Bio-Rad).

**Results:** Concussed and control participants had no demographic differences. Five participants were lost to follow up and 6 did not provide exercise intervention data. Sample quality was deemed acceptable because all samples showed high expression of the control miRNA, 16-5p. Acutely concussed patients had lower expression of miRNA 532-5p, 1246, 944, 30e-3p, 151a-3p, and 26b-5p ( $P < 0.05$ ). Over the study period, the expression of 30e-3p increased in the concussed group compared with controls ( $P = 0.047$ ). Concussed and control participants showed increased expression of miRNA 7-1-3p ( $P = 0.020$ ) independent of exercise volume ( $P = 0.091$ ). Males had a higher expression of miRNA 532-5p, 30e-3p, and 151a-5p ( $P < 0.05$ ). Increased exercise volume was associated with an increased expression of miRNA182-5p ( $P = 0.032$ ,  $r^2 = 0.102$ ).

**Conclusions:** Several miRNAs showed associations with concussion. These miRNAs did not modulate over time, regardless of recovery, consistent with reports that physiological dysfunction persists beyond clinical recovery from SRC. miR-182-5p, associated with cardiovascular function, had a direct positive relationship with exercise volume. Additionally, sex differences were detected in specific salivary miRNAs that have significance for further research.

**Significance:** Our data suggest specific salivary miRNAs may have utility as biomarkers of SRC and recovery from SRC. As further evidence emerges about salivary biomarkers, saliva assessments may one day be a part of a clinician's concussion management toolbox.

**Acknowledgements:** Jaffer Sayeed, Alexander Rawlings.

TOPIC: Musculoskeletal

STUDY TYPE: Cohort

### Outcomes of Lower Extremity Muscle Tears Classified by BAMIC in American Football College Athletes

**Submitting Author/Presenter:** William Hollabaugh, MD

Claudia Davidson, MPH, Nicholas Strasser, MD, Lauren Porras, MD, Charles Cox, MD, MPH, and Robert Fitch, MD

**Affiliation:** Vanderbilt University Medical Center Department of Orthopaedic Surgery, Division of Sports Medicine.

**Purpose:** The British Athletics Muscle Injury Classification (BAMIC) may offer therapeutic and prognostic value superior to prior muscle tear classifications. As past studies are mostly in elite soccer or track and field athletes, the value of BAMIC in college and American football is unknown but pertinent.

**Methods and Study Design:** Prospective cohort study of American football college athletes who sustained a hamstring (HS) or quadriceps (QD) tear and underwent magnetic resonance imaging (MRI) of the affected muscle group at a single institution during the 2023 season. Clinical outcomes, specifically time to full return to play (TRTP) and re-injury rate (RIR), classified by BAMIC and injury characteristics were evaluated.

**Results:** There were 24 HS and 10 QD tears in 21 (17.3%) of the 121 active roster athletes (20 + 1.2 years; 100.0% male)

who met inclusion criteria. BAMIC muscle tears included: 0a (2), 1a (3), 1b (7), 2a (5), 2b (7), 2c (4), 3a (1), 3b (5). Most (89.3%) tears occurred prior to the season and all (100%) tears occurred in practice. Excluding grade 0 injuries ( $n = 1$ ) and athletes who suffered a re-injury prior to return to play, all injured athletes ( $n = 19$ ) missed 1 to 7 weeks of play with a median of 26 days (IQR = 17-31). The RIR was 19.0% (4/21). Most (75.0%) re-injuries occurred prior to return to play. There was no statistically significant relationship between BAMIC, injury grade or injury site with TRTP or RIR, although there was a trend towards increased TRTP for injury site "c" or intra-tendinous injuries compared to "a" and "b" injuries. Regression analyses revealed no significant differences between injury site or injury grade and TRTP or RIR when controlling for age or muscle group.

**Conclusions:** Activity-related HS and QD tears are common in American football college athletes, particularly in practice and preseason. Excluding BAMIC grade 0 injuries and athletes who suffered a re-injury prior to return to play, athletes missed about 3 to 4 games, irrespective of BAMIC, albeit with nearly 1 in 5 athletes suffering a re-injury. There was no statistically significant relationship between BAMIC or muscle group and TRTP or RIR.

**Significance:** This is the first appraisal of BAMIC in college and American football athletes. The high prevalence of muscle tears highlights the need for prevention. While BAMIC lacked value in this study, future studies should evaluate BAMIC in this population.

TOPIC: Rehabilitation

STUDY TYPE: Survey

### Intravenous Therapy Use in Elite European Adult Track and Field Athletes

**Submitting Author/Presenter:** Artemii Lazarev, MD

Georgiy Malyakin, MD, Ryland Morgans, PhD, Elizaveta Kapralova, MD, Evgeny Achkasov, MD, and Eduard Bezuglov, MD

**Affiliation:** Mount Sinai Hospital, Chicago, IL.

**Purpose:** to evaluate the incidence of intravenous therapy and to identify the most commonly used pharmacological substances among elite European endurance athletes.

**Methods and Study Design:** This cross-sectional study included 153 elite track and field athletes (age  $22.7 \pm 4.6$ , 94 males, 59 females), who completed an anonymous survey created on Google Forms. The athletes were divided into 3 groups: national ( $n = 80$ ), international ( $n = 61$ ), and extra ( $n = 12$ , medalists in the major international competitions) tiers.

**Results:** Fifty-seven percent ( $n = 84$ ) of respondents confirmed the use of intravenous pharmaceutical substances not prohibited by the World Anti-Doping Agency to enhance performance and optimize post-load recovery. 17.7% ( $n = 26$ ) of the athletes used them regularly in training process and 39.5% ( $n = 58$ ) only in preparation before major competitions. No statistically significant difference was found in the frequency of intravenous therapy practice between sexes ( $P = 0.14$ ) and tiers ( $P = 0.35$ ). The most commonly used substances were actovegin (46.4%), phosphocreatine (41.8%), amino acids (35.9%), reamberine (35.3%) and hepatoprotectants such as essentielle (35.9%) and hep-tral (28.7%).

**Conclusions:** The use of intravenous therapy among elite European track and field athletes is considerably high. Actovegin is the most commonly used substance. Most often, IV therapy is used in preparation before major competitions.

**Significance:** intravenous administration of the most commonly used substances can be performed without violating anti-doping rules. However, the possible risk of complications and the lack of evidence must be taken into account.

TOPIC: Pediatrics

STUDY TYPE: Other

### **Skeletal and Chronological Age Relationship in Young Soccer Players Prior to the Growth Spurt**

**Submitting Author/Presenter:** Artemii Lazarev, MD

Eduard Bezuglov, MD, Anton Emanov, Andrei Burlakov, Georgiy Malyakin, MD, Elizaveta Kapralova, MD, Vyacheslav Kolesnichenko, MD, and Ryland Morgans, MD

*Affiliation:* Mount Sinai Hospital, Chicago, IL.

**Purpose:** To correlate the relationship between skeletal and chronological age in soccer players from elite and sub-elite youth soccer academies and to assess any differences between competition standards before the growth spurt.

**Methods and Study Design:** This cross-sectional study involved 51 elite (age  $139 \pm 5.8$  months, height  $152.2 \pm 12.8$  cm, weight  $41.0 \pm 12.8$  kg, BMI  $17.6 \pm 3.7$  km/m<sup>2</sup>) and 103 sub-elite (age  $140 \pm 6.8$  months, height  $150.2 \pm 14.2$  cm, weight  $39.9 \pm 12.5$  kg, BMI  $17.5 \pm 3.8$  km/m<sup>2</sup>) youth soccer academy players. Anthropometric measurements, somatic maturity status (Khamis-Roche formula), and skeletal age were calculated.

**Results:** Chronological age, weight, and height were comparable across both groups. Skeletal age in both elite and sub-elite groups was significantly higher than chronological age ( $146 \pm 11.7$  months,  $P = 0.037$  and  $142 \pm 12.1$  months,  $P = 0.042$  respectively). Moreover, skeletal age was significantly higher in elite than sub-elite players ( $P = 0.031$ ). The somatic maturity status was higher in the elite group of soccer players when compared with the sub-elite group ( $81.6 \pm 2.5$  % and  $80.4 \pm 2.7$  %, respectively,  $P = 0.014$ ).

**Conclusions:** The skeletal age of young soccer players from elite and sub-elite youth academies is significantly higher than the chronological age before the growth spurt. Elite players demonstrated higher skeletal age and somatic maturity than sub-elite players.

**Significance:** Selection process in the youth soccer continues to be based on maturation status both prior and during the growth spurt. It can be explained by previously proven influence of somatic maturity status on physical qualities and sports-specific skills.

TOPIC: Musculoskeletal

STUDY TYPE: Other

### **Everything but the Kitchen Sink: A Case Series for Treatment of Adhesive Capsulitis of the Shoulder**

**Submitting Author/Presenter:** Sean Bradley, MD

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*Affiliation:* Ochsner Andrews Sport Medicine Institute, Baton Rouge, LA.

**Purpose:** The purpose of this study is to examine the potential effectiveness of combined treatment of suprascapular nerve block, glenohumeral hydro dilation with corticosteroid, and immediate manual therapy for adhesive capsulitis of the shoulder.

**Methods and Study Design:** This retrospective case series examined patients treated for adhesive capsulitis between January 2021 and September 2023. Eligibility criteria included patients aged 18+, diagnosed with AC, and underwent PT at the primary institution. A standardized post-procedure protocol was followed for all patients. End points collected included DASH, VAS pain, ROM measurements, and days until PT discharge.

**Results:** Average Age 52, Majority female with 40% diabetes mellitus. A total of 35 patients were included in this study. Pre-procedure ROM revealed mean flexion of 107.5 degrees, abduction 97.5 degrees, External rotation (ER) 35.4 degrees, and internal rotation (IR) 38.9 degrees. Post-procedure measurements showed improvements in ROM with mean flexion measuring 138.2 degrees, abduction 118.3 degrees, ER 60 degrees, and IR 52.7 degrees. Post-PT ROM improved to a mean flexion of 155 degrees, abduction 146.7 degrees, ER 70.8 degrees, and IR 60.3 degrees. All ROM improvements were statistically significant,  $P < 0.05$ . Pain scores decreased from pre-procedure to PT-discharge by 50 percent on VAS from 4.6 to 2.3,  $P < 0.001$ . Number of physician visits 2.13 with 10 visits, with PT before discharge. Just over 2 months average from time of procedure to PT discharge.

**Conclusions:** The combination of suprascapular nerve block, glenohumeral hydro dilation with corticosteroid and immediate manual therapy is very effective treatment for adhesive capsulitis of the shoulder. This procedure should be considered more often for patients due to its effectiveness.

**Significance:** This review sets the stage for future studies comparing the effectiveness of combination therapies compared to the historic gold standards such as a simple intra-articular cortisone injection.

**Acknowledgements:** Dr. Jason Genin and Dr. Dominic King for their education in fellowship on this treatment model.

TOPIC: Pediatrics

STUDY TYPE: RCT

### **Comparison of Home Exercise Programs for Children and Adolescents With Lower Extremity Apophysitis**

**Submitting Author/Presenter:** Rebecca Carl, MD, FAMSSM Adam Potteiger, MS, ATC, Kristi McCracken, MS, ATC, Cynthia LaBella, MD, Sigrid Wolf, MD, and Ilona Lukina

*Affiliation:* Northwestern University, Ann & Robert H. Lurie Children's Hospital, Chicago, IL.

**Purpose:** While lower extremity apophysitis is common in young athletes, there is a lack of data on effective treatment. The purpose of this pilot study was to compare the effectiveness of 2 types of exercise programs in children with Osgood Schlatter, Sinding-Larsen and Johansson, and Sever apophysitis.

**Methods and Study Design:** Children aged 8 to 17 with apophysitis were randomized to one of 3 treatment groups: static stretching exercises, active elongation exercises

including myofascial release and mini squats, or a control group. Baseline evaluation included flexibility and pain scales. Participants completed follow-up surveys about pain intensity, frequency, and treatment adherence at 2, 4, 6, and 8 weeks.

**Results:** We recruited 129 participants. We analyzed the results for the 61 participants who had complete baseline data and returned at least one follow-up survey. Of these 61 participants, 25 (41%) presented with knee pain related to Osgood Schlatter or Sinding-Larsen and Johansson syndromes, 34 (56%) had heel pain related to Sever apophysitis, and 2 (3%) had both knee and heel pain. Pain levels were analyzed using mixed-effects ordinal regression and pain frequency was examined with 2-way repeated measures. At follow-up, there were no significant differences between treatment groups in pain frequency or pain intensity. Overall, participants with knee pain had significantly decreased pain frequency at 2, 4, and 8 weeks compared to baseline but not at 6 weeks. Heel pain was significantly decreased at 2, 4, 6, and 8 weeks. Pain intensity scores declined over time for study participants as a group, though this finding was only borderline significant.

**Conclusions:** We did not detect differences in pain intensity or frequency between participants who performed stretching exercises, active elongation exercises, or a control group (instructed to use over-the-counter pain medicine and/or ice). This may be because, given our survey response rate, our study was underpowered to detect a difference. Our results suggest that apophysitis-related pain frequency diminishes over time regardless of treatment.

**Significance:** This study adds to the paucity of data on the treatment of apophysitis. This was a pilot study and we plan to use the data to inform future, larger studies focused on individual types of apophysitis.

**Acknowledgements:** The authors would like to acknowledge Mary Weck, PT who developed the active elongation exercise program. Mary was a physical therapist at Children's Memorial Hospital (which later became Lurie Children's Hospital) for more than 45 years.

TOPIC: Epidemiology  
STUDY TYPE: Survey

### Creation of a Climbing Injury Assessment Tool and Injury Prevalence in Puerto Rican Rock Climbers

**Submitting Author/Presenter:** Claudia Jimenez, MD

Rosa Hechavarria, PhD, Gerardo Miranda, MD, and William Micheo, MD

*Affiliation: Department of Physical Medicine, Rehabilitation and Sports Medicine, University of Puerto Rico School of Medicine, San Juan, Puerto Rico.*

**Purpose:** This is a 2-part study. The first part creates and validates a tool for standardized recording and comparison of injuries amongst Puerto Rican rock climbers. The second part assesses prevalence of injury and its relation to exposure, training time and type, experience, level and type of climbing.

**Methods and Study Design:** The first part is a Validation Study/Descriptive Study to create and validate a questionnaire for standardized assessment of rock climbing injuries. The second part is a Cross Sectional Retrospective Study to assess prevalence of injury in 93 Puerto Rican rock climbers utilizing the questionnaire created in part 1.

**Results:** Of the 93 participants 68% reported to have had an injury in the past year. Most of the injuries were sustained while bouldering at a gym (48%), bouldering outdoors (21%), and sport climbing (15%). The anatomic regions most frequently affected were upper extremity (68%) and lower extremity (27%). Climbing types with prevalence of injury were bouldering (80%), gym climbing (74.1%), and lead sport climbing (66%). The highest prevalence of injury by level of climbing was found in advanced climbers, followed by beginners. Intermediate and elite climbers had the lowest level of injury. The highest injury prevalence by experience was found in climbers of 2 to 3 years of experience (81.8%), and lowest in in climbers of more than 10 years (58.3%). In term of prevalence by exposure the highest rate of injury was seen in climbing 2 to 3 times a week, followed by once a week, once every 3 months, more than 3 times a week, and once a month.

**Conclusions:** There is a high injury prevalence in Puerto Rican climbers and most are not seeking medical attention. The upper extremities, especially the hand, is the most frequently affected. A higher injury prevalence was seen in bouldering and indoor gym climbing compared to lead climbing. The lowest injury prevalence was seen in more experienced high level climbers, consistent with previous findings of low injury frequency and severity in elite climbers.

**Significance:** There is a lack of standardized instrument for assessment of climbing injuries. This instrument could allow for a standardized method for comparing injuries amongst rock climbers and a tool for comparison across studies in the future.

**Acknowledgements:** The authors wish to acknowledge El Bloque Climbing Gym for allowing the distribution of flyers for recruitment of study participants. We also wish to acknowledge the members of the expert panel for their contribution to our study.

TOPIC: Training  
STUDY TYPE: RCT

### Acute Effects of Cannabidiol (CBD) on Maximal Aerobic Capacity and Time to Exhaustion in Recreationally Active Adults

**Submitting Author/Presenter:** Brendon Ross, DO, MS

Karla Hanson, PhD, Bo Hernandez, and Mark Hogan

*Affiliation: University of Chicago, Chicago, IL.*

**Purpose:** There is emerging evidence Cannabidiol (CBD) use has increased significantly among elite level athletes. The purpose of this pilot study is to investigate the acute effects of CBD on maximal aerobic capacity and time to exhaustion in recreationally active adults.

**Methods and Study Design:** Nine subjects performed a maximal treadmill test to exhaustion with gas exchange as part of a randomized, double-blind crossover design. All subjects completed a supplement (CBD Isolate: 150 mg) and placebo (PLA) condition separated by 3 to 14 days.  $\text{VO}_2\text{max}$  (ml/kg/min), time to exhaustion (s), time to ventilatory anaerobic threshold [VAT (s),  $\text{RER} = 1.0$ ] were recorded for analysis.

**Results:** Nine recreationally active males and females (males = 6, females = 3), (age =  $26.38 \pm 7.17$  years; height =  $69.13 \pm 3.00$  inches; weight =  $194.25 \pm 39.30$  pounds) completed this study. There were no significant differences observed between CBD and PLA in  $\text{VO}_2\text{max}$  (ml/kg/min)

[CBD ( $44.22 \pm 8.19$ ), PLA ( $45.28 \pm 6.76$ ),  $P = 0.46$ ]; Time to VAT (s) [CBD ( $516.88 \pm 62.07$  seconds), PLA ( $503.55 \pm 22.44$  seconds),  $P = 0.69$ ], and Heart Rate at VAT (bpm) [CBD ( $178.33 \pm 17.4$ ), PLA ( $175.22 \pm 13.24$ ),  $P = 0.34$ ]. While there is a trend toward reaching time to exhaustion earlier following ingestion of CBD (Time to Exhaustion (s) [CBD ( $641.56 \pm 88.60$ ), PLA ( $662.89 \pm 82.22$ ),  $P = 0.14$ ]), this is not significant.

**Conclusions:** Preliminary pilot data suggest that CBD has no effect on maximal aerobic capacity and time to exhaustion in recreationally active adults. While there is a trend toward reaching time to exhaustion earlier following ingestion of CBD isolate within this preliminary data, any significant effects will continue to be examined with future data collection.

**Significance:** This is the first study evaluating aerobic effects of CBD in active adults. With rising CBD use in athletes for pain control, anxiety and sleep, this initial data helps clarify potential detrimental effects of CBD to their aerobic performance.

TOPIC: Musculoskeletal  
STUDY TYPE: Other

### Identification of Factors Related to Pain during 1,371 Musculoskeletal Injections

**Submitting Author/Presenter:** Andrew R. Christiansen, MD

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**Affiliation:** Fox Valley Family Medicine Residency, Appleton, WI.

**Purpose:** Minimal work has been done on minimizing patient discomfort during a musculoskeletal injection. The purpose of this study was to review factors associated with intra-procedure pain.

**Methods and Study Design:** Retrospective review was performed on consecutive patients undergoing musculoskeletal injections. Potential factors associated with patient-reported pain were collected, with subsequent linear regression modeling used to identify associative factors.

**Results:** A total of 1,371 injections (62.4% female, mean age  $58.6 \pm 16.1$ , body mass index [BMI]  $29.6 \pm 7.3$  kg/m<sup>2</sup>) were eligible for analysis. The median (interquartile range) intra-procedure pain score was 2 (1,3). According to the multivariate linear regression model, male sex ( $B = -0.42$ ,  $P = 0.003$ ), the use of sodium bicarbonate ( $B = -2.49$ ,  $P = 0.017$ ), lower BMI ( $B = -0.04$ ,  $P < 0.001$ ), presence of a trainee ( $B = 0.35$ ,  $P = 0.024$ ), and physician performing ( $B = -2.25$ ,  $P = 0.031$ ) had significant associations with intra-procedure pain score.

**Conclusions:** Female sex, higher BMI, presence of a trainee, physician performing the injection, and lack of buffering in the local anesthetic are potentially associated with an increase in patient-reported pain. Randomized prospective studies could clarify factors that reduce intra-procedural pain to improve provider counseling and patient experiences.

**Significance:** Incorporation of modifiable factors that decrease patient-reported intra-procedural pain may be

considered to help reduce patient discomfort during musculoskeletal injections.

TOPIC: Pediatrics  
STUDY TYPE: Other

### Prevalence and Association of Obesity and High Blood Pressure in Adolescent Athletes in Urban and Suburban Communities

**Submitting Author/Presenter:** Ronak Ahir, BS

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**Affiliation:** Sidney Kimmel Medical College—Thomas Jefferson University, Philadelphia, PA.

**Purpose:** To assess the prevalence and association of obesity and elevated blood pressure in adolescent athletes in both the urban Philadelphia area and surrounding suburban Pennsylvania and New Jersey communities using preparticipation physical evaluation (PPE) data.

**Methods and Study Design:** PPE data was collected from 2 registries for youth aged 12 to 18 from 2016 to 2018. Participant data for urban Philadelphia communities was collected from the Jefferson Athlete Health Organization ( $n = 837$ ), and for suburban communities from the HeartBytes youth registry ( $n = 3,736$ ). Blood pressure (BP) and body mass index (BMI) data were analyzed for prevalence of elevated BP and obesity readings.

**Results:** 59% and 58% of urban and suburban participants were male, respectively. Among the urban Philadelphia population, a large percentage of student-athletes were overweight (17.8%) or obese (20.7%). A significant portion of the population also had Stage 1 or Stage 2 hypertension readings (27.4%). In the suburban population, a slightly larger proportion of student-athletes were overweight (19.1%) while a smaller portion were obese (11.8%), and fewer individuals had Stage 1 or Stage 2 hypertension readings (18.7%). Across both populations, overweight classification (BMI of 85th percentile or greater) was significantly associated with elevated BP classification (elevated BP, Stage 1 or Stage 2 hypertension) ( $P < 0.001$ ). Logistic regression predicting category membership in the elevated BP category yielded significant results; athletes with overweight classification had 21.8 times greater odds of being in the elevated BP category compared to athletes with normal weight classification ( $P < 0.001$ ).

**Conclusions:** Despite athletics participation, rates of obesity and elevated blood pressure are high in the urban student-athlete population, nearing the obesity rate (22.2%) and exceeding the non-normotensive rates (near 15%) for all U.S. youth aged 12 to 19. Prevalence is particularly high when compared to their regional suburban counterparts. This poses a major concern as this population is at increased risk for future cardiovascular complications.

**Significance:** Research on differences in youth obesity and high BP rates across U.S. suburban and urban populations is limited. These findings suggest more health resources should be directed to address youth obesity and high BP in urban Philadelphia communities.

**Acknowledgements:** Jefferson Athlete Health Organization (AHO), Simon's Heart Foundation, Division of Biostatistics - Thomas Jefferson University.

TOPIC: Pediatrics  
STUDY TYPE: Other

### Can Not Wait to Educate Kids about Weightlifting

**Submitting Author/Presenter:** Joshua Kang, MS

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*Affiliation:* New York Medical College, Valhalla, NY.

**Purpose:** Children ages 4 to 18 are a high injury risk group due to increased physical activity with rapid physical development, and a lack of safe exercise equipment knowledge. Identifying risk factors and types of injury can guide better ways children can explore exercise without hurting themselves.

**Methods and Study Design:** 24,696 exercise related injuries in the NEISS (National Electronic Injury Surveillance System) database over a 10-year period between January 2013 and December 2022 were analyzed. Data was filtered to include injuries sustained during exercise with equipment among children ages 4 to 18.

**Results:** Most of the exercise equipment-related injuries were noted at 15 years old (11.59%) with mean age 12.89 years. Males (58.37%) and the Caucasian race (39.51%) were more susceptible to injury. Most common injuries were strains and sprains (27.77%) followed by fracture (12.32%) and contusion (11.65 %). Predominant injuries were in the upper trunk (10.52 %), ankle (10.47 %), and lower trunk (9.16 %). The most common exercise equipment-related injury was from weightlifting (28.13 %) followed by floors or flooring material (2.45%). Most injuries were sustained at an unidentified location (33.56%) followed by school (26.60%). 96.00 % of participants were discharged home.

**Conclusions:** Male children that weightlift in high school are at greater risk of upper trunk strains and sprains possibly due to incorrect exercise protocol and form. Appropriate exercise regimen under adequate supervision could minimize injuries in children.

**Significance:** Healthy children are active children. With better exercise equipment education and supervision, we can decrease injury rates and keep them exercising.

**Acknowledgements:** I would like to acknowledge my PM&R mentors, Dr. Lekshminarayanan and Dr. Diamond, for providing guidance throughout the creation of this abstract.

TOPIC: Musculoskeletal  
STUDY TYPE: Other

### Nonsteroidal Anti-Inflammatory Injections for Common Orthopedic Conditions: A Case Series

**Submitting Author/Presenter:** Hye Chang Rhim, MD, MPH  
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*Affiliation:* Harvard Medical School/Spaulding Rehabilitation Hospital, Boston, MA.

**Purpose:** Nonsteroidal anti-inflammatory drug (NSAID) injections have been proposed as an effective alternative treatment to steroid injections for several orthopedic conditions. The purpose of this study was to evaluate the effect of NSAID injections for the treatment of common orthopedic conditions.

**Methods and Study Design:** Retrospective chart review was performed to identify all patients who received ultrasound guided NSAID injections for musculoskeletal disorders at a single sports medicine clinic from July 2023 to November 2023. Demographic data, clinical diagnoses, and pain visual analogue scale (VAS) at baseline and 6 weeks were extracted. The VAS ranged from 0 (no pain) to 10 (worst pain possible).

**Results:** A total of 12 patients (6 females and 6 males; mean age  $57.7 \pm 12.4$  years; mean BMI  $30.3 \pm 2.2$  kg/m<sup>2</sup>) who received ultrasound guided NSAID injections were included in this study. Upper extremity diagnoses treated in this cohort included lateral epicondylitis (n = 4), medial epicondylitis (n = 2), glenohumeral arthritis (n = 1), rotator cuff tear (n = 1), adhesive capsulitis (n = 1), and distal biceps tendinopathy (n = 1). Lower extremity conditions treated included chronic anterior talofibular ligament and calcaneofibular ligament tears (n = 1), and distal semimembranosus tendon partial tear (n = 1). The mean VAS score significantly improved from  $7.2 \pm 1.2$  at baseline to  $3.3 \pm 2.3$  at 6 weeks ( $P < 0.01$ ). Nine patients exhibited 50% or more improvement in pain at 6 weeks. The pathologies with less than 50% improvement were glenohumeral arthritis (n = 1), rotator cuff tear (n = 1), and medial epicondylitis (n = 1).

**Conclusions:** The findings of the current case series support the potential therapeutic role of NSAID injections in the management of several commonly encountered orthopedic conditions. Further prospective studies with larger sample sizes and longer follow up periods are needed to confirm these findings and compare to placebo, corticosteroid, or other alternative treatments.

**Significance:** Corticosteroid injections are commonly performed for pain control in orthopedic conditions. The observed pain relief in this study supports the potential use of NSAID injections as an alternative, especially when steroids are contraindicated.

TOPIC: Epidemiology  
STUDY TYPE: Other

### Pediatric American Football Injuries in Female Athletes: A Descriptive Epidemiologic Study

**Submitting Author/Presenter:** Luke Radel, MD

David Mikhail, BS, Cassidy Schultz, BS, David Soma, MD, Dai Sugimoto, PhD, ATC, and Jacob Jones, MD

*Affiliation:* Mayo Clinic, Rochester, MN.

**Purpose:** Previous American football research has focused on male athletes, and there's a paucity of studies of female American football athletes, especially in the pediatric population. The purpose of this study was to determine common injury locations and types in young female American football players.

**Methods and Study Design:** The National Electronic Injury Surveillance System data was reviewed retrospectively. Injury data involving female American football athletes was searched from 2012 to 2021. The data for female football athletes  $\leq 18$  years old and injured body locations and diagnoses were descriptively evaluated using percentages. Pre-high school ( $<16$  years) and high school-aged (16-18 years) were compared.

**Results:** A total of 3348 injuries were included. 2342 injuries occurred in pre-high school athletes (70%) and 1006 in high school athletes (30%). Finger injuries were the most

common injured location ( $N = 1181$ , 35.3%). Head injuries were 16% of injuries ( $N = 536$ ). Higher proportions of finger injuries in pre-high school athletes (38.8%) than high school athletes (27.1%;  $P = 0.001$ ). Conversely, proportions of head, ankle, and knee injuries were greater in high school athletes (20.5%, 12.7%, and 10.3%) compared with pre-high school athletes (14.1%,  $P = 0.001$ ; 10.2%,  $P = 0.036$ ; 5.3%,  $P = 0.001$ ). The most common diagnoses were muscle, tendon, or ligament strains/sprains (35.5%). Fractures were the second most common (28.4%). Pre-high school athletes had a greater proportion of fractures (31.8%) than high school athletes (20.4%;  $P = 0.001$ ). High school athletes showed higher proportions of sprains/strains (39.3%) and concussions (11.1%) compared to pre-high school athletes (33.9%  $P = 0.003$ ; 7.4%,  $P = 0.001$ ).

**Conclusions:** Youth female football athletes suffer various injuries with the finger, head, and ankle being the most common location. Differences in the type of injury and location of injury does differ based upon age. These findings may be attributed to differences in play style and physiology between youth female football athletes of different age. These findings may guide future studies on the growing sport of football in females.

**Significance:** These findings may be the first step for identifying injury mechanism and developing injury prevention initiatives for the underserved female American football athletes.

**Acknowledgements:** We would like to acknowledge the work that everyone puts into contributing to the fantastic NEISS database.

TOPIC: Epidemiology

STUDY TYPE: Other

### Sleep Consistency as a Risk Factor for Lower Extremity Injuries in Division I Soccer Athletes

**Submitting Author/Presenter:** Kimberly Burbank, MD

Jeremy Swisher, MD, Zach Sitton, MD, and Chris Miles, MD

*Affiliation: Wake Forest University School of Medicine, Winston-Salem, NC.*

**Purpose:** This study investigated the impact of various sleep metrics, specifically sleep.

**Methods and Study Design:** Wake Forest University women's soccer players were studied retrospectively throughout their 2023 fall season. Baseline sleep architecture and injury rates were calculated for each athlete. Sleep consistency and sleep duration were divided into 2 different groups and analyzed. The cut off for sleep consistency was 70 and for sleep duration was 8 hours.

**Results:** There were 15 total acute injuries reported over the 2023 fall season for the Wake Forest women's soccer team. Ten out of 15 injuries were lower extremity injuries. Nine out of 10 players with a lower extremity injury had a sleep consistency less than 70 throughout the season compared to injured athletes who had a sleep consistency greater than 70 ( $P < 0.05$ ). There were 4 athletes who slept greater than 8 hours with 2 of them suffering a lower extremity injury. Thirty-one athletes slept less than 8 hours with 8 of them having a lower extremity injury. The average total sleep time over the fall season for the women's soccer team was 7 hours and 8 minutes with 89 percent of the women's soccer team

sleeping less than the recommended 8 hours. The average sleep consistency was 66.93.

**Conclusions:** Among the athletes with lower extremity injuries, those with poor sleep consistency had increased frequency of injury during the fall 2023 season. Decreased sleep duration did not show significance on rates of injury as 50% of those athletes sleeping greater than 8 hours experienced a lower extremity injury while 25% of those sleeping less than 8 hours experienced a lower extremity injury.

**Significance:** This study elucidates the importance of sleep consistency as it relates to lower extremity injuries in Division 1 soccer athletes. Improving this metric may be beneficial towards reducing the frequency of lower extremity injuries in this population.

**Acknowledgements:** Thank you to WHOOP and Wake Forest University for their assistance in developing this data set.

TOPIC: Osteoarthritis

STUDY TYPE: Survey

### Assessing Patient Knowledge of Osteoarthritis and Barriers to Treatment

**Submitting Author/Presenter:** Nehi Patel, DO

Anisha Tyagi, BS and Jason Womack, MD

*Affiliation: Rutgers Robert Wood Johnson Medical School New Brunswick, NJ.*

**Purpose:** Determine the relationship between the knowledge patients with osteoarthritis have about their disease process and their perceived barriers to receive medical care for it.

**Methods and Study Design:** This is a prospective cohort study. Patients at a large urban family medicine office aged 40 or greater, with a documented diagnosis of osteoarthritis of the knee or hip, were identified via Epic EMR. A survey was disseminated via QR code on flyers in the office, hard copy surveys, phone calls from researchers, EMR administration, or email. Results were collected through Qualtrics.

**Results:** Patients recognize over 80% of their available treatment options for their knee or hip osteoarthritis. Approximately 60% of patients believe that their success in treatment of osteoarthritis aligns with their physician's perspective of success. Cost and transportation represented the largest volume of responses in regards to being a barrier to receiving care. There was 62% response that transportation to their doctor's office was a barrier to treatment. Some of the responses included comments such as "I am unable to sit on a bus through the city as the pain from arthritis is too much." Notably, 50% responded that cost of advanced treatments was a barrier.

**Conclusions:** Osteoarthritis is a disease that affects over 32 million adults in the US. Unfortunately, patients and physicians share treatment goals surrounding osteoarthritis only 60% of the time. Transportation and cost are major barriers that patients face in treatment. To optimize care, physicians should engage in goal alignment with patients and consider socioeconomic factors limiting optimal treatment.

**Significance:** Information collected in this study can be translated to various practices for those treating Osteoarthritis. Future studies can explore alternatives to treatment modalities, including telehealth and home visits to overcome socioeconomic barriers.



**Acknowledgements:** I would like to acknowledge the staff in the Departments of Family Medicine at the Rutgers-RWJ Family Medicine Residency for their contribution and efforts in this study.

TOPIC: eSports  
STUDY TYPE: Survey

### Health Demographics in Collegiate ESports: A Comprehensive Exploration and Strategic Approach

**Submitting Author/Presenter:** Briana Santiago, DO, MS, Marcos R. Henriquez, MD, Scott Schonewolf, DO, Carson Wright, Sean J. McGinity, MS, Albert Botchway, PhD, and Edward C. Qian, MD

Marcos Henriquez, MD, Scott Schonewolf, DO, Carson Wright, Sean McGinity, MS, Albert Botchway, PhD, and Edward Qian, MD

*Affiliation:* Rush University Medical Center, Chicago, Illinois.

**Purpose:** Data on collegiate level eSport athletes is limited. Meanwhile, colleges are rapidly integrating eSports into athletic divisions. Acquiring health habits and demographics from eSport athletes will provide valuable insight to implement evidence based and data driven guidelines.

**Methods and Study Design:** Observational study performed by anonymous electronic survey sent to eSport athletes at Southern Illinois University Carbondale and Edwardsville (N = 71). Multivariate logistic regression was used to evaluate likelihood of eSport athlete injury and impact on return to play. Time to medical care, if any, was assessed using categorical questions and analyzed with frequency percentage.

**Results:** 49.3% of eSport athletes reported an injury or illness that impaired their ability to play at total capacity. MSK complaints included hand pain (44.57%), neck pain (28.57%), back pain (28.57%), carpal tunnel (22.86%), and shoulder pain (14.29%). Past injuries, sleep average, BMI, hours per week played, number of eSports teams involved, and competition involvement were included together as variables in the likelihood of experiencing injury and illness among eSports athletes. 95% Confidence Interval respectively: [1.1030, 1.1092]; [1.2643, 1.2800]; [1.0268, 1.0301]; [1.3872, 1.3976]; [1.4117, 1.4365]; [7.1145, 7.1657]. 37.13% of athletes sought medical care after injury or illness during the first 2 weeks. 14.92% had injuries they felt were severe but seeing a medical provider was a hassle. If given easier access to medical care 5.59% of athletes would take advantage of a sports medicine specialist. No significant barrier was found based on demographics, academic year, or location.

**Conclusions:** Nearly half of eSport athletes reported injury or illness that limited performance. Six modifiable and statistically significant factors contributed to these issues. Addressing these variables could improve outcomes. While over one-third sought general medical care, few would utilize specialized Sports Medicine care, despite the high incidence of MSK issues. Further research is needed to advance the niche development of eSports Medicine.

**Significance:** Musculoskeletal issues have a high incidence rate in eSports. Involving the Sports Medicine Department of a collegiate eSports program can provide sustainable growth

in offering specialized training, ergonomics, and health education initiatives.

**Acknowledgements:** Other research: eSports Medicine.

TOPIC: NCAA  
STUDY TYPE: Case-Control

### A Comparative Analysis of Single-Leg Balance Metrics in Intercollegiate Athletes Who Sustained Ankle Sprains

**Submitting Author/Presenter:** Jake Schutzman, MD

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*Affiliation:* Crozer Health Sports Medicine Institute, Springfield, PA.

**Purpose:** Single-leg (SL) balance training is commonly implemented by clinicians rehabilitating athletes recovering from ankle sprains. The purpose of this research was to prospectively investigate if deficits in SL balance performance exist prior to an ankle sprain in an athletic population.

**Methods and Study Design:** Twenty-seven (16M, 11F) intercollegiate athletes with ankle sprains were double-matched to healthy controls (n = 54) via sex and sport. SL eyes open balance scans were performed monthly on Sparta Science force plates. Variables extracted for both groups included t-score values for Multivariate Multiscale (MM) Entropy, Balance, Control, CoPx Sway, and CoPy Sway. Data were analyzed using independent *t*-tests.

**Results:** Sparta Science t-scores of 50 represent the mean, with scores <50 denoting below-average and >50 denoting above-average. MM Entropy t-scores were lower for the control group ( $45.9 \pm 11.1$ ) compared to the ankle sprain group ( $47.3 \pm 10.8$ ). This trend followed for the other variables including Balance (control:  $47.8 \pm 8.5$ , sprain:  $49.5 \pm 10.4$ ), Control (control:  $50.0 \pm 8.9$ , sprain:  $52.7 \pm 8.8$ ), CoPx Sway (control:  $48.3 \pm 10.1$ , sprain:  $50.1 \pm 11.3$ ), and CoPy Sway (control:  $47.4 \pm 9.6$ , sprain:  $49.0 \pm 13.0$ ). However, there were no significant differences in MM Entropy ( $t = -0.530$ , *df* [79],  $P = 0.869$ ), Balance ( $t = -0.764$ , *df* [79],  $P = 0.224$ ), Control ( $t = -1.272$ , *df* [79],  $P = 0.104$ ), CoPx Sway ( $t = -0.764$ , *df* [79],  $P = 0.224$ ), or CoPy Sway ( $t = -0.625$ , *df* [79],  $P = 0.267$ ). The corresponding small Cohen's *d* effect sizes for MM Entropy ( $d = -0.13$ ), Balance ( $d = -0.18$ ), Control ( $d = -0.30$ ), CoPx Sway ( $d = -0.18$ ), and CoPy Sway ( $d = -0.15$ ) suggest the lack of differences between groups.

**Conclusions:** Counter to what we hypothesized, the ankle sprain group tended to have better t-scores than the matched-control counterparts. Despite this, there were no significant differences between the groups, a finding supported by the small effect sizes. The Sparta Science balance scans requires eyes open during the static SL balance task which may contribute to the t-scores of both groups averaging around 50 for each metric.

**Significance:** While the results of this study did not produce actionable findings using a static SL balance assessment, future research should investigate the use of a dynamic balance assessment to help clinicians identify athletes at risk for an ankle sprain.

**Acknowledgements:** University of Delaware Athletic Training Research Laboratory.

TOPIC: Biologics  
STUDY TYPE: Survey

### Analyzing Disparities in Platelet-Rich Plasma Pre-Injection Protocols for Musculoskeletal Injuries

**Submitting Author/Presenter:** Jacob Barr, BA  
Matthew Stern, BSN, Krystal Hunter, PhD, MBA, Pietro Gentile, BS, and Cody Clinton, DO

*Affiliation: Cooper Medical School of Rowan University, Camden, NJ.*

**Purpose:** Analyzing the efficacy of platelet-rich plasma (PRP) injection for musculoskeletal injuries is difficult due to poor protocol standardization and PRP preparation heterogeneity. We aim to clarify current PRP protocols to serve as a benchmark to improve consistency in future research interpretation.

**Methods and Study Design:** We conducted a prospective cohort study by surveying AMSSM physician's pre-treatment PRP injection protocols. Demographic information, number of injections, conditions treated, and average cost were assessed. Outcomes were centrifuge kits, leukocyte preparation, complete blood count (CBC) ordered, and NSAID restriction. Preferred classification systems of PRP researchers were also assessed.

**Results:** Of the 246 survey participants, 214 providers treated patients w/PRP injections with an average of 7.21 ( $\pm$  8.80 SD) per month. 91% of practitioners worked in academic, hospital systems, or private practice. Nearly 3/4 of participants (73.7%) were family medicine trained. Practice location skewed towards the South (34.3%), with the Midwest and West regions representing 23.3% & 24.9%, respectively. Most common procedures were Degenerative Joint Disease (DJD) of the Knee (85.7%) & Lateral Epiphysealitis (LE) (72.4%). 190 (90.5%) responders used commercial kits. ACP (26.5%) and Regenlab (9.0%) preparation systems were frequently reported. Leukocyte-Rich and Leukocyte-Poor preparations (63.0%) were favored. CBCs were not ordered in 93.3% of pre-injection, & NSAIDs were discontinued in 92.4% of encounters. PRP researchers comprised 15.2% ( $n = 32$ ) of participants. Single classification systems were favored by 81.3%, w/most common classifications being PAW, MARSPILL, or Other, each representing 25% of the total responses.

**Conclusions:** Physicians preferred commercial kits and mixed leukocyte preparations. Providers ordered NSAID discontinuation and denied CBC testing prior to injection. The most common injections were for DJD of the knee and LE. Limitations to the study include recall and response bias as data was collected via survey. Further research should include post-injection preferences as well as effectiveness of PRP for common etiology to guide future standardization.

**Significance:** Standardized pre-injection protocol for PRP research begins the process of uniformly approaching future PRP studies. Understanding each step in the process will limit variability, improve results, and guide research-driven recommendations.

**Acknowledgements:** We would like to thank the AMSSM for the distribution of our survey, alongside the Cooper Bone and Joint Institute and the Cooper University Hospital statisticians for immense help throughout our project.

TOPIC: Musculoskeletal  
STUDY TYPE: Other

### Gender Differences: Representation of Women in Lateral Ankle Sprain Research

**Submitting Author/Presenter:** Nicole B. Katz, MD

Julie K. Silver, MD and Kelly C. McInnis, DO

*Affiliation: Harvard Medical School/Spaulding Rehabilitation Hospital, Boston, MA.*

**Purpose:** Lateral ankle sprains (LAS) are a common injury for women and men athletes. Historically, there has been low representation of women as participants and authors in sports medicine research, so we aimed to assess the representation of women participants and authors in LAS research.

**Methods and Study Design:** This is an observational study of original research included in systematic reviews on LAS in adults published between May 2013 and May 2023. We assessed the proportion of women participants and in author roles (primary, senior, and overall). Gender was determined by online information mostly using pronouns. When unavailable, photographs or Gender API (online gender tool) were used to infer gender.

**Results:** Eleven reviews with 77 unique studies (10,080 participants, 335 authors) were identified. Participant gender was not reported for 8 studies, and author gender was undetermined for more than 25% of authors for 4 studies; these studies were excluded from the analyses. No participant or author was identified as non-binary. Studies had a mean publication year of  $2006 \pm 8$ ,  $5 \pm 2$  authors, and  $146 \pm 176$  participants. Of the study populations, 55% were general, 43% athlete, and 3% military. The overall proportion of women participants was 41%; less than in the United States population ( $P < 0.001$ ). The proportion of women participants in general population (40%) and athlete studies (42%) were similar ( $P = 0.1$ ). Women were the minority of primary (32%), senior (29%), and overall authors (26%). There were weak positive correlations between women participants and women authors overall, publication year and women participants, and publication year and women authors overall (all  $r < 0.2$ , all  $P > 0.1$ ).

**Conclusions:** We found underrepresentation of women as research participants, and a minority of women as study authors. It is not known how this low representation may impact clinical care for patients or career advancement for women physicians and scientists. An effort should be made to increase the proportion of women included in this research and conducting this work. Further investigation is also warranted.

**Significance:** Despite the high prevalence of LAS in women athletes, the research guiding clinical care disproportionately included men, which may have limited knowledge about LAS in women. Greater efforts are needed to increase women as participants and authors.

TOPIC: Exercise Day vs. Night  
STUDY TYPE: Other

### Does Within-day Exercise Timing Affect Metabolic Outcomes in Patients With Type 2 Diabetes?

**Submitting Author/Presenter:** Jesse Gettinger, MD

Anthony D'onofrio, DO, Julianne Clina, PhD, Laura Kaizer, MPH, Seth Creasy, PhD, Richard Sayer, PhD, and Irfan Asif, MD

*Affiliation:* University of Alabama at Birmingham, Birmingham, AL.

**Purpose:** Limited research suggests within-day exercise timing may affect weight loss and metabolic outcomes, which could be used to optimize exercise prescriptions. We examined whether morning vs. afternoon exercise affects weight loss and A1c in participants with T2D during a 1-year weight loss trial.

**Methods and Study Design:** Participants were classified as morning (AM) and evening exercisers (PM) based on accelerometry counts. Differences in weekly physical activity, weight, and A1c at baseline, week 16, and week 52 were compared between AM and PM using linear mixed models. Tukey's post-hoc test determined differences in lsmeans for significant group\*time (baseline vs. week 16 vs. week 52) interactions.

**Results:** Sixty-one adults with obesity and T2D (80% female, age:  $55.2 \pm 10.8$  y, BMI:  $38.7 \pm 7.4$  kg/m<sup>2</sup>, A1c:  $7.0 \pm 1.3\%$ ) were included in this retrospective analysis. Participants were counseled to engage in 400 weekly minutes of exercise as part of a comprehensive behavioral weight loss intervention but were not given any instructions on with-in day exercise timing. At baseline, 73.8% were PM exercisers, whereas 44.2% and 54.1% were classified as PM at week 16 (end of active weight loss phase) and week 52 (follow-up), respectively. A significant ( $P = 0.0261$ ) group  $\times$  time interaction was observed such that AM completed more weekly minutes of MVPA ( $368.6 \pm 31.9$  minutes) at week 16 than PM ( $205.7 \pm 36.2$  minutes, Tukey-adjusted  $P = 0.0077$ ). No other contrasts between AM and PM MVPA minutes were significantly different. Group  $\times$  time interactions for weight ( $P = 0.3285$ ) and A1c ( $P = 0.9776$ ) were not significant.

**Conclusions:** Morning exercisers spontaneously engaged in more physical activity than evening exercisers. This difference only occurred during the active weight loss phase and was not maintained into the follow-up phase of the intervention. This did not translate into significant differences in weight loss or A1c reduction.

**Significance:** Self-selected timing of exercise may not impact weight or A1c levels in patients with diabetes. Future studies should continue to explore how best to optimize exercise prescription in patients with T2D.

**Acknowledgements:** Beef Checkoff and National Cattle-men's Beef Association.

TOPIC: Pediatrics

STUDY TYPE: Other

**Methods and Study Design:** We completed a retrospective chart review of patients diagnosed with non-traumatic femoral neck BSIs at 6 academic centers. These diagnoses were confirmed with imaging. A common data collection form was used on REDCap, and the following data was collected: injury and sport history, clinical findings, imaging, laboratory work-up, and injury management.

**Results:** 94 cases were identified (66% female) with an overall mean age of 15.2 years, an average BMI of 20 and 55% of cases occurring on the right side. The top 3 sports identified as the athlete's primary sport were cross country (52%), soccer (14%), and track and field (9%), with 90% of bone stress injuries occurring during the primary sport. At time of diagnosis, 94% of athletes reported pain when walking, 100% pain with hopping and experienced pain for an average 5.2 weeks before diagnosis. Of the 51 athletes screened, 14% had a history of disordered eating/eating disorder. Previous BSI was reported in 31% of athletes. Fracture line was visible on plain radiographs in 18% while on MRI, 41% showed a fracture line. Bone marrow edema was present on T1 and T2 in 49% and 78% of athletes respectively. 61% had laboratory data and 34% DXAs obtained due to their FNBSI. Most patients (87/94) were managed non-operatively. Average duration of partial/non-weightbearing precautions was 6 weeks, <span style="font-family: Calibri, sans-serif; font-size: 11pt;">average for return to running was 12 weeks and return to full sport participation was 15 weeks.

**Conclusions:** Femoral neck BSIs can result in a significant amount of time off from sport in adolescent athletes. Females and athletes participating in cross country and soccer were at highest risk. MRI may help in the diagnosis and identification of a fracture line. Most athletes were managed non-operatively with a full return to sport in 4 months. A history of disordered eating or eating disorder may place athletes at higher risk.

**Significance:** Little research has been done on adolescent FNBSIs. A better understanding of risk factors and the use of early imaging, particularly MRI, can help guide clinicians in optimal management, as well as understand what additional studies to obtain.

**Acknowledgements:** Pediatric Research in Sports Medicine (PRISM) bone stress injury research interest group

TOPIC: Musculoskeletal

STUDY TYPE: Other

## A Descriptive Multi-Center Analysis of Adolescent Femoral Neck Bone Stress Injuries

**Submitting Author/Presenter:** Naomi Brown, MD

Abby McIntyre, BS, Mark Halstead, MD, Danielle Magrini, DO, Mikel Joachim, PhD, Eric Nussbaum, ATC, Kathryn Ackerman, MD, and Emily Kraus, MD

*Affiliation:* Children's Hospital of Philadelphia Philadelphia, PA.

**Purpose:** Femoral neck bone stress injuries (FNBSIs) are high risk due to the potential complications of not being detected early and managed optimally. Our goal was to better understand clinical characteristics of FNBSIs related to mechanism of injury, risk factors, method of diagnosis, and recovery.

## Systematic Review of the Outcomes of Treatments for Popliteal Artery Entrapment Syndrome

**Submitting Author/Presenter:** Evan O'Malley, DO

Simon Moskowitz, DO, Aubree LaForce, MD, and Aaron Lear, MD

*Affiliation:* Cleveland Clinic Akron General, Akron, OH.

**Purpose:** The goal of this systematic review was to identify available treatments and their outcomes for popliteal artery entrapment syndrome (PAES). Particularly, studies which compared surgical to non-surgical interventions, including conservative measures or botulinum toxin A injections (BTA).

**Methods and Study Design:** Literature search was performed using 7 databases and hand search of included articles' bibliographies. The search included controlled trials, cohort studies, and case series published in English; after 1999; in

patients 40 and under. Eligible studies reported on at least one of several predetermined patient outcomes. The JBI critical appraisal tool was used to assess bias.

**Results:** Two thousand seven hundred fifty-five titles and abstracts were identified and screened, 45 full texts were screened and 28 full texts, all case series, were selected for inclusion and extracted. Each stage of review was performed by at least 2 blinded reviewers. Risk of bias (ROB) was judged to be high overall. In included articles, 344 subjects underwent surgery with success or symptom improvement reported in 320 (93%; 95% CI: 90, 95%); Articles reporting arterial patency post-surgery showed 102 of 111 (92%; 95% CI: 85, 96%) patent at 1 year after procedure. Harm from surgery was variably reported and consisted primarily of local infection, seroma and hematoma. In the articles which reported harm, there were 12 arterial occlusions, leading to 3 amputations. 33 underwent treatment with BTA. 27 (82%; 95% CI: 65, 92%) had good or mild/moderate improvement and 5 (15%; 95% CI: 6, 31%) had poor or no improvement with 1 lost to follow up; 25 had conservative treatment with poorly reported outcomes and decision making.

**Conclusions:** The literature base for treatments of popliteal artery entrapment is focused largely on surgical intervention. While success of surgical treatment is reportedly high, the generally high ROB, the low level evidence found in case series, and the lack of standardization in the reporting of outcomes or follow up leads us to have low certainty that the outcomes identified in this review are generalizable.

**Significance:** We believe this to be the first systematic review of the literature focused on PAES, which identifies the low level of evidence supporting the current treatment and suggests a need for standardized reporting of patient centered outcomes and harm.

**Acknowledgements:** Jennifer Feldman, Medical Librarian at Cleveland Clinic Akron General Mary Pat Harnegie, Medical Librarian at Cleveland Clinic Main Campus.

TOPIC: Epidemiology  
STUDY TYPE: Survey

## Epidemiology of Injuries in Acrobatic Dunking Athletes

**Submitting Author/Presenter:** Steven Gay, DO

Elisabeth Guenther, MD

*Affiliation: Guthrie Robert Packer Hospital Sayre, PA.*

**Purpose:** To our knowledge, the injuries seen in acrobatic dunking athletes have not been studied. Our objective is to determine the most common self-reported injuries sustained by current professional acrobatic dunking athletes and their etiologies.

**Methods and Study Design:** Eligible participants were invited to complete the anonymous survey via the AD Facebook site with approximately 400 members. The survey instrument contained 21 questions covering demographics, history of injuries and additional questions specific to acrobatic dunking. Inclusion criteria: self-identified Dunkers. Exclusion criteria: age less than 18 years.

**Results:** There were 62 total respondents. Approximately 84% were associated with a professional Dunk Team. Only 38.7% reported having a trainer on the team. Among respondents, there was an average of 8.7 years of experience with dunking (median 7, SD 5.9 years) and an average of

1.1 days (median 1.0, SD 1.3 days) or 3.8 hours (median 2, SD 6.2 hours) of practice per week. The most common area of injury was the ankle (50%), knee (12.5%), head or neck (10%), and upper leg (7.5%). These injuries occurred primarily during the landing phase of the dunk (70%) and dunking the ball (13.3%) while at practice (71.8%) and performance (28.2%). The majority of respondents sought care from a physician (55.2%), followed by a trainer (17.2%), nurse (10.3%), and paramedic or emergency medical technician (EMT) (6.9%). An average of approximately 16 days were missed due to this injury (median 4, SD 28.4 days).

**Conclusions:** Acrobatic dunking is associated with significant injuries, most of which are musculoskeletal. Further study is needed.

**Significance:** This study is a first look at the epidemiology of injuries in acrobatic dunking athletes that we are aware of. We hope this work paves the way for more research on injury patterns and prevention.

**Acknowledgements:** We would like to thank the Jerry Burrell for his assistance in contacting current acrobatic dunking athletes.

TOPIC: Diabetes  
STUDY TYPE: Other

## Greater Physical Activity during a Behavioral Weight Loss Trial Improves Glycemic Control

**Submitting Author/Presenter:** Anthony D'Onofrio, DO

Jesse Gettinger, MD, Julianne Clina, PhD, Laura Kraizer, MPH, Seth Creasy, PhD, R Drew Sayer, PhD, and Irfan Asif, MD

*Affiliation: University of Alabama Birmingham Sports and Exercise Medicine, Birmingham, Alabama.*

**Purpose:** Research suggests that increases in weekly moderate-to-vigorous physical activity (MVPA) improves markers of cardiometabolic health. We examined the impact of accelerometry-measured MVPA on body weight and A1c during a 1-year weight loss trial of high protein (HP) v. normal protein (NP) diets.

**Methods and Study Design:** Adults with obesity and T2D were randomized to a HP (40%) or NP (21%) diet. All participants were advised to perform 400 min/wk of MVPA. Differences in weekly MVPA at baseline, week 16, and week 52 were compared between HP and NP groups using linear mixed models with age and sex as covariates. Pearson's correlation coefficients of MVPA with body weight and A1c were calculated.

**Results:** Sixty-one adults with obesity and T2D (80% female, age:  $55.2 \pm 10.8$  y, BMI:  $38.7 \pm 7.4$  kg/m<sup>2</sup>, A1c:  $7.0 \pm 1.3\%$ ) were included in this secondary analysis of NCT03832933. MVPA did not significantly differ between the HP and NP groups ( $P = 0.5894$ ), but MVPA increased in the entire sample at week 16 ( $301.2 \pm 26.3$  minutes [lsmeans  $\pm$  SE]) and week 52 ( $260 \pm 18.1$  minutes) compared to baseline ( $115.8 \pm 23.7$  minutes). Weekly minutes of MVPA was significantly and negatively linearly correlated with A1c ( $r = -0.226$ ,  $P = 0.0128$ ). A similar pattern was observed for weight, but the relationship was not statistically significant ( $r = -0.150$ ,  $P = 0.0768$ ).

**Conclusions:** Adults with obesity and T2D who were encouraged to achieve 400 min/wk of exercise as part of a HP v. NP weight loss trial sustained a more than 2-fold increase in

weekly MVPA after 1-year as measured by accelerometry. This was associated with improved glycemic control.

**Significance:** Behavioral-based weight loss programs with high weekly targets for PA can lead to sustained increases in MVPA with accompanied improvements in clinical outcomes for individuals with obesity and T2D.

**Acknowledgements:** Beef Checkoff/National Cattlemen's Beef Association.

TOPIC: COVID

STUDY TYPE: Cohort

### Utilization of the Concussion Profiles Screening Tool in Long COVID vs Persistent Post Concussive Syndrome Patients

**Submitting Author/Presenter:** Daniella Rivera, DO, MS

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*Affiliation: David Grant Medical Center Travis Air Force Base, California.*

**Purpose:** To compare Concussion Clinical Profiles Screening Tool (CP screen) symptom profiles in Long COVID and persistent post concussive syndrome (PPCS) cohorts undergoing concussive treatment management.

**Methods and Study Design:** Retrospective longitudinal review of 24 Long COVID patients and 24 PPCS diagnosed with Long COVID (symptoms greater than 3 months) or chronic PPCS (symptoms greater than 3 months) from 2019 to 2023 at their initial, midpoint, and last examination undergoing a multimodal treatment plan. Seven profile symptom scores were assessed with the CP screen. Type of treatment(s) was documented and tracked.

**Results:** For the Long COVID cohort, the top 3 CP profiles at the initial, midpoint, and last appointment were cognitive (cog) fatigue, mood, and sleep. For the PPCS cohort, the top 3 CP profiles at the initial appointment were cog fatigue, ocular, and mood. At the midpoint and last evaluation, top profiles changed to cog fatigue, ocular, and cervical. Overall, both groups showed improved total CP and cog fat scores from first to last visit, with more gradual improvements in the Long COVID group. The total CP score improved from 35/81 to 30/81 and from 42/81 to 24/81 in the Long COVID and PPCS cohort respectively. Specifically, the cog fatigue scores improved in the Long COVID cohort from 1.78/3 to 1.58/3 and in the PPCS cohort from 1.78/3 to 1.09/3. Treatments during this time frame ranged from 6 to 25 months (avg 12 months) and were multidisciplinary including active rehab protocol, physical therapy, occupational therapy, and cognitive behavioral therapy.

**Conclusions:** The CP screen findings in Long COVID patients are similar to symptom profiles in patients with chronic PPCS, with cognitive fatigue being the predominant complaint. Both cohorts showed improvement in total CP scores and cog fatigue after undergoing different types of routine concussion treatment intervention such as active rehab protocol and physical/occupational therapy.

**Significance:** The CP screen is a validated tool in measuring concussive symptoms, and may be useful in tracking progress in Long COVID patients with functional neurological deficits undergoing similar multidisciplinary concussion management.

**Acknowledgements:** Thank you to SPARCC Tucson.

TOPIC: Education

STUDY TYPE: Survey

### Dance Medicine Knowledge and Education Across Different Residency Specialties

**Submitting Author/Presenter:** Kenneth Peyser, DO

Ziva Petrin, MD and Lauren Murphy, PhD

*Affiliation: Rutgers-NJMS, Newark, NJ.*

**Purpose:** While many resident physicians will encounter dance injury over the course of their careers, dance medicine education may be lacking in graduate medical training. This study aimed to identify disparities in dance medicine education and knowledge among different residency specialties.

**Methods and Study Design:** A cross-sectional survey was administered to a sample of pediatric, orthopedic, emergency and internal medicine, and physical medicine and rehabilitation (PM&R) residents at one institution. Participants rated their interest and experience with dance medicine and completed a knowledge-based questionnaire on terminology and dance injury management. Descriptive and bivariate statistics were utilized.

**Results:** Forty participants responded to the survey (internal medicine 30%, emergency medicine 15%, PM&R 47.5%, orthopedic surgery 5%, pediatrics 2.5%). 42.5% reported personal dance experience, and 30% reported spectating dance performances. The majority of participants reported limited formal dance medicine education during residency, with fifty percent of participants reporting no formal dance medicine lectures. 95% of PM&R residents reported having had dance medicine lectures, while only 10% of all other specialties reported the same. Overall, 75% reported a lack of confidence in recognizing common dance injury, and 60% reported feeling uncomfortable with common dance terminology. The mean score on the knowledge-based quiz was 43% (SD = 0.21). PM&R residents had significantly higher quiz scores compared to all other medical specialties (53% vs 35%,  $P = 0.01$ ), and a greater portion of PM&R residents agreed that formal residency education and exposure to dance medicine was moderately important.

**Conclusions:** This study highlights a lack of formal preparation for dance injury diagnosis and management reported among residents of diverse medical specialties and suggests that exposure to common dance terminology and dance injuries should be included in graduate medical training.

**Significance:** No prior studies have evaluated dance medicine knowledge among different medical training specialties. Integration of formal dance medicine education is essential to provide optimal care to our dancer patients.

**Acknowledgements:** Rutgers-NJMS and Kessler Research foundation.

TOPIC: Epidemiology

STUDY TYPE: Other

### PHQ-9 Scores in Athletes Post-Musculoskeletal Injury a Retrospective Chart Review

**Submitting Author/Presenter:** Nathan Boys, DO

Gurjinder Olekh, MD, Austin Priaux, DO, Michael Nwokorie, MD, Devin Vicknair, PhD, and Leslie David, MD

*Affiliation: Northeast Georgia Medical Center Gainesville, Georgia.*

**Purpose:** Depression prevalence is estimated to be from 15 to 21%, with poor insight on athlete-specific assessments and interventions. This study examines the intersection between physical and mental health in athletes with musculoskeletal injuries using the PHQ-9 post-injury.

**Methods and Study Design:** Patients 12 to 30 years old with musculoskeletal injuries and PHQ-9 within 2 months post injury were randomly selected until statistical power was achieved. Patients with confounding diagnoses such as concussion and depression were excluded. Athletic status was determined via chart review. Analyses of PHQ-9 scores with respect to athletic status, gender, and age utilized the *t*-test and ANOVA.

**Results:** There was not a statistically significant difference in athlete versus non-athlete PHQ-9 scores post injury (1.78 versus 1.35,  $P = 0.22$ ); however, the average PHQ-9 score of male athletes compared to male non-athletes was statistically significant (2.07 versus 0.85,  $P < 0.01$ ). The average PHQ-9 score in female athletes compared to female non-athletes was not statistically significant (1.28 versus 2.0,  $P = 0.16$ ). There was not a statistical difference between average PHQ-9 scores of male and female athletes' post-injury (2.07 versus 1.28,  $P = 0.09$ ), but there was in the non-athletic group (0.85 for men versus 2.0 for women,  $P < 0.02$ ). There was not a statistical difference in PHQ-9 scores by athlete age group ( $P = 0.17$ – $0.97$ ). There was a statistically significant difference in average age between athletes and non-athletes (16.5 years versus 21.8 years,  $P < 0.001$ ), although there was not statistical significance comparing PHQ-9 scores of athletes to non-athletes of the same age group ( $P = 0.08$ – $0.8$ ).

**Conclusions:** In our population, male athletes, on average, scored higher on their PHQ-9 than male non-athletes. Providers working with male athletes should administer a PHQ-9 during post-injury care to identify and provide comprehensive support through the recovery process. Further investigation into why male athletes have higher PHQ-9 scores post-injury compared to non-athletes is warranted.

**Significance:** To our knowledge, this is the first study to show male athletes have higher PHQ-9 scores than their non-athletic peers following musculoskeletal injury without a coinciding traumatic brain injury.

**Acknowledgements:** We would like to thank Shane Robinson, Dr. Sohail Vaghari, and Katelyn DeRogatis, LPC for their support of this work.

TOPIC: Musculoskeletal

STUDY TYPE: Case-Control

### Comparative Analysis of Jump Metrics in Intercollegiate Athletes Who Sustained ACL Injuries: A Prospective Study

**Submitting Author/Presenter:** Kunal A. Anandpara, DO

Amanda N. Delaney, MS, David Baxter, DO, David Webner, MD, Kevin DuPrey, DO, and Thomas W. Kaminski, PhD, ATC

*Affiliation: Crozer Health Sports Medicine Institute, Springfield, PA.*

**Purpose:** ACL injuries are currently on the rise, causing extensive time loss and health care burdens. The purpose of this study was to determine if differences in Counter

Movement Jump (CMJ) metrics exist between intercollegiate athletes sustaining ACL injuries versus their athlete-matched controls.

**Methods and Study Design:** Sixteen (7 M, 9 F) intercollegiate athletes who sustained a non-contact ACL injury were double-matched to 32 healthy controls via sport and sex. CMJs were performed monthly on Sparta Science force plates. Metrics extracted and available for both groups included: Sparta Score, Load, Explode, Drive, Jump Height, and a ratio of Eccentric time/Unweighing time. Data were analyzed using independent *t*-tests.

**Results:** There were no significant differences in Sparta Score ( $t = -0.015$ ,  $df [46]$ ,  $P = 0.230$ ), Load ( $t = -0.168$ ,  $df [46]$ ,  $P = 0.434$ ), Explode ( $t = 0.417$ ,  $df [46]$ ,  $P = 0.339$ ), Drive ( $t = -0.628$ ,  $df [46]$ ,  $P = 0.266$ ), or Jump Height ( $t = -0.015$ ,  $df [46]$ ,  $P = 0.494$ ). These results correspond with small effect sizes for Sparta Score ( $d = 0.23$ ), Load ( $d = 0.05$ ), Explode ( $d = 0.13$ ), Drive ( $d = 0.19$ ), and Jump Height ( $d = 0.00$ ). Conversely, the ratio of Eccentric time/Unweighing time was significantly different ( $t = 2.54$ ,  $df [46]$ ,  $P = 0.007$ ) between groups (ACL:  $1.67 \pm 0.58$ , Control:  $1.30 \pm 0.41$ ). The ACL group spent longer time in the eccentric phase (ACL:  $0.41 \pm 0.11$  s, Control:  $0.37 \pm 0.06$  s) and less time in the unweighing phase (ACL:  $0.26 \pm 0.06$  s, Control:  $0.30 \pm 0.10$  s) when compared to their healthy controls. Cohen's *d* of the ratio of Eccentric time/Unweighing time indicates a large effect size ( $d = 1.3$ ), suggesting that there is a large difference between groups.

**Conclusions:** The differences in the ratio of Eccentric time/Unweighing time suggests that the ACL-injured athletes are spending more time in the eccentric phase compared to the unweighing phase during the downward movement of the CMJ. This may translate into the ACL-injured athletes seeing an imbalance in their movement patterns, contributing to a lack of control while trying to stabilize during the eccentric phase to prepare for the ensuing upward jump.

**Significance:** Understanding how CMJ metrics play a role in ACL injuries is important to inform mitigation strategies. The differences shown here may be related to the mechanisms of ACL injury, especially those involving change of direction/ deceleration movements.

**Acknowledgements:** University of Delaware Athletic Training Research Laboratory.

TOPIC: NCAA

STUDY TYPE: Other

### The Effect of Sport Specialization on Injury Rate in Female NCAA Gymnasts

**Submitting Author/Presenter:** Steven Gay, DO

William Maloney, DO, Alexis Amatisto, DO, Johannie Spaan, PhD, and Edith Sperling, DPT

*Affiliation: Guthrie Robert Packer Hospital Sayre, PA.*

**Purpose:** The goal of this study was to identify whether there is an association between early specialization of female NCAA gymnasts and higher rates of injury, when compared to gymnasts who cross-train and/or play other sports.

**Methods and Study Design:** Fifty-nine female NCAA gymnasts from throughout the USA completed an online survey. They self-reported injuries occurring over the course of their gymnastics career; if they participated in other athletics throughout their life, and if so, which ones; and

when they began to specialize in gymnastics. The participants averaged a starting age of 4.4 years for both specialized and non-specialized gymnasts.

**Results:** Gymnasts who did not specialize had a higher rate of reported injuries, at 4.90 ( $n = 21$ ), while those who did had an average of 4.00 injuries ( $n = 38$ ). This difference was not significant ( $P = 0.1135$ ). Those that reported that they had participated in other sports or cross-training reported 40% of the injuries vs. no cross-training was 60%. The data also showed that the earlier an athlete began gymnastics, risk of injury increased 5% per year ( $P = 0.0926$ ). Programs requiring weight training showed a lower risk of injury, as opposed to programs that required running that had an increased risk; however, these were not significant.

**Conclusions:** These data suggest an association between cross-training, specialization, and rate of injuries. Further research with greater response rates are needed.

**Significance:** While research has been conducted on sports specialization in relation to injuries, this has not been demonstrated with NCAA female gymnasts. This could allow for better understanding and injury prevention strategies.

**Acknowledgements:** We'd like to thank all the gymnasts who took the time to fill out our survey.

TOPIC: Running  
STUDY TYPE: Cohort

### Prevalence of Lower Extremity Injuries in Division 1 Cross Country Runners

**Submitting Author/Presenter:** Alexander Grover, DO  
Kendra McCamey, MD, James Borchers, MD, MPH, and Sean Jones, ATC

**Affiliation:** *The Ohio State University Jameson Crane Sports Medicine Institute, Columbus, Ohio.*

**Purpose:** To investigate the prevalence of lower extremity injuries in Division I cross country runners over a 3-year time frame during the 2020-2023 academic years.

**Methods and Study Design:** Retrospective cohort study involving men and women cross country student athletes at a Division I university over a 3-year interval from 2020 to 2023. Data was collected from both annual health evaluations and incoming physical exams and translated into a percentage of athletes who suffered lower extremity injuries compared to those who did not.

**Results:** Out of 118 responses, a total of 45 injuries were reported from 2020 to 2023. The year 2021 had the highest percentage of lower extremity injuries with 19 injuries amongst 37 student athletes, a percentage of 51%. The previous year, 2020 reported the lowest percentage of injuries of 12 amongst 35 athletes, a percentage of 34%. In the year 2022, 14 injuries amongst 30 athletes, a percentage of 46%. Female student athletes sustained more injuries (45, 65 and 38%) respectively across 2020, 2021 and 2023 than male runners (20%, 35% and 31%). The most common injury reported were overwhelmingly tibial and metatarsal stress injuries/ fractures accounting for 24 of the 45 (53%) reported injuries.

**Conclusions:** The data from this study show that lower leg injuries are significantly prevalent among this patient population affecting between 34% and 51% of student athletes on the cross-country team over the given time frame. Female

runners were also found to more likely to sustain a lower extremity injury than male runners from the data above.

**Significance:** Given the prevalence of lower extremity injuries in the division I Cross Country athlete population, assessing the occurrence and progression of injuries is crucial for developing precise and targeted prevention strategies.

**Acknowledgements:** I would like to thank Sean Jones, ATC for his help in the data collection for this study.

TOPIC: Epidemiology  
STUDY TYPE: Survey

### Association of Depression and Anxiety With Performance-Related Musculoskeletal Disorders in Collegiate Musicians

**Submitting Author/Presenter:** Stephen Luebbert, MD, MS  
Ann Laurie Wells, PhD and Emily Miller Olson, MD  
**Affiliation:** *University of New Mexico, Albuquerque, New Mexico.*

**Purpose:** Earlier research has shown depression and anxiety in musicians at higher rates compared to the broader workforce, with a significant prevalence of performance-related musculoskeletal disorders (PRMDs) of up to 93%. This study explored the relationship between mental health issues and PRMDs.

**Methods and Study Design:** A survey was distributed to multiple music departments to gather information on the music and non-music-related work/school hours per week, and scoring of PHQ-9, Nordic Musculoskeletal Questionnaire, and GAD-7. REDCap was used for data gathering, and Fisher's exact tests to determine correlations.

**Results:** In this convenience sample, 26 collegiate musicians participated, yielding a 9.28% response rate. The respondents included 16 males and 11 females. 7 students scored as having none to minimal depression, 8 mild, 5 moderate, 5 moderately severe, and 2 severe. Every respondent experienced some form of musculoskeletal disorder, with 18 out of 26 (66.7%) feeling pain or discomfort only while playing their instruments. 6 reported past traumatic injuries or surgeries in the areas where they now feel pain. There was a significant negative correlation between time spent playing music and PHQ-9 scores for depression ( $P = 0.0033$ ), whereas non-music work hours and music hours showed no link to musculoskeletal pain ( $P = 0.8044$  and  $0.4562$ , respectively). Age and PHQ-9 scores did not have a statistical correlation with musculoskeletal pain ( $P = 0.2696$ ). Additionally, there was no correlation found between pain experienced while playing an instrument and PHQ-9 scores ( $P = 0.1288$ ). There was a significant correlation between GAD-7 and PHQ-9 scores ( $P = 3.94 \times 10^{-7}$ ).

**Conclusions:** Our study found no notable association between PRMDs and depression. Yet, more hours of playing were associated with lower PHQ-9 scores, suggesting that playing music may have a protective effect on mental health. Participants who had prior reported injuries could also have influenced the number of reported PRMDs. The findings are limited by the small sample size and would be strengthened by a larger respondent pool for more robust conclusions.

**Significance:** This study addresses 2 major limitations found in prior research: it investigates a defined population to determine wider relevance, and employs validated

screening tools for anxiety and depression to explore their relationship with PRMDs.

**Acknowledgements:** We would like to thank the University of New Mexico School of Medicine librarian team for their assistance in our literature review.

TOPIC: Musculoskeletal

STUDY TYPE: Other

### **Injury Trends Between Male and Female Premier Rugby Sevens Competitors**

**Submitting Author/Presenter:** Morgan Birrell, MD, MSc Rachel Sachs, DO, CAQSM, Katherine Henry, MSc, ATC, and An-Lin Cheng, PhD

*Affiliation:* University of Missouri - Kansas City, Kansas City, MO.

**Purpose:** Our aim is to examine recent player injury data from Premier Rugby Sevens events to clarify the incidence of injury, injury profile and identify any sex-specific trends. Premiere Rugby Sevens is growing in popularity and this data can inform medical staff allocation and injury prevention campaigns.

**Methods and Study Design:** This observational study collected injury data from rostered Premier Rugby Sevens athletes for the 2021 to 2023 events; there were no specific exclusions. Athletes reported injury presence or absence, as well as the type of injury they sustained, after evaluation by the team's ATC or physician. Data were analyzed to detect injury location, change in injury rate over time, and sex-specific trends.

**Results:** The number of athletes that participated in years 2021, 2022 and 2023 were 96, 280 and 480, respectively. The post-event injury form had a 100% response rate. Injury rates from these years did show a trend toward declining overtime, with rates of 27.1%, 20.8%, and 18.5%, respectively. However, this decline was not statistically significant ( $P = 0.157$ ). The distribution of injuries between sexes shifted over the study period. Males accounted for 73.08% of injuries in 2021 and only 30.34% of injuries in 2023, whereas females accounted for the majority of injuries at 69.66% in 2023. There was no association between the type of injury and the year of the study, though lower extremity injuries made up the bulk of injuries, accounting for 52.57% (92/175) of injuries during the study period. Concussions accounted for only 6.29% (11/175) of injuries over the study period, and there did not appear to be an association with any study year or sex.

**Conclusions:** As Premiere Rugby Sevens popularity increases, injury awareness, prevention and treatment are essential considerations. The combined injury rate was 20.3% over 3 years and the yearly injury rate remained stable over the study period. There was a shift in sex-specific injury rates over the study period, with women making up a higher proportion of injuries with each new season. The majority of injuries appear to affect the lower extremities.

**Significance:** This data can inform relevant injury awareness campaigns and sex-specific injury prevention strategies for Premier Rugby Sevens. Understanding injury incidence will allow for appropriate resource planning and allocation of medical support staff.

**Acknowledgements:** We would like to acknowledge Premier Rugby Sevens, and their medical team for their help in collecting the data for this project.

TOPIC: Concussion

STUDY TYPE: Other

### **DS Concussion Care a Cervical Spine Strengthening and Stability Program for Concussion Injury Prevention**

**Submitting Author/Presenter:** Amy Leu, DO

Christian Ahlstrom, MAT, ATC, Jason Xu, MD, Rahil Hudda, DO, MPH, Nicole Davidson, Vanessa Yang, MS, ATC, SFG, and Sophie Webb

*Affiliation:* UC San Diego School of Medicine, Department of Family Medicine, Division of Sports Medicine.

**Purpose:** This retrospective data analysis study evaluated a novel cervical spine strengthening program that athletes who previously had concussions underwent. The purpose is to demonstrate the strength adaptations in the cervical spine by completing this program.

**Methods and Study Design:** The program consists of 20-minute sessions, twice a week, led by certified athletic trainers and physical therapist assistants. Measurements for cervical strength in the sagittal, coronal, and rotational planes will be taken before the program, midway through (at the 2-week mark), and after program completion. This approach aims to demonstrate the strength adaptations gained through the program.

**Results:** Averaging all participants who participated in at least 3 sessions, cervical flexion, cervical extension, right lateral flexion, and left lateral flexion all saw positive adaptations. On average, cervical flexion improved by 3.4%, cervical extension improved by 5%, right lateral flexion improved by 6.3%, and left lateral flexion improved by 6.4%. Averaging all participants who participated in at least 6 sessions, cervical flexion, cervical extension, right lateral flexion, and left lateral flexion all saw positive adaptations as well. On average, cervical flexion improved by 7.3%, cervical extension improved by 9.3%, right lateral flexion improved by 8.4%, and left lateral flexion improved by 8.7%.

**Conclusions:** The proposed analysis and subsequent validation of this strengthening program will provide a framework for the Athletic Department to then apply it across all high-risk sports. This will set the foundation to allow for a prospective observational study to determine if the implementation of this validated program results in a decrease in concussion incidence in university athletes that have completed the program compared to those who have not.

**Significance:** Cervical spine stability and strength has been more recently identified as another area that can be addressed pre-season to help with concussion prevention, particularly in contact and collision sports such as football, soccer and basketball.

**Acknowledgements:** UC San Diego School of Medicine, Department of Family Medicine UC San Diego Department of Athletics.

TOPIC: Rehabilitation

STUDY TYPE: Other

### **A Comparison of Physical Activity in Golfers With Physical Disabilities: An Observational Study**

**Submitting Author/Presenter:** Joseph Aguirre, DO



Yelyzaveta Merenzon, William Zhang, and Prakash Jayabalan, MD, PhD

*Affiliation: Northwestern University (Shirley Ryan Ability Lab), Chicago IL.*

**Purpose:** Compare the effects of a round of golf on individuals with and without disabilities measurement of heart rate (HR) and relative perceived exertion (RPE). We hypothesize that golfers with disabilities will report higher HR measurements during a round of golf compared to non-disabled golfers.

**Methods and Study Design:** Participants filled out a pre-participation survey with demographic information, disability diagnosis and golf history. Data was gathered during the practice round of an adaptive golf event, during which participants wore a Fitbit to monitor HR during the round.

**Results:** Thirteen participants completed the study (2 female and 11 male). Nine golfers with disability (GwD) and 4 without. Age ranged from 26 to 56 (Average 39.5 years ( $\pm 10.5$  SD)). Four participants were individuals with lower extremity amputation, 2 upper extremity, 1 with cerebral palsy, 1 with spinal cord injury and 1 with multiple sclerosis. Non-disabled golfers had an average HR of 108.3 ( $\pm 14.3$  SD) beats per minute (bpm) and average max HR of 145.8 ( $\pm 16.9$  SD). They spent 17.3% ( $\pm 22.7$  SD) of their time with a HR above 70% of maximal HR and 48.4% ( $\pm 30.7$  SD) of time with HR between 50 and 69% of maximal during the round of golf. Average RPE was 12 ( $\pm 2.7$  SD). GwDs had an average HR of 114 ( $\pm 11.7$  SD) bpm and average max HR of 161.3 ( $\pm 12.2$  SD). They spent 25.2% ( $\pm 26.9$  SD) of their time with a HR above 70% of maximal HR and 47.9% ( $\pm 16.1$  SD) of time with HR between 50 and 69% of maximal during the round of golf. Average RPE was 12.2 ( $\pm 3.9$  SD). 88.9% of GwDs reported that they agreed or strongly agreed that golf has improved their physical, mental, social and overall quality of life.

**Conclusions:** Although sample size was small for this study, descriptive findings demonstrated that GwDs experienced a higher maximal HR and higher average HR during a similar round of golf. Rating of perceived exertion was similar between groups. Also importantly, both groups highly rated the benefits of golf on their physical, mental, social and overall quality of life.

**Significance:** This study allowed us to quantify the level of physical activity of a round of golf in individuals with disability. We hope this study and others will further highlight the health benefits of golf in individuals with physical disabilities.

**Acknowledgements:** We greatly appreciate the Midwestern Amputee Golf Association and Bradley Schubert for allowing us to recruit participants during their event. We also greatly appreciate the Golf and Health Initiative for their support through this project.

TOPIC: Concussion

STUDY TYPE: Cohort

### Relationship Between Orthostatic Vital Signs and Post-concussion Recovery in Athletes

**Submitting Author/Presenter:** Aarthi Manjunathan, DO  
James Eckner, MD, Michael Popovich, MD, and Matthew Lorincz, MD, PhD

*Affiliation: University of Michigan, Ann Arbor, MI.*

**Purpose:** To evaluate the relationship between initial visit (within 2 weeks of injury) orthostatic heart rate (HR) changes and time until clearance for unrestricted sport in athletes with concussion (primary); to explore factors associated with initial visit post-concussion orthostatic HR changes (secondary).

**Methods and Study Design:** Patients 6 to 24 years seen within 2 weeks of concussion included. Positive orthostatic HR cohort defined based on sustained HR increase of 30 bpm at 2 minutes. Cox regression compared time until clearance for unrestricted sport between cohorts in primary analysis. Secondary analyses used *t*-tests and  $\chi^2$  tests to explore associations between other clinical variables and orthostatic HR changes.

**Results:** Forty-six patients with positive orthostatic HR changes ( $14.8 \pm 2.3$  years; 37.0% female), 285 patients without ( $15.6 \pm 3.1$  years; 38.6 % female) eligible for inclusion. Mean time to initial visit with orthostatic HR measurement ( $6.3 \pm 3.6$  days) post-injury. In primary analysis, time until clearance for unrestricted play did not differ between patients with and without positive orthostatic HR changes (HR = 0.96, 95% CI 0.67-1.36;  $P = 0.78$ ). In secondary analyses, age was the only clinical variable explored found to be associated with presence of positive orthostatic HR changes ( $P = 0.04$ ); patients with positive orthostatic HR changes were significantly younger ( $14.8 \pm 2.3$  years) than those without ( $15.8 \pm 3.1$  years). Cohorts did not differ by sex ( $P = 0.83$ ), race ( $P = 0.94$ ), ethnicity ( $P = 0.24$ ), SCAT symptom number or score ( $P = 0.45$ ; 0 = 0.22), presence of loss of consciousness ( $P = 0.26$ ), prior history of concussion ( $P = 0.80$ ), migraine headache ( $P = 0.52$ ), ADHD ( $P = 0.29$ ), depression ( $P = 0.80$ ), or anxiety ( $P = 0.67$ ).

**Conclusions:** Our results do not support the hypothesis that positive orthostatic HR changes in the initial 2 weeks following concussion are associated with longer recovery times. While those with positive orthostatic HR changes were younger than those without, none of the other demographic variables, injury characteristics, or neurological comorbidities investigated were associated with presence of positive orthostatic HR changes.

**Significance:** Despite an increased prevalence of positive orthostatic HR changes following concussion, especially in younger athletes, our results do not suggest that initial orthostatic HR changes within 2 weeks of injury are associated with recovery.

TOPIC: Musculoskeletal

STUDY TYPE: Cohort

### Patellar Fatpad Hydrodissection Outcome Predict Patient Reported Outcome of Arthroscopic Debridement

**Submitting Author/Presenter:** Matthew Kampert, DO, MS  
Michael Del Busto, MD, Alexander Cantrell, MD, Gabrielle Scariano, BS, Chao Zhang, MS, Jason Genin, DO, and Lutul Farrow, MD

*Affiliation: Cleveland Clinic Cleveland, OH.*

**Purpose:** The objectives is to determine whether clinically-reported improvement in knee symptoms after an ultrasound-guided infrapatellar fat pad hydrodissection in patients with IFP impingement is a predictor of achieving KOOSpain MCID and PASS 1 year postoperatively after arthroscopic fat pad debridement.

**Methods and Study Design:** Patients were diagnosed with isolated IFP impingement if they reported anterior knee pain in the infrapatellar region and also had a positive Hoffa's test, pain on forced hyperextension of the knee, and edema in the superolateral portion of the infrapatellar fat pad (IFP) on magnetic resonance imaging (MRI) without other intra-articular abnormalities. IFP hydrodissection done under ultrasound.

**Results:** Variables collected included PASS, KOOS, demographics, psychiatric comorbidities, pre-operative pain and activity level, if an ultrasound-guided IFP hydrodissection was completed and procedural information, if pain relief was reported clinically post-hydrodissection, and postoperative complications (eg, infection). Of the 75 included patients, 39 (52%) had 1-year postoperative patient-reported outcomes scores. Thirty-one of those 39 patients (79.5%) reached the minimally clinically important difference (MCID, defined as 10 points) for KOOSpain at 1 year postoperatively and 28/39 (71.8%) reported PASS at that time. Of the 75 included patients, 26 patients underwent hydrodissection and 21 reported clinically-improved pain post-procedurally. Eight patients reported relief after undergoing pre-operative hydrodissection and had PROM at T1, and 6/8 (75%) reached pain MCID with the same number (6/8, 75%) reporting PASS. Two-sample *t*-test or Wilcoxon rank sum test was utilized to compare continuous variables, as appropriate.

**Conclusions:** Arthroscopic IFP debridement can be a highly effective treatment for patients with IFP impingement as defined as reaching KOOSpain MCID and reporting PASS at 1 year postoperatively. Larger sample size studies are needed to more accurately determine if there is a predictive link between hydrodissection pain relief and improvement after arthroscopic IFP debridement.

**Significance:** Our data suggest experiencing pain relief from pre-operative hydrodissection is correlated with reaching MCID for KOOSpain and reporting PASS at 1-year following arthroscopic IFP.

**Acknowledgements:** Kurt Spindler MD Jennifer Baldwin.

TOPIC: Running

STUDY TYPE: Cohort

## Investigating Factors Influencing Healthcare Utilization among Injured Runners of the NYC Marathon

**Submitting Author/Presenter:** Tyler Jackson, MD  
Brett Toresdahl, MD and Mark Fontana, PhD

*Affiliation:* Hospital for Special Surgery, New York, NY.

**Purpose:** Demographic factors have been associated with varying levels of healthcare utilization across other areas of medicine, yet a better understanding of the factors impacting runners is needed. The purpose of the study was to investigate the factors influencing injury care received in marathon runners.

**Methods and Study Design:** This is a secondary analysis of previously reported data. Adult registrants of the 2022 New York City Marathon were recruited by email for a 16-week observational study. The baseline survey included demographics (age, sex, race, ethnicity, marital status, income, and education). Injury surveys were collected weekly during training, which included injury severity and care received.

**Results:** A total of 894 runners registered for the study and were uninjured at the start of the study. Four hundred thirty-one runners reported an injury resulting in modified training. Average age of injured runners was 42.8 years and 55% were female. The median number of distinct injuries per runner included was 1 (mean of 1.26). Each of the baseline factors were assessed in a multivariable logistic regression model controlling for previous running injury, goal finishing time, and number of prior marathons and half marathons completed. The baseline factor associated with higher healthcare utilization was marital/partner status (odds ratio [OR] 3.1 for unpartnered, 95% confidence interval [CI] 1.6-6.4,  $P = 0.002$ ), injury severity (odds ratio [OR] 3.0, 95% confidence interval [CI] 2.1-4.3,  $P = 0.001$ ). There was no significant association with age, sex, race, ethnicity, household income, education level, or number of injuries during training.

**Conclusions:** Although demographics including race, ethnicity, and income have been previously identified as barriers to healthcare utilization in other populations, this was not the case in this cohort of runners training for a marathon. Instead, married/partnered status and injury severity were associated with a higher rate of receiving injury care.

**Significance:** The results support prior research suggesting marital status as a factor influencing healthcare utilization, while highlighting the need for further runner-specific studies to demonstrate reproducibility among less homogenous cohorts.

**Acknowledgements:** The authors wish to thank New York Road Runners for their assistance with recruiting runners for this study.

TOPIC: Musculoskeletal

STUDY TYPE: Other

## Clinical Effectiveness of Ultrasound Guided Toradol Injections for Patients With Elbow Epicondylitis: A Case Series

**Submitting Author/Presenter:** Devon Shannon, MD  
Theodora Swenson, MD and Stephen Schaaf, MD

*Affiliation:* Vanderbilt University Medical Center Department of Physical Medicine and Rehabilitation, Nashville, TN.

**Purpose:** To determine the effectiveness of ultrasound-guided Toradol injections in reducing pain and disability for patients with elbow epicondylitis by analyzing numerical rating scale (NRS) of pain and Disabilities of the Arm, Shoulder, and Hand (DASH) scores, respectively.

**Methods and Study Design:** This was a case series of patients with a diagnosis of lateral or medial elbow epicondylitis who were treated with a single ultrasound-guided Toradol (30 mg) injection to the effected elbow tendon sheath. The primary outcomes were changes in NRS of pain and DASH scores at initial visit, 4 weeks after injection, and 3 months after injection.

**Results:** Eight patients were included in this case series, all of which were male with ages ranging from 42 to 64. Six patients had lateral epicondylitis and 2 had medial epicondylitis. DASH mean scores at initial, 4 weeks, and 3 months were 47.81, 33.54, and 28.68 respectively. NRS mean scores at initial, 4 weeks, and 3 months were 6.13, 4.00, 2.63 respectively. The study population met the minimally clinical important difference (MCID) of a reduction of 15 points for

the DASH score between initial score and at 3 months with an average change of 19.13, but this was not met at 4 weeks. The study population also met the MCID of a reduction of 2 points for the NRS score between the initial score and at both 4 weeks and 3 months with a reduction of NRS of 2.13 and 3.50, respectively. No post-injection complications were reported.

**Conclusions:** Patients met minimally clinical important difference in DASH scores at 3 months post Toradol injection as well as in NRS for pain at both 4 weeks and 3 months post injection. The results of this case series suggest that the use of an ultrasound-guided Toradol injection for elbow epicondylitis is an effective and safe treatment as it can lead to meaningful changes in clinical outcomes when looking at both the DASH and NRS scores.

**Significance:** Ultrasound-guided Toradol injections are an effective and safe treatment for elbow epicondylitis. Toradol should be considered as a first-line injection and acceptable alternative to corticosteroid injections for elbow epicondylitis.

**Acknowledgements:** References: Franchignoni F, Vercelli S, Giordano A, Sartorio F, Bravini E, Ferriero G. Minimal clinically important difference of the disabilities of the arm, shoulder and hand outcome measure (DASH) and its shortened version (QuickDASH). J Orthop Sports.

TOPIC: Concussion

STUDY TYPE: Cohort

### Orthostatic Vital Signs as a Predictor of Prolonged Recovery Post-Concussion

**Submitting Author/Presenter:** Justin Foley, MD

Richard Figler, MD

*Affiliation: The Cleveland Clinic, Cleveland, OH.*

**Purpose:** This study aims to evaluate for the presence of orthostatic vital signs in post-concussion athletes to determine if it can be used as a prognostic indicator for concussion recovery.

**Methods and Study Design:** This is a retrospective cohort study where data will be collected from concussion office visits seen through the sports medicine department. Variables include orthostatic vital signs, PCSS, balance and ImPACT scoring, reaction time, and VOMS testing collected from 2014 to 2022. Patients will be followed from their initial visit for concussion until their last visit where they are cleared by a doctor.

**Results:** The study is currently being considered for IRB approval and will be completed prior to the annual meeting.

**Conclusions:** The study is currently being considered for IRB approval and will be completed prior to the annual meeting.

**Significance:** To determine if easily obtained vital signs can help determine length of recovery and/or used as a marker of clinical recovery from concussion.

TOPIC: Other

STUDY TYPE: Other

### The Physician Divide: Analyzing the Gender Disproportions of Physicians Within Professional Sports

**Submitting Author/Presenter:** Marisa A. McDow, MD

Lawrence H. Brown, PhD

*Affiliation: Dell Medical School at The University of Texas at Austin, Austin, TX.*

**Purpose:** To describe the gender distribution of sports medicine physicians working with National Football League (NFL), National Hockey League (NHL), Major League Baseball (MLB), and National Basketball Association (NBA) teams, and contrast that with the gender distribution in the U.S. physician workforce.

**Methods and Study Design:** This observational study used internet searches of publicly available websites to compile information on NFL, NHL, MLB and NBA team physicians. Individual professional sports team websites, as well as public websites with information on the physicians (eg, their academic institutions' public webpages) were used for data collection, including gender, team affiliation, and medical specialty.

**Results:** Among 570 individual physicians working with NFL, NHL, NBA, and MLB teams, 37 (6.5%) were female. This contrasts with 37% of actively licensed U.S. physicians being female. At the sport-specific level, the MLB had the most female physicians (9%), followed by the NBA (8%), NHL (7%) and NFL (3%). Female representation among the medical specialties included: orthopedic surgery, 9/275 (3%); internal medicine, 5/73 (7%); ophthalmology, 2/30 (7%); family medicine, 10/116 (9%); and emergency medicine, 5/31 (16%). The remaining specialties (physical medicine/rehabilitation, n = 12; neurosurgery, n = 6; plastic surgery, n = 6; and psychiatry, n = 3) had too few physicians to reliably estimate female representation (n = 6 overall for remaining female physician specialties).

**Conclusions:** The data suggests a paucity of female sports medicine physicians within professional sports. This appears to be true across all the major sports, and across medical specialties. No specialty with 30 or more team physicians had female representation approaching that of the physician workforce generally.

**Significance:** Although major strides have been made, additional work is needed to increase female representation among sports medicine physicians working with professional sports teams.

**Acknowledgements:** Special thanks to the emergency medicine residency leadership team at Dell Med for their support in scholarly activities.

TOPIC: PPE

STUDY TYPE: Cohort

### Screening for Low Energy Availability in the Collegiate Training Room

**Submitting Author/Presenter:** Lauren Wichman, MD

Marie Schaefer, MD

*Affiliation: Cleveland Clinic Sports Medicine, Cleveland, OH.*

**Purpose:** The primary objective of this study is to determine the prevalence of low energy availability (EA) in Division 1 male and female collegiate athletes participating in endurance sports, aesthetic sports, and weight-class sports.

**Methods and Study Design:** This is a retrospective cohort study from the 2022 to 2023 academic year. Information was gathered from questionnaires completed pre-season, mid-season, and post-season by athletes from Men's and Women's Soccer, Women's Cross Country, Men's Wrestling, and Men's and Women's Swimming and Dive. This included medical/injury history and responses to applicable and validated low EA tools.

**Results:** The validated low EA tools analyzed in this study were the Eating Disorder Screen for Primary Care (ESP) and Brief ED in Athletes Questionnaire (BEDA-Q). The ESP is a 5-item questionnaire previously validated in university students and was administered to our male and female athletes. The BEDA-Q was only previously validated in adolescent elite female athletes and was therefore only given to our female athletes. Results indicate 7% positive screening using the ESP during pre-season. Men's Wrestling had 14% of their athletes screening positively, followed by Women's Soccer at 11% and Women's Swimming and Dive at 7%. Impaired reproductive function is one of the most well-documented sequelae of low energy availability. However, 64% of our female athletes are using hormonal birth control, indicating menstrual function monitoring is likely an unreliable measure of REDs in many collegiate female athletes.

**Conclusions:** In the most recent 2023 International Olympic Committee's (IOC) consensus statement on Relative Energy Deficiency in Sport (REDs), the authors described the staff burden associated with repeated calculations of energy availability in athletes. The first step of their new clinical assessment tool includes initial screening using population specific questionnaires. This study analyzes results from low EA screening in the collegiate training room.

**Significance:** Establishing the prevalence of low EA in our collegiate training room can promote widespread EA screening across the country at the collegiate level and can help direct resources to athletes at high risk of injury and other serious low EA sequela.

**Acknowledgements:** We would like to thank the athletic training staff at Cleveland State University and members of the Cleveland Clinic Sports Medicine Research team for their assistance with data collection and analysis.

TOPIC: Other

STUDY TYPE: Other

### Cross Covering: Analyzing Multi-Team Physician Coverage Within Professional Sports

**Submitting Author/Presenter:** Marisa A. McDow, MD  
Lawrence H. Brown, PhD

**Affiliation:** Dell Medical School at The University of Texas at Austin, Austin, TX.

**Purpose:** To describe multi-sport coverage among sports medicine physicians working with professional sports teams in the National Football League (NFL), National Hockey League (NHL), Major League Baseball (MLB), and National Basketball Association (NBA).

**Methods and Study Design:** This observational study used internet searches of publicly available websites to compile information on NFL, NHL, MLB and NBA team physicians. Individual professional sports team websites, as well as public websites with information on the physicians (eg, their academic institutions' public webpages) were used for data collection included team affiliation and specialty.

**Results:** Among the NFL, NHL, NBA, and MLB, 48 physicians out of the 570 total physicians covered more than one professional team. The majority ( $n = 44$ ) of these 48 physicians only covered 2 teams, and 4 physicians covered 3 teams. The highest percentage of cross coverage was between the MLB and NFL ( $n = 14$ ), with the next most likely combination tied between MLB-NBA ( $n = 11$ ) and NFL-NHL

( $n = 11$ ). Cross coverage of teams within the same sport was rare: one physician covered 2 MLB teams and another covered 2 NBA teams. The medical specialties of physicians cross-covering multiple teams included orthopedic surgery ( $n = 30$ ), family medicine ( $n = 9$ ), internal medicine ( $n = 6$ ), physical medicine and rehabilitation ( $n = 2$ ), and ophthalmology ( $n = 1$ ).

**Conclusions:** Most sports medicine physicians working with professional sports teams serve a single team. Approximately 8% of sports medicine physicians working in professional sports cover more than one team. Most sports medicine physicians covering multiple teams were orthopedic surgeons. Cross coverage of multiple teams was less common for sports that had overlapping of their seasons.

**Significance:** It appears opportunities might be limited to cover multiple professional teams, with only 8% of physicians within the 4 major professional sports represented.

**Acknowledgements:** Special thanks to the emergency medicine residency leadership team at Dell Med for their support in scholarly activities.

TOPIC: Education

STUDY TYPE: Survey

### Medical Students' Attitudes Towards Interprofessional Teamwork, Roles, and Responsibilities at a Day in Sports Medicine

**Submitting Author/Presenter:** Katlyn Droke, BS, MS

Andrew S. Nowak, JD, Gabrielle E. Kennelley, MS, Chin-I Cheng, PhD, Rebecca M. Northway, MD, Noshir Y. Amaria, DO, AT, ATC, CAQSM, Melissa Tinney, MD, and Adam Lewno, MD

**Affiliation:** Central Michigan University College of Medicine, Mt Pleasant, MI.

**Purpose:** To investigate volunteer medical students' attitudes toward interprofessional teamwork and individual professions' roles and responsibilities after working with physicians, athletic trainers, physical therapists, recreational therapists, nutritionists, and coaches at A Day in Sports Medicine.

**Methods and Study Design:** Medical student volunteers (MS1-MS4,  $n = 14$ ) were asked to complete the 9-item (Likert scale) Teamwork, Roles, and Responsibilities (TRR) section of the Interprofessional Attitudes Survey before and immediately after the event to evaluate attitude changes regarding work with interprofessional teams. A mixed-design ANOVA model was used to compare pre- and post-event survey responses.

**Results:** A total of 13 students completed both surveys. There was a significant increase in the average attitudes score toward interprofessional teamwork, and individual roles and responsibility in the post-event survey ( $P = 0.002$ ) compared to the pre-event survey. The increase was irrespective of the gender ( $P = 0.372$ ). When attitude changes towards interprofessional teamwork, roles, and responsibilities were assessed based on volunteers' medical school year, there was again a significant change overall from pre- to post-event ( $P = 0.007$ ). However, there was no meaningful difference in responses between medical school years ( $P = 0.751$ ).

**Conclusions:** Medical students had improved attitudes toward interprofessional teamwork, roles, and responsibilities after participating in the A Day in Sports Medicine event.

There were no significant changes in attitudes based on gender or year in medical school. This implies that interprofessional work is important for improving medical students' attitudes towards interprofessional teamwork regardless of gender or class cohort.

**Significance:** The improvement in TRR Interprofessional Attitudes Survey scores indicates that medical students should have more opportunities to engage in interprofessional team events to improve their attitudes toward working with other health professionals.

**Acknowledgements:** The investigators would like to thank the AMSSM for the Agostini Medical Student Community Outreach Grant, the Mid-Central Area Health Education Center (AHEC) for the Outreach and Research Grant, and our volunteers for making this event a success.

TOPIC: Education

STUDY TYPE: Survey

### **Assessing Medical Students' Attitudes Towards Caring for those With Disabilities Through "A Day in Sports Medicine"**

**Submitting Author/Presenter:** Andrew S. Nowak, JD

Katlyn Droke, MS, Gabrielle E. Kennelley, MS, Chin-I Cheng, PhD, Rebecca M. Northway, MD, Noshir Y. Amaria, DO, AT, ATC, CAQSM, Melissa Tinney, MD, and Adam Lewno, MD

*Affiliation: Central Michigan University College of Medicine, Mt. Pleasant, MI.*

**Purpose:** To evaluate medical students' attitudes towards caring for individuals with disabilities through A Day in Sports Medicine (event for high school/college students with disabilities) and investigate if exposure increases medical students' comfort and confidence working with this unique population.

**Methods and Study Design:** Medical student volunteers (MS1-MS4,  $n = 14$ ) were asked to complete the 17-item (Likert scale) Disability Attitudes in Healthcare Survey before and immediately following engagement with individuals with disabilities at A Day in Sports Medicine. A mixed-design ANOVA model was used to compare pre- and post-event survey responses, as well as their interaction with gender and student class.

**Results:** A total of 13 medical student mentors completed both surveys. Overall, there was no statistically significant change in attitudes toward caring for individuals with disabilities across the 2-time points ( $P = 0.079$ ), although there was a positive trend. There were also no differences between pre- and post-event responses between genders. However, when individual medical student class cohorts were considered, the MS3 medical student volunteers had a statistically higher average score in attitudes (both pre- and post-event) regarding caring for individuals with disabilities than each of the other class cohorts ( $P < 0.001$ ).

**Conclusions:** Medical student volunteers at A Day in Sports Medicine had no significant attitude changes regarding caring for individuals with disabilities, but attitudes between time-points trended in the positive direction. A lack of change may also have been due to some disabilities not being outwardly apparent. Pre-event medical school curriculum or volunteers' personal experiences may have also provided a higher attitude score at baseline.

**Significance:** Medical student exposure to individuals with disabilities is important to career preparation. While no significant attitude changes were seen here, we hypothesize students may require additional in-person exposures for meaningful changes to be seen.

**Acknowledgements:** The investigators would like to thank the AMSSM for the Agostini Medical Student Community Outreach Grant, the Mid-Central Area Health Education Center (AHEC) for the Outreach and Research Grant, and our volunteers for making this event a success.

TOPIC: Education

STUDY TYPE: Survey

### **Understanding Anterior Cruciate Ligament (ACL) Injury Risk Mitigation in Female Athletes**

**Submitting Author/Presenter:** Bridget Murphy, MD

Beth Damitz, MD

*Affiliation: Medical College of Wisconsin.*

**Purpose:** The study's primary purpose was to increase participants' knowledge of ACL function, injury risk factors and mechanism of injury. A secondary purpose was to evaluate the efficacy of informal lectures as a teaching modality for sport-specific topics important to athletic performance and health.

**Methods and Study Design:** Two women's teams from the Chicago Rugby Club participated in a pre-lecture survey, a one hour informal lecture, a demonstration of a validated strength and balance protocol, and an identical post lecture survey. The survey evaluated their knowledge of knee health and risk of injury on a 5 point Likert scale. This occurred on field after practice to be more accessible to the team.

**Results:** A total of 16 female participants aged 21 to 40 completed 2 non-paired anonymous surveys (one pre and one post intervention). They were analyzed using a one-tailed, unpaired  $t$ -test. All 5 questions showed statistically significant improvement in knowledge, with  $P$  values  $< 0.0001$ .

**Conclusions:** Informal lectures on sports specific topics are effective tools in increasing knowledge surrounding athletic performance and overall athlete health.

**Significance:** Female athletes tear their ACLs at up to 9 times the rate compared to their male counterparts. Increasing knowledge as well as the implementation of a strength and balance protocol can help mitigate their risk.

**Acknowledgements:** Special thanks to Chicago Rugby Club.

TOPIC: COVID

STUDY TYPE: Survey

### **Long-COVID Syndrome Rates in College Athletes Compared to Non-Athletes**

**Submitting Author/Presenter:** Thomas Ricks, MD

Cindy Nguyen, BS, Ariel Kidwell, MA, Jose Ortega, MD, Ian Yarbrough, BS, and Matt Ithurburn, DPT, PhD

*Affiliation: American Sports Medicine Institute, Birmingham, Alabama.*

**Purpose:** With physical inactivity being a consistent risk factor for Long-COVID, we sought to further examine the potential protective quality of sport-related physical activity against the development of Long-COVID symptoms by

comparing Long-COVID symptoms between college athletes and non-athletes peers.

**Methods and Study Design:** We administered a survey to collegiate students that assessed suspicion/diagnosis of long-COVID, vaccination status, and symptoms using the Long-COVID Symptom Tool. We compared the proportions of suspected long-COVID and of >2 persistent symptoms (lasting >30 days) between athletes and non-athletes and compared the proportions of suspected long-COVID by vaccination status using  $\chi^2$  tests.

**Results:** Surveys were completed by 131 participants, including 61 athletes and 70 non-athletes. Eight (13.1%) athletes versus 20 (28.6%) non-athletes reported suspected or diagnosed long-COVID ( $P = 0.03$ ). In contrast, there were no group differences in the proportions who experienced >2 persistent symptoms following COVID infection between athletes (45.9%) and non-athletes (37.1%) ( $P = 0.31$ ). Amongst the entire cohort (athletes and non-athletes), 83.2% of participants were partially vaccinated, and we found that those vaccinated prior to COVID infection had lower proportions of suspected long-COVID (17.4%) compared to those who were not vaccinated (40.9%) ( $P = 0.01$ ). Within athlete and non-athlete subgroups, we similarly found that 8.3% of vaccinated athletes experienced long-COVID versus 30.8% of those non-vaccinated ( $P = 0.03$ ), and that 24.6% of vaccinated non-athletes experienced long-COVID versus 55.6% of those non-vaccinated ( $P = 0.06$ ).

**Conclusions:** In this study, we found lower proportions of suspected/diagnosed long-COVID in collegiate athletes compared to non-athletes. However, we did not find a difference between athletes and non-athletes when comparing the proportions with >2 persistent long-COVID-related symptoms following acute infection. We further found lower proportions of long-COVID in those vaccinated versus those unvaccinated, regardless of athlete/non-athlete group.

**Significance:** The lower proportions of long-COVID in athletes versus non-athletes may indicate a protective effect of physical activity and/or fitness. However, further study is needed to measure and account for daily physical activity on risk of COVID sequelae.

**Acknowledgements:** Special thanks to Jacksonville State University, Birmingham Southern College, Samford University, University of Alabama Birmingham, and University of West Alabama for participation in this survey study.

TOPIC: Cardiology  
STUDY TYPE: Survey

## AED Screening in Community Athletic Complexes

**Submitting Author/Presenter:** Christoffer Amdahl, MD

Sana Qureshi, DO, Sadra Forati, DO, Joshua Allen, DO, Ian Taylor, MD, Lindsay Porter, MD, Tasaduq Mir, MD, and Curtis Johnson, MD

*Affiliation: Medical City Arlington, Arlington, TX.*

**Purpose:** Determine the prevalence and accessibility of AEDs within Tarrant and Denton County athletic fields and facilities, evaluate the knowledge and confidence levels of Tarrant and Denton County athletic fields and facilities staff regarding AED usage and emergency response procedures.

**Methods and Study Design:** An electronic survey was sent to publicly available emails for Tarrant and Denton County athletic facilities regarding AED presence and number of SCA

events with and without AED use. Inclusion Criteria: Free standing recreational fields in athletic complexes in Tarrant or Denton Counties, not affiliated with a school/pool, and able to read or understand English at a 5th grade level or higher.

**Results:** There were 3 facilities who responded to the email, and there were 3 AEDs at their facilities total, with one average AEDs per facility. Regarding the knowledge of AED use, one facility responded that their board members were required to be trained but the other facilities did not respond to this question. There were zero recorded events with SCA as the listed diagnosis total, and no reported uses of AEDs at the facilities. The facilities had up to 5000 participants per week, were predominantly used for soccer, and used by athletes

**Conclusions:** While AEDs themselves do not prevent SCA, their strategic placement at athletic fields is vital for timely intervention, community preparedness, and the overall well-being of individuals participating in sports activities. This aligns with legal and ethical obligations for public safety, emphasizing the importance of the need to address the increased potential for cardiac emergencies in sports setting.

**Significance:** AEDs are vital in preventing sudden cardiac arrest-related fatalities by providing prompt and effective intervention. Having AEDs at athletic fields can help provide rapid response treatment during cardiac events in sports settings.

TOPIC: Cardiology  
STUDY TYPE: Survey

## ECG Interpretation in the Primary Care Setting

**Submitting Author/Presenter:** Justin Chu, MD

Jordan Hilgefort, MD

*Affiliation: University of Louisville; Louisville, KY.*

**Purpose:** Athlete cardiac anatomy and physiology are unique to the general population in a myriad of ways. Primary care sports medicine providers should have the clinical expertise to identify and distinguish these exercise-induced cardiac remodeling changes that are noted on screening electrocardiogram.

**Methods and Study Design:** Primary care physicians within our community served as test subjects and were asked to look at 10 different screening ECGs. After each ECG, they were asked whether or not they would medically clear the athlete for sports participation. If they restricted the athlete from play, they were asked what workup they would pursue.

**Results:** Primary care providers from various specialties completed the study. Specialties included Family Medicine (44%), Med-Peds (33%), Internal Medicine (6%), Pediatrics (6%), PM&R (11%). Forty-four percent were attending physicians, 44% were resident physicians, and 11% were nurse practitioners. The youngest post graduate year of the participants was 2 years out, and the oldest was 15-20 years out of graduation. Only 11% of the participants completed a sports medicine fellowship. The range of percentage of correct answers was 22-89%. Three questions had less than 50% correct response and 3 questions had greater than 80% correct response.

**Conclusions:** The baseline understanding from primary care providers on ECG interpretation for athletes has room for improvement. This study demonstrates that there is a need for educational intervention regarding athlete screening ECG interpretation for primary care providers throughout all

specialties. This would not only aid in the overall care of athletes but also save the healthcare system significant from unnecessary additional testing.

**Significance:** This study emphasized the increased need for primary care education in athlete ECG screening. This will likely positively impact the global healthcare system by decreasing unnecessary testing, and preventing detrimental outcomes.

**Acknowledgements:** The authors would like to thank Dr. Joseph Barsa for his contributions to this project.

TOPIC: Eating Disorders  
STUDY TYPE: Other

### Mental Health Pathology in Collegiate Athletes With and Without Bone Stress Injury

**Submitting Author/Presenter:** Crystal Graff, MD

Christian Nicolosi, MD, Avinash Chandran, PhD, Adrian Boltz, MSH, Neel Rao, MPH, and Karin VanBaak, MD

*Affiliation: University of Colorado - Department of Physical Medicine and Rehabilitation, Denver, Colorado.*

**Purpose:** Eating disorder/disordered eating is known to be a risk factor for bone stress injury (BSI), along with several medical factors. This study aimed to examine mental health markers and the development of BSI in NCAA Division 1 athletes.

**Methods and Study Design:** BSI incidence was collected from Fall 2017 to Spring 2022 and mental health measures—Athlete Psychological Strain (APSQ), Eating Disorder Examination Questionnaire Short (EDEQ-S), General Anxiety Disorder-7 (GAD7), and Patient Health Questionnaire-9 (PHQ9)—biannually (T1:Fall 2020, T2: Spring 2021, T3:Fall 2021, T4:Spring 2022). These measures were evaluated in athletes with and without BSI.

**Results:** Four hundred eighteen athletes completed mental health measures in Fall, 2020 and were included in analysis (45% female). Forty-four of these sustained a BSI (59% female, 47.7% women's track & field, 31.8% men's track & field) during the observation period. We observed comparable trajectories of APSQ (BSI: T1 = 17 (SD = 6.0) T2 = 17.7 (SD = 6.0) T3 = 13.3 (SD = 4.4) T4 = 17.6 (SD = 7.3); non-BSI T1 = 15.2 (SD = 5.2) 15.1 (SD = 5.6) 13.3 (SD = 5.1) 14.1 (SD = 5.3)), GAD7 (BSI T1 = 4.4 (SD = 5.2) T2 = 5.2 (SD = 5.4) T3 = 2.3 (SD = 3.5) T4 = 3.4 (SD = 4.0); non-BSI T1 = 2.8 (SD = 3.8) 2.9 (SD = 3.8) 1.9 (SD = 3.3) 2.5 (SD = 3.8)), and PHQ9 (BSI T1 = 3.8 (SD = 4.5) T2 = 3.8 (SD = 4.3) T3 = 2.1 (SD = 3.5) T4 = 2.1 (SD = 4.01); non-BSI T1 = 2.5 (SD 3.3) 2.4 (SD = 3.5) T3 = 1.7 (SD = 3.7) T4 = 2.4 (SD = 3.6)) scores between groups over the 4 time points measured. We observed different trajectories of EDEQS scores between the BSI and non-BSI groups (BSI T1 = 3.3 (SD = 5.1) T2 = 3.7 (SD = 5.0) T3 = 1.1 (SD = 1.8) T4 = 2.8 (SD = 4.9); non-BSI T1 = 2.7 (SD = 4.6) T2 = 3.2 (SD = 5.6) T3 = 2.2 (SD = 5.0) T4 = 2.0 (SD = 3.4)).

**Conclusions:** Most athletes with BSIs participated in track and field. In this subset of collegiate athletes, those with BSI during their collegiate career had similar or higher baseline scores for psychological strain, anxiety, depression, and eating disorder thoughts than those who did not sustain a BSI. Change in each of these measures over time in athletes with

BSI warrants more detailed evaluation with respect to injury timing.

**Significance:** BSI's lead to significant morbidity, time loss for athletes, and are often a harbinger of a systemic nutritional deficiency. Data gained here will help develop a more complete mental health profile for athletes with this injury.

TOPIC: Musculoskeletal  
STUDY TYPE: Cohort

### Impact of Childhood Opportunity Index on Treatment Outcomes of Osteochondritis Dissecans of the Knee

**Submitting Author/Presenter:** Colton Schwarz, MD

Kennedy Morey, BS, Brian Lee, PhD, Angela Vanderpool, CPNP, Kevin Latz, MD, Natalie Stork, MD, Donna Pacicca, MD, and Brian Harvey, MD

*Affiliation: Children's Mercy, Kansas City, MO.*

**Purpose:** We aim to explore the relationship that Childhood Opportunity Index (COI), a validated measure of socioeconomic status (SES), has on the outcomes of treatment of osteochondritis dissecans (OCD) lesions of the medial femoral condyle (MFC) of the knee.

**Methods and Study Design:** This retrospective cohort study included patients 0-18 within a single pediatric academic center with a diagnosis of MFC OCD of the knee between 2015 and July 2023. Patients were stratified into 4 groups based on COI and we examined associations between conservative management failure, defined as progression to surgery, time to return to modified activity, and sport.

**Results:** We analyzed 230 patients that met initial inclusion criteria. 16 patients were excluded leaving a total of 214 patients with 266 lesions. 159 (74.3%) patients underwent initial conservative management. Patients with "low" (very low pentile plus low pentile) COI had a failed conservative management rate of 22.9% as compared to patients with "moderate" (11.4%), "high" (13.6%), and "very high" (17.8%). The "low" COI group had a longer duration of treatment prior to surgery (66 weeks and 7.0-9.0 clinic visits) as compared to "high" (22 weeks and 3.0-7.0 clinic visits) or "very high" (21 weeks and 2.5-5.5 clinic visits). 88.9% of the "very high" cohort returned to modified activity within 6 months as compared to 74% of the "low" COI group. Additionally, for the athletic population, 75.7% of the "very high" cohort returned to sport within 6 months as compared to 38.9% of the "low" COI group.

**Conclusions:** Patients with "low" COI had increased rates of failed conservative management although trending, did not meet statistical significance. However, there was a statistically significant difference for "low" COI patients to have a longer duration of treatment and more clinic visits until surgery was performed. Additionally, patients with "very high" COI had a quicker return to modified activity and sport compared to their "low" COI counterparts.

**Significance:** This study sheds light on the health disparities that may exist with treatment of MFC OCD of the knee. We need to identify solutions for patients with "low" COI to achieve equitable outcomes in time to surgery and return to sport.

**Acknowledgements:** Shannon Margherio, PT—research coordinator.

TOPIC: Ultrasound  
STUDY TYPE: Other

### Ultrasound Evaluation in Carpal Tunnel Syndrome: Post-Tunnel Enlargement Phenomenon

**Submitting Author/Presenter:** Rohan Sebastian, MD, MBA  
Shaun Garff, DO

*Affiliation:* Methodist Health System, Dallas, TX.

**Purpose:** Carpal tunnel syndrome (CTS) is a result of compression of the median nerve leading to paresthesia in a specific hand distribution. The purpose of this observation study was to report the findings of post-tunnel enlargement of the median nerve as seen on ultrasound in those with diagnosed CTS.

**Methods and Study Design:** An observation study was performed on 20 patients with diagnosed CTS. Median nerve cross-sectional area (CSA) at 3 different levels was assessed using ultrasound. Pre-tunnel measurements were taken at the level of the lunate, intra-tunnel measurements at the level of the hamate, and post-tunnel measurements prior to the distal median nerve split as it exits the flexor ligament.

**Results:** The study population included 20 patients (14 women, 6 men, mean age of 57.5). Ultrasound evaluation of 32 symptomatic wrists was performed using a GE Logiq 12 MHz linear transducer. The mean pre-tunnel and intra-tunnel median nerve CSA measurements were  $18.59 \pm 6.73 \text{ mm}^2$  and  $9.34 \text{ mm}^2 \pm 3.31 \text{ mm}^2$ , respectively. The post-tunnel median nerve CSA mean measurement was  $15.28 \text{ mm}^2 \pm 4.31 \text{ mm}^2$ . Statistical analysis was performed to calculate the percentage difference of the median nerve CSA between the pre-tunnel level and intra-tunnel level as well as between the intra-tunnel level and the post-tunnel level. The median nerve CSA showed a reduction of 46.6% between the pre-tunnel and intra-tunnel levels. A mean percentage increase of 75.75% change in median nerve CSA was calculated when going from intra-tunnel to post-tunnel.

**Conclusions:** Median nerve CSA measurements as it courses through the anatomical carpal tunnel demonstrated compression of 46.6% upon entering the tunnel and enlargement of 75.75% while exiting. Ultrasound is a clinically applicable tool that could help quantify and allow for better diagnosis and management of CTS. Specifically, this post-tunnel enlargement phenomenon not described in the literature could have significance in clinical practice.

**Significance:** Measurement of the median nerve CSA in CTS could provide useful quantifiable data that may allow for a reduction in additional testing such as electromyography studies leading to improved time to treatment and cost benefits for patients.

TOPIC: Epidemiology  
STUDY TYPE: Other

### Rule Revision Rumble: Exploring the Impact of Rule Changes on Olympic Judo Injuries

**Submitting Author/Presenter:** Alisha Galle, MBS  
Emmanuel Magsino, MD, MS and Michael  
Fredericson, MD

*Affiliation:* Kansas City University College of Osteopathic  
Medicine, Kansas City, MO.

**Purpose:** After each Olympics, judo undergoes rule changes mainly for spectator appeal. We questioned if these changes inadvertently affected injury rates among Olympic Judo participants. This study reviews data over 4 Olympics (2008-2020) to identify correlations between rule changes and injury trends.

**Methods and Study Design:** We reviewed summary data for each Olympics as reported by the International Olympic Committee Injury and Illness Surveillance system, athlete attendance for each summer game, and rule change records. We calculated injury incidence rates per 100 registered athletes (IIRa), proportions of injuries categorized by body region and injury type, and differences with  $\chi^2$ .

**Results:** About 1/3 of athletes were returning participants, reflecting consistent representation of demographics. IIRa of overall injuries in each Olympic game was 11.2, 12.3, 11.3, 14.6 ( $P = 0.52$ ), and IIRa of time loss injury was 6.4, 5.7, 4.9, 8.7 ( $P = 0.16$ ). Data for the 2008 Olympics game regarding specific body parts and injury type was unavailable. Several injury proportions include the proportion of head/neck injuries [10.6, 13.6, 8.7 ( $P = 0.74$ )]; upper extremity injury [51.1, 50, 36.8 ( $P = 0.26$ )]; lower extremity injury [36.2, 31.8, 40.4 ( $P = 0.68$ )]; and joint injury [61.7, 54.5, 59.6 ( $P = 0.78$ )].

**Conclusions:** Overall changes included a ban on leg grabbing, stricter regulations for headfirst landings during throws, and alterations to match structure, which did not correlate with significant changes among various injury rates across 4 Olympic games. These findings may be influenced by low overall incidence, high conditioning levels, and unpredictable match dynamics.

**Significance:** Ongoing rule changes for spectator appeal may eventually affect injury incidences as athletes use riskier techniques. Further research exploring associations between rule changes and injury patterns in all competition levels will be important.

**Acknowledgements:** Kristin Sainani.

TOPIC: Epidemiology  
STUDY TYPE: Other

### Epidemiology of Rugby Related Injuries in the United States, a NEISS Database Study

**Submitting Author/Presenter:** Sheung Man Alexander Sin, MD

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**Purpose:** Rugby is one of the fastest growing sports in the US. This study aims to describe rugby associated injury patterns in the US from 2013 to 2022 as reported by the National Electronic Injury Surveillance System (NEISS), a national probability sample of patients presenting to US Emergency Departments.

**Methods and Study Design:** The NEISS dataset was to identify patients with injuries sustained from rugby (product code 3234) between calendar years 2013 to 2022. Data on age, sex, race, ethnicity, body part(s) injured, diagnoses, location of injury, and disposition were extracted. National estimates with 95% CIs were reported based on weighted analyses.



**Results:** NEISS recorded 2,714 (national estimate of 92,104) patient encounters from 2013 to 2022. Calendar year 2013 had most injuries in our sample (14.7%). Subsequent years recorded less injuries due to a downward trend with 9.1% of all injuries occurring in 2019, an abrupt decrease in 2020 (2.6%), followed by a rebound increase in 2022 (7.2%). Most injuries occurred between age 18-22 years (52.2%), followed 15-17 (18.8%), and 23-30 (16.3%), and most were male (74%). The most common body parts injured was head/neck (41.3%), lower extremities (26%), and upper extremities (24.7%). The most common primary diagnoses were strain/sprain (22%), fracture(s) (16.9%), and penetrating injury (11.3%). Most injuries occurred at a recreational facility (72%), with school (10.8%), home (9.5%), and other public properties (1.5%) being other locations. Of all the patient encounters, 96.3% were treated and released from the ED, while 1.9% were admitted, 0.6% held for observation, and 0.2% were transferred.

**Conclusions:** Rugby is popular sport in the US and related injuries may require ED visits. There was a downward trend in the incidence of rugby-related injuries over the past 10 years, with an abrupt decrease in 2020, likely due to decreased exposure during the COVID-19 pandemic. Most injuries occurred in adolescent and young adults (15-30), involving the head/neck region, and did not require a hospital admission.

**Significance:** This study includes practical stratification by age groups based on non-contact / contact play, age class (U-10, U-13, U-15, U-18, collegiate), with weighted incidence calculated for subgroups (age, gender) and injury type (body part, diagnosis).

**Acknowledgements:** Deidentified dataset was obtained from NEISS database <https://www.cpsc.gov/Research-Statistics/NEISS-Injury-Data>.

TOPIC: Education

STUDY TYPE: Other

### Automated SMS Text Messaging for Learning Plain Film Sports Radiographs

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**Purpose:** Current literature supports the use of spaced repetition for learning. There currently resides a considerable deficit in resident interpretation of plain film sports radiographs. Our purpose is to develop an SMS based spaced-repetition learning tool for teaching plain film sports radiographs.

**Methods and Study Design:** The tool aimed to support a month-long sports medicine rotation for family medicine residents. A system was created to automate daily delivery of sports injury cases to learners. This included sending a radiographic image, a vignette, and a prompt for interpretation via text. Users received immediate feedback, with automated replies providing case explanations and learning points.

**Results:** Our project was successful in developing an automated SMS based application to send automated cases including plain sports films to our resident learners. In

addition to reliably sending and receiving responses from learners enrolled in our application, our system was also able to record responses for further analysis and evaluation of our cases.

**Conclusions:** SMS messaging is an easily accessible and reliable way of utilizing the concept of spaced repetition for learning plain film sports radiographs.

**Significance:** To our knowledge, this is the first free learning tool of this kind to teach sports x-rays. With successful refinement and completion of the system, we hope to develop a similar curriculum and system for sports medicine fellows.

TOPIC: Concussion

STUDY TYPE: RCT

### Vision Profile Scores in Post-Concussion Patients Compared to Biomarkers of Concussion Recovery

**Submitting Author/Presenter:** Alicia Chen, BS

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**Purpose:** Visual dysfunction plays a role in concussion symptomatology. Vestibulocular and visual markers such as King Devick (KD), near point convergence (NPC), and force plate (FP) can be valuable objective measures.

**Methods and Study Design:** Retrospective review of 61 patients with 228 clinical visits for concussion symptoms between 4/23/19 and 12/1/23. The average initial visit was 28.6 days after injury. Patients were given the CP screen questionnaire and were evaluated by a concussion specialist and tested for KD, NPC, accommodation, and FP. The weighted screening of visual symptoms determines the visual profile score (VPS).

**Results:** Visual symptomology was categorized based on VPS values, Low, less than or equal to 1, Moderate, 1 to 2, and High, greater than 2. The average KD, NPC, and FP measures for each VPS category were compared with a one-way ANOVA. The mean KD scores for the VPS Low, VPS Moderate, and VPS High are 16.06 s, 21.10 s, and 24.77 s respectively,  $P$ -value = 1.01E-08. The mean NPC measures for the VPS Low, VPS moderate and VPS High are 13.94 cm, 17.54 cm, and 22.93 cm respectively,  $P$ -value = 0.0000115. The mean FP sway velocities for the VPS Low, VPS moderate, and VPS High are 2.17 deg/s, 2.07 deg/sec, and 1.2 deg/sec respectively,  $P$ -value = 0.002. Accommodation asymmetry was defined as right vs left eye having a >3 cm change. Therefore accommodation asymmetry did not have a significant correlation to VPS,  $P$ -value 0.4471.

**Conclusions:** Patient-reported vision profile scores per validated CP screen may be a reliable indicator for patient visual function after a concussion. Worse vision profile scores were correlated with worse KD, NPC, and FP scores. Accommodative symmetry was not an indicator of patient visual functionality in our population.

**Significance:** The VPS from the validated CP screen tool is an easily accessible tool that can be used in the clinic to help better understand both subjective functional visual symptoms

as well as likely underlying objective visual and/or vestibular deficits.

**Acknowledgements:** SPARCC research team.

**TOPIC:** Pediatrics

**STUDY TYPE:** Survey

### **The Association Between the Social Vulnerability Index (SVI) and Access to California High School Athletic Trainers**

**Submitting Author/Presenter:** Frances Tao, MD, MPH

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**Purpose:** To (1) evaluate the association between county and census tract-level SVI scores and California Interscholastic Federation (CIF) high school access to school-based athletic trainers (ATs) and certified ATs (ATCs), and (2) to assess the variability in SVI scores between and within counties.

**Methods and Study Design:** This is a retrospective, cross-sectional, IRB-exempt study using data from CIF high schools that participated in the 2022 to 2023 Participation Census. SVI scores were extracted from the U.S. Census Bureau based on school addresses. Univariable regression was used to analyze the relationship between independent and dependent variables. Coefficients of variability were calculated.

**Results:** There were 1,598 respondent schools (65% public, 24% private, and 11% charter). Forty-nine percent of high schools reported having an AT on staff, with 41% reporting an ATC. When adjusted for school type, school enrollment size, and total sport participation, an increased SVI score (indicating increased vulnerability) in household characteristics was associated with lower odds of having a high school AT on staff at both county (OR: 0.89 (95% CI: 0.80, 0.99);  $P = 0.03$ ) and census tract levels (OR: 0.93 (95% CI: 0.89, 0.97);  $P = 0.002$ ). Increased socioeconomic status SVI scores were associated with lower odds of having a high school ATC at the census tract level (OR: 0.94 (95% CI: 0.89, 0.98);  $P = 0.006$ ), but not the county level ( $P = 0.16$ ). Intercounty variability was highest in household characteristics SVI scores, and lowest in racial & ethnic minority status SVI scores. Marin County has the greatest intra-county variability in overall SVI score.

**Conclusions:** Increased vulnerability in household characteristics (eg, increase in elderly and pediatric household members, individuals with disabilities, single-parent households, and poor English language proficiency) is associated with decreased odds of access to high school-based ATs. Future studies investigating the role of household characteristics as a social determinant of health in sports and exercise are warranted.

**Significance:** This is the first study to utilize SVI to study health inequities in the field of sports and exercise medicine. Results from this study may have implications clinically as well as on the state and county policy level.

**Acknowledgements:** AMSSM Collaborative Research Network (CRN); California Interscholastic Federation (CIF).

**TOPIC:** Concussion

**STUDY TYPE:** RCT

### **Utility of Osteopathic Manipulation Treatment in MTBI Patients With PPCS and Cervicogenic & Vestibuloocular Profiles**

**Submitting Author/Presenter:** Alicia Chen, BS

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**Purpose:** Investigate clinical improvement and specific changes in objective vestibular and visual markers after Osteopathic Manipulative Therapy (OMT) in mTBI/PPCS patients.

**Methods and Study Design:** Retrospective review of 210 encounters with OMT in 66 patients aged 15 to 75 in 2022 to 2023. Vestibular and visual markers were evaluated pre- and post-OMT procedure. Vestibular markers were assessed by way of center-of-gravity (COG) sway velocity. Visual markers were assessed using King Devick testing and near point convergence (NPC) break/recovery and accommodation.

**Results:** Overall clinical improvement in cervicogenic symptoms was endorsed in the majority of patients (95.45%) post OMT. King Devick times significantly improved by an average of  $-2.48$  seconds ( $P = 0.0000682$ ). Vestibular sway markers improved by an average of  $-0.063$  deg/sec ( $P = 0.0645$ ) on same day post-procedure testing. The data presented for the King Devick test showed statistically significant improvement, while sway velocity data also suggests an improvement trend but was not significant. NPC break ( $P = 0.639$ ) and recovery ( $P = 0.598$ ), as well as accommodation ( $P = 0.641$ ) present no significant change.

**Conclusions:** OMT may have utility in reducing both immediate and long-term post-concussive cervicogenic symptoms including neck pain, headache, imbalance, visual dysfunction, and potentially exercise intolerance. The data suggests that OMT for uncomplicated mTBI patients without contraindications may be beneficial concerning cervical, visual, and vestibular profiles.

**Significance:** OMT may be a valuable treatment option in the management of mTBI patients with PPCS. Future research with randomized controls and investigation of long-term outcomes is needed.

**Acknowledgements:** SPARCC research team.

**TOPIC:** Ultrasound

**STUDY TYPE:** Cohort

### **Comparison of Stress Ultrasonography Techniques of the Medial Ulnar Collateral Ligament in Healthy Elbows**

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**Purpose:** Ultrasonography (US) is an excellent modality for dynamic assessment of the medial ulnar collateral ligament (MUCL) by measuring ulnohumeral joint (UJ) widening

under stress. The primary purpose of this study was to compare 3 different stress US techniques.

**Methods and Study Design:** We conducted a prospective study of 3 stress US exam techniques evaluating MUCL integrity in healthy male elbows. Sixty-six elbows were evaluated with stress US by single-operator (SO), dual-operator (DO), and Telos device (TD) techniques by 2 experienced operators blinded to measurements. UHJ width was measured under unstressed and stressed conditions and a stress delta (SD) was calculated.

**Results:** SD measurements (mean, standard deviation) for each technique were as follows: SO (1.47 mm, 0.72 mm), DO (1.09 mm, 0.64 mm), TD (1.37 mm, 0.80 mm). SO vs DO SD measurements demonstrated an Intraclass Correlation Coefficient (ICC) of 0.46 (95% CI 0.18 mm, 0.63 mm) and Concordance Correlation Coefficient (CCC) of 0.45 (95% CI 0.28 mm, 0.62 mm), indicating poor reliability between SO and DO. SO vs TD SD measurements had an ICC of 0.52 (95% CI 0.32 mm, 0.68 mm) and CCC of 0.51 (95% CI 0.34 mm, 0.69 mm), indicating moderate reliability between SO and TD. The Bland Altman lower and upper Limits of Agreement for SO vs DO (−0.92 mm, 1.68 mm), and SO vs TD (−1.37 mm, 1.56 mm) indicated the expected range of differences between the techniques' SD measurements. Subjects ranked the techniques from most to least comfortable as follows: DO, SO, then TD.

**Conclusions:** The novel SO stress US technique for MUCL integrity resulted in SD measurements of poor and moderate reliability compared with DO and TD techniques, respectively. Given that the proposed stress US measurement for MUCL tears is a SD of >2.4 mm when performed by DO technique, our observation that SO technique SD varies from DO and TD technique SD by greater than 1 mm suggests that proposed abnormal stress US measurements may be technique specific.

**Significance:** This is the first study to provide head-to-head comparison of various MUCL stress US techniques. Clinicians and sonologists should use caution applying stress US cutoff measurements from a technique that differs from their practice.

**Acknowledgements:** Mayo Clinic Orthopedic Research Review Committee.

TOPIC: Pediatrics

STUDY TYPE: Other

### The Impact of the COVID-19 Quarantine on Athletic Performance in Minoritized Youth Athletes

**Submitting Author/Presenter:** Bianca Edison, MD, MS

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**Affiliation:** Children's Hospital Los Angeles, USC Keck School of Medicine, Los Angeles, California.

**Purpose:** The purpose of this study was to identify the barriers to physical activity and organized sports experienced by ethnic minoritized youth athletes during the COVID-19 pandemic and how the quarantine impacted their performance upon return to sports.

**Methods and Study Design:** Youth athletes self-identifying as minoritized and their caregivers completed surveys and semi-structured focus groups from September 2021 to March

2023 assessing physical activity and sports involvement before, during, and after the COVID-19 pandemic. Transcriptions were coded using conventional content analysis and analyzed using grounded theory to identify thematic categories and common factors.

**Results:** 63% (20/32) of youth athletes and 46% (16/35) of caregivers felt COVID-19 created barriers to physical activity. Specifically, both groups consistently mentioned 4 key factors impacting athletic performance: lack of accountability, decreased motivation to train during the pandemic, access to limited equipment at home, and a loss of safe places to practice. The pause in organized sports and closure of recreational spaces in California had the greatest impact on athletic performance. As parks closed and schools transitioned to remote learning, many athletes lost the resources they had relied on to continue training. Some athletes trained with the equipment they had from home while others felt they could use the time off and return to their sport once the COVID restrictions were lifted. However, once in-person sports and activities resumed, many athletes found that their level of conditioning and skills had been negatively affected by their routines during the quarantine.

**Conclusions:** Training during the COVID-19 pandemic was made difficult due to the many obstacles encountered as public spaces shut down and schools transitioned to remote learning. Athletes lost access to the resources that were essential in maintaining their physical fitness. The results of this study emphasize the importance of consistent, vigorous training in youth athletes to maintain their level of conditioning and skill.

**Significance:** This study highlights the effects of long-term periods of detraining, as initiated by the COVID-19 pandemic for minoritized youth. With such interruptions, training alternatives of similar vigor are needed to maintain athletic conditioning and skill.

**Acknowledgements:** The researchers wish to acknowledge the many families who made tremendous sacrifices during the COVID-19 pandemic.

TOPIC: Running

STUDY TYPE: Cohort

### Bone Characteristics among Female Endurance Athletes at Risk of Relative Energy Deficiency in Sport

**Submitting Author/Presenter:** Emily Kraus, MD

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**Affiliation:** Stanford University, Stanford, CA.

**Purpose:** Problematic low energy availability can result in deleterious health and performance outcomes in a condition called relative energy deficiency in sport (REDs). This pilot study provides descriptive bone health measures among young female endurance athletes at risk of REDs.

**Methods and Study Design:** We categorized female endurance athletes ages 18 to 30 years into REDs risk using the REDs Clinical Assessment Tool 2. Bone mineral density (BMD) was quantified using dual x-ray absorptiometry. Bone microarchitecture and geometry of the proximal and distal tibia were measured using high-resolution peripheral

quantitative computed tomography. Results were analyzed using descriptive statistics.

**Results:** Eleven female participants (mean age = 27, SD = 3) were stratified into risk levels based on increasing severity of REDs (green,  $n = 3$ ; yellow,  $n = 7$ ; orange,  $n = 1$ ; red,  $n = 0$ ). Mean lumbar spine BMD Z-score values for green, yellow, and orange risk levels were  $-0.5$  (SD = 0.3),  $-0.4$  (SD = 1.3),  $-2.4$ , respectively. Compared to green and yellow risk levels, the orange risk level had lower mean values for total area ( $677.3 \text{ mm}^2$ , SD = 85.4;  $690.8 \text{ mm}^2$ , SD = 36.2;  $623.5 \text{ mm}^2$ , respectively), trabecular BMD ( $207.3 \text{ g/cm}^3$ , SD = 17.7;  $213.2 \text{ g/cm}^3$ , SD = 43.8  $\text{g/cm}^3$ ;  $194.5 \text{ g/cm}^3$ , respectively), and cortical thickness (1.4 mm, SD = 0.2; 1.4 mm, SD = 0.2; 1.3 mm, respectively) of the distal tibia as well as cortical thickness of the proximal tibia (5.8 mm, SD = 0.3; 6.0 mm, SD = 0.8; 5.3 mm, respectively).

**Conclusions:** REDs is a result of problematic low energy availability, which has been shown to negatively impact bone health. This pilot study found that female endurance athletes with green and yellow REDs risk levels had similar bone health measures, including BMD, microarchitecture, and geometry while the one participant at orange risk level had less optimal bone health measures. This pilot study is underpowered to make more definitive conclusions.

**Significance:** Female endurance athletes with higher REDs risk levels appear to have poorer measures of bone microarchitecture, geometry, and BMD. Further research is needed on the relationship between low energy availability and various measures of bone health.

TOPIC: Musculoskeletal

STUDY TYPE: Other

## Utilization of Sports Medicine Clinic Within a Student Health Center

**Submitting Author/Presenter:** Kim C. Stewart, DO, PhD

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**Purpose:** Limited research detailing injury patterns in the non-student athlete college population exists. The purpose of this study was to investigate the utilization and most commonly addressed musculoskeletal (MSK) complaints within a large university's student health-based sports medicine clinic (SMC).

**Methods and Study Design:** We analyzed retrospective data from the University of Tennessee-Knoxville (UTK) Student Health Center's electronic health records from 2017 to 2019. Visits were extrapolated using International Classification of Diseases-10 codes and categorized based upon body region and commonality of complaint. Statistical analyses were performed using Microsoft Excel to establish trends and comparisons.

**Results:** Between 2017 and 2019, 13.4% of students who sought care at the Student Health Center were treated within the SMC, totaling 1917 patients (955 males, 950 females, 13 gender unspecified). Foot/ankle/leg injuries had the most visits with 595 (31%), followed by knee/thigh (411, 21%), shoulder/elbow/forearm (282, 14%), hand/wrist/finger (197, 10%), thorax/lumbar (195, 10%), concussion/head/neck (149, 8%), hip/SI/pelvis (127, 7%), dermatologic (53, 4%), and ADHD/mood complaints (46, 2%). Our catch-all other

group had a broad scope of msk and non-msk complaints, totalling 789 (41%) visits. Males had a higher percentage of upper extremity complaints (66.3% for shoulder/elbow/forearm and 60.4% for hand/wrist/fingers) whereas females had a higher proportion of hip/SI/pelvic (63.4%) and ankle/foot/leg complaints (56.8%). Further examinations revealed 411 visits for ankle sprains (22.1% of its category), 178 visits for concussion care (55.2%), and 369 visits for low back pain or lumbar pathology (76%).

**Conclusions:** Our findings show that a variety of injuries are common among college students. Complaints included, but were not limited to, tendinopathies, sprains, strains, fractures, concussions, and an assortment of dermatologic and other primary care concerns. Lower extremity issues, specifically ankle sprains, were most frequently addressed. Males had more upper extremity injuries while females had more hip, SI and pelvis complaints.

**Significance:** The scope of MSK injuries and primary care concerns often simultaneously addressed within the SMC highlights the importance and versatility of sports medicine physicians in the student health setting to properly care for the non-student athlete.

**Acknowledgements:** We would like to thank Carman North who promptly and efficiently extracted the necessary information and assisted with our statistical analyses, both very crucial steps for the completion of this project. We also thank the administration of the UTK Student.

TOPIC: Concussion

STUDY TYPE: Cohort

## Predictors of Post-Concussion Severe Musculoskeletal Injury

**Submitting Author/Presenter:** Amir Razani, DO

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*Affiliation: Crozer Sports Medicine Fellowship Program.*

**Purpose:** There is a well-established 2x elevated risk of MSK injury in the year following concussion; however prior studies have grouped all injuries together regardless of severity. The purpose of this study was to identify predictors which resulted in athletes being out of sport for at least 21 days.

**Methods and Study Design:** There were 97 collegiate athletes with a diagnosed concussion and subsequent injuries over the following year. Groups were compared with independent t-tests and a binary logistic regression with injury severity as the outcome measure and predictors being LOC, sex, concussion history, acute symptom severity, and days till both symptom free and full return to play while controlling for sport type.

**Results:** Of the 97 participants (55.7% female), 15 experienced a severe time loss injury (time loss:  $137 \pm 152$  days). There was a group difference in prior concussion history (Severe Injury: 73.3%, No Severe Injury 35.1%,  $P = 0.006$ ). There were no group differences Severe Injury and No Severe Injury in LOC rate (23.1% vs 11.0%,  $P = 0.233$ ), sex (53.3% and 56.1% female,  $P = 0.845$ ), acute symptom severity (Graded Symptom Checklist:  $28.9 \pm 22.1$  and  $25.0 \pm 19.5$ ,  $P = 0.528$ ), days till symptom free ( $12.3 \pm 8.7$  and  $9.7 \pm 6.5$  days,  $P = 0.207$ ), and days till RTP ( $19.7 \pm 10.5$  and  $17.8 \pm 11.0$  days,  $P = 0.553$ ). Only prior concussion history (yes/no) was a significant predictor of experiencing a severe subsequent MSK injury ( $P = 0.049$ ; Odds Ratio: 6.76 (95%

CI: 1.01-45.19)). The remaining predictors were not significant; LOC ( $P = 0.143$ ), Sex ( $P = 0.743$ ), acute symptom severity ( $P = 0.323$ ), days till symptom free ( $P = 0.636$ ), and days till RTP ( $P = 0.616$ ).

**Conclusions:** There is a well-established elevated rate of post-concussion musculoskeletal injury and the results of this study suggest an additional prior concussion (at least 2 total) increases the risk (OR: 6.8x) of a severe musculoskeletal injury (time loss >21 days) within the next year. None of the other typical clinical measures which often predict concussion outcomes were associated with the risk of a severe musculoskeletal injury.

**Significance:** These results help identify a specific subset of athletes who are at high risk for a severe musculoskeletal injury following a concussion. Sports medicine physicians can work to target these athletes with injury risk reduction interventions.

TOPIC: REGENMED  
STUDY TYPE: Cohort

### Minimally Invasive Needle Tenotomy Versus Platelet-Rich Plasma Injections for Pain Relief in Chronic Elbow Epicondylitis

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**Purpose:** Medial and lateral epicondylitis are common causes of elbow pain from tendon overuse. Differences in pain relief and overall safety profile between platelet-rich plasma (PRP) injection and minimally invasive needle tenotomy (MINT) for refractory epicondylitis are less explored in the literature.

**Methods and Study Design:** A retrospective cohort chart review from a single provider including 51 patients who had at least 3 months of elbow pain, despite conservative treatment, were enrolled (23 underwent PRP, 28 underwent MINT). Pain improvement via the Visual Analog Scale (VAS) was assessed over a 7 month period and correlated with initial MRI severity of epicondylitis.

**Results:** There was a statistically significant decrease in elbow pain (via VAS) post-procedure for both MINT and PRP groups ( $P < 0.001$ ); however, the MINT group had greater patient-reported pain relief percentage than that of the PRP group ( $P = 0.032$ ). There were no statistical differences in VAS score at long term follow up (at 7 months) between the 2 groups. However, after adjusting for treatment groups, the odds of significant or complete improvement were 1.51 times higher with each additional month of follow up for both the MINT and PRP groups, suggesting some benefit in longer term pain relief ( $P = 0.008$ ). There were no statistically different outcomes in pain relief based on varying MRI severity of epicondylitis (mild versus moderate versus severe epicondylitis). No adverse events were reported for either group.

**Conclusions:** For refractory lateral and medial epicondylitis, 2 safe and effective management options are PRP injections and MINT, irrespective of initial radiographic severity on MRI. Though reported pain relief as a percent is higher in the

MINT group, both procedures can induce long-lasting pain relief which may lead to improved function.

**Significance:** Ten percent of elbow epicondylitis is refractory to conservative management and referred for surgical intervention. PRP and MINT are 2 safe and effective non-surgical options to decrease long-term pain in chronic elbow epicondylitis.

TOPIC: Pediatrics  
STUDY TYPE: Other

### The Impact of the COVID-19 Quarantine on the Motivation of Minoritized Youth Athletes

**Submitting Author/Presenter:** Bianca Edison, MD, MS

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*Affiliation: Children's Hospital Los Angeles, USC Keck School of Medicine, Los Angeles, California.*

**Purpose:** The purpose of this study was to identify the barriers to physical activity and organized sports experienced by minoritized youth athletes during the COVID-19 pandemic and how the quarantine impacted their motivation to return to sports.

**Methods and Study Design:** Youth athletes self-identifying as minoritized and their caregivers completed surveys and semi-structured focus groups from September 2021 to March 2023 assessing athlete identity and sports involvement before, during, and after the COVID-19 pandemic. Transcriptions were coded using conventional content analysis and analyzed using grounded theory to identify thematic categories and common factors.

**Results:** The COVID-19 quarantine significantly affected the motivations of minoritized youth athletes to return to their sport once leagues and schools reopened. The most cited motivations for youth athletes to continue sport participation were "to stay in shape" 20/32 (63%), "to have fun" 20/32 (63%), and "to be on a team" 15/32 (47%). Three key factors that influenced youth athletes' changes in attitude toward sports were: (1) the long-term interruption in training, (2) emotional distress from increased isolation and (3) lack of access to safe spaces and equipment for physical activities. Survey results show that those with athlete identity scores of low to medium were more likely than those with high athlete identity to report limited access to equipment ( $P = 0.04$ ) and barriers to physical activity ( $P = 0.03$ ). Athletes and caregivers reported having to overcome obstacles to continue training during and after the pandemic, which ultimately led many to lose motivation to continue with their sport.

**Conclusions:** The COVID-19 pandemic introduced a new way of life, challenging minoritized athletes to re-evaluate reasons for participating in sports and to decide whether they wanted to continue training. This long-term pause in organized physical activity reduced social interaction and physical activity, ultimately leading to emotional distress, reduced interest in sports participation and decreased motivation to resume sports participation.

**Significance:** Decreased access to physical activity and social interaction during the COVID-19 pandemic contributed to inability to achieve top goals of sports participation and loss of interest, especially in minoritized youth with low-medium athletic identity.

**Acknowledgements:** The authors wish to acknowledge the many families who underwent tremendous sacrifice and loss during the COVID-19 pandemic.

TOPIC: Exercise Medicine  
STUDY TYPE: Other

### Exercise is Medicine: Access to Free Health Coaching for All in the Family Medicine Clinics at University of Iowa (UIHC)

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**Purpose:** Exercise Is Medicine (EIM) is a global health initiative committed to making physical activity (PA) assessment & promotion a standard in clinical care. This abstract describes a quality improvement (QI) project that integrates EIM into clinical practice to connect patients with free health coaches.

**Methods and Study Design:** This QI project took place within 9 Family Medicine Clinics at UIHC for all annual exam visits. PA was screened with the 2-item Physical Activity Vital Sign (PAVS). Inactive patients were asked if they wanted to meet with a health coach. Those replying yes received a link to a request survey on their after visit summary (AVS) and MyChart. We assessed implementation rates in our EMR system.

**Results:** Since the implementation of this new protocol into our electronic medical record (EMR) in August 2023, a total of 125,837 patients were seen across our clinics. Of those, 12,067 patients (9.6%) were screened with the PAVS by a medical assistant. A total of 5,911 screened patients (48.9%) reported less than 150 minutes of exercise/week (inactive). Overall, 12% of inactive patients replied “yes” to meeting with a free health coach. Of those, 19% received the health coaching request form in their AVS and MyChart. Of those, 20% completed the health coach request form. The percentage of inactive patients that replied ‘yes’ to a health coach increased from 3.2% in August to 19.7% in November. The percentage of patients who receive the health coaching instructions in their AVS and MyChart from their provider increased from 16.7% in August to 23.8% in November. Finally, the percentage of patients who completed the health coach request form decreased from 22.2% in August to 16.1% in November.

**Conclusions:** Identifying inactive patients who would benefit from health coaching in primary care practices can have great impact on health outcomes at reduced cost to the healthcare system. This project examines the integration of EIM with referral to free health coaching into annual primary care visits. Results suggest that PAVS tool raises awareness about insufficient PA, but only 20% of patients referred to health coaching completed the request form.

**Significance:** Barriers to completion of the health coaching request form can include lack of clinical time, lack of provider training on counseling, or language of instructions on the AVS. Further research to address barriers is necessary to assess their impact.

**Acknowledgements:** Thank you to all employees across the Family Medicine Clinics at University of Iowa Hospitals and Clinics.

TOPIC: REGENMED  
STUDY TYPE: Other

### PRP & Partial-thickness Rotator Cuff Tears—A Systematic Review of Therapeutic Outcomes

**Submitting Author/Presenter:** Isaiah Hughes, BS

Sara Vaughn, BS, Kelsey Martin, BS, Pietro Gentile, BS, and Cody Clinton, MD

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**Purpose:** The purpose of this review is to provide additional insight into the efficacy of platelet-rich plasma in improving pain and shoulder function in partial-thickness, traumatic rotator cuff tears.

**Methods and Study Design:** PubMed and EMBASE were queried for “rotator cuff tears,” “partial-thickness,” “platelet-rich plasma,” “PRP,” “injections,” “non-operative management,” and “orthobiologics.” Studies included adults with traumatic, partial-thickness rotator cuff tears treated solely with PRP. Outcomes considered were pain (VAS), ASES score, and CMS.

**Results:** Ten studies were included in the analysis. For VAS, ASES, and CMS, the PRP group demonstrated superior results at each time point compared to controls. VAS: 3 months: 4.21 control, 3.43 PRP,  $P < 0.001$ , 6 months: 5.32 control, 2.53 PRP,  $P < 0.001$ , 1 year: 3.57 control, 1.63 PRP,  $P < 0.001$ . ASES: 3 months: 60.54 control, 70.19 PRP,  $P < 0.001$ , 6 months: 68.73 control, 75.31 PRP,  $P < 0.001$ , 1 year: 61.45 control, 74.44 PRP,  $P < 0.001$ . CMS: 3 months: 67.60 control, 80.40 PRP,  $P < 0.001$ , 6 months: 72.17 control, 83.59 PRP,  $P < 0.001$ , 1 year: 56.49 control, 80.89 PRP,  $P < 0.001$ .

**Conclusions:** In this review, patients receiving a platelet-rich plasma injection demonstrated superior outcomes in all measured variables in both short- and long-term times of follow-up. In contrast to some previous studies that have demonstrated waning long-term efficacy of platelet-rich plasma, this review suggests that platelet-rich plasma may provide long-term benefits over traditional non-operative management of partial-thickness rotator cuff tears.

**Significance:** PRP represents an efficacious approach to managing non-operative sports injuries. Despite PRP becoming increasingly utilized in the field of non-operative sports medicine, there is still no established consensus on the composition of PRP solutions.

TOPIC: Musculoskeletal  
STUDY TYPE: Cohort

### Does Sport Effect Recovery GRIT and Lysholm Scores for Artistic and Ball Sport Athletes during ACL Reconstruction

**Submitting Author/Presenter:** Emily Nepomuceno, MD

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**Affiliation:** University of Colorado Anschutz Medical Campus, Aurora, CO.

**Purpose:** We explored if there were differences in knee function (via the Lysholm Knee Scoring Scale) or grit (via the Grit-S survey) between artistic (cheer, dance, gymnastics) and ball sport (soccer) athletes at pre- and post-operative assessments after Anterior Cruciate Ligament Reconstruction (ACLR).

**Methods and Study Design:** We conducted a prospective cohort study of patients enrolled prior to ACLR and followed longitudinally. All participants completed the GRIT-S questionnaire and Lysholm Scale at a pre-operative appointment and again following ACLR. We used a linear mixed model analysis to assess the effects of time (pre-op and post-op) and group (artistic and soccer athletes) on GRIT-S and Lysholm scores.

**Results:** We enrolled and assessed 16 artistic athletes and 49 soccer athletes. The artistic athletes were comprised of significantly more female patients (100% vs. 71%;  $P = 0.016$ ) and were significantly younger (age =  $13.4 \pm 5.5$  vs.  $15.9 \pm 1.9$  years of age;  $P = 0.015$ ) than the soccer athletes. On average, participants completed Grit and Lysholm questionnaires at similar time points,  $17 \pm 15$  days before surgery, and  $117 \pm 44$  days post-surgery. There were no significant effects of group ( $P = 0.32$ ), time ( $P = 0.77$ ), or interaction between group and time ( $P = 0.72$ ) on Grit ratings. Lysholm scores (higher scores indicate better function) improved significantly across time for both groups (mean =  $48.7 \pm 17.0$  vs.  $62.5 \pm 18.3$ ;  $P < 0.001$ ), but there was no effect of group ( $P = 0.54$ ) or interaction between group and time ( $P = 0.87$ ).

**Conclusions:** Artistic and soccer athletes demonstrate similar Grit scores pre- and post-op ACLR, and both groups have similar improvements in knee function over time. The artistic athletes were younger, which may be expected as dancers and gymnasts often specialize at a younger age. A larger sample size, following athletes for a longer period, or a different comparative ball sport in future research may help to better characterize sport-specific differences.

**Significance:** This is the first study to directly compare grit and knee function between artistic and ball sport athletes pre- and post- ACLR. More research is needed to evaluate sport-specific differences in attitudes and function related to ACLR recovery.

**Acknowledgements:** Thank you to our research team and participants in the ACL registry, and to our research director Dr. David Howell for supporting this project.

TOPIC: Musculoskeletal

STUDY TYPE: Other

### The Safety and Efficacy of Percutaneous Needle Tenotomy for Gluteus Medius Tendinopathy

**Submitting Author/Presenter:** Clayton Walker, MD

Chantal Nguyen, MD, Derek Schirmer, DO, Andrew Ernst, MD, Matt Kaufman, MD, Yue Meng, MD, and Eugene Roh, MD

**Affiliation:** Stanford University, Redwood City, CA.

**Purpose:** The purpose of this study is to evaluate the overall safety and efficacy of percutaneous needle tenotomy (PNT) for gluteus medius tendinopathy.

**Methods and Study Design:** This case series included all patients of a single provider who PNT of the gluteus medius tendon between November 2021 and May 2022 who had Visual Analog Scale (VAS) pain score recorded at baseline, then at 1-, 3-, and 6-months post-procedure. The Victorian Institute of Sport Assessment-Gluteal (VISA-G) was used to assess function. Adverse events were determined through chart review.

**Results:** Of the 9 patients who underwent PNT, only 4 met inclusion criteria. The average VAS pain score decreased by 3.25 ( $P = 0.007$ ) at one month, 2.75 ( $P = 0.04$ ) at 3 months, and 2.50 ( $P = 0.09$ ) at 6 months when compared to baseline. Only 3 of the 4 patients had VISA-G scores for the same time intervals, but all 4 completed baseline and the 6-month questionnaires. The average VISA-G score increased by 13.25 ( $P = 0.04$ ) at 6 months when compared to baseline. No adverse events were noted in the 4 patients over the 6-month period.

**Conclusions:** This limited case series shows that patients who underwent a PNT for tendinopathy of the gluteus medius tendon had a significant improvement in pain for up to 3 months after the procedure and had improvement in function up to 6 months after the procedure indicating good efficacy. Additionally, there were no reported adverse events in the 6-month time period indicating good safety.

**Significance:** While the safety and efficacy of PNT is well-studied, there is little data published on its use for gluteus medius tendinopathy. This case series shows that it can be used safely for gluteus medius tendinopathy and may improve pain and function.

**Acknowledgements:** Clayton Walker, MD severed at the first author of the abstract. Chantal Nguyen, MD, assisted with editing the abstract and data collection. Derek Schirmer, DO, Andrew Ernst, MD, Matt Kaufman, MD, and Yue Meng, MD assisted with data collection. Eugene Roh.

TOPIC: Concussion

STUDY TYPE: Cohort

### Assessing Heart Rate and Heart Rate Variability in Pediatric Patients With Dysautonomia Before Exertional Testing

**Submitting Author/Presenter:** Tyler Marx, MS

Alicia Chen, BS, Brett Dusenberry, MD, Jon Minor, MD, Leslie Streeter, DNP, Jaden Bailey, PA-C, Cindy Ong, MD, and Mo Mortazavi, MD

**Affiliation:** Arizona College of Osteopathic Medicine, Glendale, AZ.

**Purpose:** We investigated the link between the autonomic clinical markers heart rate (HR) and heart rate variability (HRV) score in concussed pediatric patients who are exercise tolerant (ET) and exercise intolerant (EI) during standardized exertional testing.

**Methods and Study Design:** We performed a retrospective cohort study of 90 pediatric patients, ages 7 to 18, with 266 clinical visits for concussion symptoms between 10/6/21 and 6/19/23. HR and HRV score measurements were recorded via a chest strap heart rate monitor before intensity-graded standardized exertional testing. ET and EI were determined by evaluating the onset of signs or symptoms of cardiovascular dysautonomia.

**Results:** There was a significant difference in HRV score between ET patients who completed high-intensity (HI) exertional testing, 57.26, and EI patients who failed to complete HI exertional testing due to cardiovagal dysautonomia, 49.77 ( $P = 0.0224$ ). While non-significant, the HR of ET patients who completed HI exertional testing, 86.37 bpm, was lower than EI patients who failed to complete HI exertional testing, 95.1 bpm ( $P = 0.0599$ ). The HRV score for ET patients who completed low-intensity (LI) exertional testing, 53.16, and medium-intensity (MI) exertional testing, 55.96, was not significantly different from EI patients who failed to complete LI exertional testing, 59.42 ( $P = 0.0747$ ), and MI exertional testing, 57.33 ( $P = 0.5678$ ). The HR of patients who completed LI exertional testing, 89.18 bpm, and MI exertional testing, 84.48 bpm were not significantly different from EI patients who failed to complete the respective exertional testing, 87.75 bpm ( $P = 0.6216$ ), and 83 bpm ( $P = 0.4605$ ).

**Conclusions:** A lower HR and higher HRV score was seen in ET pediatric patients when compared to their EI counterparts at HI exertional testing. Therefore, HR and HRV score measurements may be useful autonomic clinical markers when assessing a patient's exercise tolerance, especially when progressing to high-intensity exercises.

**Significance:** Considering the link between concussions and cardiovagal dysautonomia, autonomic clinical markers can provide insight into exercise intolerance. This allows for a more targeted approach to the management of concussions within pediatric patients.

**Acknowledgements:** Thank you to everyone who contributed to the research project!

TOPIC: Osteoarthritis

STUDY TYPE: Cohort

### Impact of Intra Articular Steroid Knee Injections in a Large FQHC Setting for Type 2 Diabetic Patients

**Submitting Author/Presenter:** Sabrina Serrano, MD, MS

Miguel De La Cruz, MD, Calvin Truong, MD, Chris Alvarado, MD, and Daniel Diaz, DO

*Affiliation: Altamed, Los Angeles, CA.*

**Purpose:** The purpose is to determine the safety of intra-articular corticosteroid knee injections to treat osteoarthritis, and to determine if there is a significant impact on fasting blood glucose, Hemoglobin A1c, and if medical complications occur in Type 2 diabetic patients.

**Methods and Study Design:** This is a retrospective cohort study to review electronic health records of AltaMed patients. Inclusion criteria are patients who have Type 2 diabetes with radiographic confirmation of osteoarthritis, and have received an intra-articular corticosteroid injection in the knee. Exclusion criteria will be patients with osteoarthritis without diabetes, or with Type 1 diabetes.

**Results:** Based on the literature review, the fasting blood glucose levels are expected to be elevated higher than the patient's baseline within 5 to 10 days of receiving the intra-articular corticosteroid knee injection. Systematic reviews have determined short-term effects on fasting blood glucose can range between 5 and 84 hours post injection, or up to 7 days from the injection. Most studies have assessed patient's with controlled Type 2 diabetes and yet to evaluate the impact on uncontrolled Type 2 diabetes. Type 2 diabetic patients on insulin are expected to have more elevated fasting blood

glucose levels compared to those patients on oral medications. The Hemoglobin A1c value is not expected to dramatically change as a result of the corticosteroid injection, based on previous studies determining the impact on blood glucose is short-term and most likely will not impact the Hemoglobin A1c level. Interestingly, one study determined the higher the Hemoglobin A1c, the more likely the patient will experience a hyperglycemic event, meaning their fasting blood glucose will likely increase over 5 days.

**Conclusions:** The hypothesized conclusions are to expect a rise in fasting blood glucose over 5 to 7 days post-injection, with a higher rate of elevation in uncontrolled versus controlled Type 2 diabetics. There will be no significant impact on Hemoglobin A1c levels. There is an expectation of a higher number of hyperglycemic events, however, there will most likely be very few if any medical complications as a result of the injection.

**Significance:** The significance is to determine the effects and complications after receiving an intra-articular steroid knee injection. These injections may provide pain relief and encourage exercise which can contribute to weight loss and improve glycemic control.

**Acknowledgements:** The investigators would like to acknowledge AltaMed Health in their unwavering support as well as use this opportunity to acknowledge the hard-working efforts of the sports medicine fellowship faculty including program director, Dr. Daniel Diaz, and suppo.

TOPIC: Bicycling

STUDY TYPE: Survey

### Cycling in the Big Apple If You Can Cycle Here You Can Make It Anywhere But Maybe Not Injury Free

**Submitting Author/Presenter:** Laurenie Louissaint, MD, MS  
Monica Gibilisco, DO, Irene Kalbian, MD, Lauren Bagneris, Miguel X. Escalon, MD, MPH, FAAPMR, and Jaime Wood, PT, PhD

*Affiliation: Icahn School of Medicine at Mount Sinai, Department of Rehabilitation and Human Performance.*

**Purpose:** Cycling in New York City, the most populated city in North America, comes with several challenges. These include finding accessible bike paths to the risk of debilitating injuries. The purpose of this study was to evaluate the prevalence of traumatic and non-traumatic among New York cyclist in 2022.

**Methods and Study Design:** A 16-question survey was designed by the research team and administered via REDCap. Questions were organized into 4 categories; cyclist demographics, bicycle characteristics, safety precautions, and cycling injuries. A recruitment flyer was distributed via email and social media platforms. Responses were collected between 7/31/23 and 10/17/23.

**Results:** One hundred eighty-one adults (90 female [9.7%], mean age 34 to 48 [44.8%] years [95% CI]) completed the survey. 160 [88.4%] participants identified as recreational cyclists, with spring (91.7%) and summer (93.4%) being the most popular seasons for cycling. 110 (60.8%) identified as road cyclists. 86 (47.5%) reported never having a bike fitting performed. 91 (50.3%) used cycling cleats and clipped pedals. 133 (73.5%) wore a helmet more than 50% of time and 119 (65.7%) rode in the biking lane more than 50% of the time. 44 (24.3%) suffered a traumatic injury while cycling in 2022; of



these, 33 (75.0%) while wearing a helmet. 16 (47.1%) incidents were due to collision with a moving car. 15 (34.1%) participants were evaluated in the emergency room, 2 (4.5%) required hospitalization. 17 (38.6%) were unable to cycle for a prolonged period of time and 23 (52.3%) were unable to perform their daily activities. 45 (24.9%) suffered a non-traumatic injury; 27 (60.0%) lower extremity and 22 (48.9%) were evaluated.

**Conclusions:** The survey showed that traumatic and non-traumatic injuries among New York City cyclists had similar prevalence with traumatic injuries primarily occurring with a moving car and only a small number requiring hospitalization, yet these injuries still prevented many from returning to regular activities.

**Significance:** This data provides valuable information for cyclists and healthcare providers. A repeated survey in 2023 will allow for a multi-year comparison. This data can be used to identify factors to improve overall cyclist health, safety or road changes.

**Acknowledgements:** We would like to take the time to acknowledge the New York city cycling community for their participation in this survey.

TOPIC: Concussion

STUDY TYPE: Cohort

### Neurostimulant's Effect on Persistent Post-Concussive Symptoms

**Submitting Author/Presenter:** Byron Moran, MD

Kristin Terry, MD, David Orlando, MS, and Nathan Schilaty, DC, PhD

*Affiliation: University of South Florida Morsani College of Medicine, Department of Family Medicine, Division of Sports Medicine, Tampa, FL.*

**Purpose:** Persistent post concussive symptoms (PPCS) including neurocognitive dysfunction is an increasingly recognized complication of mild traumatic brain injury with limited guidance on management (1). Our study aims to evaluate the functional impact of stimulant therapy use in mTBI patients with PPCS.

**Methods and Study Design:** A retrospective review of 1,028 unique patients with clinically diagnosed sport-related concussion compared patients confirmed via medical record for neurostimulant (NS) therapy ( $n = 21$ ) to standard-of-care (SOC;  $n = 1,007$ ). Statistical analysis compared longitudinal effects of PPCS on dependent variables of PHQ-9, GAD-7, Total Symptom Severity, and VOMS/NPC foginess scores with a mixed model ANOVA.

**Results:** Mixed model ANOVA demonstrated NS had higher PHQ-9 scores vs SOC for Visit 1-2 ( $P 0.05$ ). For GAD-7 with mixed model ANOVA, NS had higher scores vs SOC for Visit 1-2 ( $P 0.05$ ). For Total Symptom Severity, NS had higher scores for Visits 1-2 ( $P 0.05$ ). For VOMS Foginess or NPC Foginess, NS had higher scores for Visits 1-2 ( $P 0.05$ ).

**Conclusions:** Patients receiving NS therapy had higher scores in total symptom severity score, PHQ-9, GAD-7, balance impairments, foginess complaint during VOMS and NPC at the initial visit. These differences resolve within 2 to 3 visits following NS therapy initiation. The data presented suggests NS therapy may provide normalization of PPCS compared to SOC for those with higher scores of PHQ-9, GAD-7, VOMS/NPC Foginess.

**Significance:** As a retrospective study, correlation of NS to decreases of PPCS is evident, but causation cannot be confirmed. Sufficient evidence justifies a prospective trial with NS therapy to determine its effect on decreasing PPCS.

TOPIC: NCAA

STUDY TYPE: Survey

### Sports Specialization and Mental Health in Collegiate Athletes

**Submitting Author/Presenter:** Greta Bires, MD

Chelsea Salas-Tam, MD, Aisha Bowen, MD, Bradley Smith, MD, Christopher Mehallo, DO, Stephen Stache, MD, and Adam Chrusch, MD

*Affiliation: Jefferson Einstein Medical Center, Philadelphia, PA.*

**Purpose:** Sport specialization is thought to affect an athlete's psychosocial wellbeing. There is minimal research on sports specialization and mental health. We hypothesize specializing at a younger age would lead to higher rates of depression and/or anxiety in collegiate athletes.

**Methods and Study Design:** In this prospective cohort study, athletes at Division I and II Universities completed a QR code or paper survey during the yearly pre-participation physicals in 2023. Chi square and  $t$ -test for categorical and continuous variables respectively.

**Results:** Two hundred sixty-one collegiate athletes completed the survey. Baseline demographics showed slight male preponderance (51% male, 49% female), majority white (89.7% vs. 6.51% black vs. 2.3% Asian, and 1.53% other), and majority freshman (34.1% vs. 29.1% soph vs. 26.8% junior vs. 7.28% senior vs. 2.68% grad student). Rate of sport specialization was 64.8% with the athlete as the primary motivator (77.4%). 99.2% were glad they chose their current sport. 11.9% athletes had anxiety per GAD7 and 9.2% had depression per PHQ9. Of the cases with depression and anxiety, there was a significant difference in female cases ( $P < 0.001$ ) and in seeking mental health support ( $P < 0.001$ ). The average age of sport specialization was 13.2 (SD 3.33). There was no statistical significance in age of sport specialization and cases of depression ( $P = 0.342$ ) or anxiety compared to not ( $P = 0.421$ ).

**Conclusions:** Baseline demographics showed a higher rate of male, white, and freshman respondents. There was a lower rate of depression and anxiety among this population. There was no relation of age between sport specialization to cases of anxiety or depression. Of those that did have mental health symptoms, a high rate sought care showing promising access to resources and support.

**Significance:** This is the first study looking at mental health and sport specialization. Preliminarily age of sport specialization does not have an impact on mental health of collegiate athletes, but further research needs to be done.

**Acknowledgements:** Matthew Sherman for his statistics.

TOPIC: Concussion

STUDY TYPE: Other

### Mitigation of Concussion Risk: A Meta-Analysis of the Evidence for JVC Use in Contact Sports

**Submitting Author/Presenter:** Zankhan Mirani, MD

Derrick Miller, MD, Manthan Mirani, MD, Yun Shumei, MD, Joseph Winters, BSJ, Jaya Sri, BS, and Emily Gorman  
*Affiliation: University of Maryland Capital Region Health Largo, Maryland.*

**Purpose:** JCVD's are a promising modality for concussion prevention. JCVD's aim to reduce slosh mediated brain injury by increasing intracranial blood volume and in turn, reducing the potential for brain movement in the skull. This meta-review will analyze the evidence for the use of JCVD's in contact sports.

**Methods and Study Design:** Through a vocabulary and keyword search of 6 scientific databases, 356 studies were identified. Using Covidence and manual review, these studies underwent title and abstract screening. Based on a full text review of the 34 remaining studies, 14 met the inclusion and exclusion criteria. Extracted data underwent statistical analysis. Articles lacking combinable variables were used in the discussion.

**Results:** All studies used JVCD's. Study structures included one RCT, one single cohort self-control cross over, and twelve Quasi experimental studies with nonrandom assignment. Follow up parameters varied, occurring post-season, after a set length of time (ex 6 months), only after a concussion, or after a set number of hits (ex 40). Three common study endpoints included quantitative measurement of white matter changes on MRI (12 studies), fMRI changes during a working memory task (2 studies), and behavioral changes (2 studies). The studies included both male and female participants with the average age ranging from 15.8 to 17.63. Average sample size was largest in the studies on behavioral changes (81), middling in the study on white matter changes (40.85) and lowest for the study on working memory (25). Follow up varied widely from 33% to 98%. Within the JVCD group, changes in white matter and fMRI activity with working memory tasks decreased, while the attention system was better maintained.

**Conclusions:** Given the reduction in both white matter changes on MRI, and fMRI activity with working memory tasks, as well as early evidence for a potential protective effect on the alerting attention system, the JVCD carries an exciting potential as a concussion prevention device. However, inconsistent study endpoints and methodologies, as well as a narrow subject demographics limits further analysis, as well as the power and generalizability of these studies.

**Significance:** JVCD's carry potential for concussion prevention. However, RCT's trials with larger and more diverse patient populations as well as improved study methodology are needed to help improve validity and generalizability and prove clinical benefit.

TOPIC: Concussion  
 STUDY TYPE: Other

## Emergency Department and Psychology Care Patterns that Develop Following A TBI in Children and Young Adults

**Submitting Author/Presenter:** Jeremy Shapiro, MD  
 Surbhi Bhatnagar, PhD, Alexis Mitelpunkt, MD, Bruce Aronow, PhD, and Brad Kurowski, MD, MS  
*Affiliation: Division of Pediatric Rehabilitation Medicine, Cincinnati Children's Hospital Medical Center, Cincinnati,*

*OH; Division of Sports Medicine, Cincinnati Children's Hospital Medical Center.*

**Purpose:** The purpose of this study is to characterize Traumatic Brain Injury (TBI) follow-up patterns in a pediatric tertiary medical center, with a focus on emergency department and psychology visits.

**Methods and Study Design:** Data were extracted retrospectively from a database constructed from the entirety of CCHMC EPIC electronic health records from 2006 to 2022. Patients included those who presented to CCHMC with a TBI (all severities) over this period who were 21 years of age or younger at time of initial TBI diagnosis. Alteryx was used to characterize demographic data, diagnosis, ED visits, and psychology appointments.

**Results:** 27,485 patients met initial inclusion criteria with close to 75% having a diagnosis of a concussion without loss of consciousness. The most common age at injury was 15 years with 42% of patients being female. Approximately, 67% of this patient group had visits to the Emergency Department and 23% had visits to Psychology during the first 7 years following their TBI. There was a large increase in the number of visits in the initial year following the TBI to both the Emergency Department and Psychology compared to prior to the injury. The number of Emergency Department visits returned to pre-injury levels 1 year after injury and Psychology visits remained elevated up to 3 years after injury.

**Conclusions:** TBI in children is associated with an initial increase of visits to the Emergency Department and Psychology appointments, with the number of visits returning to baseline levels one year after injury and 3 years after injury for the ED and Psychology respectively. Future research should further delineate the nature of these visits and consider ways to optimize care for these individuals, especially during the initial years after injury.

**Significance:** This retrospective data review shows evidence that Psychology visits continue to remain elevated for several years after the injury. More research and funding should be focused on mental health especially after TBIs in pediatric patients.

**Acknowledgements:** Thank you to the Traumatic Brain Injury research group and to the data scientists who put this data into the database to begin with.

TOPIC: Concussion  
 STUDY TYPE: Other

## Concussion Epidemiology in a Colorado Ski Resort

**Submitting Author/Presenter:** Yana Klein, DO  
 Morteza Khodaei, MD, John Paul Spittler, MD, David Howell, PhD, and Laura Pierpoint, MD  
*Affiliation: University of Colorado Anschutz Primary Care Sports Medicine Fellow.*

**Purpose:** The purpose of this study is to evaluate the demographics, characteristics, and injury mechanisms associated with concussion among patients evaluated at a Colorado ski resort.

**Methods and Study Design:** Descriptive epidemiological study. Denver Health Winter Park Medical Center during the 2012/2013 to 2016/2017 ski seasons. Patients: All patients evaluated at the clinic with the diagnosis of concussion as a result of skiing/snowboarding injuries. Assessment of Risk

**Factors:** We evaluated risk factors such as age, sex, sport, use of helmet, ability level, slope difficulty, and injury mechanism.

**Results:** A total of 582 patients with concussion were diagnosed (9.1% of total clinic visits) during the study period, corresponding to an overall concussion incidence of 12.4 per 100,000 resort participant-visits. The average age was 25.6 years (range: 3 to 84 years). The majority of patients were male (61.7%) and concussion sustained while skiing (62.4%). The most common mechanism of injury was a fall onto snow while skiing or snowboarding (72.8%). Most patients were wearing a helmet when the injury occurred (86.1%). Most patients self-identified as beginner or intermediate skill-level (65.3%) and most injuries occurred on green (easiest) and blue (intermediate) slopes (64.5%). Concussion characteristics data pending.

**Conclusions:** A greater proportion of concussions occurred among men, with beginner/intermediate skills, on the easy/intermediate slopes. Additionally, the data on concussion characteristics within this set is pending.

**Significance:** This study can inform development of prevention strategies and management for concussion sustained while skiing and snowboarding in addition to offering a comprehensive understanding of concussion characteristics in this demographic.

**Acknowledgements:** I would like to thank Dr. Khodaei as he has been my mentor in facilitating this project and Dr. David Howell for walking me through this project. I would like to thank everyone who helped contribute to analyzing this data.

TOPIC: Pediatrics

STUDY TYPE: Other

### Demographic and Sports-Specific Data of Patellofemoral Pain Syndrome Within a Pediatric Sports Medicine Clinic

**Submitting Author/Presenter:** Paige Daily, MD

Carey Wagoner, DO, Logen Breehl, DO, Neil McNinch, Biostatistician, and John Wigal, DO

*Affiliation: Akron Children's Hospital, Akron, Ohio.*

**Purpose:** Our study sought to characterize subjects with patellofemoral pain syndrome (PFP) within Akron Children's Hospital's sports medicine clinics.

**Methods and Study Design:** Data was extracted via SlicerDicer. We included those under 18 years old diagnosed with PFP and associated diagnoses from 2017 to 2022 seen at Akron Children's Sports Medicine. Those seen at the PCP, orthopedics, and ED or those with an initial diagnosis at a follow-up were excluded. Subjects were identified via MRN and birth date. Analysis was descriptive in nature.

**Results:** A total of 691 cases met inclusion criteria with 66.8% of these patients reported as female and 33.2% as male. Basketball and soccer were the most played sports (21.6% and 17.2% respectively). However, when combined, the running sports [cross country (11.4%) and track & field (15.5%)] were the most common sports with 186 patients diagnosed (26.9%). Age ranged from 8.0 to 18.0 years, with a mean (SD) of 14.1 (2.0) years and those aged 14.0 or 15.0 representing 37.4% of sample.

**Conclusions:** Females comprised a majority of subjects with PFP at our hospital with a female: male ratio of 2:1 which aligns with other studies (1,2). PFP is often referred to as

"runner's knee"; this correlates with our study finding subjects were most commonly involved in soccer, basketball, cross country, or track & field. Among our subjects, the mean age correlates with the start of high school athletics, providing opportunity for prevention efforts.

**Significance:** PFP estimated prevalence in adolescents is 28.9% (3). It is important to establish common traits to determine injury prevention windows. Our study suggests prevention programs should be directed towards early high school females in running sports.

TOPIC: Epidemiology

STUDY TYPE: Other

### Does Body Composition Analysis Differ Among Retired NFL Athletes By Position?

**Submitting Author/Presenter:** Mark Carrasco, MD

Navneet Baidwan, PhD, Chris Grijalba, DO, Caroline Cohen, PhD, Ian McKeag, MD, and Irf Asif, MD

*Affiliation: University of Alabama at Birmingham Sports and Exercise Medicine.*

**Purpose:** Athletes with excess body fat are at higher risk for developing chronic diseases associated with obesity. The purpose of this investigation was to assess body composition in retired NFL athletes and compare differences among offensive and defensive players.

**Methods and Study Design:** This is a retrospective study of retired NFL players residing in Birmingham. A health assessment event was held at UAB where participants underwent body composition testing using an InBody S10 device which operates using bioelectrical impedance analysis. Primary outcomes include comparison of BMI, body fat mass, lean body mass, and percent body fat by position using a crude regression model.

**Results:** Twenty four of 30 participants were utilized in the study. Four participants were excluded due to unknown position type and 2 participants (one kicker and one punter) were excluded because they did not fit in either the offensive or defensive category. As compared to those who played offensive positions, retired defensive players had 0.69 kg/m<sup>2</sup> lower BMI score on average (95% CI: -4.86, 3.47). As compared to retired offensive players, defensive players had 11.03 lbs lower body fat mass score on average (95% CI: -36.01, 13.95), 3.27 lbs greater lean body mass score on average (95% CI: -16.63, 23.17), and 2.23% lower percent body fat on average (95% CI: -8.65, 4.19).

**Conclusions:** Retired NFL defensive players have a lower BMI, greater lean body mass, and lower body fat percentage compared to retired NFL offensive players, although not statistically significant.

**Significance:** Retired NFL athletes are at risk for developing obesity and chronic diseases. Future investigations should continue to identify who is at highest risk and what resources should be provided to this population to reduce morbidity and mortality.

TOPIC: Musculoskeletal

STUDY TYPE: Cohort

### Impact of Dry Needling on Hamstring Injuries: A Retrospective Cohort Study

**Submitting Author/Presenter:** Katherine Rizzzone, MD, MPH

Anish Rana, BA, MS2, Kevin Yoon, BS, MS2, and Courtney Jones, MPH, PhD

*Affiliation: University of Rochester Medical Center.*

**Purpose:** Dry needling is a potential treatment modality for musculoskeletal pain. There is a paucity of sports medicine literature examining the impact of dry needling on hamstring injuries. Our aim was to examine a cohort of patients who had received dry needling for hamstring injuries.

**Methods and Study Design:** This was a retrospective cohort chart review of patients who underwent dry needling for a hamstring injury in an academic outpatient sports medicine clinic between 2010 and 2023. Potential participants were identified through an electronic health record query for the term “dry needling.” Demographic details, diagnosis, management, and patient-reported outcomes were abstracted from the charts.

**Results:** There were 49 patients included in our cohort, with a mean age of  $32.5 \pm 16.95$  years, 51% women, 81% white, 6% Latinx. The majority of the cohort identified as a runner (59.2%) and more than a third (36.7%) identified as a collegiate/elite/professional athlete. The side affected was almost evenly split (49% right, 45% left). The majority did not have a precipitating injury (68.8%). The most common previously utilized treatment modalities prior to presentation included physical therapy (67.4%), heat/ice (57.1%), and over-the-counter oral medication (51.0%). Baseline Visual Analog Scale (VAS) was  $2.88 \pm 2.26$ . Average VAS after receiving the first dry needling therapy session was  $2.56 \pm 2.14$ . Average VAS difference pre- and post-dry needling was  $-0.33 \pm 2.88$ . However, based on patient self-report, dry needling benefited most (69.4%) with improved symptoms and 59.2% resumed their physical activities post-treatment.

**Conclusions:** Dry needling improved most participants' hamstring injury symptoms, which aligns with previous studies that have also shown dry needling's beneficial effects on pain and function in patients with other musculoskeletal injuries. However, the improvement was more subjective than on patient reported measures. Future steps include continued enrollment of participants in a prospectively dry needling study on return to sport and functional outcomes.

**Significance:** Hamstring injuries are often difficult to treat since reinjury is common. This study shows that dry needling may be a potential management strategy and should be studied further for applications to hamstring and other sports-related injuries.

**Acknowledgements:** We appreciated the help of Ashley Binn, research study coordinator.

TOPIC: PPE

STUDY TYPE: Other

## Do Airbag Vests Provide Protection Against Injury in Equestrian Sport

**Submitting Author/Presenter:** Gracie Meyer, BS

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**Purpose:** Equestrian sports are associated with risk of spinal and thoracic injuries. Air vests (AV) have become popular in equestrian sports, but their efficacy in protecting athletes from

trunk injury has not been well-studied nor have injury reduction-based product testing standards been clearly defined.

**Methods and Study Design:** A systematic review applying the PRISMA framework, NIH Study Quality Assessment, and CEBM Level of Evidence was conducted. Employing variations of “equestrian sport,” “powered 2-wheeled vehicle,” “thoracic injury,” “chest deflection,” “airbag vest,” and “safety vest,” 5 articles were identified for data collection from 3 recognized research databases and citation searching.

**Results:** In laboratory studies, AV demonstrated varying ability to protect against thoracic injuries, with one study using impacts (2.5 kg drop weight) far below expected forces associated with equestrian injury patterns, and the other study noting a decreased risk of severe chest injury from 94% to 81%. However, the authors note that severe injury is likely with forces of this magnitude, despite AV deployment. Experimental studies reported increased injury rates and risk associated with AV use. Equestrians in international competitions who wore an AV had 1.7 times increased odds of sustaining a serious/fatal injury (95% CI 1.14-2.64;  $P = 0.010$ ). Another study found that AV usage was associated with high-risk falls ( $P = 0.029$ ). Additionally, one study documented an injury rate of 13.7% with AV, compared to 9% without AV.

**Conclusions:** AV have not demonstrated reduced morbidity or mortality within equestrian sports. Research in this area is limited and future large-scale studies should be conducted to further evaluate the efficacy of the air vests.

**Significance:** Although widely utilized by equestrians, there is no conclusive evidence to support that AV decrease injury in equestrian sports. On the contrary, studies suggest that there may be a higher injury risk associated with AV use.

TOPIC: Concussion

STUDY TYPE: Other

## Adolescent Concussion: Sex Differences in Symptom Severity and Healthcare Utilization

**Submitting Author/Presenter:** Marcus Anthony, MD

Shae Datta, MD, Julia Drattell, PhD, Sara Hyman, MS, and Laura Balcer, MD

*Affiliation: NYU Langone & NYU Langone Concussion Center, New York, New York.*

**Purpose:** Fewer, less severe symptoms and immediate care post-injury are associated with faster adolescent concussion recovery. We aimed to describe sex differences in symptom severity and healthcare utilization after adolescent concussions.

**Methods and Study Design:** Retrospective cross-sectional chart review of patient data collected as part of the NYU Langone Concussion registry. Participants included were 12 to 18 year-old concussed adolescents ( $n = 78$ , average 15.5 years, 43.6% female) between 2013 and 2021. Outcomes were Sport Concussion Assessment Tool symptom number and severity, presence of immediate care, and time to specialty care.

**Results:** Female sex trended towards association with higher symptom severity (mean=43.1, 95% CI: 33.8, 52.37;  $P = 0.075$ ) and symptom number (mean = 14.37, 95% CI: 12.29, 16.45;  $P = 0.057$ ) compared to male symptom severity and number (mean = 31.6, 95% CI: 23.26, 39.94; and 11.3,

95% CI: 9.05, 13.55; respectively). Despite higher symptom severity and number, females were not more likely to receive immediate medical care (% of female participants who received immediate care = 34%, % of male participants = 53%,  $\chi^2 = 2.70$ ,  $df = 1$ ,  $P = 0.100$ ) and presented to specialty care in similar time frame compared to males (female mean = 86 days, 95% CI: 41.3, 130.7; male mean = 82.7, 95% CI: 42.9, 122.5;  $P = 0.914$ ).

**Conclusions:** Although concussed female adolescents had clinically significant worse symptoms, they were not more likely seek earlier or specialty care. This raises concern about barriers that may prevent prompt management of concussion in the adolescent female population. Future research should explore potential barriers and identify strategies to remove obstacles for treatment in this population.

**Significance:** Modern incidence of pediatric concussion is rising with studies finding that adolescents may be at increased risk of concussion compared to adults. Female sex has also been independently associated with persistent postconcussion symptoms.

**Acknowledgements:** A huge thank you to all at the NYU Langone Concussion Center for your ongoing support and encouragement.

TOPIC: Epidemiology  
STUDY TYPE: Survey

### Relationship Between Self Esteem (SE), Disordered Eating, Risky Sexual Behavior and Body Image Drive

**Submitting Author/Presenter:** Allison Lukacic, DO, MPH  
Emily Sherrard, MD and Jessica Knapp, DO  
*Affiliation:* MAHEC Asheville, NC.

**Purpose:** Current literature indicates that female athletes engage in less risky sexual behavior, have higher self-esteem and have higher rates of disordered eating compared to the general population. Previous research has shown an inverse correlation between self-esteem and disordered eating.

**Methods and Study Design:** Observational cross-sectional study of 529 female student athletes age 14 to 26. Tools administered were drives for thinness, muscularity, and leanness, Female Athlete Screening Tool, Rosenberg SE Scale, and Youth Risk Behavior Survey. Analysis of continuous variables was performed with a linear regression model. Analysis for comparing categorical variables was performed using a  $\chi^2$  analysis.

**Results:** Drive for Thinness (DT) is significantly ( $P = 0.024$ ) related to whether an athlete had ever had sexual intercourse. Those who have had intercourse were more likely to have a high DT (22.4%, 73/326) versus those who hadn't (13.4%, 19/142). Desire for Muscularity (DM) is significantly ( $P = 0.024$ ) related to whether an athlete used a condom the last time they had sex. Those who did not use a condom were more likely to have a high DM (27.1%, 35/129) versus those who did (16.6%, 30/181). The Female Athlete Screening Tool score for disordered eating increased by an average of 1.10 ( $P < 0.001$ ) units for each unit increase of the self-esteem measure. A higher value of the self-esteem measure indicates poorer self-esteem.

**Conclusions:** Lower self-esteem levels appear to be related to disordered eating in female athletes. A high and drive for thinness appear to be related to engaging sexual activity. Drive for muscularity appears to be related to lower condom use, a measure of risky sexual behavior. One limitation may be that

sexual orientation data was not collected or participants allowed to select multiple birth control methods.

**Significance:** Lower self-esteem levels appear to be related to disordered eating in female athletes. A high and drive for thinness appear to be related to engaging sexual activity. Drive for muscularity appears to be related to lower condom use, measure of risk.

**Acknowledgements:** Chelsea Atkins; Wendy Nuzzo, MS.

TOPIC: Ultrasound  
STUDY TYPE: Cohort

### Reliability of a Single-Operator Stress Ultrasonography Technique for Assessing the Medial Ulnar Collateral Ligament

**Submitting Author/Presenter:** Giorgio Negron, MD  
Ben Kopecky, DO, Brian Sutterer, MD, Jacob Sellon, MD, and Brennan Boettcher, DO  
*Affiliation:* Mayo Clinic, Rochester, Minnesota.

**Purpose:** There have been a wide variety of techniques suggested for performing stress ultrasonography (US) of the medial ulnar collateral ligament (MUCL) and associated ulnohumeral joint (UHJ) instability. The purpose of this study was to investigate the reliability of a novel single-operator technique.

**Methods and Study Design:** We conducted a prospective validation study of a single-operator technique in uninjured male elbows. Twenty-four elbows were evaluated with valgus stress US by 2 skilled ultrasonographer operators (JS, BB), who were blinded to their measurements. Medial UHJ width was measured twice under 2 conditions (unstressed and stressed), and stress deltas (SD) were calculated.

**Results:** Intra-rater reliability analysis of SD measurements demonstrated an Intraclass Correlation Coefficient (ICC) of 0.54 (95% CI 0.19 mm, 0.77) and 0.63 (95% CI 0.32 mm and 0.82 mm) for JS and BB, respectively, both indicating moderate intra-rater reliability. Bland-Altman Coefficients of Repeatability were 2.0 mm and 1.6 mm, respectively. Inter-rater reliability analysis demonstrated an ICC of 0.79 indicating good reliability and a Concordance Correlation Coefficient (CCC) of 0.78 indicating strong reliability. The Bland Altman lower and upper Limits of Agreement were -1.2 mm to 1.2 mm.

**Conclusions:** Our investigation suggests that this single-operator stress US technique is a reliable method to dynamically measure UHJ widening under stress as a surrogate measure of MUCL integrity.

**Significance:** This study assessed the reliability of a novel single-operator stress US technique. Sports medicine physicians and other sonologists may consider using this simple stress US method in the evaluation of MUCL injuries.

**Acknowledgements:** Mayo Clinic Orthopedic Research Review Committee.

TOPIC: Training  
STUDY TYPE: Other

### Exercise Equipment Boon or Bane

**Submitting Author/Presenter:** Matthew Brandenburg, MS  
Josh Kang, MS, Anusha Lekshminarayanan, MBBS, and Paul Diamond, MD

*Affiliation: New York Medical College Valhalla, NY.*

**Purpose:** This study aimed to identify injuries sustained by adults utilizing exercise equipment who presented to the Emergency Department over a 10 year-period from 2013 to 2022. Quantifying this data will allow trainers to recognize high risk maneuvers for clients so that they can adjust accordingly.

**Methods and Study Design:** 13,231 gym equipment-related injuries in patients aged 20 to 60 from 2013 to 2022 were identified in the NEISS (National Electronic Injury Surveillance System) database. Data was filtered to exclude the words “team, athlete, player, coach, and professional” as to isolate patients with no athletic training to best represent the general population.

**Results:** Among exercise-equipment injuries, the most common were sustained by people in the 20 to 29 (38.22%) and 30 to 39 (28.82%) age groups and Caucasian race (42.76%). Mean age of injured patients was 35.14 years of age. The most common injuries sustained were strains and sprains (54.46%) followed by fracture (12.65%) and contusions/abrasions (12.60%). The injuries were mainly located in the lower trunk (19.72%), shoulder (13.20%), and upper trunk (10.55 %). Injury data was stratified into equipment mishandling including drops, falls, trips, slips, or crush injuries considered “accidental” (36.16%), and those not in this category. Weightlifting was the most common overall mechanism of injury (70.41%), and a majority of these injuries were sustained while training for sports (45.23%).

**Conclusions:** The most common injuries were strains and sprains of the trunk and shoulder. To prevent injury, trainers should encourage a stretching routine, strict adherence to proper form, and heightened environmental awareness. Roughly 1/3 of these injuries involved dropping weights, losing balance while holding equipment, or tripping on equipment on the ground. Maintaining mindfulness throughout the exercise session is vital to limiting injury.

**Significance:** Quantifying these injuries may be useful in enhancing guidelines for workout regimens designed by trainers. Exercises which may have previously been regarded as universally safe may be causing unforeseen harm in certain populations.

TOPIC: Mental Health

STUDY TYPE: Cohort

### Differences in Brief Resilience Scores Among Retired Offensive and Defensive NFL Players

**Submitting Author/Presenter:** Chris Grijalba, DO

Navneet Baidwan, PhD, Mark Carrasco, MD, Caroline Cohen, PhD, Ian McKeag, MD, and Irfan Asif, MD

*Affiliation: University of Alabama at Birmingham Sports and Exercise Medicine, Birmingham, AL.*

**Purpose:** Retired athletes face mental health challenges, and how those challenges are faced depends on one's level of resilience. The purpose of our investigation was to assess whether the resilience of retired NFL athletes differed by position type.

**Methods and Study Design:** Retired NFL players completed the validated 6-item Brief Resilience Scale questionnaire which is a valid and reliable measure of resilience. The possible score range on the BRS is from 1 (low resilience) to 5 (high resilience). The primary outcome was to evaluate the

relationship between position played and BRS scores. A regression model was used to calculate for associations.

**Results:** Twenty-nine retired NFL players completed the Brief Resilience Scale (BRS) questionnaire, but 6 participants were excluded due to incomplete data. The remaining 23 participants were divided into 2 groups of offensive ( $n = 14$ ) and defensive ( $n = 9$ ) position played while in the NFL. As compared to retired offensive players (mean BRS = 4.3), defensive players (mean BRS = 3.0) had 1.23 units lower BRS score on average (95% CI:  $-1.89, -0.56$ ;  $P = 0.0003$ ).

**Conclusions:** A lower Brief Resilience Scale score was largely seen in retired NFL defensive players compared to retired NFL offensive players. Regression analysis showed a statically significant association between position played and its effect on resilience.

**Significance:** NFL players face an increased risk for mental health challenges. With player health and safety at the forefront of the NFL, more focus can be placed on retired defensive players to implement programs to build resilience skills.

TOPIC: Education

STUDY TYPE: Survey

### Assessing Understanding and Utility of VO2max in Medical Providers

**Submitting Author/Presenter:** Josh Schulte, MD

Jake Knupp, BS and Kolin Schulte, BS

*Affiliation: UT Southwestern, Dallas, TX.*

**Purpose:** Assess the current use and understanding of VO2max in clinicians and medical students, provide an educational video-based lecture, and then reassess understanding and perceived utility by the same clinicians and students.

**Methods and Study Design:** An introduction to the study was distributed via email to the UTSW family medicine faculty and residents and the medical student's sports medicine interest group. Participants then filled out a 10-question survey, followed by a video-based lecture, then the survey was repeated 2 weeks later. Results were analyzed qualitatively.

**Results:** Fifty-three people agreed to participate via email introduction. 30 people completed a pre-lecture survey, 15 completed the lecture, and 10 completed the post-lecture survey. Of the post-lecture surveys, 9 participants were residents and 1 was a medical student. We analyzed 10 participants that completed both surveys data. Prior to the lecture, the majority of participants did not currently use or plan to use VO2max in patient care. After the lecture, the results were equally split. Prior to the lecture most participants reported VO2max was not necessary to overall health. After the lecture, most participants reported it was necessary. Prior to the lecture, the majority of participants felt uncomfortable defining VO2max, describing its purpose, performing and interpreting a VO2max test, and offering strategies to improve a VO2max. After the lecture, the majority of participants felt comfortable or very comfortable with these same questions. After the lecture, most participants preferred the smartwatch and portable technology in the clinic setting to measure a patient's VO2max.

**Conclusions:** Our study shows most clinicians that completed the surveys found VO2max to be unnecessary but lacked to comfortability with the topic. After a 20 minutes

lecture, they then felt more comfortable and found VO<sub>2</sub>max to have more importance and utility in providing care to patients. As the technology and estimation of VO<sub>2</sub>max continue to improve we believe clinicians and patients would benefit from access to education regarding VO<sub>2</sub>max.

**Significance:** With educational exposure, clinicians may start to utilize the VO<sub>2</sub>max in a broad health setting. Improving the VO<sub>2</sub>max has significant capacity to improve overall health in the general population and has been shown to improve performance in sports.

**Acknowledgements:** We would like to personally thank Dr. Chelsea Cole in her advisor role as well as the UTSW institution and Family Medicine program for supporting our project.

TOPIC: Musculoskeletal

STUDY TYPE: Other

### **Intra-articular Nonsteroidal Anti-inflammatory Drug Versus Corticosteroid Injections in the Management of Knee Osteoarthritis**

**Submitting Author/Presenter:** Jason Schon, MD

Hye Chang Rhim, MD, Joseph Ruiz, MD, Wilma Afunugo, MD, Zack Crockett, MD, Jaehyung Shin, and David Robinson, MD

**Affiliation:** Spaulding Rehabilitation Hospital / Harvard Medical School, Department of Physical Medicine and Rehabilitation, Charlestown, MA.

**Purpose:** The purpose of this systematic review was to compare clinical outcomes between intra-articular nonsteroidal anti-inflammatory drug (NSAID) and corticosteroid injections for knee osteoarthritis.

**Methods and Study Design:** A systematic review of all randomized controlled trials (RCTs) and comparative studies that compared outcomes between NSAID and corticosteroid injections for knee osteoarthritis from the Medline, Embase, Web of Science, and Cochrane Central Register of Controlled Trials databases was performed. Meta-analysis was performed using a random-effects model considering heterogeneity across the studies.

**Results:** A total of 7 studies (5 RCTs and 2 retrospective comparative studies) with 468 patients were included. Meta-analysis of 5 studies demonstrated that there was no significant difference between NSAID and corticosteroid injection in pain VAS at baseline (WMD -0.02; 95% CI, -0.44 to 0.39; I<sup>2</sup>, 79.2%), 1 month (WMD 0.08; 95% CI, -0.35 to 0.52; I<sup>2</sup>, 85.8%) and 3 months (WMD 0.09; 95% CI, -0.08 to 0.27; I<sup>2</sup>, 36.3%). Meta analysis of 4 studies demonstrated no significant difference between NSAID and steroid injection in WOMAC at baseline (WMD -0.07; 95% CI, -1.51 to 1.38; I<sup>2</sup>, 52%); however, at 1 month, there was a statistically significant difference in WOMAC favoring the steroid injection group (WMD 0.90; 95% CI, 0.31 to 1.49; I<sup>2</sup>, 8.2%). At 3 months, there was no significant difference in WOMAC between groups (WMD 0.33; 95% CI, -0.59 to 1.24; I<sup>2</sup>, 0%).

**Conclusions:** The results of this study suggest that intra-articular NSAID injections are as effective as corticosteroid injections in pain reduction and improvement in function for patients with knee osteoarthritis. There was statistically significant difference favoring the steroid injection group for WOMAC at 1 month (WMD 0.90); however, this is unlikely

clinically significant given MCID for between group difference in knee osteoarthritis of 9 to 12.

**Significance:** Intra-articular NSAID injection is comparable to steroid injection for knee osteoarthritis and should be considered for patients who require frequent injections or for those with contra-indications to steroids.

**Acknowledgements:** The authors acknowledge Atta Taseh, MD, Xiaoyu Pan, MD, PhD, Sean Schowalter, MD, and Ki-Mo Jang, MD, PhD for their contributions to this study.

TOPIC: NCAA

STUDY TYPE: Cohort

### **Epidemiology of Hip, Thigh, and Knee Injuries Across NCAA Division I Soccer Players**

**Submitting Author/Presenter:** Jaclyn Gilday, BS

Daniel Gehlbach, MD, MPH, Madison Goon, BS, Alexandra Klomhaus, PhD, Joshua Goldman, MD, MBA\*, and Emily M. Miller, MD\*

**Affiliation:** University of California, Los Angeles.

**Purpose:** Collegiate soccer players experience a range of lower extremity injuries which vary by gender, mechanism, playing surface, and time loss. Our study categorized thigh, hip, and knee injuries in collegiate soccer players recorded by the PAC-12 surveillance database from 2016 to 2022.

**Methods and Study Design:** This retrospective cohort study used de-identified data from the PAC-12 Health Analytics Program. We stratified data by player position, gender, injury type, & mechanism. We compared gender differences utilizing a  $\chi^2$  test. We obtained incidence rate ratios with 95% confidence intervals from a Poisson regression. Injuries per hour were calculated using athlete exposure data.

**Results:** There were 951 thigh/hip injuries (58.7% female, 41.1% male) and 1.52 injuries/1,000 exposure hours. Hamstring injuries were the most reported (28.1%), followed by the hip (19.9%) and quadriceps (10.8%). Hip/groin injuries resulted in the longest average time loss (16.96 weeks). There were 669 knee injuries (70.3% female, 29.7% male) and 1.45 injuries/1000 exposure hours. Patella/patellar tendon injuries were the most reported (16.38%), followed by MCL injuries (14.20%), knee contusions (11.96%), and ACL tears (7.8%). ACL injuries made up 3.4% of female and 0.8% of male injuries ( $P$  less than 0.0001) with non-contact mechanisms of injury seen more commonly for ACL injuries than contact mechanisms in both sexes. ACL tears resulted in the longest average missed time (44.88 weeks). For both the knee and hip/thigh, the majority of injuries occurred during season (45.63% and 49.33% respectively) and resulted in time loss from sport (60.69% and 54.79% respectively).

**Conclusions:** While higher numbers of hamstring, hip and quadriceps injuries versus knee injuries were reported in our cohort, knee injuries more frequently resulted in time loss. Hip/groin injuries and ACL tears were associated with the longest time loss of the injuries reported. Limitations include variability in reporting and categorizing injuries across institutions as well as time loss may vary based on time in season.

**Significance:** This data can lead to expansion of existing injury prevention programs for collegiate soccer players to reduce risk of not only season ending injuries such as ACL tears but also the most common muscle/tendon injuries that lead to time loss.

**Acknowledgements:** Research reported in this project was supported by the National Center for Advancing Translational Science (NCATS) of the National Institutes of Health under the UCLA Clinical and Translational Science Institute grant number UL1TR001881.

TOPIC: Musculoskeletal  
STUDY TYPE: Other

### An Underrecognized Extra-Articular Etiology of Anterolateral Hip Pain: A Narrative Review

**Submitting Author/Presenter:** Jessica Buttinger, MS, MD

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*Affiliation: Trinity Health, Grand Rapids, Michigan.*

**Purpose:** An often-overlooked diagnosis of anterolateral hip pain is proximal iliotibial band origin (PITB) tendinopathy. The purpose of this narrative review is to describe anatomy of the PITB, clinical diagnosis of PITB tendinopathy, and summarize the imaging findings and treatment options.

**Methods and Study Design:** In August 2023, a systematic search strategy was utilized to answer the question, “What are the incidence, diagnostic criteria and treatment options for PITB tendinopathy?” using CINAHL, ERIC, PubMed, MEDLINE, and Web of Science search engines. Strict inclusion and exclusion criteria were employed as studies underwent review by a 2-reviewer system for final inclusion into the narrative review.

**Results:** Eighty-two articles were reviewed for eligibility using the PRISMA guidelines for reporting systematic reviews. Of those articles, 17 met the inclusion criteria for final analysis. Twelve articles were case reports describing various treatments and outcomes of PITB tendinopathy or tearing. The remaining 5 articles were descriptive articles touching on the anatomy, pathology, or imaging of the PITB or some combination of these 3 topics. The articles were then categorized to answer our initial questions outlining anatomy, history/physical exam, imaging, or treatment options.

**Conclusions:** PTIB tendinopathy may be an overlooked etiology of anterolateral hip pain. Due to the limited literature available on this condition, this review summarized the relevant anatomy, history and physical exam findings, imaging findings, and treatment outcomes for this condition.

**Significance:** Patients with PITB tendinopathy may present with undiagnosed pain and symptoms for months to years, significantly impacting their ability to participate in activities. It is vital to educate clinicians on this overlooked cause of hip pain.

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TOPIC: Musculoskeletal  
STUDY TYPE: Cohort

### Operative and Conservative Management of Pediatric Trigger Digits: A Systematic Review

**Submitting Author/Presenter:** Oluwatobi Lasisi, MBBS, MSBS

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*Affiliation: Department of community and family medicine, Howard University, Washington, DC.*

**Purpose:** The purpose of this systematic review is to evaluate the current evidence to compare the treatment outcomes between conservative and surgical management of pediatric trigger digits. We evaluated the treatment outcomes, recurrence rate and the development of complications.

**Methods and Study Design:** A systematic review was conducted by searching MEDLINE, EMBASE, Scopus and PubMed. Two reviewers independently extracted data on cure and recurrence rates among conservative and surgical methods. All the articles included in this review were prospective and retrospective cohort studies. Case reports, syndromic trigger digits, reviews, non-comparative studies, and studies with adults were excluded.

**Results:** There was a total of 437 studies and only 11 studies met the inclusion criteria. There was a total of 1,335 patients across the 11 studies reviewed. The age range was 0 to 13 years with a male to female ratio of approximately 1:1. Over the 11 studies, an initial approach of conservative management was adopted in 731 patients while 604 patients were operatively managed. Of those who were initially managed conservatively, 4 authors reported more than 70% cure rate. Eight authors reported that patients received surgery after failure of conservative management. Majority of the authors reported over 85% of complete resolution with surgical management. Only 4 authors reported recurrence rate ranging from 1.4% to 40% after surgical intervention. Three of the authors reported superficial infections resulted after surgery.

**Conclusions:** Based on our review, surgical management of pediatric trigger digits resulted in higher cure rate than conservative management. However, conservative management is a viable initial treatment option especially for patients who declined surgery.

**Significance:** Trigger digits is important because it is one of the most common causes of hand pain in the pediatric population. If left untreated can cause both short term and long-term disabilities, including contractures, synovitis and arthrosis.

**Acknowledgements:** Acknowledgements goes to all the authors of this study for their hard work and dedication.

TOPIC: Running  
STUDY TYPE: Other

### Running Retraining Effect on Biomechanical Variables in Amateur Runners

**Submitting Author/Presenter:** Martin Roldan, MD

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*Affiliation: PM&R Residency Program and Sports Medicine Fellowship Program of the University of Puerto Rico, Medical Science Campus, Puerto Rico.*

**Purpose:** To explore the effects of running gait retraining intervention in foot strike landing using immediate and faded visual and/or auditory biofeedback to modify cadence and step length in amateur runners.

**Methods and Study Design:** Eight amateur runners with overstriding underwent biomechanical analysis and 4 gait retraining sessions. Interventions included supervised warm-up exercises followed by treadmill running using immediate and faded visual (cadence and step length) or auditory



(cadence) biofeedback. The main biomechanical variable was the heel-to-center of mass (COM) distance on foot strike.

**Results:** A total of 8 runners completed 4 sessions of supervised retraining. Cadence (steps/minute) increased in all runners (3.5-23.7%), step length decreased in all runners (2.4-23.2%), and the distance of the heel to the center of mass decreased or stayed the same in all runners (0-75%). The increased in cadence correlated with a more significant change in the position of the foot on foot strike. Additionally, 7 runners demonstrated tibial angle changes on foot strike with 50% them changing from rear foot strike to midfoot strike.

**Conclusions:** Gait retraining focused on variables (cadence and step length) can effectively alter running biomechanics like foot position on initial contact which correlates with decreased vertical reaction forces. Correcting overstride may help decrease the risk of running related injuries by decreasing the forces applied to the lower limb bony and soft tissues. Further research is needed to optimize these interventions and understand long-term outcomes.

**Significance:** Running related injuries affect close to 80% of all runners. Some running gait biomechanical variables are associated with increased risk of injury therefore gait retraining can play a major role in injury prevention.

**Acknowledgements:** We thank the PM&R Residency Program, the Sports Medicine Fellowship Program of the University of Puerto Rico, Medical Science Campus and the Excel Rehabilitation clinic for their essential contributions to our gait retraining study.

TOPIC: COVID

STUDY TYPE: Cohort

### The Effect of COVID-19 on Autonomic Nervous System Function in Division 1 College Football Athletes

**Submitting Author/Presenter:** Sami Rifat, MD, FAMSSM

Bruce S. Miller, MD, MS, Eugene H. Chung, MD, MSc, Philip D. Johnson, MS, AT, ATC, and Kaylee Sarna, MSc

*Affiliation: Cleveland Clinic, Cleveland, Ohio.*

**Purpose:** The aim of this study is to compare resting heart rate, heart rate variability, respiratory rate and hours sleep, as indicators of autonomic dysfunction, in division 1 collegiate football players who have recovered from COVID 19 with position matched teammates who never had COVID 19.

**Methods and Study Design:** Prospective observational matched cohort study in division 1 collegiate football players. The control group was matched based on position including the following 3 groups: Linemen, Large Skill Athletes and Small Skill Athletes. All participants wore a multi sensor wrist device to measure RHR, HRV, RR, hours sleep per night throughout a 6 week period during their football season.

**Results:** Twenty-nine players completed the study. Eleven individuals were removed, 8 from the COVID cohort and 3 controls because they did not wear the wrist band long enough to acquire a baseline. There was no statistically significant difference between the groups with the exception of the big skill subgroup with a higher BMI for the COVID 19 group ( $P = 0.0460$ ). Throughout the study period there was a statistically significant difference ( $P = 0.0434$ ) between control/covid participants for RHR mean for the skill group with a higher mean of the mean in COVID participants compared to control participants mean. There was no

statistically significant difference between groups for any other variables.

**Conclusions:** COVID 19 does not appear to have significant long term effects on RHR, HRV, RR and total sleep in division 1 collegiate football players who fully recovered from COVID 19 and were cleared to return to play.

**Significance:** To our knowledge this is the first study to look at the effect of COVID 19 on cardiac autonomic function in football athletes during their season. This information can be important in injury prevention and management of elite athletes.

**Acknowledgements:** MiCHAMP.

TOPIC: Musculoskeletal

STUDY TYPE: Cohort

### Hip Fracture After Hip Area Corticosteroid Injection: A Retrospective Analysis

**Submitting Author/Presenter:** Sarah Kim, BA

Jacob Reisner, DO, Taylor Struble, BS, Ryan Groseclose, BS, Laura Krech, MPH, Steffen Pounders, BS, Jacob Boersma, MD, and Matthew Lypka, MD

*Affiliation: Michigan State University College of Human Medicine, Grand Rapids, MI.*

**Purpose:** The primary aim was to determine the incidence of hip fracture (IHF) post-hip corticosteroid injection (CSI). Secondary aims included comparing IHF for intraarticular vs. extraarticular hip CSI and comparing IHF after hip CSI vs. a matched cohort without hip CSI.

**Methods and Study Design:** Retrospective chart review from November 2017 to September 2022 at a regional medical center identified the total number of patients who received a hip area CSI. A control cohort, with preexisting hip pain but no hip area CSI history, was generated via 1:1 propensity matching on age, sex, race, ethnicity, and BMI. Electronic medical records for both cohorts were examined for osteoporosis history.

**Results:** Five hundred patients were identified who received at least one hip area CSI during the study period. The median age was 65 [54; 76 IQR] and 213 (61%) were female. Hip fractures were identified in 16 (3.2%) patients after a hip area CSI from the total population. Out of these 16 patients, 8 (50%) received extraarticular hip area CSI, 5 (31%) received intra-articular hip area CSI and 3 (19%) received both locations. After propensity matching, 347 patients were included in each group. Hip fractures were found in 13 (3.7%) of the treatment group vs. 20 (5.8%) in the control group. A documented diagnosis of osteoporosis was found in 6 (46.2%) of those with hip fractures after CSI and 0 (0.0%) of the control patients.

**Conclusions:** We found a higher proportion of extraarticular CSI in patients with hip fractures, which may highlight the role hip tendinopathy plays in fall risk and hip fractures. We found no significant difference between the incidence of hip fractures in patients with history of hip area CSI versus a matched cohort without. A significant number of hip fractures after hip area CSI occurred in patients with comorbid osteoporosis compared to the control.

**Significance:** This is the first study to describe the incidence of hip fracture after a hip area CSI. Osteoporosis was significantly associated with hip fractures for patients with CSI and may be important for clinicians considering this treatment.

**Acknowledgements:** The deepest appreciation to Dr. Reisner and the rest of the team for their hard work and dedication to make this research possible.

TOPIC: Concussion  
STUDY TYPE: Other

### Stroop Testing Using a Hart Chart Format to Assess Sport Related Concussion

**Submitting Author/Presenter:** Hagar Elgendy, MD, MS  
Joseph Clark, PhD

*Affiliation: University of North Carolina.*

**Purpose:** Neurological testing is vital as a component of pre participation physicals. Computerized testing is the standard of practice. We propose an additive test that can identify deficits via the visual complex neurological pathways. We propose the addition of Stroop testing for Pre participation exams.

**Methods and Study Design:** A 3-step Stroop panel was performed on 13 concussed athletes and 167 PPE baselines non concussed athletes. We examined the time it took to complete an  $8 \times 8$  grid of Stroop words using a Hart chart saccadic eye movement task, plus a 10-word recall task. The 3-step Stroop test set progressed in difficulty. The times it took to perform the tasks were assessed.

**Results:** We found that the concussed athletes performed significantly slower in the Stroop task, taking  $84.5 \pm 24.8$  seconds compared to the PPE baseline non concussed athletes of  $62.3 \pm 11.9$  seconds ( $P = 0.000001$ ). Both groups were similar in the 10-word recall of  $4.0 \pm 2.5$  vs  $4.2 \pm 1.7$  correct out of ten. However, the 10 words had an undisclosed theme therein. When asked to identify the theme, the PPE baseline group recognized the theme 90% of the time compared to 31% for the Concussed athlete group ( $P = 0.0000001$ ).

**Conclusions:** Stroop testing is quantitative, cost-effective, can be completed in about 3 minutes, and revealing of significant neurological function. The results support that the test can be used to assess memory, saccadic eye movement, and prefrontal cortex function. Stroop testing can complement standardized protocols and serve as a part of baseline and sideline assessment to identify acute concussions.

**Significance:** Concussion impairments can greatly impact quality of life. The need for an efficient, acute, cost-effective sideline assessment tool is vital. Stroop testing can reveal minute neurological impairment and ultimately protect the athlete.

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Department of Sports Medicine, and the University of Cincinnati Athletic Department.

TOPIC: Training  
STUDY TYPE: Other

### Seven Years of Pre-Season and In-Season NeuroVisual Training Resulted in Significantly Improved Batting Statistics

**Submitting Author/Presenter:** Hagar Elgendy, MD, MS  
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**Purpose:** Visual processing requires a complex system of both anatomical and functional circuits. NeuroVisual Training (NVT), is a type of performance enhancement training. Most studies are anecdotal in utility of NVT. We present evidence of sustained batting performance statistics in utilizing NVT.

**Methods and Study Design:** NVT was performed over 7 years out of a 12-year period. The University of Cincinnati baseball team had NVT initiated about 6 weeks prior to the season with a maintenance NVT of once a week during the season. Batting statistics for the team over the years of the study were collected using a public database. Over the course of the 12 year time period, 3 coaches took the lead of the team.

**Results:** The University of Cincinnati baseball team participated in vision training for 7 years and no vision training for 5 years. During the years of vision training batting average, Slugging %, on base % and On Base % + Slugging % (OPS) were significantly improved compared to the non-NVT years. Improvements were: 0.030, 0.107, 0.042 and 0.035 respectively. The winning percentage for the NVT years was 47.6 compared to 40.5% for non-NVT, although statistical significance was not found.

**Conclusions:** In this paper we present a retrospective analysis of batting performance comparing 7 years of NVT and 5 years of no-NVT. The results are highly suggestive that NVT has a positive benefit on batting performance supporting the role of NVT for performance enhancement. NVT carries the capacity to improve and strengthen visual neural processing and translate it to functional gains.

**Significance:** NeuroVisual Training is the process of using visual exercises as part of a structured sports conditioning program. Inclusion of NVT has the capacity to improve both sport performance and prevent injury (Clark, et al).

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